

ANALYSIS ON THE CONSOLE MARKET: A FOCUS ON XBOX AND THE EFFECT OF GAME PASS SUBSCRIPTIONS

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3 MAJOR PLAYERS



Nintendo

First to enter the market with the Nintendo Entertainment System (NES) in 1983



Sony

Enters the market in 1994 with the Playstation One (PS1)



Microsoft

Last to enter the market, in 2001, with the Xbox



A GROWING MARKET

The Gaming Console Market size is expected to grow from USD 53.36 billion in 2023 to USD 75.54 billion by 2028



The amount of time consumers spend on gaming is increasing, with the global average being 7.11 hours per week



XBOX GAME PASS

- Launched in July 2017
- Subscription service by Microsoft that offers access games on Xbox consoles, PC and via cloud
- Catalogue is updated monthly, adding new games even on day one
- Can be seen as the main killing feature for Microsoft's Xbox consoles

Most popular on cloud



X GAME PASS

Recently added



TASKS



Game Pass subscriptions

- Investigate the time series of subscriptions
- Perform forecasts



Xbox consoles sales

- Investigate the time series of sales
- Analyze the effect of Game Pass on sales
- Perform forecasts



Consoles sale comparison

- Graphical sales comparison of the three companies
- Analyze competitions between
 - Microsoft and the others
 - Different generations of Xbox consoles

DATA SOURCES

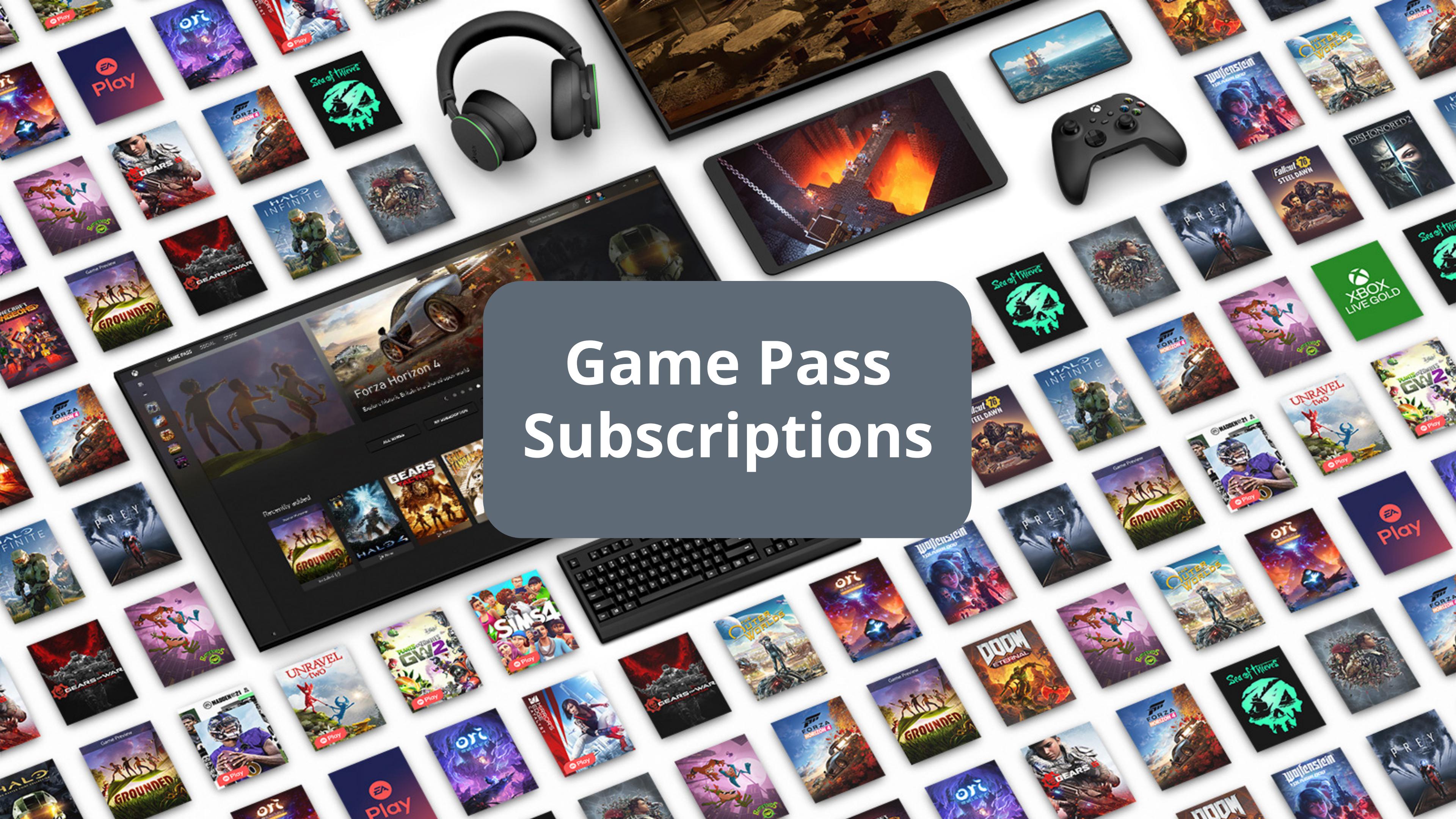


<https://www.statista.com/>



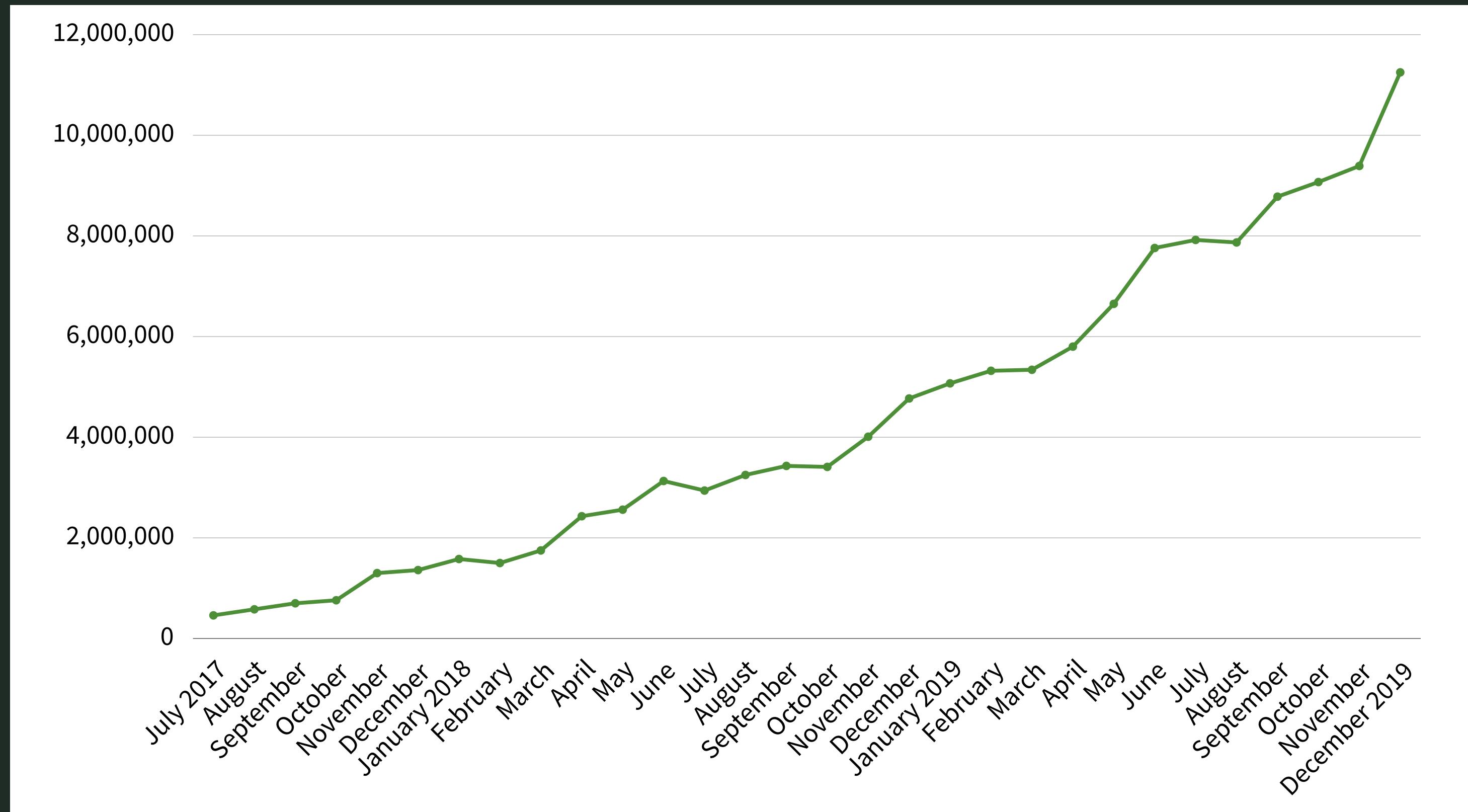
<https://www.vgchartz.com/>

Game Pass Subscriptions



Gamepass time-series

(July 2017 - December 2019)

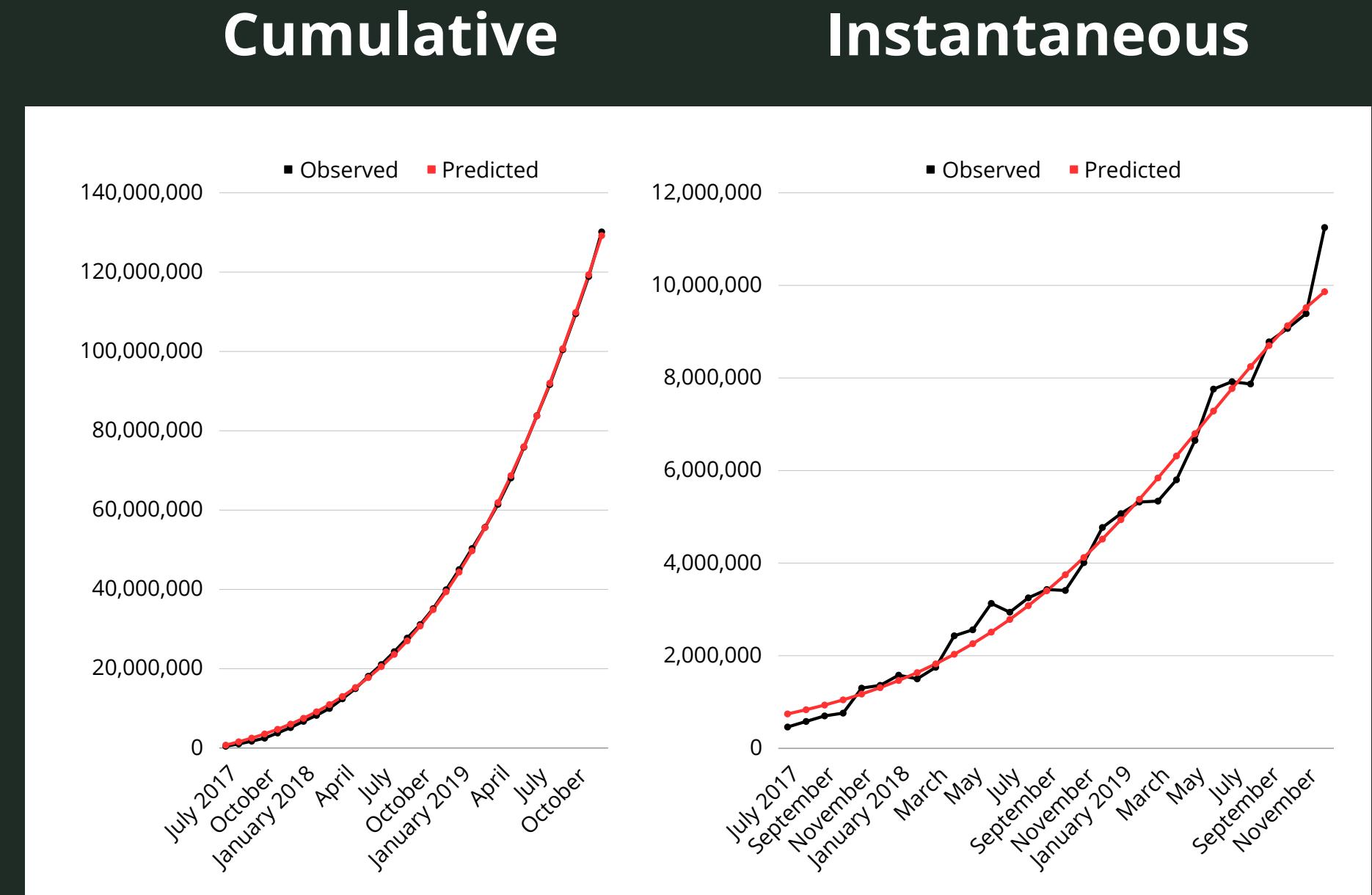


Bass model

Coefficient	Estimate	$Pr(>t)$
m	3.511404e+08	2.26e-14 ***
p	1.996260e-03	2.04e-18 ***
q	1.172436e-01	8.44e-27 ***

$$R^2 = 0.9987$$

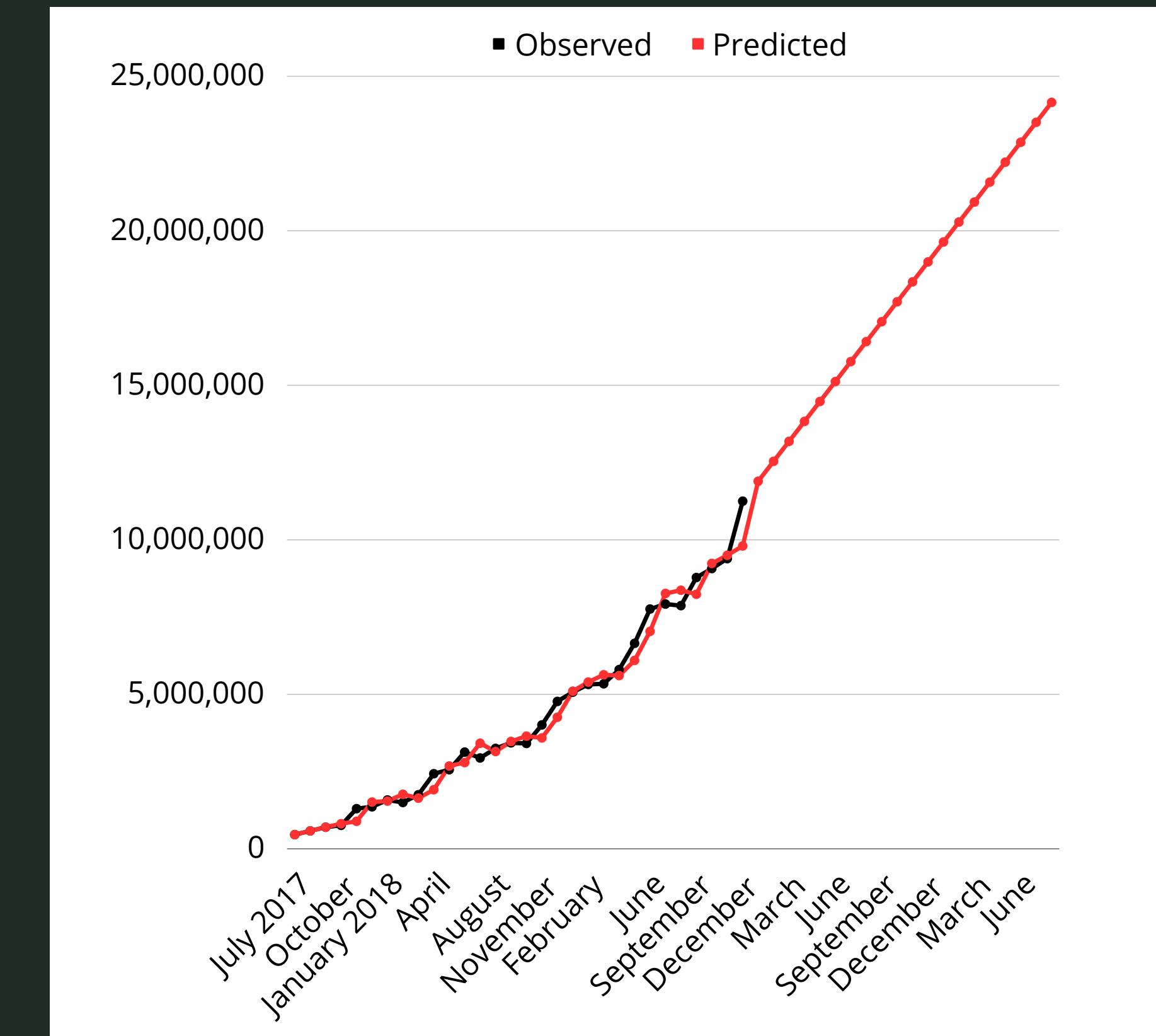
- All coefficients are significant
- No need to use more complex models (Generalized Bass Model, Guseo-Guidolin Model)



ARIMA

Coefficient	Estimate	s.e.
ma1	-0.8383	0.1043

- Auto-Arima model: [0,2,1]
- Residuals behave as White Noise



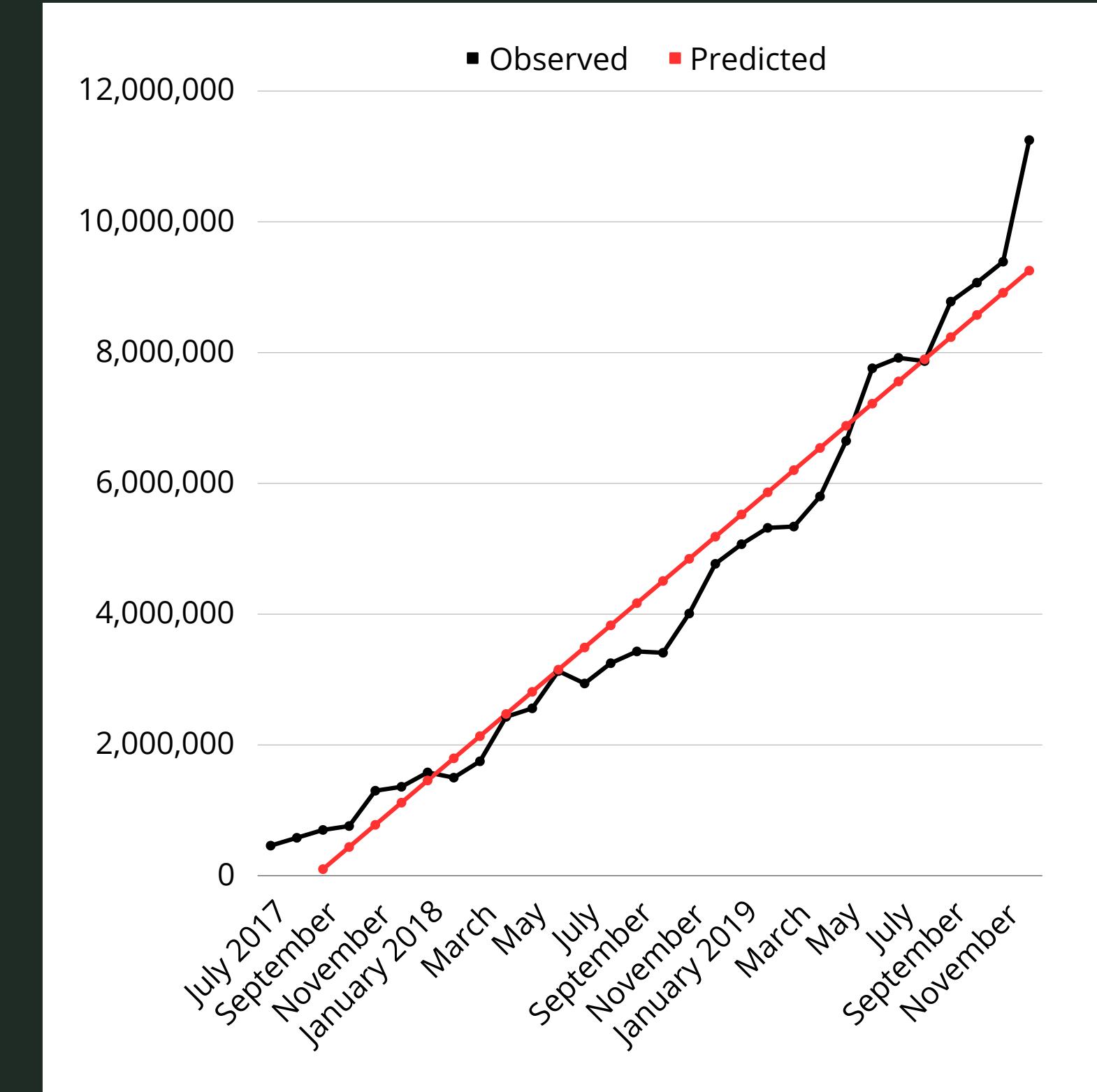
Linear regression

Gamepass ~ trend

Coefficient	Estimate	<i>Pr(>t)</i>
Intercept	-916828	0.0013 **
Trend	339021	<2e-16 ***

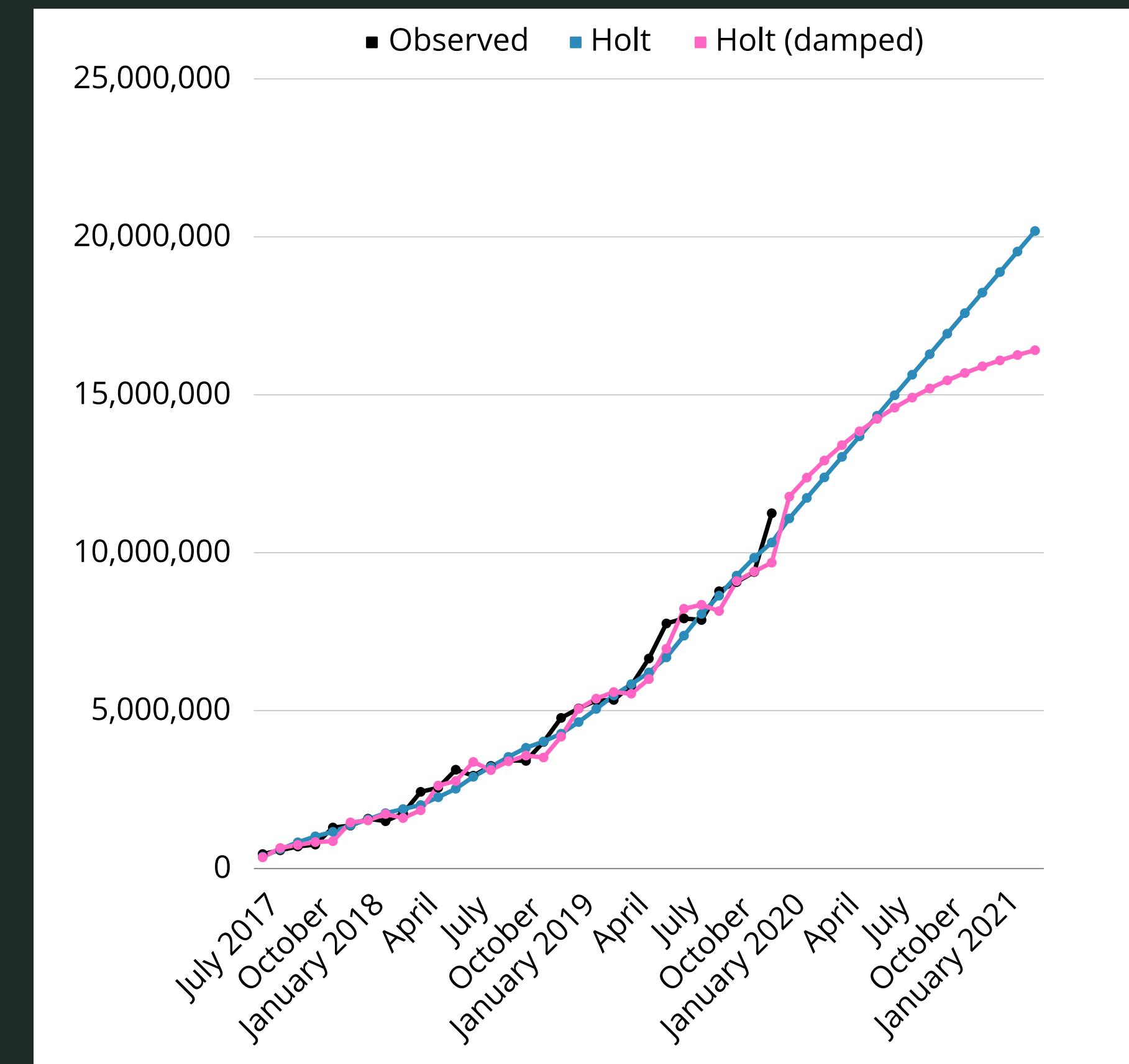
$$R^2 = 0.9516$$

- Model containing *trend+seasonality* was also tested, however *seasonality* resulted non-significant.
- Residuals behave as White Noise.



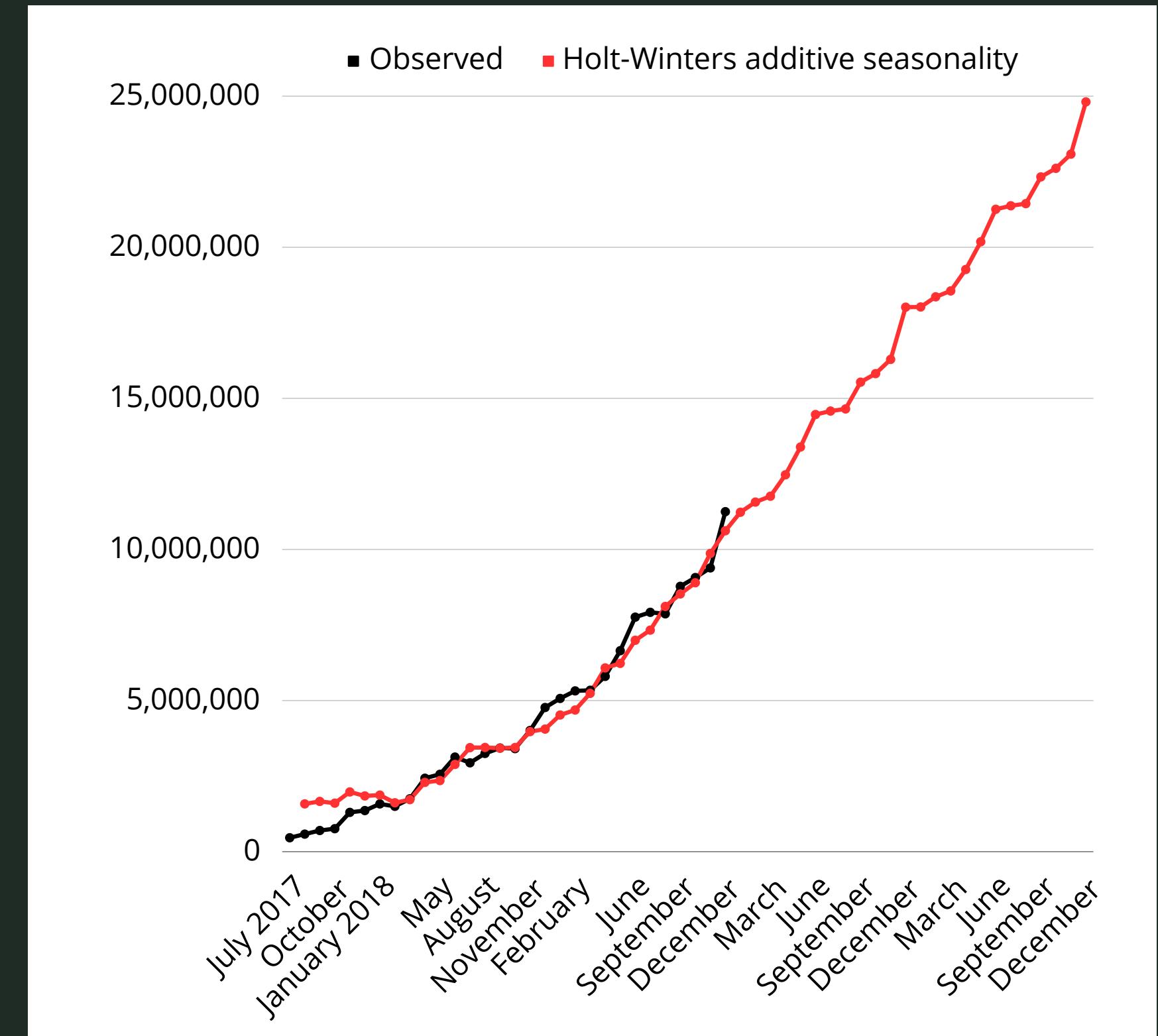
Holt linear trend

- Holt's method shows a constant straight linear increase
- Damped Holt's method shows a non linear increasing



Holt-Winters (additive seasonality)

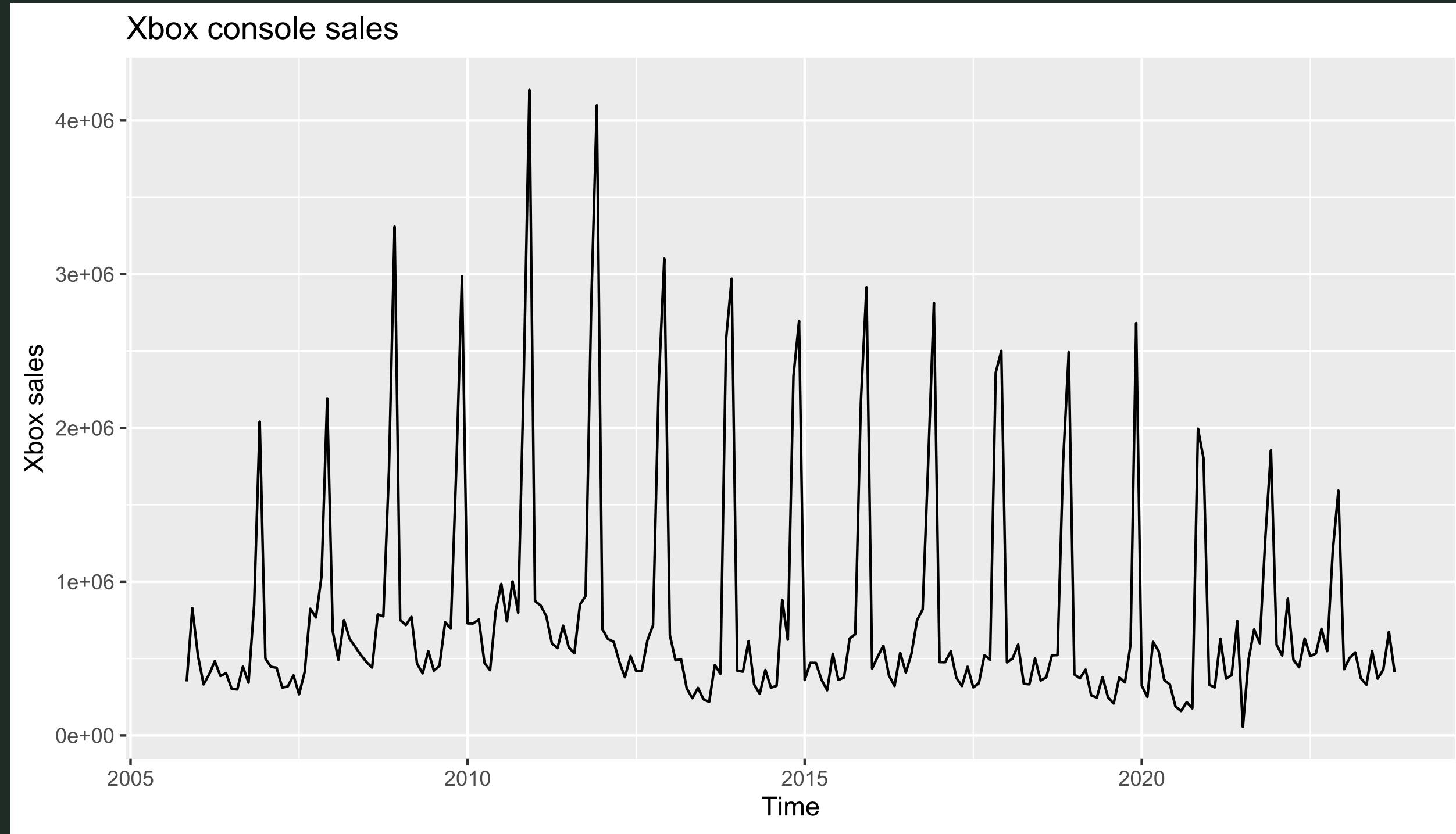
- Considering the seasonality, the method still shows an almost linear increase, with some very specific behaviors depending on the periods.



Xbox consoles sales

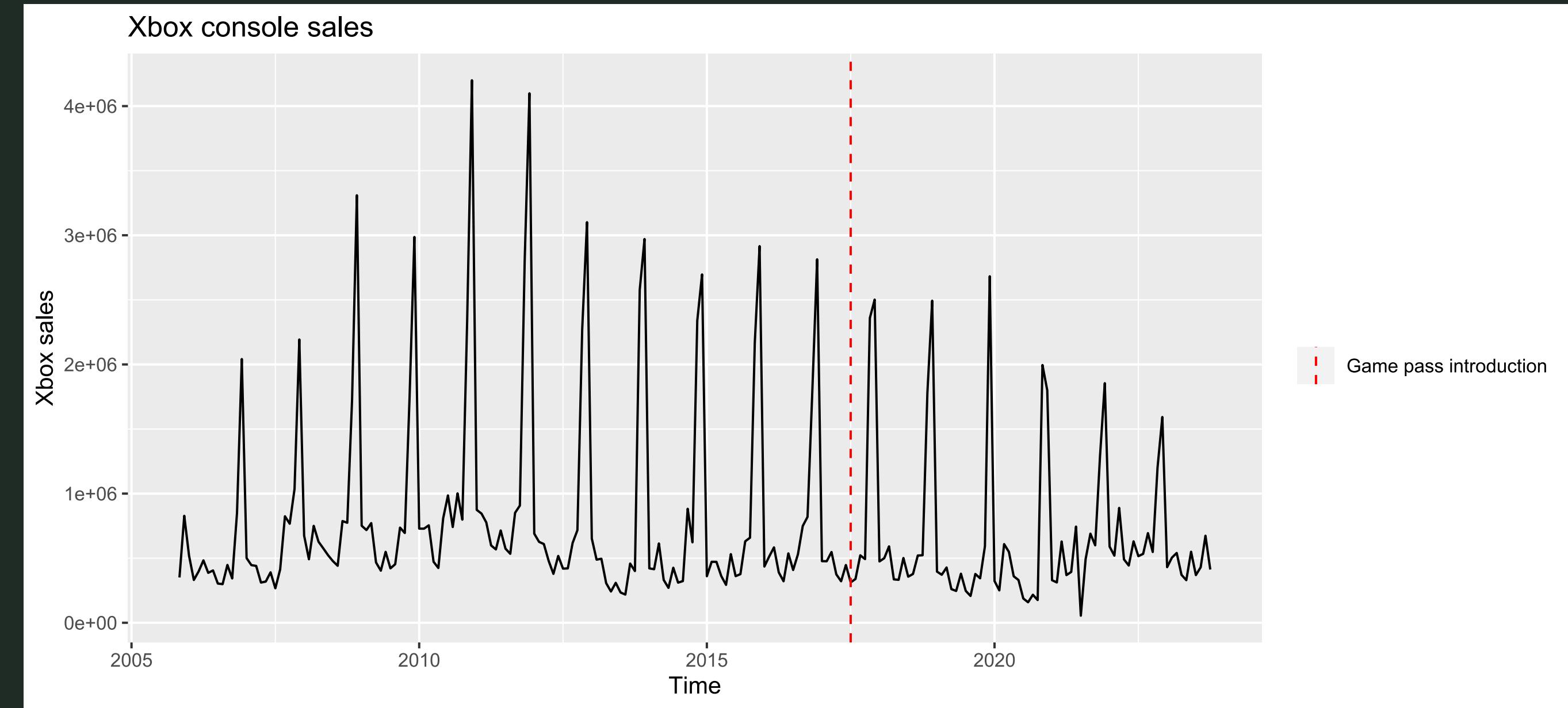


Time span: 2005/11 - 2023/10



- Seasonality: spikes in November and December each year
- High Variance

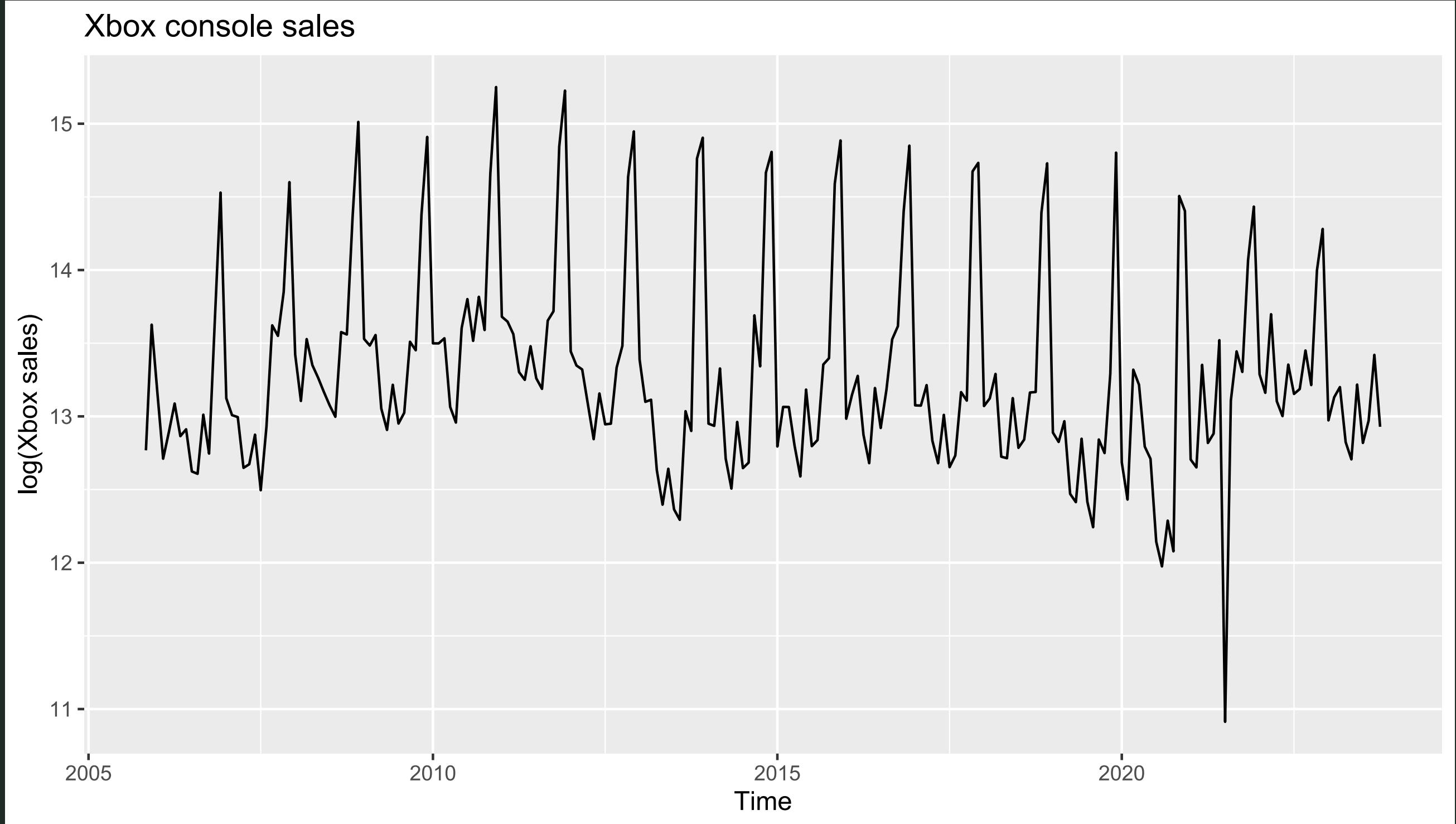
The game pass
was introduced
in July, 2017



To model its effect over the Xbox sales, it was used a dummy variable:

- 1 after the introduction
- 0 before

log transformation



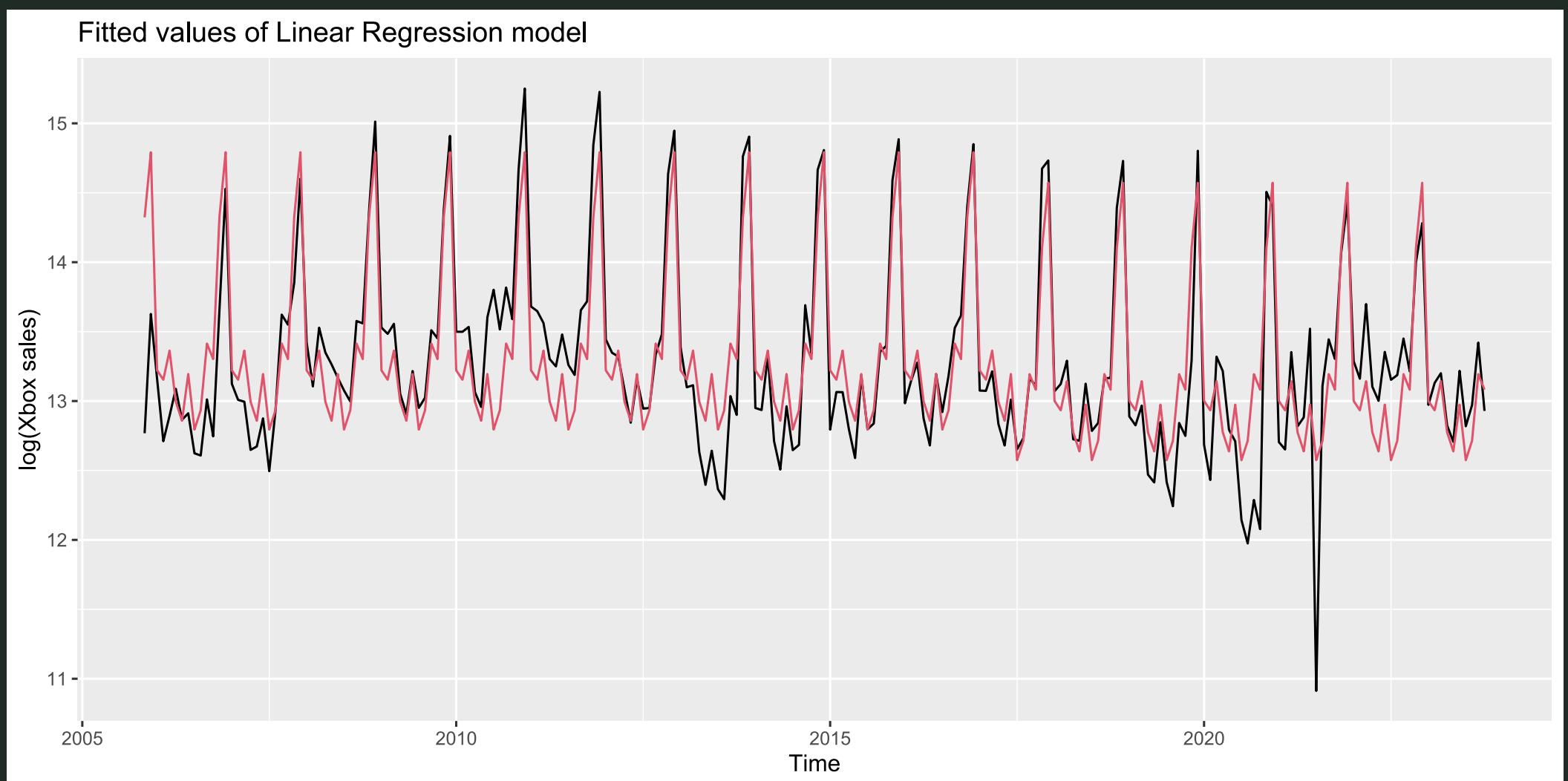
- Reduces Variance
- Highlights a minimum in July 2021

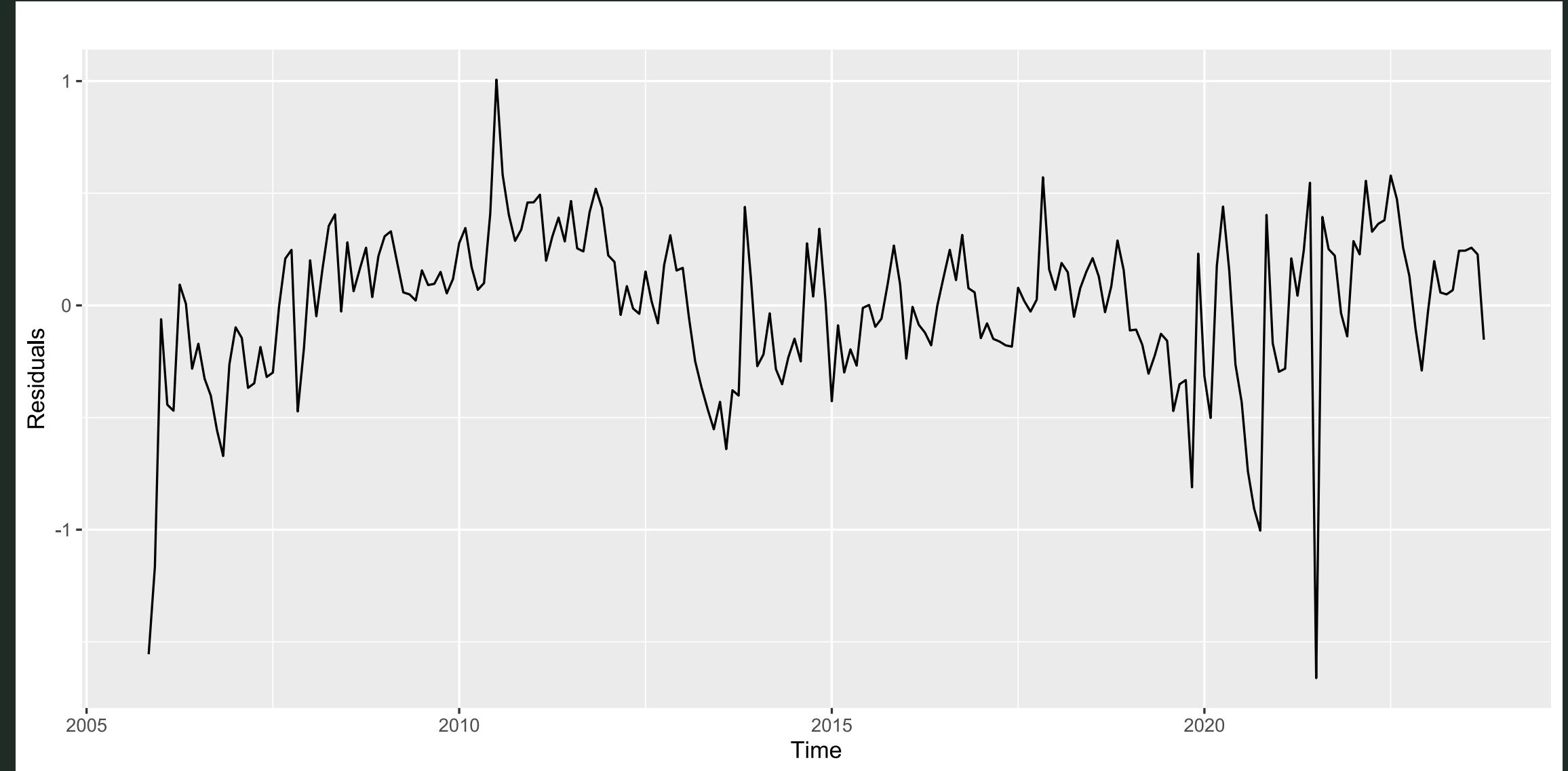
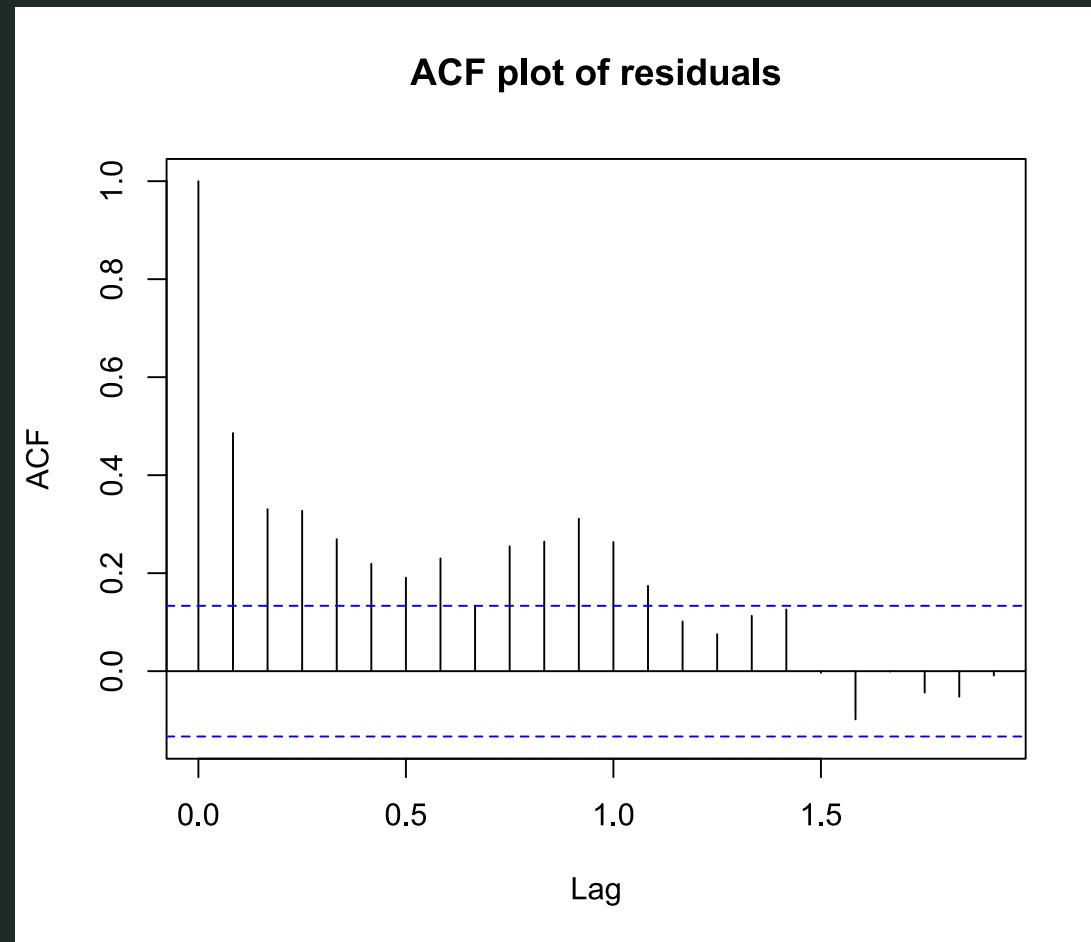
Linear regression

$Sales \sim Dummy + Season$

Coefficient	Estimate	$Pr(>t)$
Dummy	-0.22034	2.51 10 ⁻⁵ ***

$$R^2 = 0.7402$$



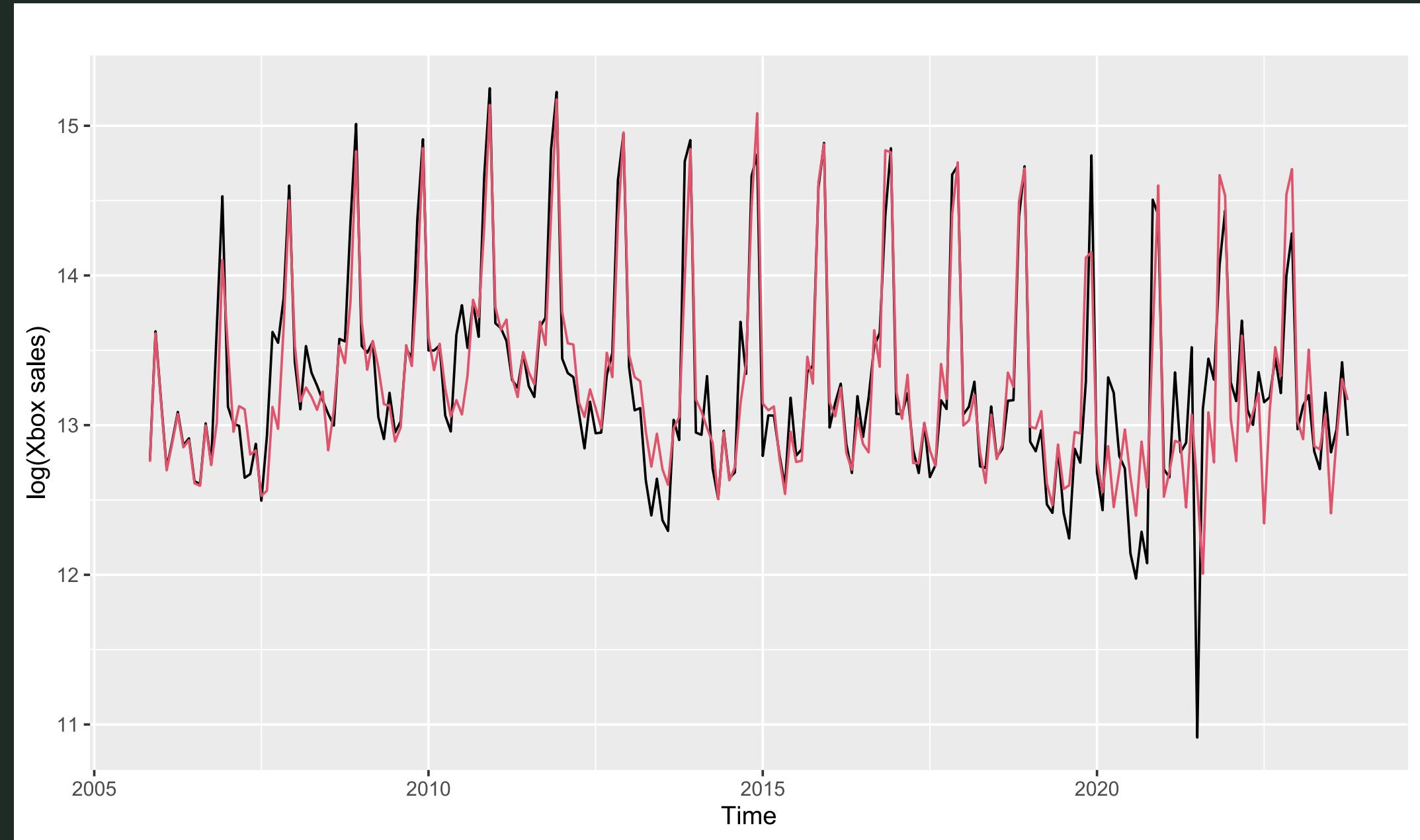


The ACF plot highlights the presence of autocorrelation in the residuals
Durbin-Watson test confirms it

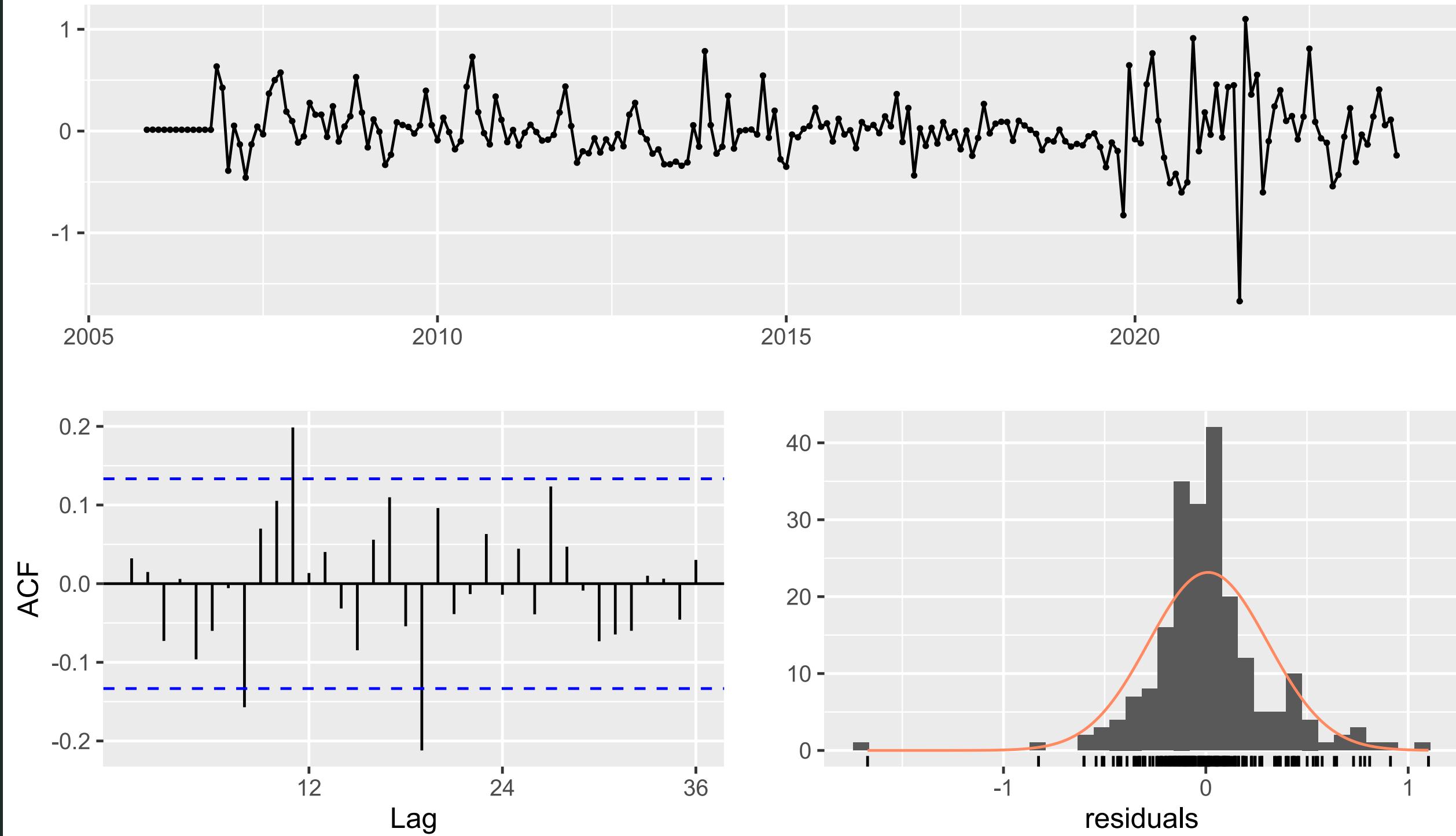
Regression with ARIMA(2,0,2)(0,1,1)[12] errors

xreg	Estimate
Dummy	-0.0435

- Auto-Arima model
- About the regressor:
- Negative relationship
 - Low magnitude



Residuals from Regression with ARIMA(2,0,2)(0,1,1)[12] errors



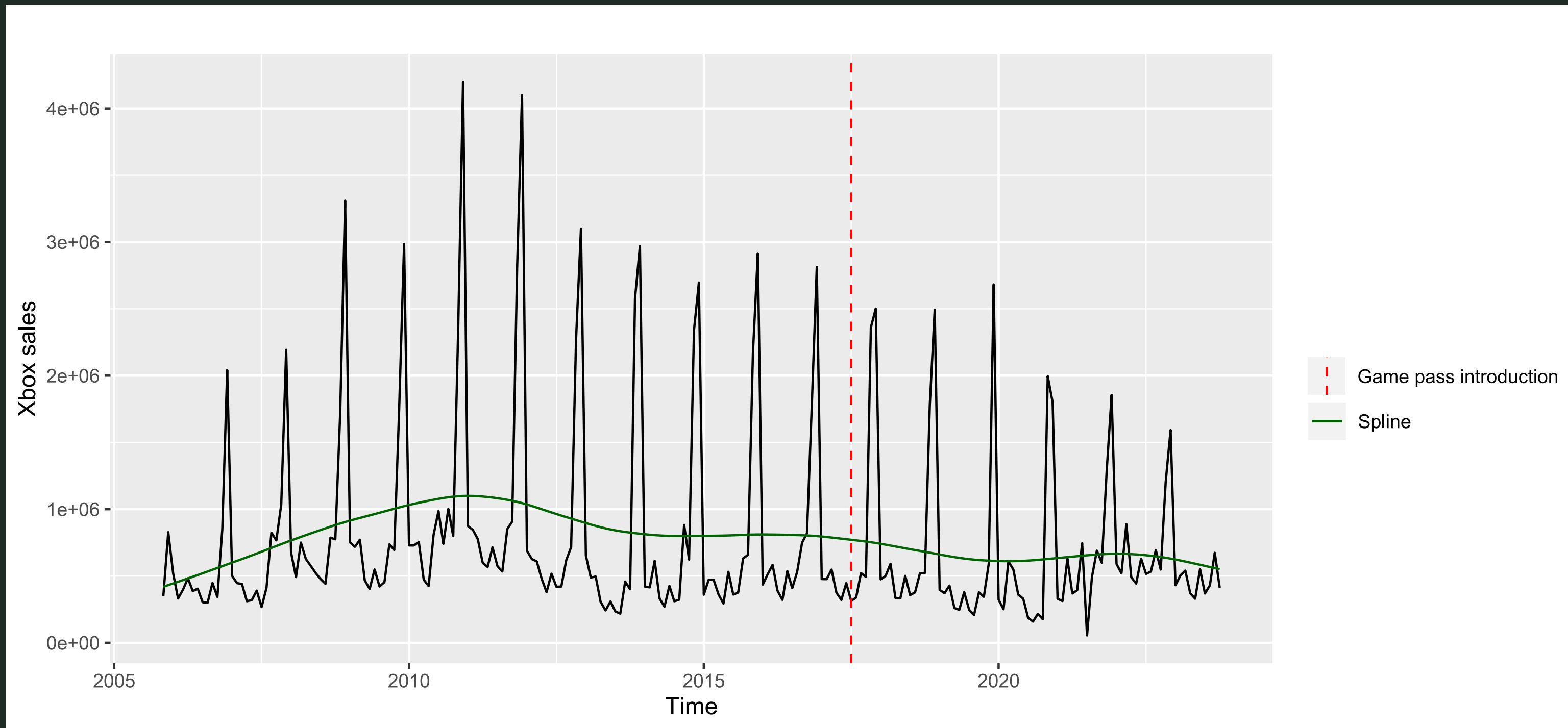
- The ACF plot suggests the presence of autocorrelation in the residuals
- Ljung-Box test confirms it
- The histogram of the residuals shows one negative outlier

ABOUT THE GAME PASS

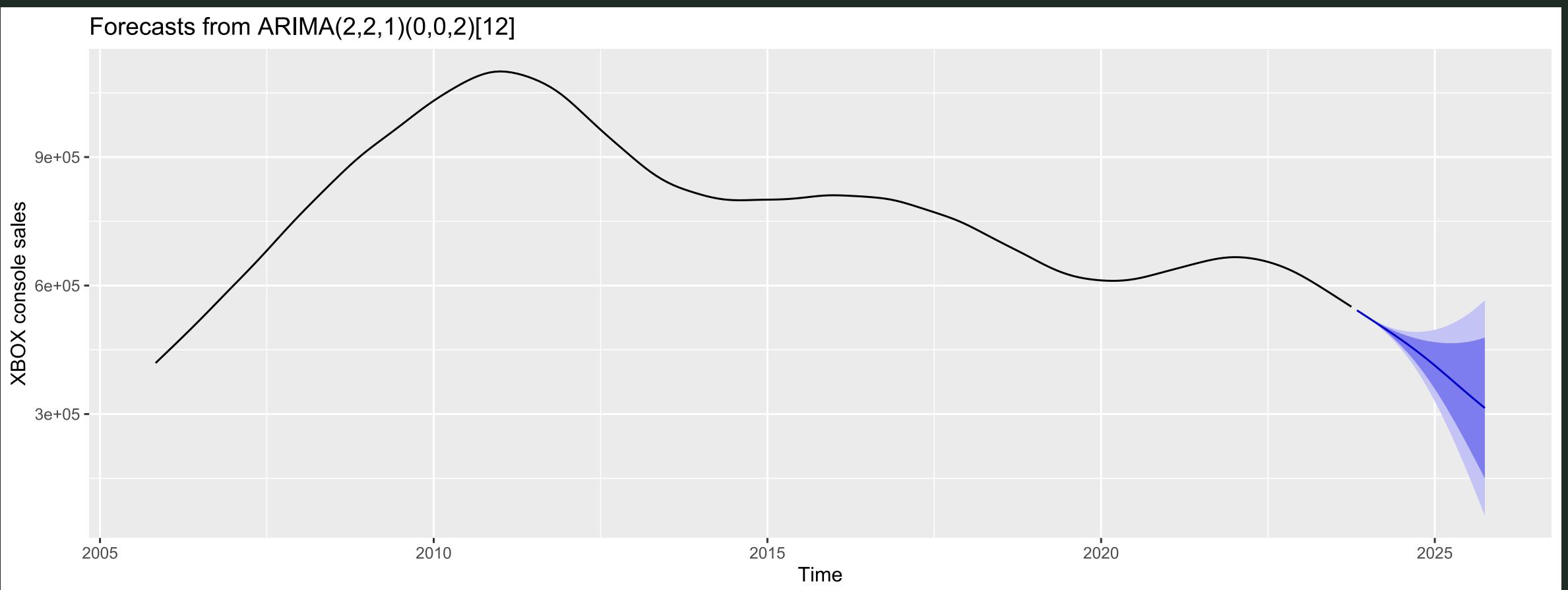
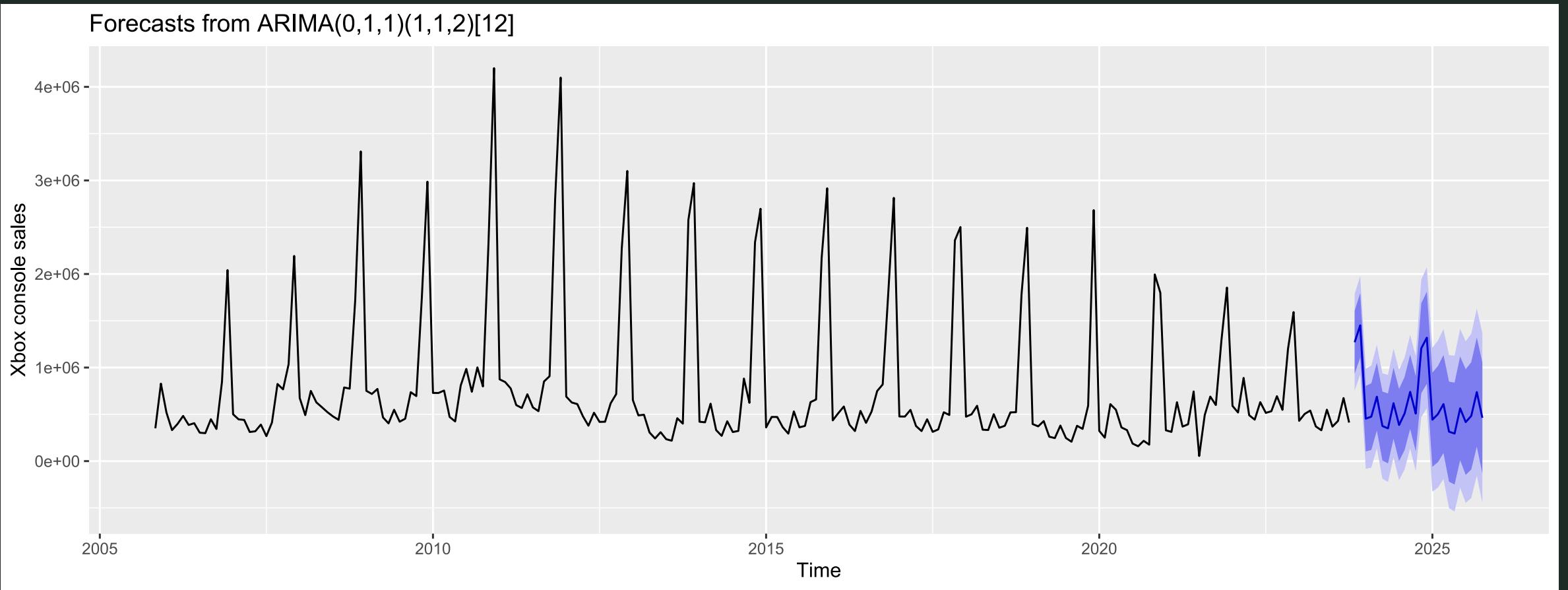
The analysis of the previously presented models gives some insights on the relationship between sales and the game pass introduction:

- It's weak
- It looks like the game pass negatively affects the sales. Probably, this happens because the models capture the decrease in sales of the last years through the dummy variable

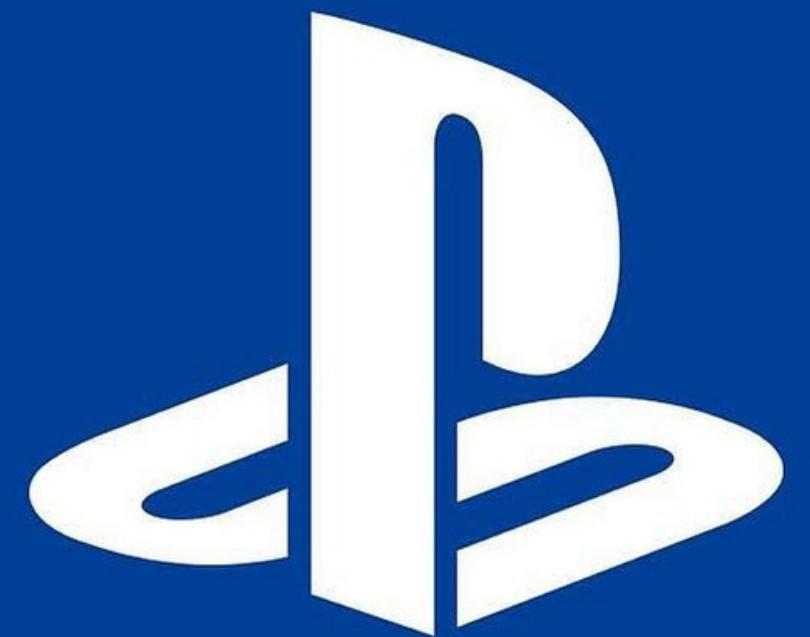
A smoothing spline is used to describe the mean behavior of the series



- Both are Auto-Arima models
- The model fitted on the spline shows autocorrelation in the residuals, while the one fitted on the original time series does not
- The forecasts confirm the winter peaks and highlight a slight decrease in sales with respect to the last three years

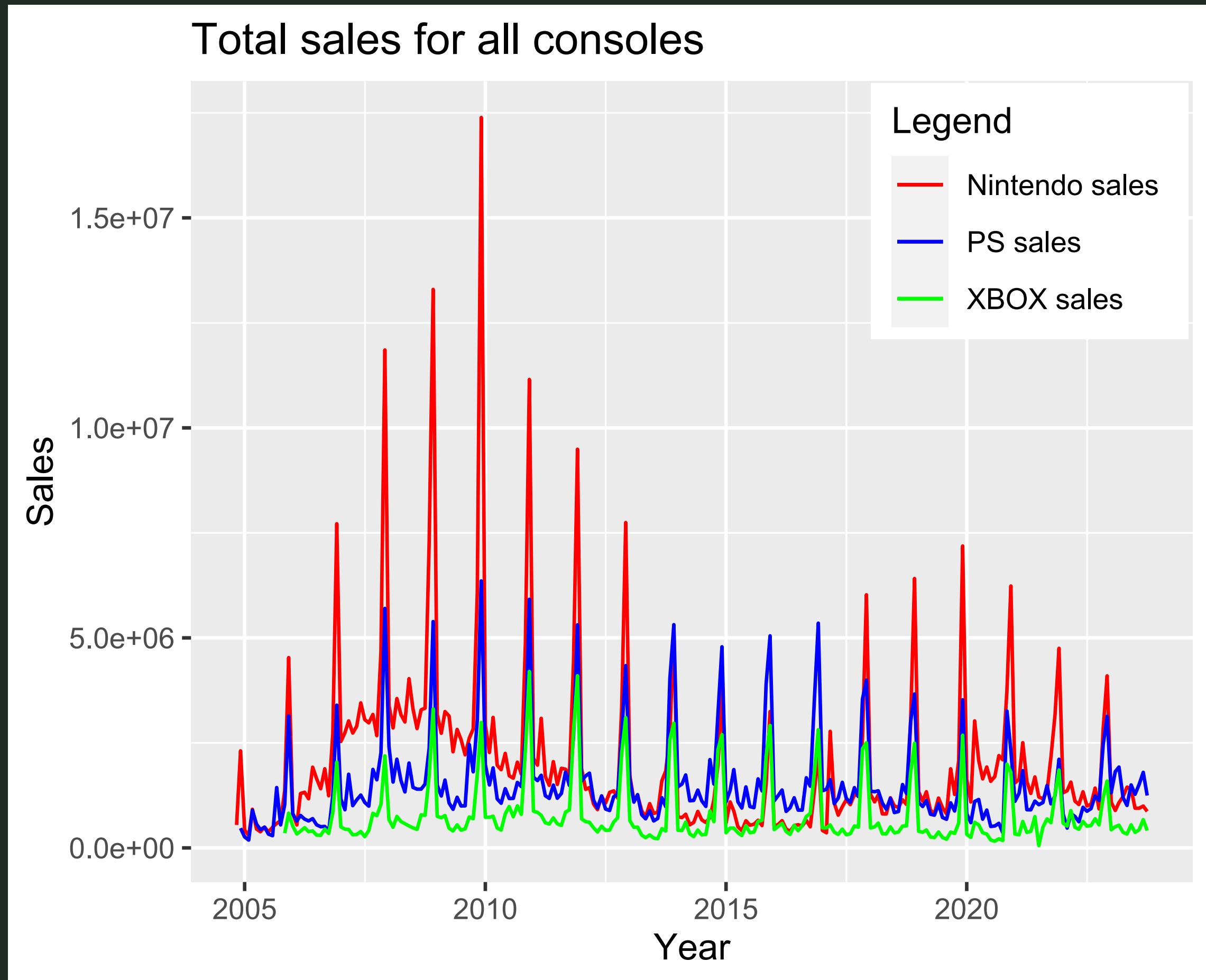


Consoles sale comparison



Overall, considering all the sales, **Nintendo** is the **best selling one**, followed by Sony and then Microsoft, except for a window between 2013 and 2016.

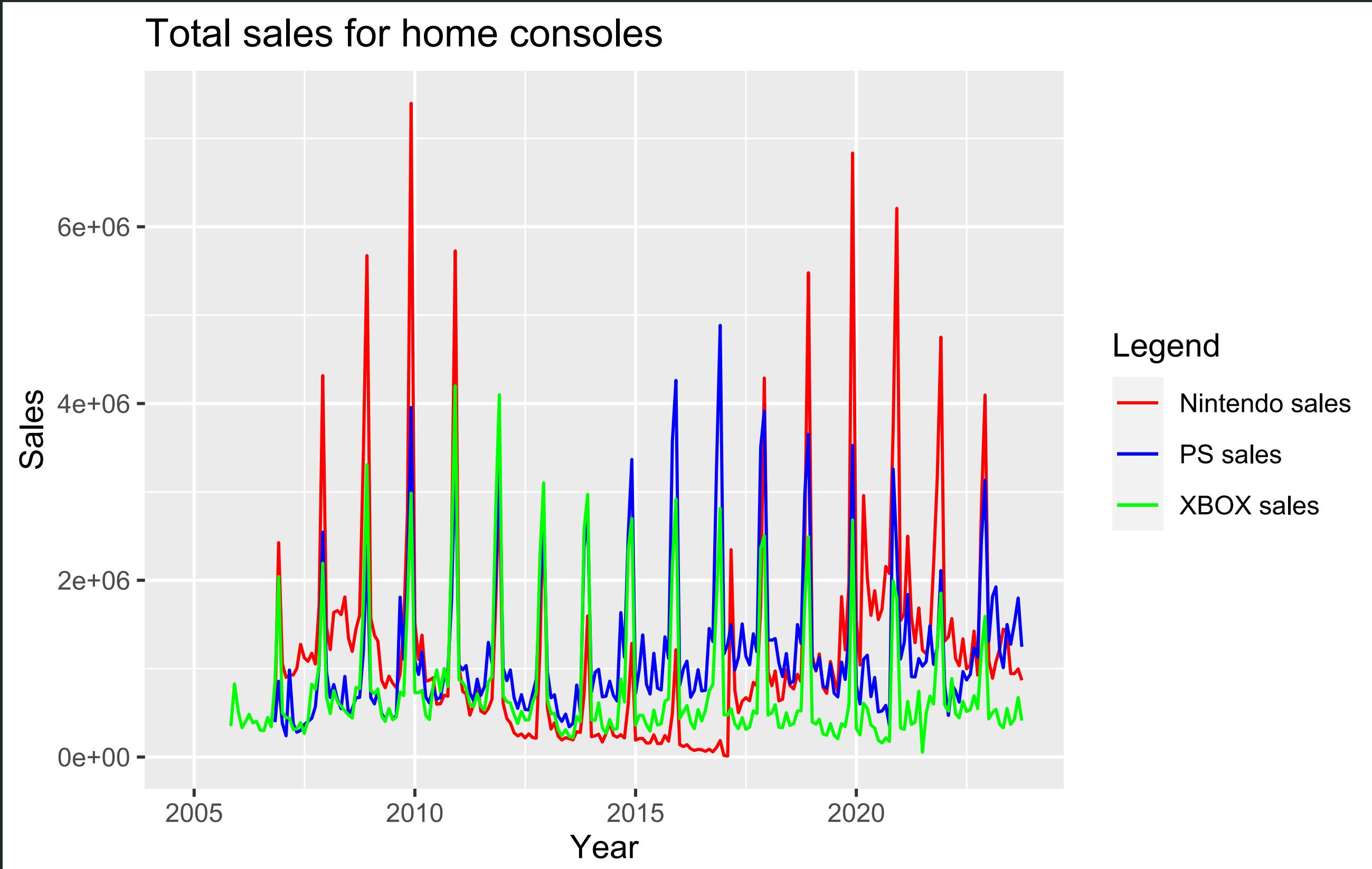
We want to **confront similar products** (home consoles): we need to eliminate all the portable consoles sales from the PS and Nintendo data.



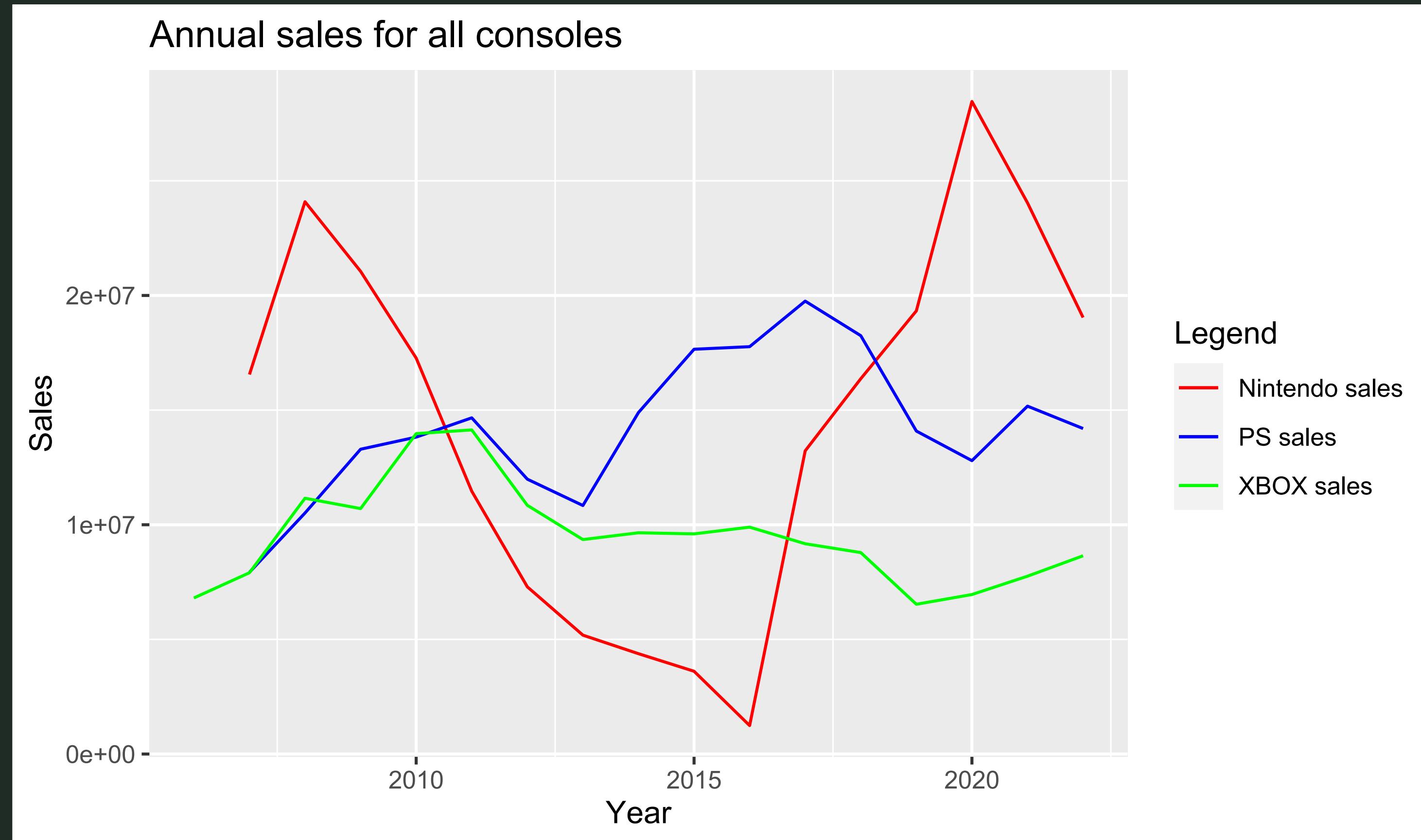
Goal: use a
Unbalanced
Competition and
Regime Change
Diachronic Model
(UCRCD).

The assumption is
they follow a **simple**
Bass model, but we
have data with strong
seasonality.

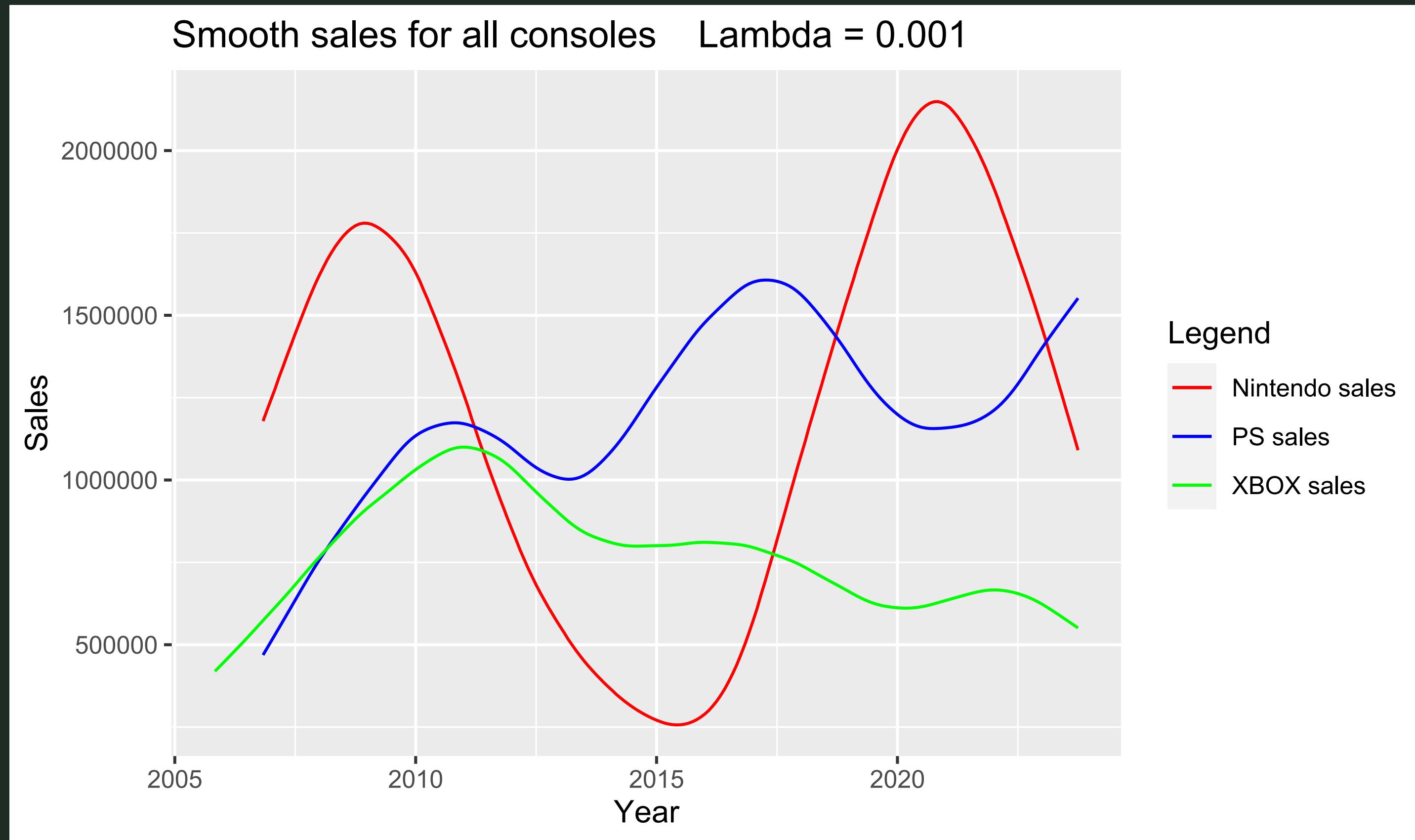
Three approaches:
1) Ignore seasonality



2) Use yearly data



3) Use data smoothed using splines





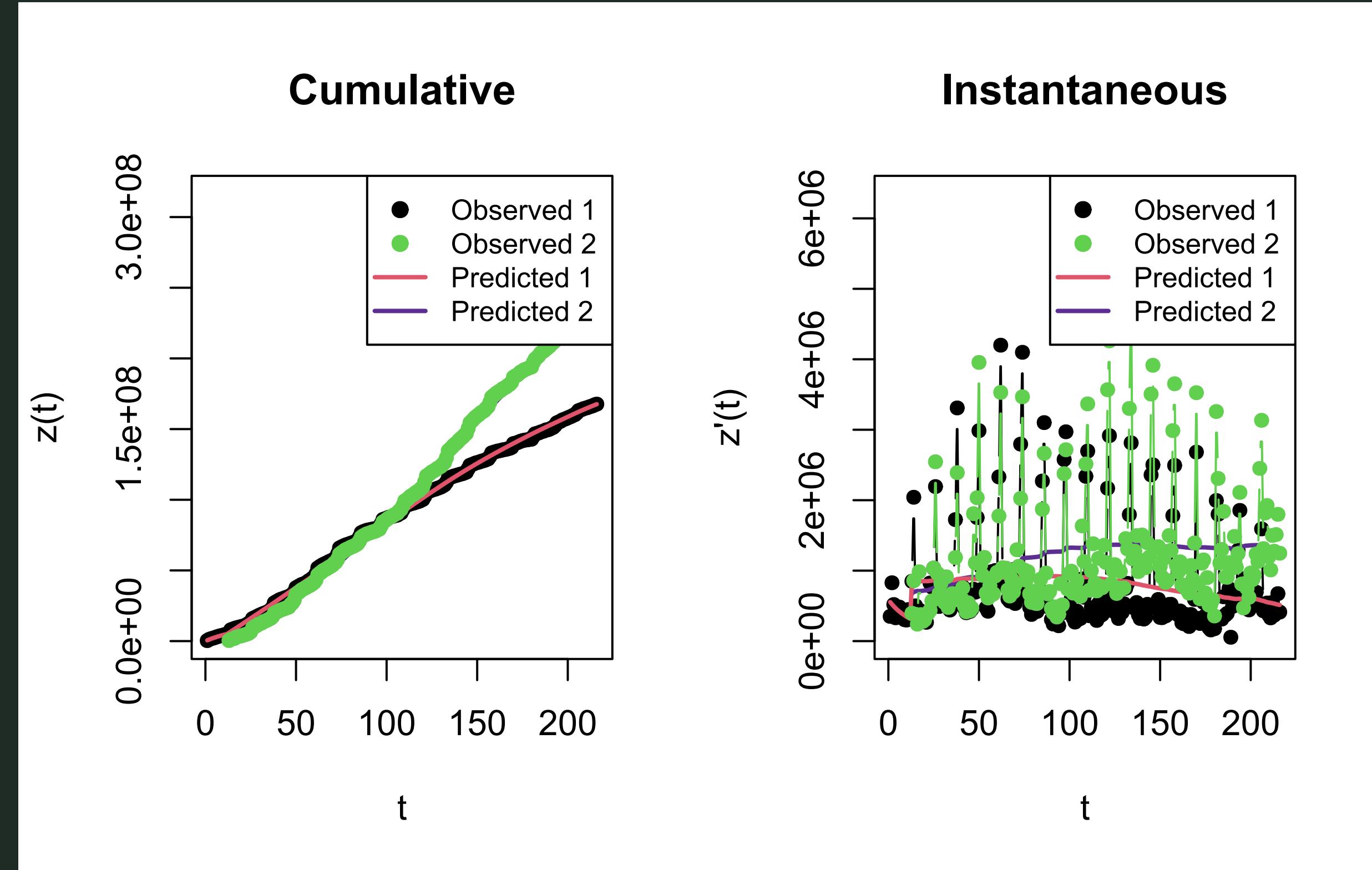
Ignoring seasonality: XBOX VS PS

In these graphs:

- 1 = XBOX
- 2 = PS

$$R^2 = 0.1160$$

As we can see the predictions are **pretty bad**, so ignoring seasonality does not seem like a good solution to handle these data.



Yearly data: XBOX VS PS

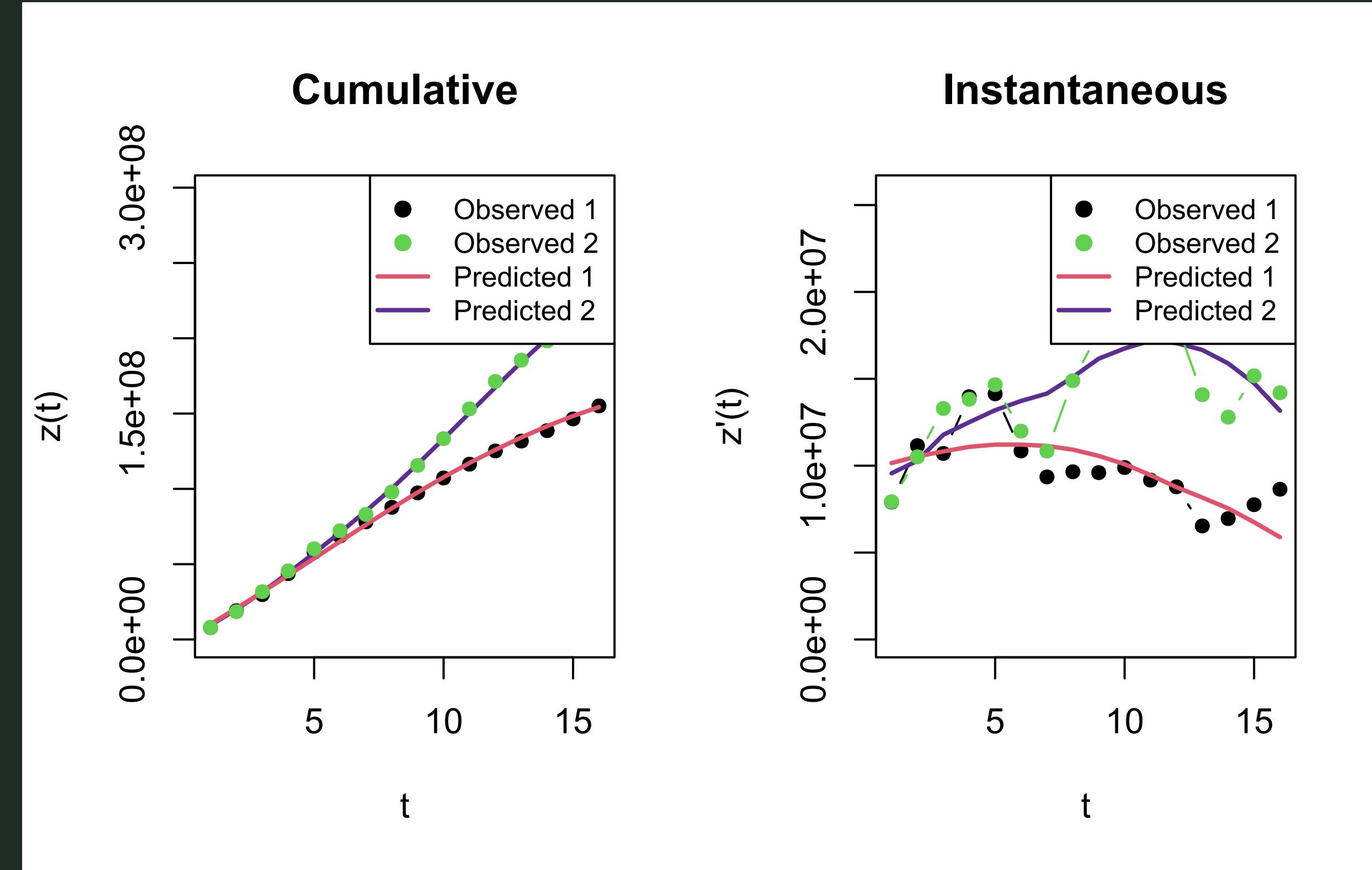
In these graphs:

- 1 = XBOX
- 2 = PS

$$R^2 = 0.7585$$

The **predictions improved** a lot!

For getting this result we ignored one year, 2006, for the XBOX, as it was not enough to build a pre-competition Bass model



- Only the innovation coefficients are significant with an alpha = 0.001;
- The market potential is significant, which is the actual market “slice” that the two companies are competing for;
- The **imitation coefficients are not significant**, both the within imitation and cross imitation ones. This suggests that the **actual competition is not present**, since only “new” customers influence both the products sales.

Coefficient	Estimate	<i>Pr(>t)</i>
mc	5.04 10^8	5.88 10^-11 ***
p1c	1.95 10^-2	1.95 10^-5 ***
p2	1.75 10^-2	1.06 10^-4 ***
q1c	2.50 10^-2	0.816
q2	0.35	6.45 10^-2
delta	3.19 10^-2	0.894
gamma	0.57	0.151

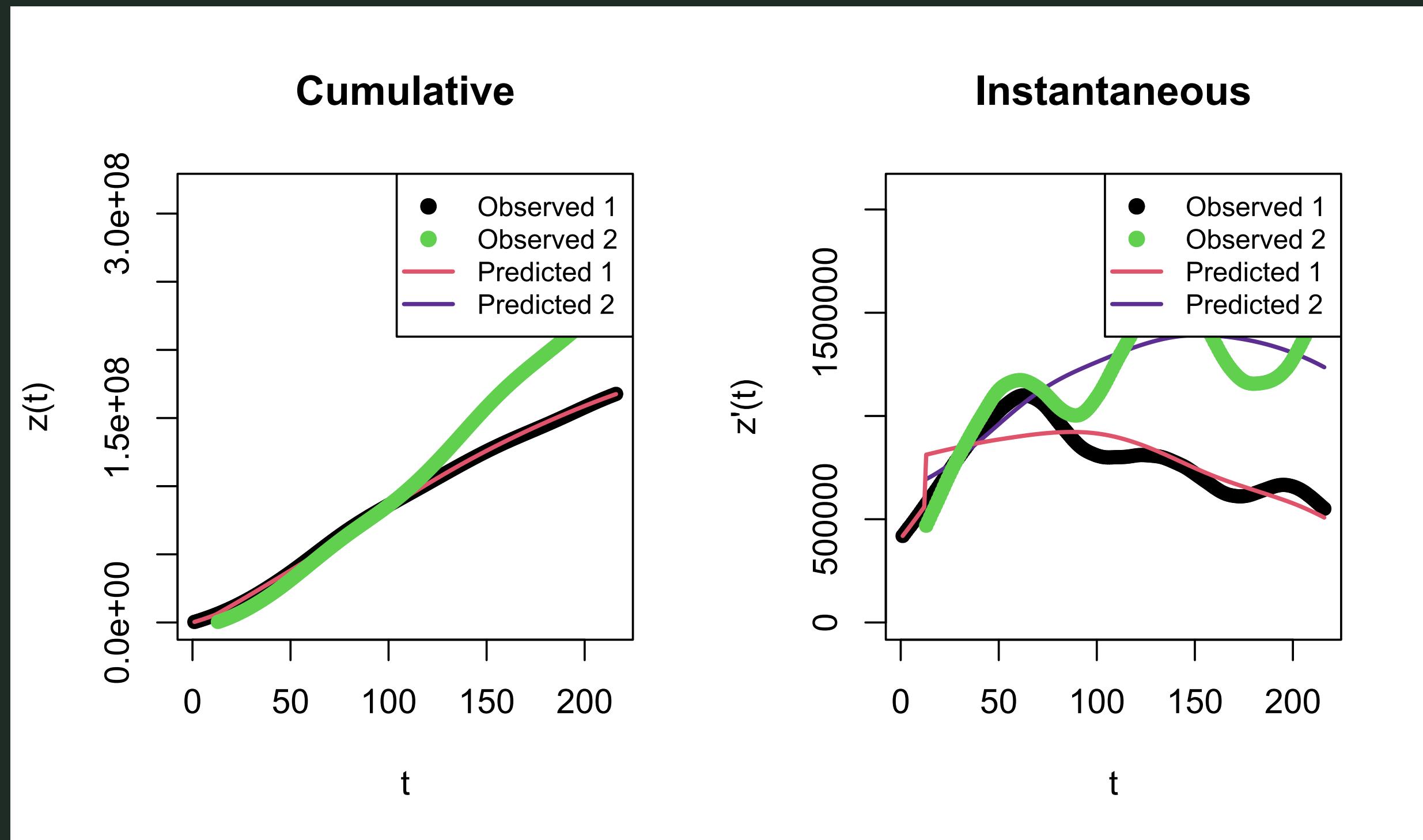
Smoothed data: XBOX VS PS

In these graphs:

- 1 = XBOX
- 2 = PS

$$R^2 = 0.8329$$

The fit improved once again.



- Except for gamma, all the **coefficients are significant** with an alpha of 0.05;
- q_{1c} is negative and $(q_2 - \text{gamma})$ is positive, so it looks like the PS is competing with the XBOX, while the latter is collaborating with the PS;
- It seems like the XBOX follows a bass model before the arrival of the PS in the market.

Coefficient	Estimate	$Pr(>t)$
ma	$6.25 \cdot 10^7$	< 0.001 ***
p1a	$6.61 \cdot 10^{-3}$	< 0.001 ***
q1a	$3.59 \cdot 10^{-2}$	< 0.001 ***
mc	$6.56 \cdot 10^8$	< 0.001 ***
p1c	$1.16 \cdot 10^{-3}$	< 0.001 ***
p2	$1.03 \cdot 10^{-3}$	< 0.001 ***
q1c	$-4.40 \cdot 10^{-3}$	< 0.05 *
q2	$8.16 \cdot 10^{-3}$	< 0.05 *
delta	$1.44 \cdot 10^{-2}$	< 0.001 ***
gamma	$4.26 \cdot 10^{-3}$	0.57



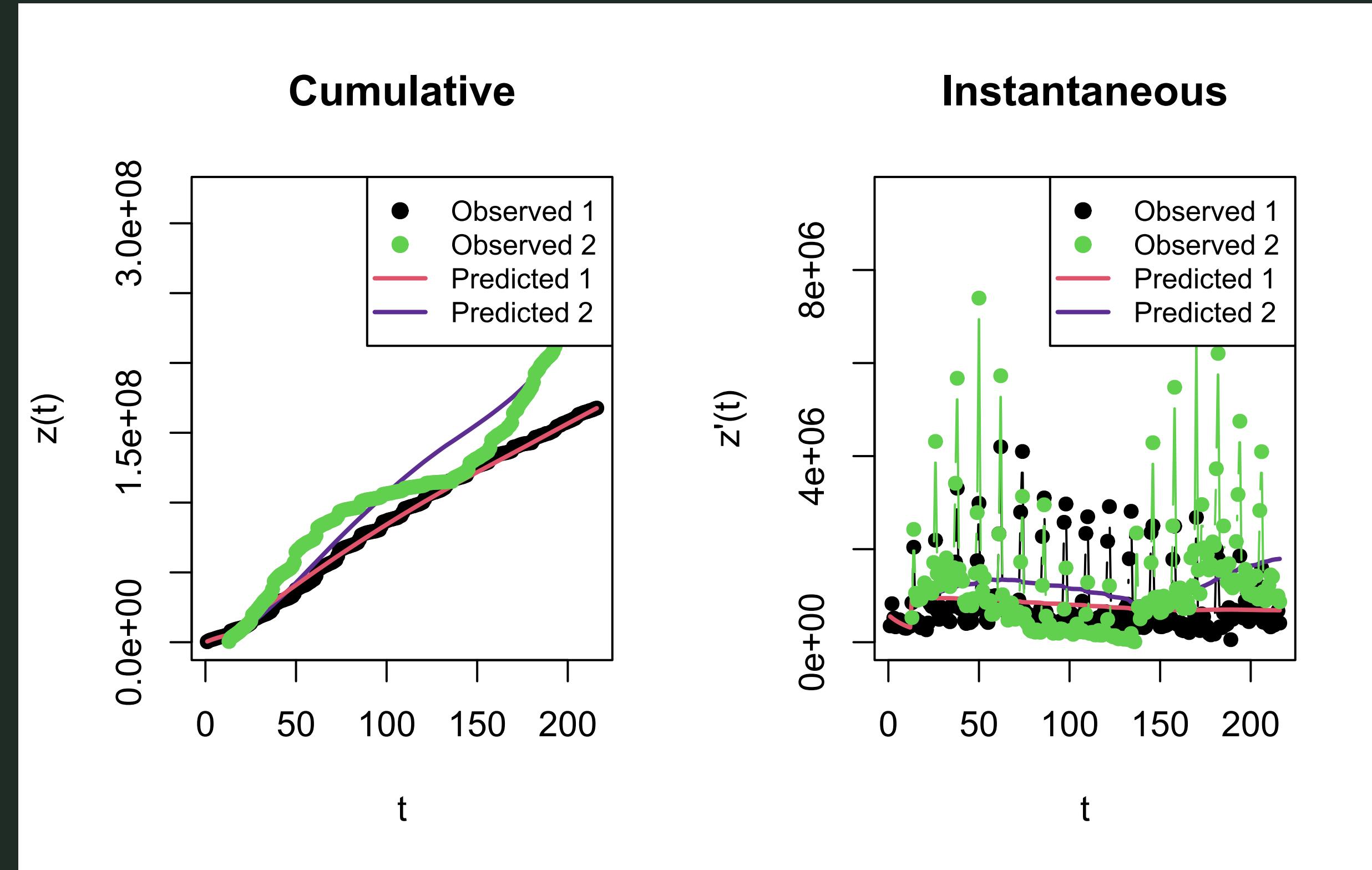
Ignoring seasonality

In these graphs:

- 1 = XBOX
- 2 = Nintendo

$$R^2 = 0.0784$$

Just like we could expect from the previous result, the results here are **not good at all**.



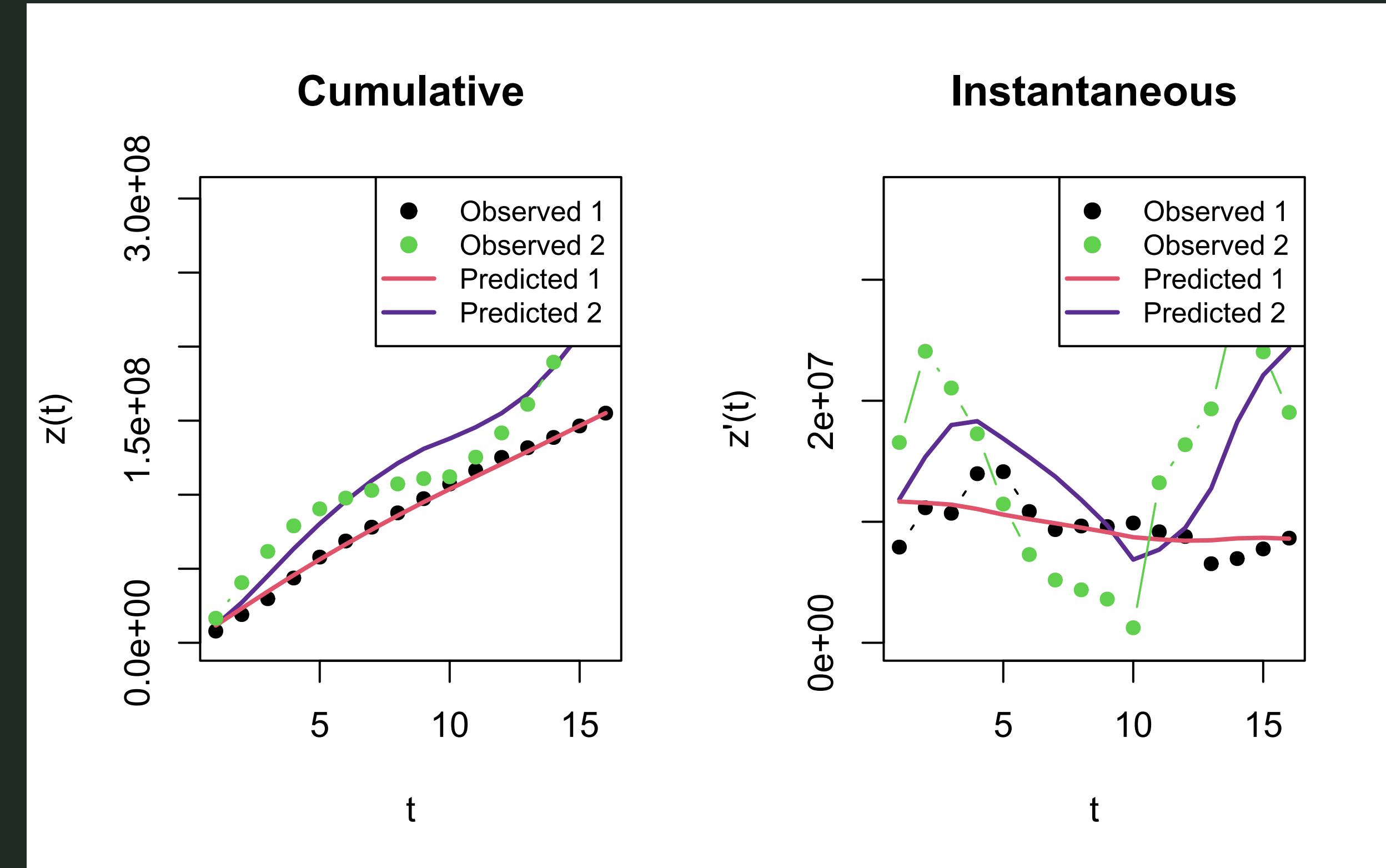
Yearly data

In these graphs:

- 1 = XBOX
- 2 = Nintendo

$$R^2 = 0.4520$$

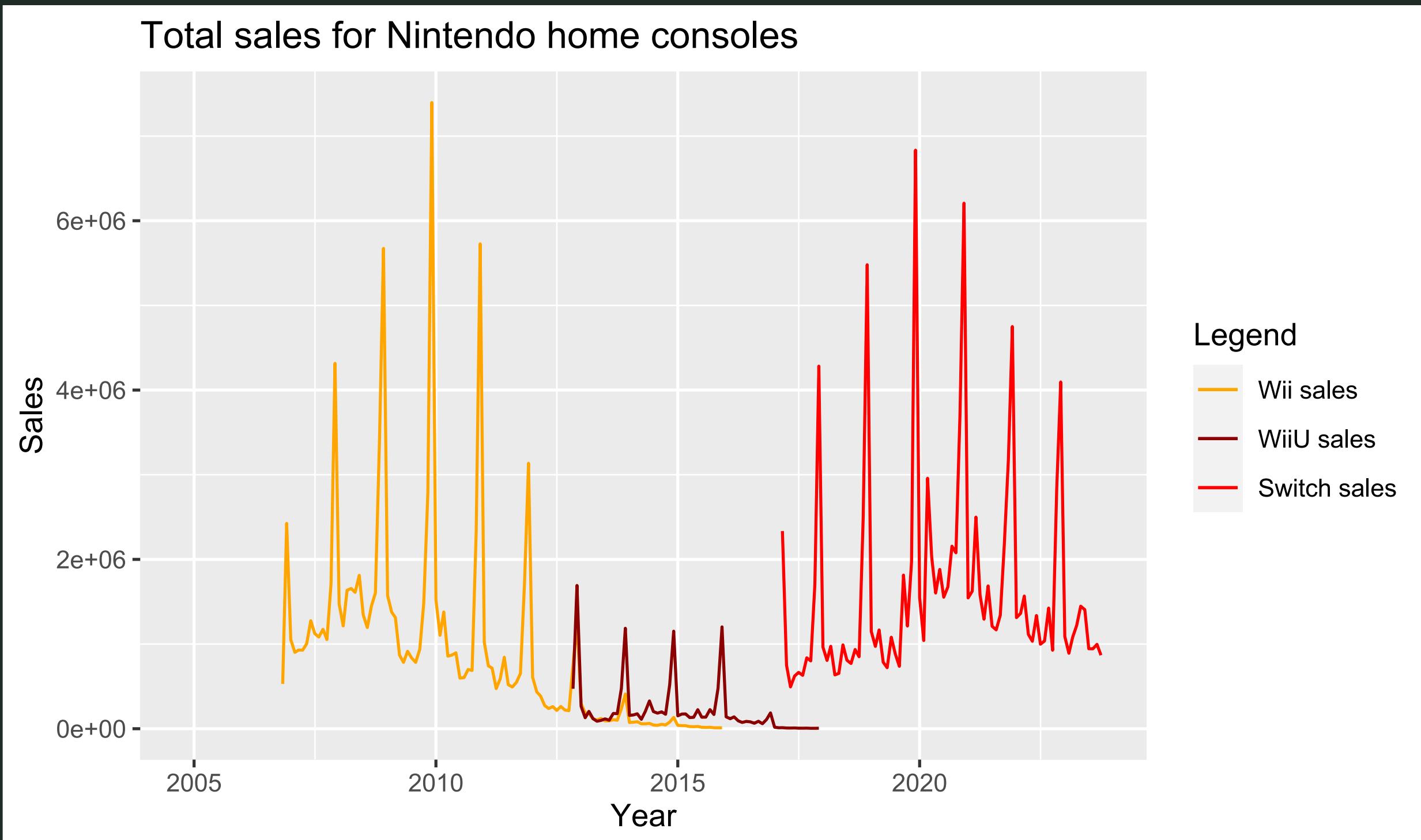
Problem: the
Nintendo series
clearly **does not**
follow a Bass
model.



What is going on?

In November 2012
the **Wii U console**
was released.

As we can see from
the graph, it was a
big **flop** for the
Nintendo.

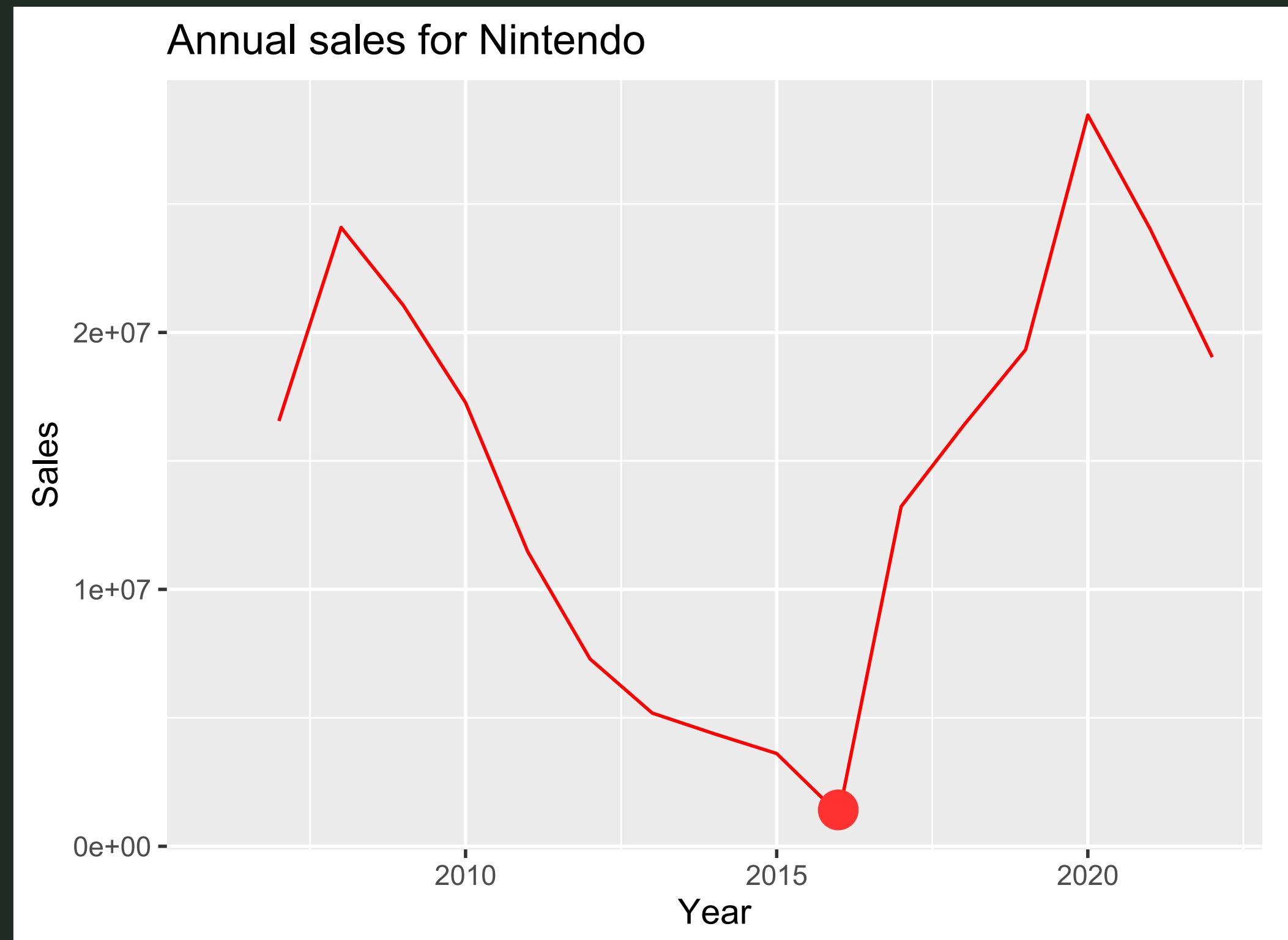


The series looks like two Bass models concatenated

- > **split the series** into two:
 - Up to the Wii U failure
 - After the Switch release

Another problem: little data for both the series using the yearly sales

- > use smoothing splines on monthly data.



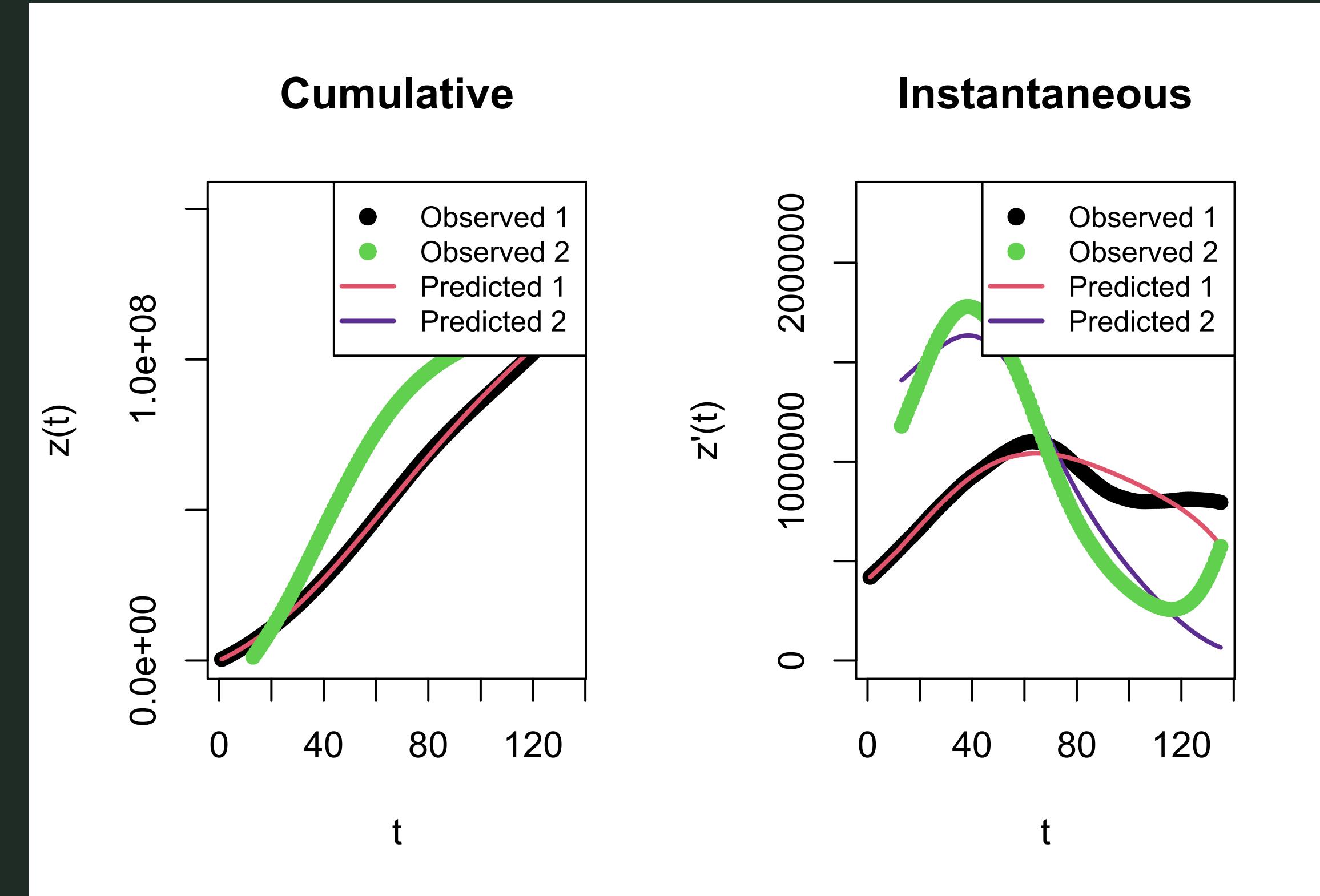
Smoothed data: from 2006 to end of 2016

In these graphs:

- 1 = XBOX
- 2 = Nintendo

$$R^2 = 0.9282$$

Notice that the discrepancy in the last part of the instantaneous Nintendo sales is most likely due to the smoothing approximation.



- Except for q_{1c} , all the **coefficients are significant**;
- q_{1c} is positive and $(q_2 - \gamma)$ is negative, so it looks like the XBOX is competing with the Nintendo, while the latter is collaborating with the XBOX;
- It seems like the XBOX follows a Bass model before the arrival of the Nintendo in the market (actually, same results of the PS competition model, but it was expected).

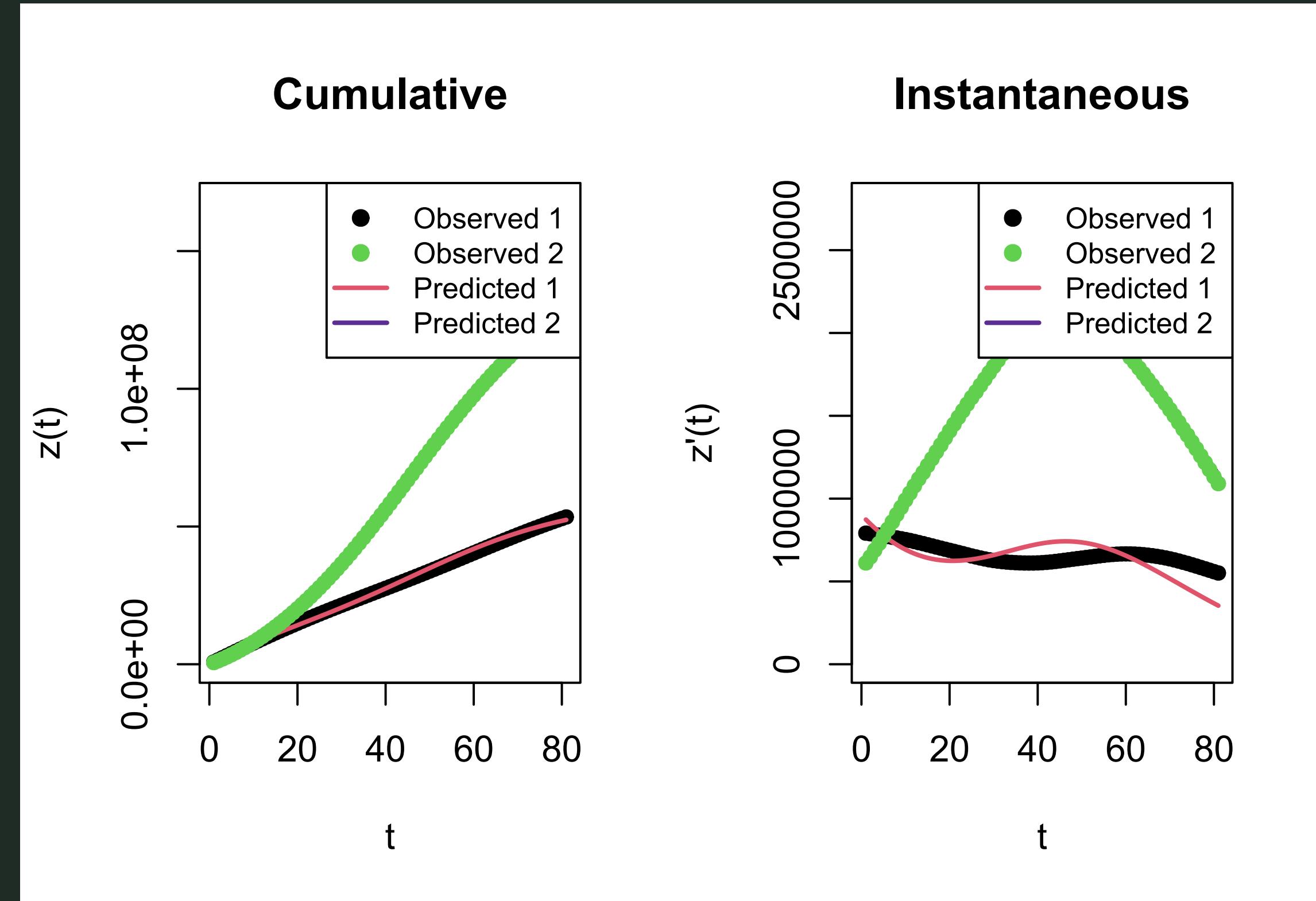
Coefficient	Estimate	$Pr(>t)$
ma	$6.25 \cdot 10^7$	< 0.001 ***
p1a	$6.61 \cdot 10^{-3}$	< 0.001 ***
q1a	$3.59 \cdot 10^{-2}$	< 0.001 ***
mc	$2.71 \cdot 10^8$	< 0.001 ***
p1c	$1.45 \cdot 10^{-3}$	< 0.001 ***
p2	$6.56 \cdot 10^{-3}$	< 0.001 ***
q1c	$7.69 \cdot 10^{-4}$	0.876
q2	$4.68 \cdot 10^{-2}$	< 0.001 ***
delta	$2.98 \cdot 10^{-2}$	< 0.05 *
gamma	$1.07 \cdot 10^{-1}$	< 0.001 ***

Smoothed data: from 2017 to end of 10/2023

In these graphs:

- 1 = XBOX
- 2 = Nintendo

$$R^2 = 0.9851$$



- With an alpha of 0.001, all the **coefficients are significant** except the gamma;
- Both q1c and (q2 - gamma) are positive, so it **seems like the two companies are collaborating**, which is weird.

Coefficient	Estimate	<i>Pr(>t)</i>
mc	2.21 10^8	< 0.001 ***
p1c	4.07 10^-3	< 0.001 ***
p2	2.53 10^-3	< 0.001 ***
q1c	2.96 10^-2	< 0.001 ***
q2	3.27 10^-2	< 0.001 ***
delta	-8.03 10^-2	< 0.001 ***
gamma	3.49 10^-4	0.97



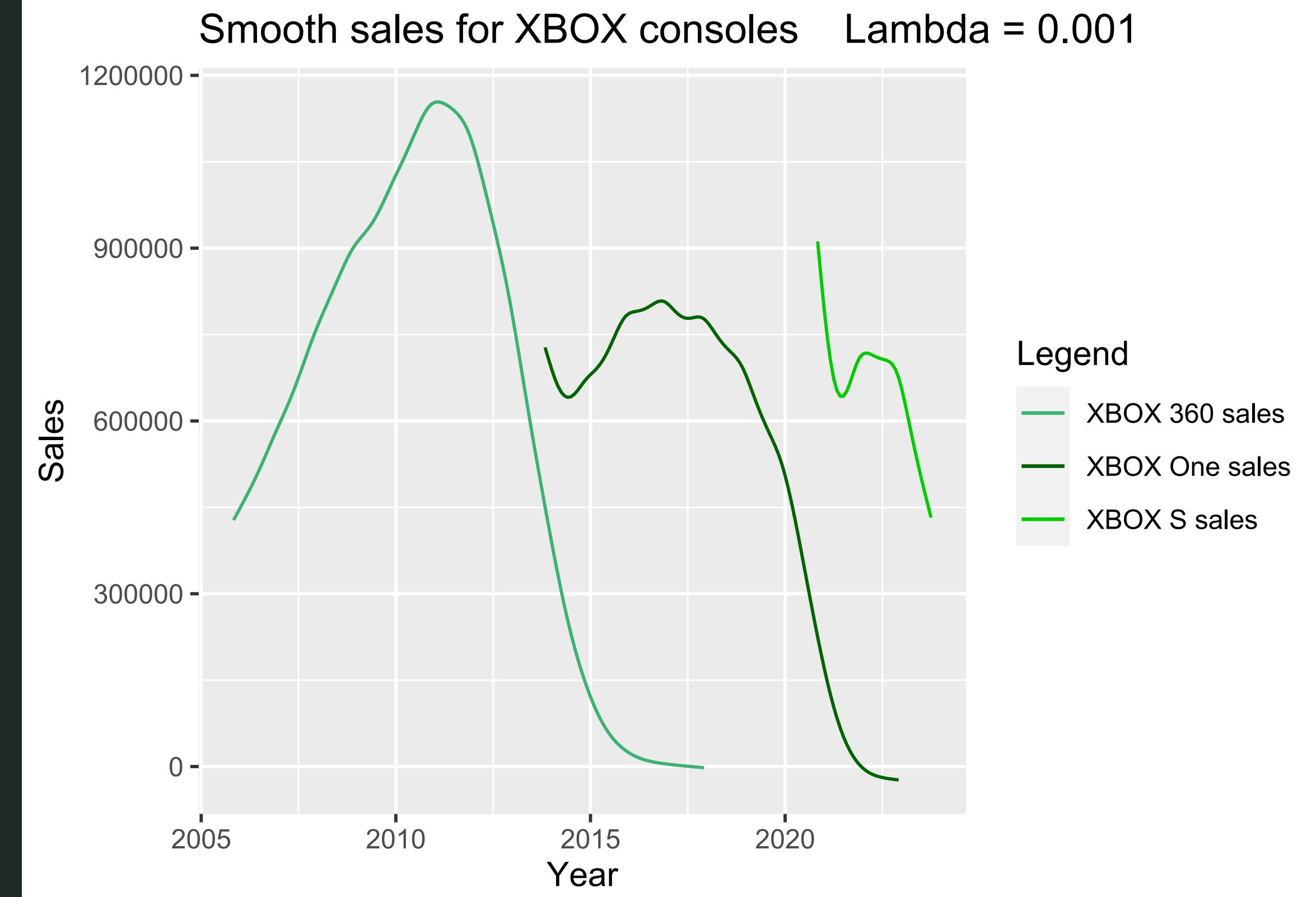
XBOX



XBOX

From our previous analysis we can avoid the approach which ignores seasonality.

As far as it concerns the yearly data, we have again the problem of too little data points, so we directly opt for the **smoothing splines analysis**.

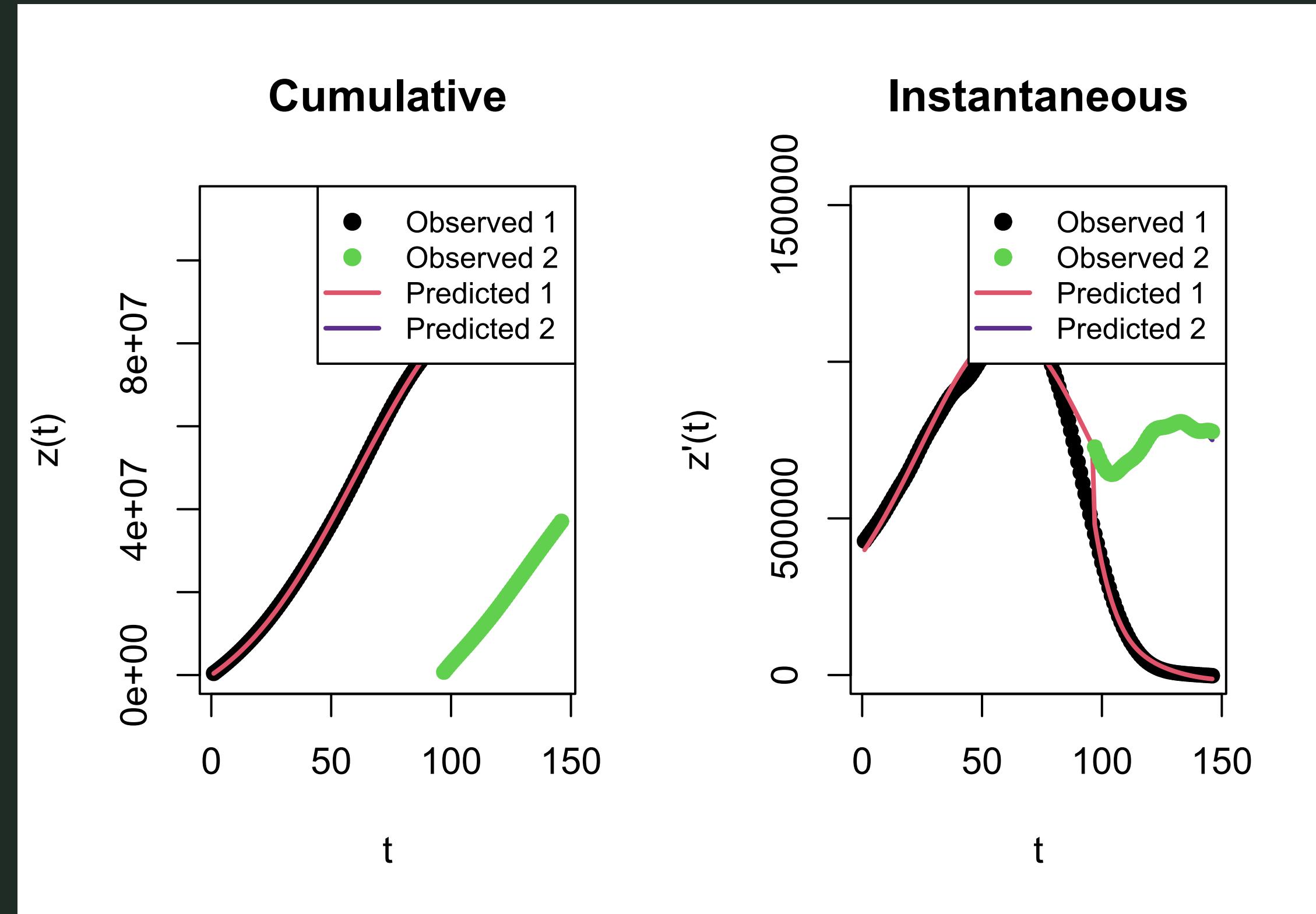


Smoothed data: XBOX 360 vs XBOX One

In this graphs:

- 1 = XBOX 360
- 2 = XBOX One

$$R^2 = 0.9817$$



- All the coefficients are significant with an alpha of 0.001;
- q_{1c} and $(q_2 - \gamma)$ are negative, so it looks like a **full competition** model.

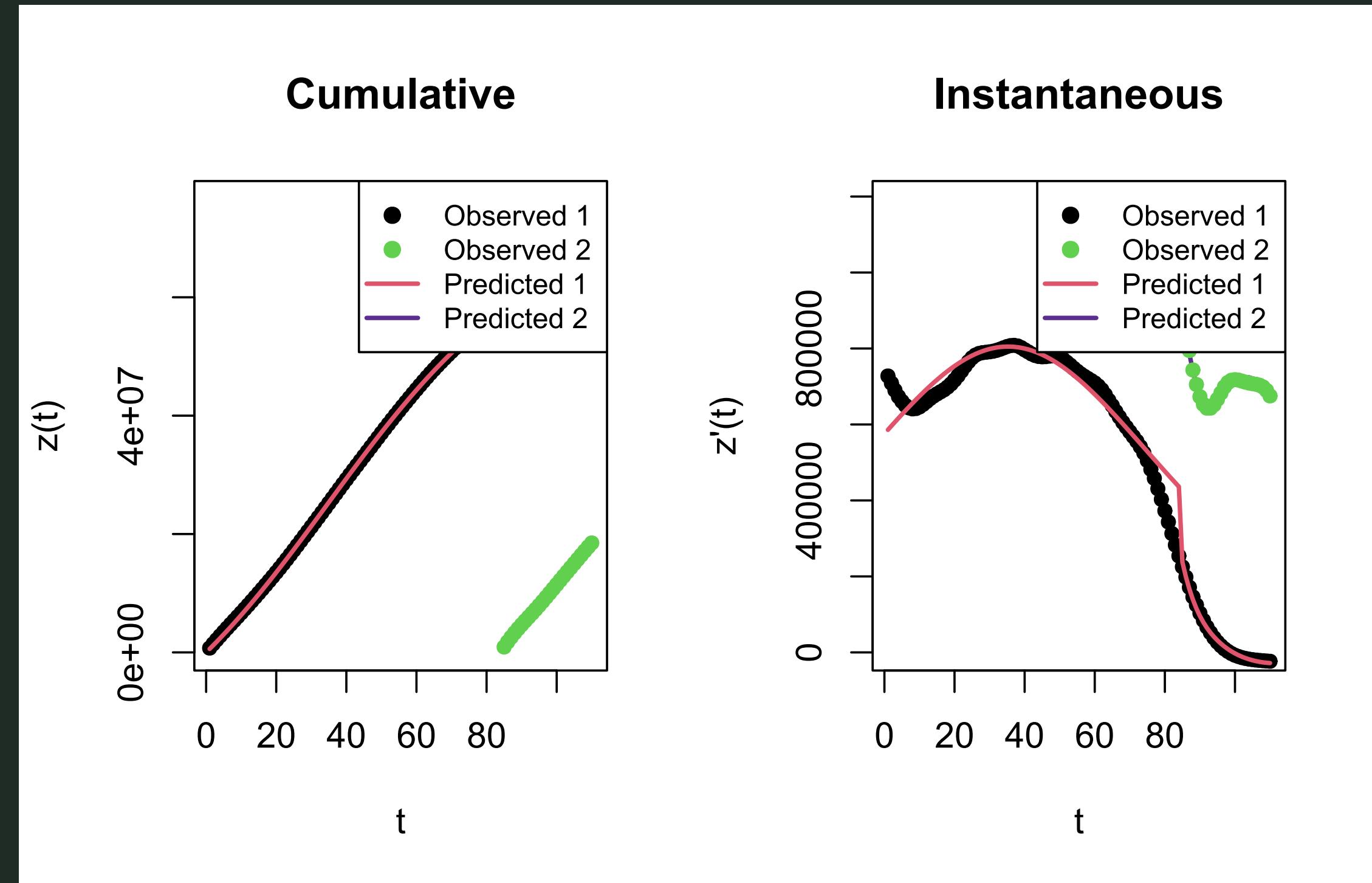
Coefficient	Estimate	$Pr(>t)$
ma	1.07 10 ⁸	< 0.001 ***
p1a	3.67 10 ⁻³	< 0.001 ***
q1a	3.30 10 ⁻²	< 0.001 ***
mc	1.49 10 ⁸	< 0.001 ***
p1c	1.10 10 ⁻¹	< 0.001 ***
p2	1.02 10 ⁻¹	< 0.001 ***
q1c	-9.02 10 ⁻³	< 0.001 ***
q2	9.49 10 ⁻²	< 0.001 ***
delta	-1.78 10 ⁻¹	< 0.001 ***
gamma	2.62 10 ⁻¹	< 0.001 ***

Smoothed data: XBOX One VS XBOX S

In this graphs:

- 1 = XBOX One
- 2 = XBOX X|S

$$R^2 = 0.9810$$



- All the coefficients are significant with an alpha of 0.001;
- q_{1c} and $(q_2 - \gamma)$ are negative, so it looks like a **full competition** model.

Coefficient	Estimate	$Pr(>t)$
ma	7.28 10 ⁷	< 0.001 ***
p1a	7.97 10 ⁻³	< 0.001 ***
q1a	2.58 10 ⁻²	< 0.001 ***
mc	8.67 10 ⁷	< 0.001 ***
p1c	2.08 10 ⁻¹	< 0.001 ***
p2	1.13	< 0.001 ***
q1c	-3.98 10 ⁻²	< 0.001 ***
q2	2.41 10 ⁻¹	< 0.001 ***
delta	-2.63 10 ⁻¹	< 0.001 ***
gamma	1.91	< 0.001 ***

Conclusions and future works

About the Game Pass...



- All the models have shown an **increasing trend**
 - This is coherent with the last informations from Microsoft :)
- **Holtz-Winters (additive) seasonality model** has given more specific predictions

About the Xbox console sales ...



- The available data show a rather **weak** relationship between the sales and the introduction of the game pass
- Forecasts of Microsoft console sales show a **non-increasing** behavior

About the competition...



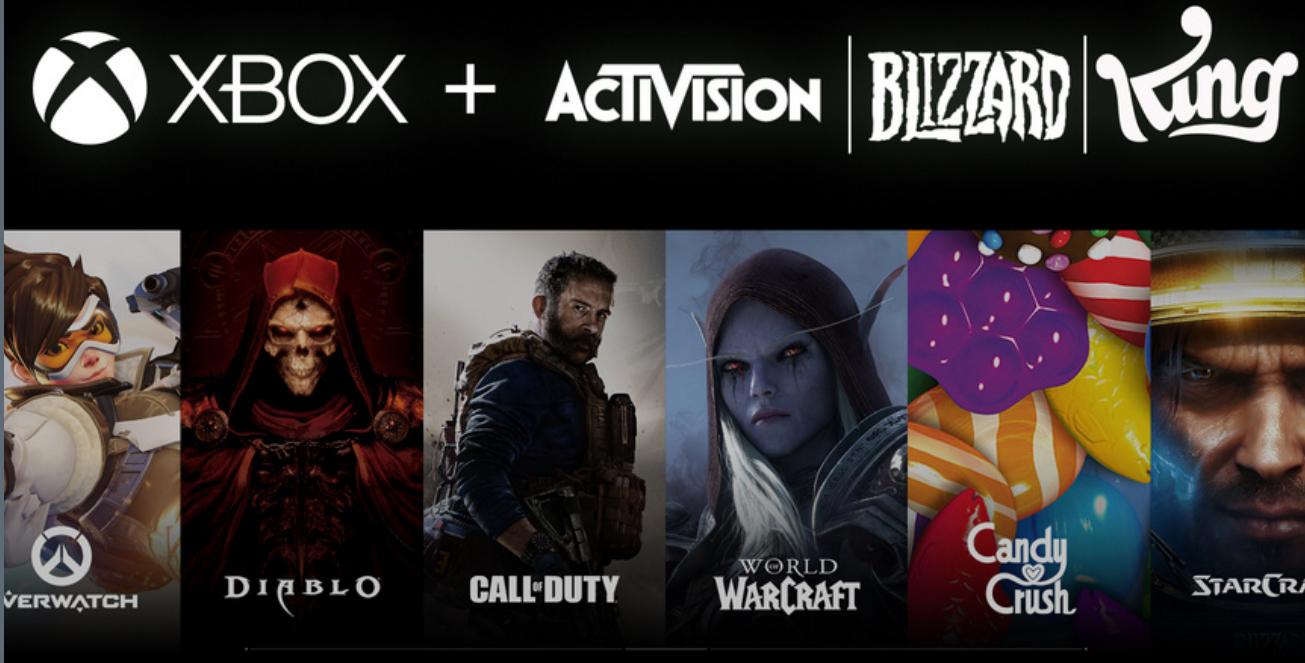
- The **UCRCD** is a very **simplistic** model, so the type of competition results should be taken with a grain of salt (for example, it's weird that some companies seem to cooperate with each other)
- Nonetheless, the **in-company** competition results have the simplest context and give really **good results** that make sense

Recent events to be considered

Microsoft has bought Activision Blizzard

Jim Ryan, CEO of Sony, resigned

Nintendo is rumored to launch its new generation console in 2024



THE END

Thank you for your attention!

GAME
OVER