



# **FINAL PRESENTATION**

## **ARC\_DIRECT**

**Shu-Ping Chen  
Jinping Guo  
Jing Lin  
Shih-Siang Lin  
Po-Han Yen**

# MEET THE TEAM



Jing  
Lin



Shu-Ping  
Chen



Shih-Siang  
Lin

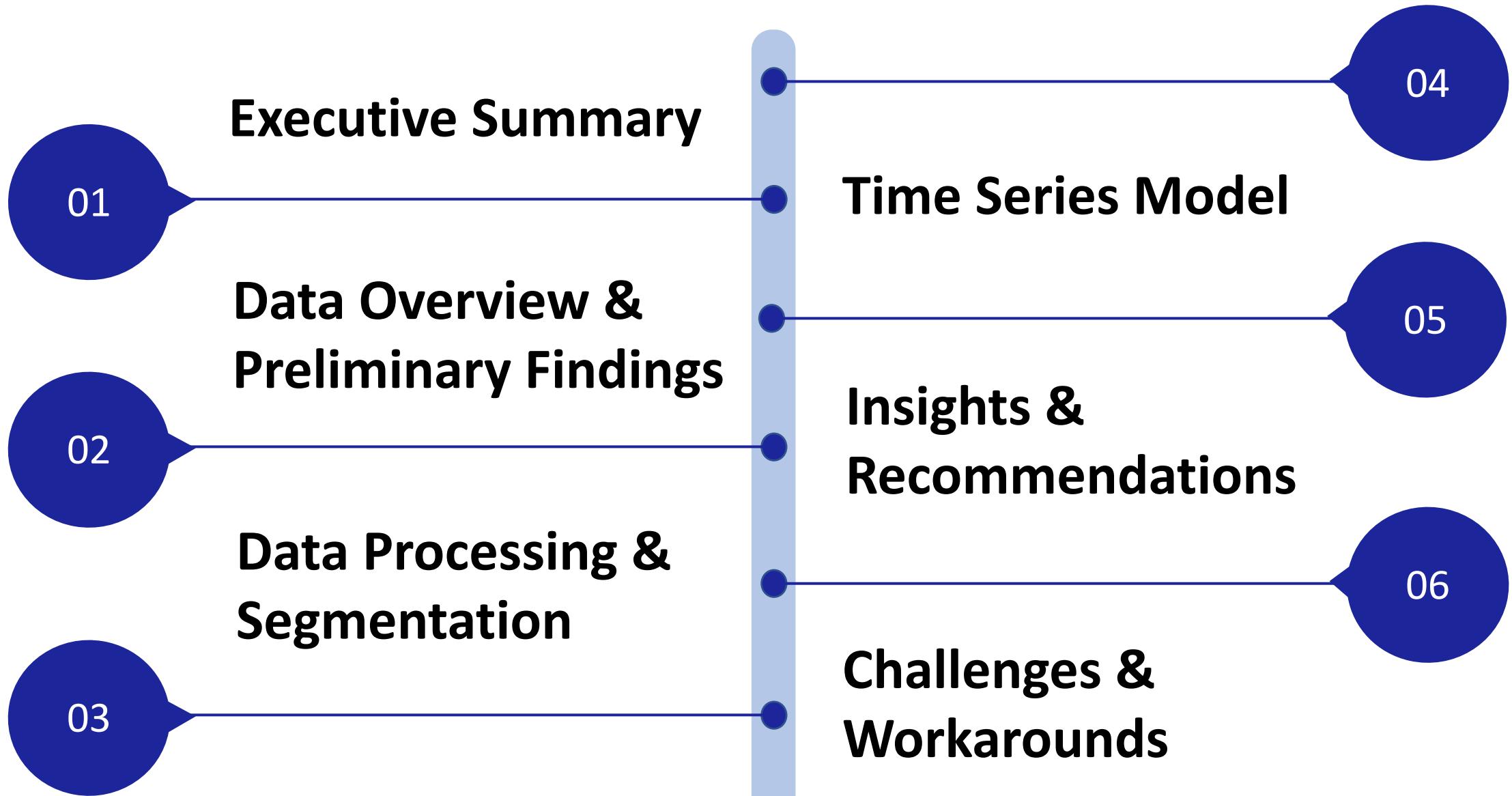


Po-Han  
Yen



Jinping  
Guo

# AGENDA





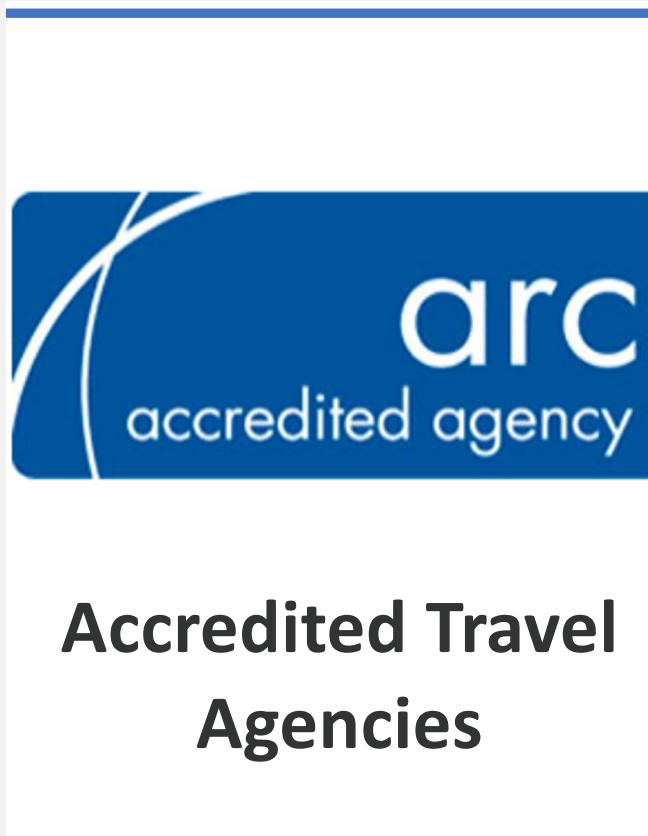
1

# EXECUTIVE SUMMARY

# **BACKGROUND of ARC**



**Airline Reporting  
Corporation**



**Accredited Travel  
Agencies**



**Participating  
Airlines**

# **MISSIONS** of ARC

Air Travel  
Acceleration



Revenue  
Increase





# BUSINESS PROBLEM

An increase in direct booking from airlines will bring about a negative revenue impact to both ARC itself and the cooperated travel agencies.



# OUR GOAL

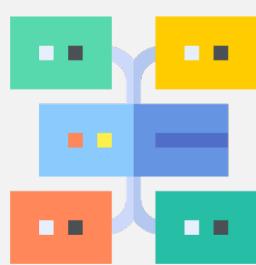
⇒ Forecast the direct booking from airlines in 2022 - 2024



2

# DATA OVERVIEW & PRELIMINARY FINDINGS

# DATA INFORMATION



- Internal Data Resource: ARC snowflake
- Number of Observations: 141 millions (rows)
- Number of Variables: 12 (columns)
- External Data Source: EFA, Our World In Data
- External Variables: Oil price, Covid Policy (stringency index)



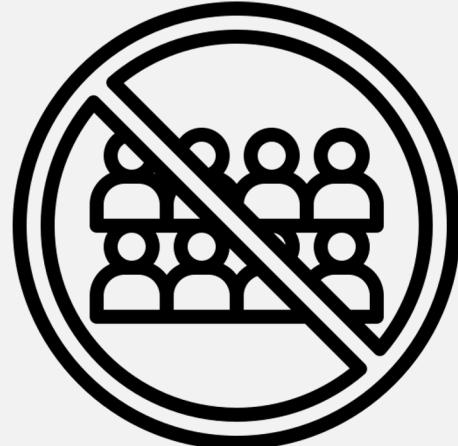
1	DATA_SOURCE	AGENCY_TYPE	ADV_PURCH_DAYS	CARR_NM	ISSUE_YR	ISSUE_WEEK	TRAN_CD	TRIP_TYPE_CD	DOMNT_CABIN_CLASS_CD	ORIGIN_COUNTRY	DESTINATION_COUNTRY	TKT_CNT
2	Direct	Uncategorized	61+	AIR BERLIN	2017	20 R	RT	F		DE	SE	2
3	Direct	Uncategorized	15-28	Egyptair	2020	42 E	OW	C		EG	GB	1
4	Direct	Uncategorized	61+	AVIANCA	2018	26 I	OW	Y		CN	CN	1
5	Direct	Uncategorized	0-7	AIR FRANCE	2017	8 I	RT	AO		DK	IT	1
6	Direct	Uncategorized	0-7	British Airways p.l.c.	2021	12 R	RT	Y		CA	US	1

# EXTERNAL - COVID POLICY

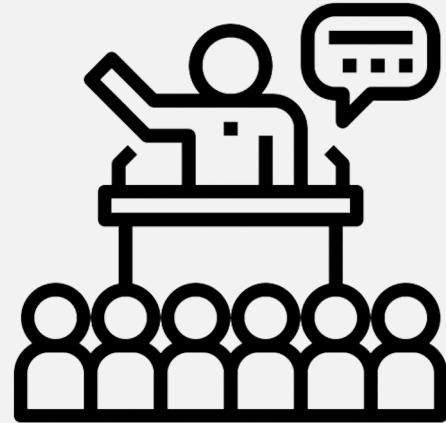
⇒ Criterion: Stringency Index (0-100)



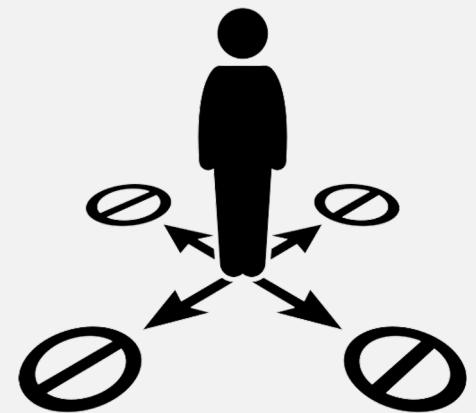
Closures of  
school &  
workplace &  
public transport



Restrictions of public  
events & gatherings



Public  
information  
campaign



Restrictions of internal  
& international  
movement & stay-at-  
home

# EXTERNAL - OIL PRICE



## Observation of relationship with historical Jet Fuel price

- Data Period: 10/2017 to 09/2022 (monthly)
- Jet Fuel: U.S. Gulf Coast Kerosene-Type (\$/gallon)
- Crude Oil: average of Brent, Dubai and WTI (\$/barrel)

⇒ Correlation coefficient: 98%

⇒ use oil price as our fuel price

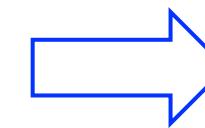


## Predictive Crude Oil Price

- Data Resource: Economy Forecast Agency (EFA)
- Data Period: 1/2017 to 12/2024 (weekly)
- Crude Oil: average of Brent, WTI (\$/barrel)

# TICKET BY COUNTRY

	DESTINATION_COUNTRY	TOTAL_TICKETS
1	US	1,648,664,071
2	CN	766,016,190
3	BR	198,937,142
4	CA	144,070,615
5	DE	143,668,167
6	RU	142,067,113
7	AU	130,249,392
8	GB	129,924,998
9	FR	110,276,013
10	TR	107,338,559
11	KR	91,418,445
12	ES	85,664,157
13	IT	74,493,531
14	SA	72,051,631
15	CO	61,043,323
16	IN	55,035,977
17	JP	43,475,533
18	MX	43,231,840
19	AE	39,907,846



**69.93%**

# TICKET TREND





3

# DATA PROCESSING & SEGMENTATION

# DATA CLEANSING & PREPARATION



- ✓ Utilize SQL to extract target features:  
ISSUE\_YR, ISSUE\_WEEK, TRAVELER\_TYPE, GEO\_SEGMENTS, TOTAL\_TICKETS
- ✓ Transfer tickets from week 53 to week 52 in 2020 & 2021
- ✓ Extract fuel price by year and week
- ✓ Extract covid policy index for top 10 countries;  
Calculate average index for other countries
- ✓ Combine fuel price and covid policy

# FEATURE ENGINEERING



## Time

Combine year and week to generate the feature “time” which is more suitable for time series models  
(Constant increment format)

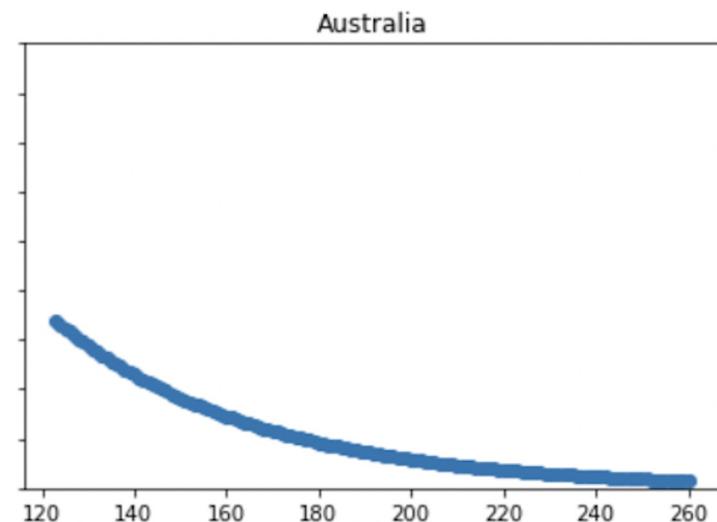
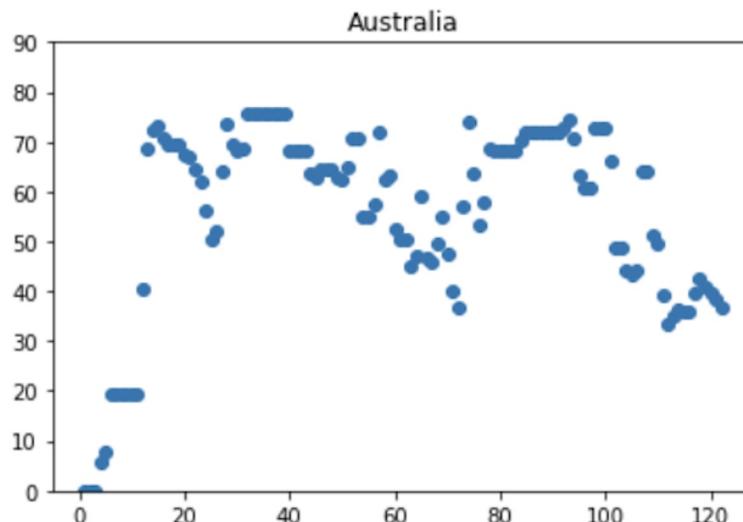
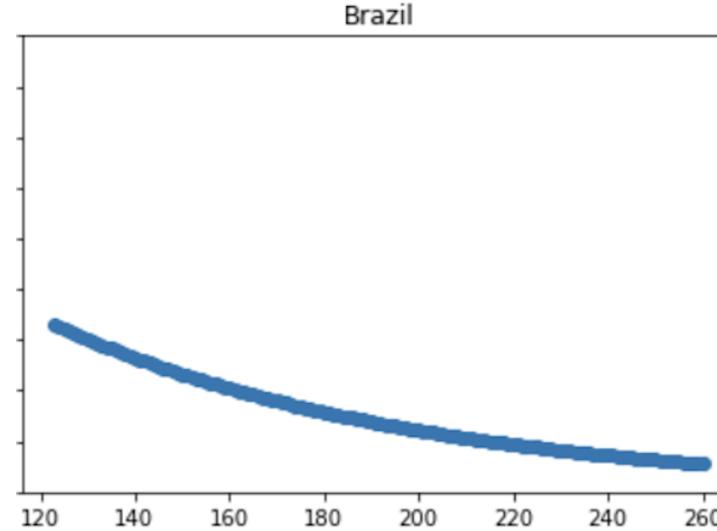
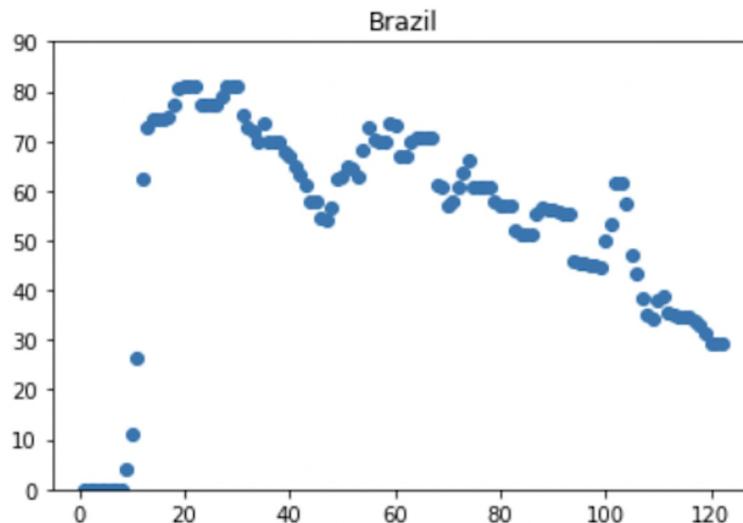
## Traveler\_type

Classify travelers to business and leisure based on different cabin classes  
(Business: First & Business class, Leisure: Other classes)

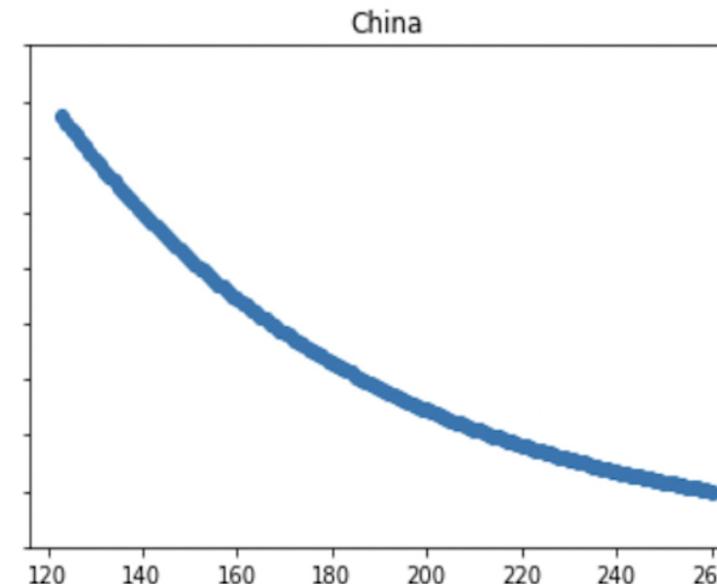
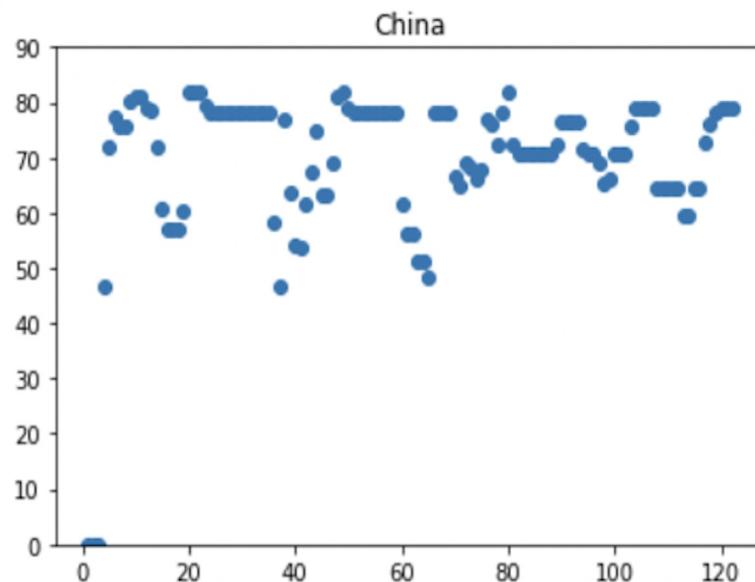
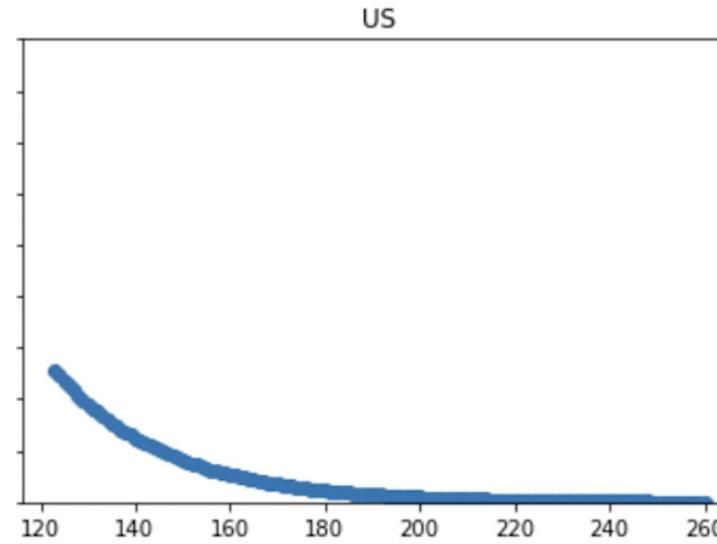
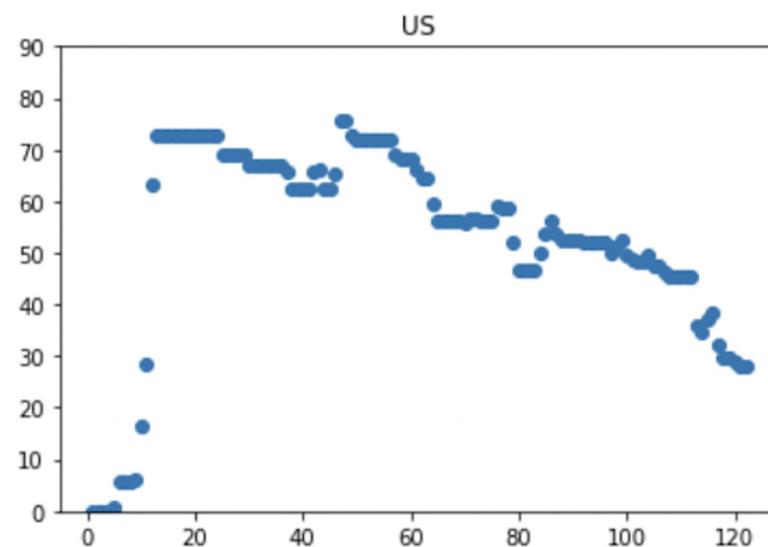
## Geo\_segments

Top 10 countries with the most ticket amounts  
Other countries with fewer ticket amounts  
Domestic vs International

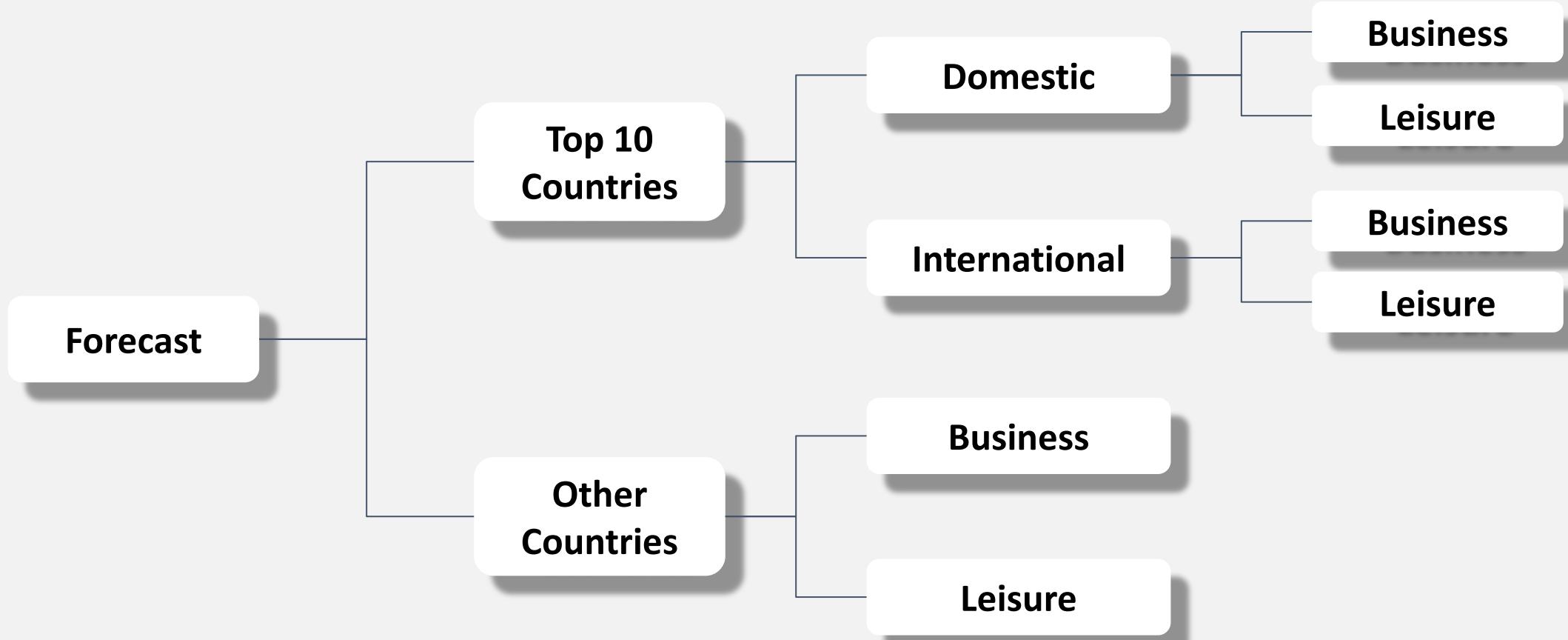
# Predict covid policy for each country



# Predict covid policy for each country



# Segmentation





4

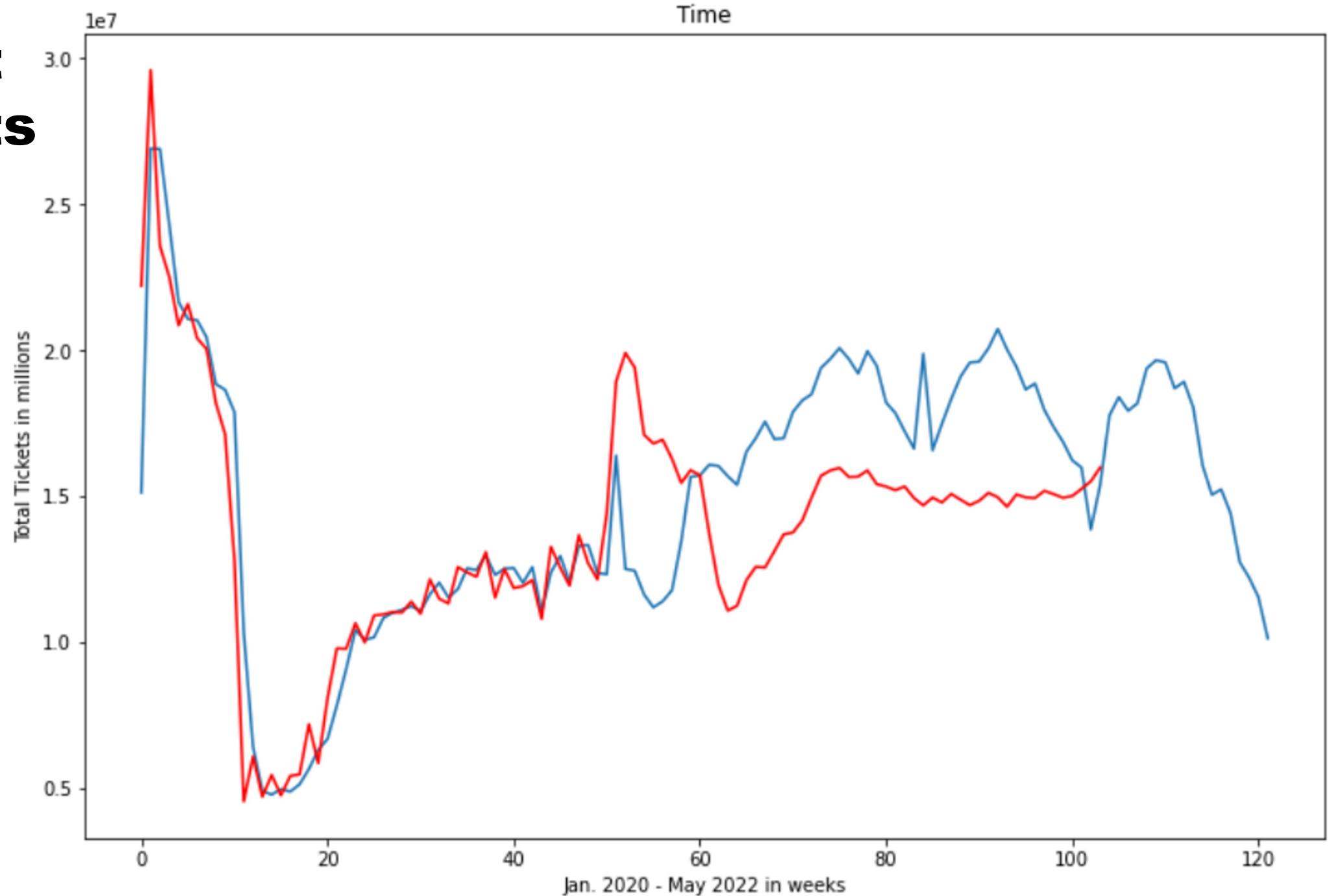
# TIME SERIES MODEL



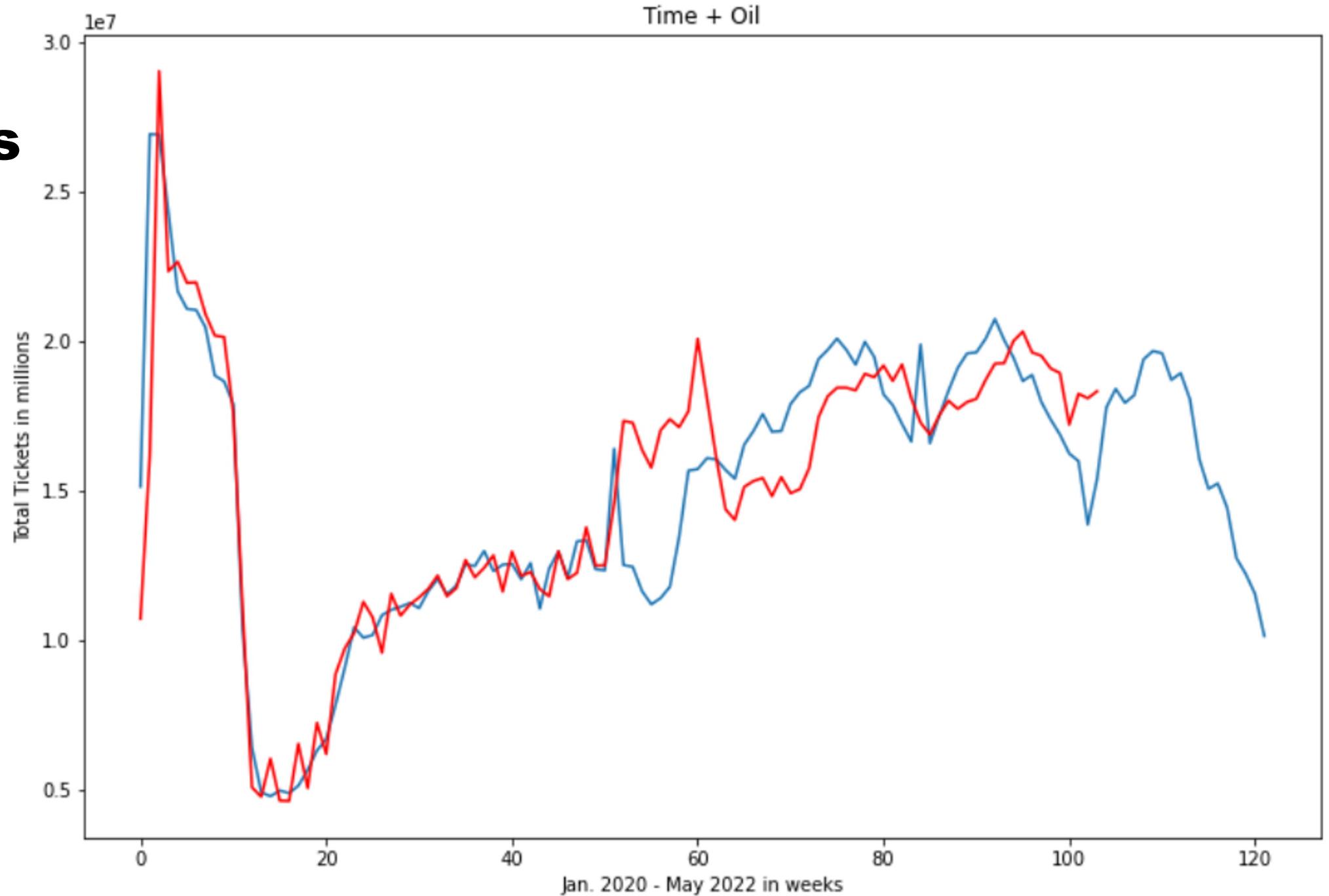
# SARIMAX (52, 1, 4)(Oil Price, Covid Policy)



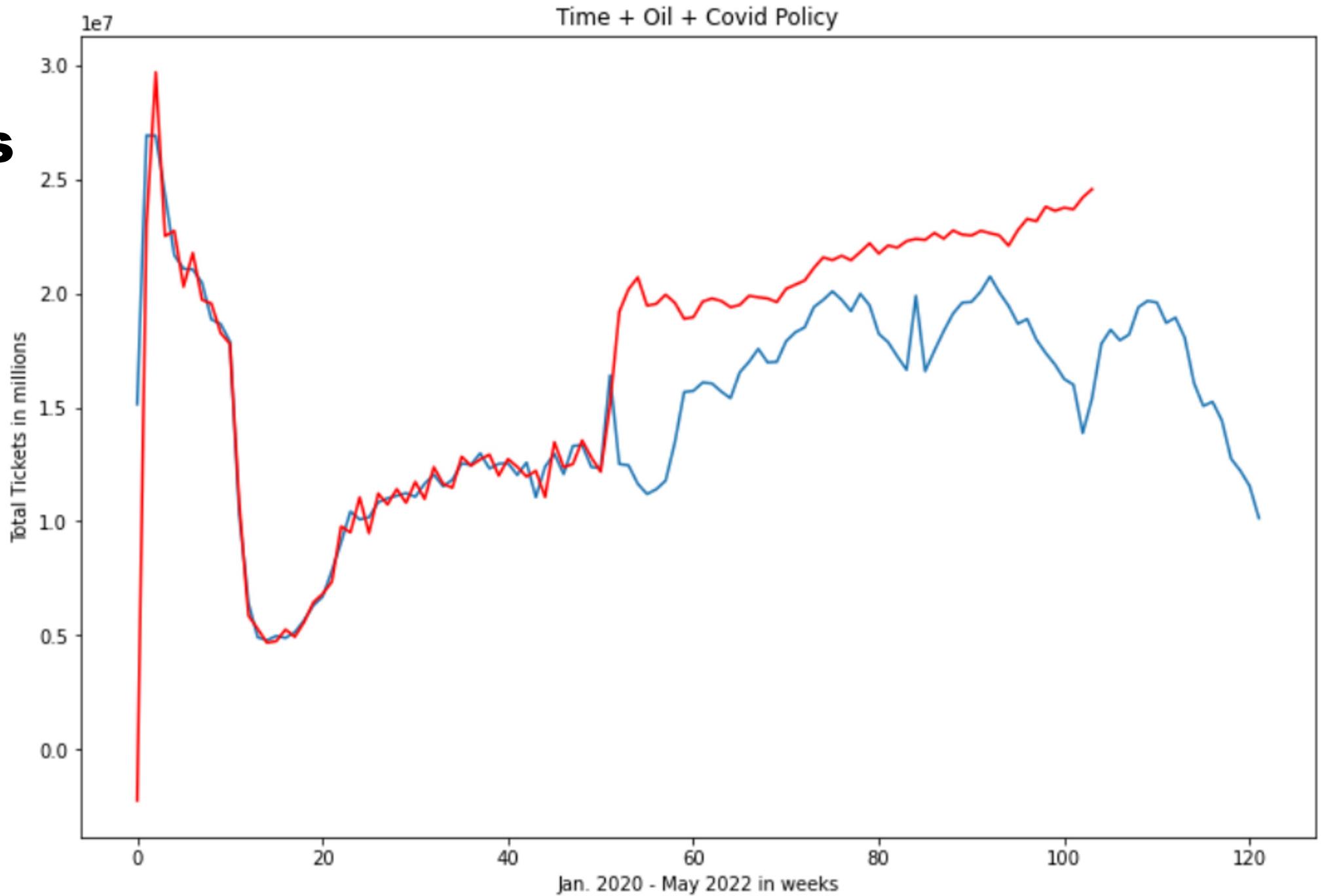
# Without Segments



# Without Segments

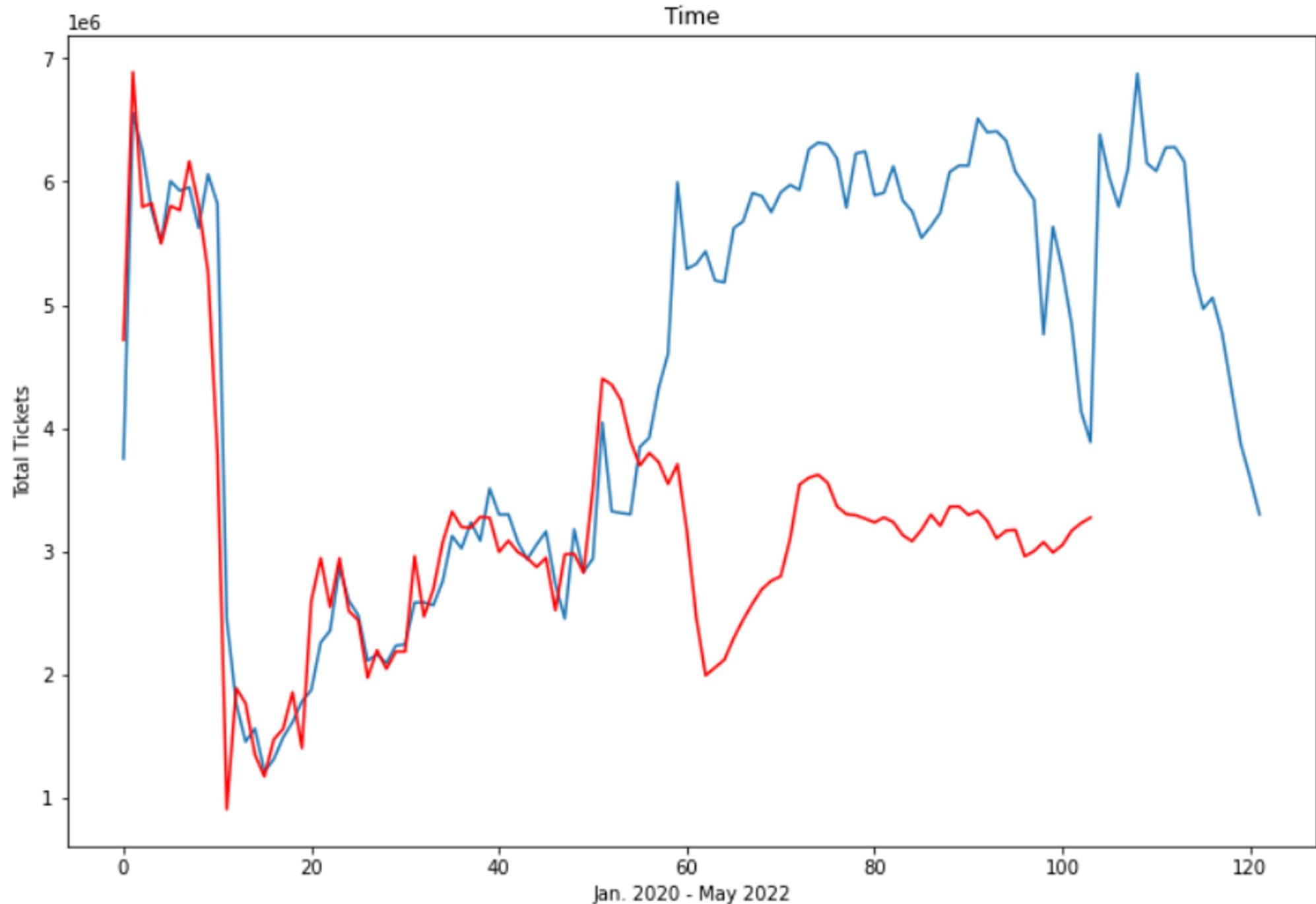


# Without Segments



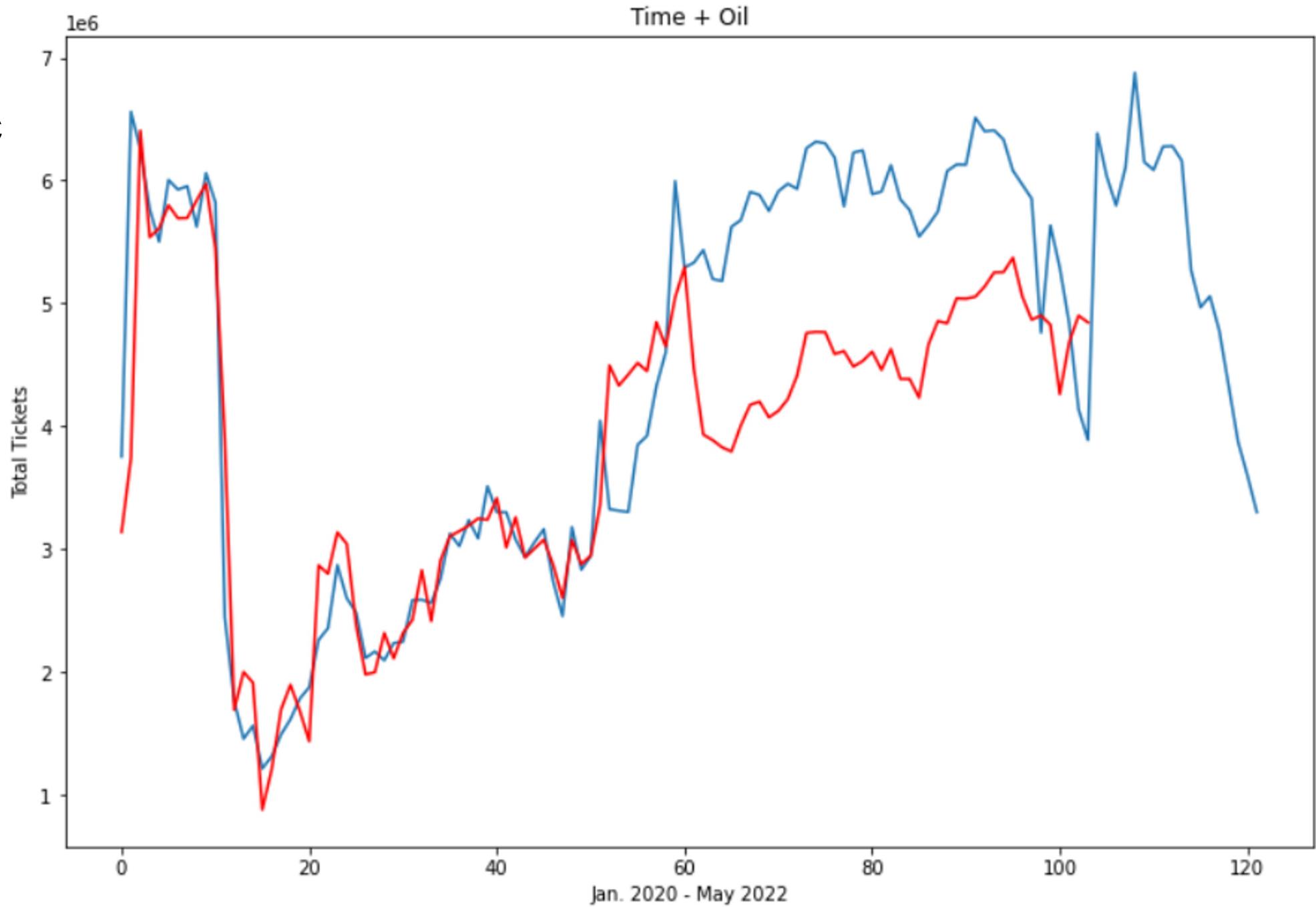
# US

## Domestic

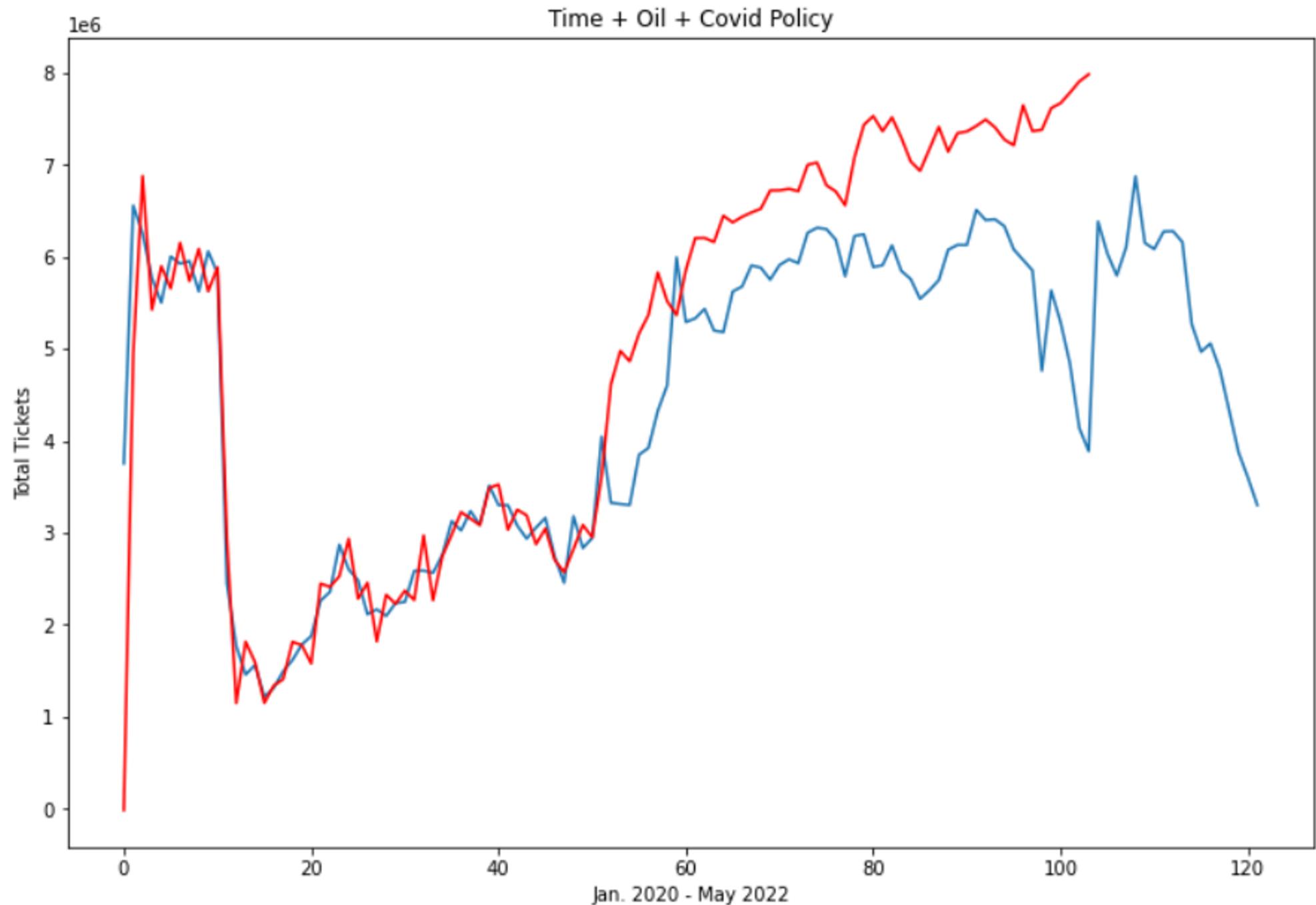
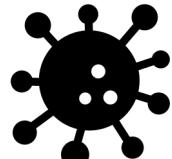


# US

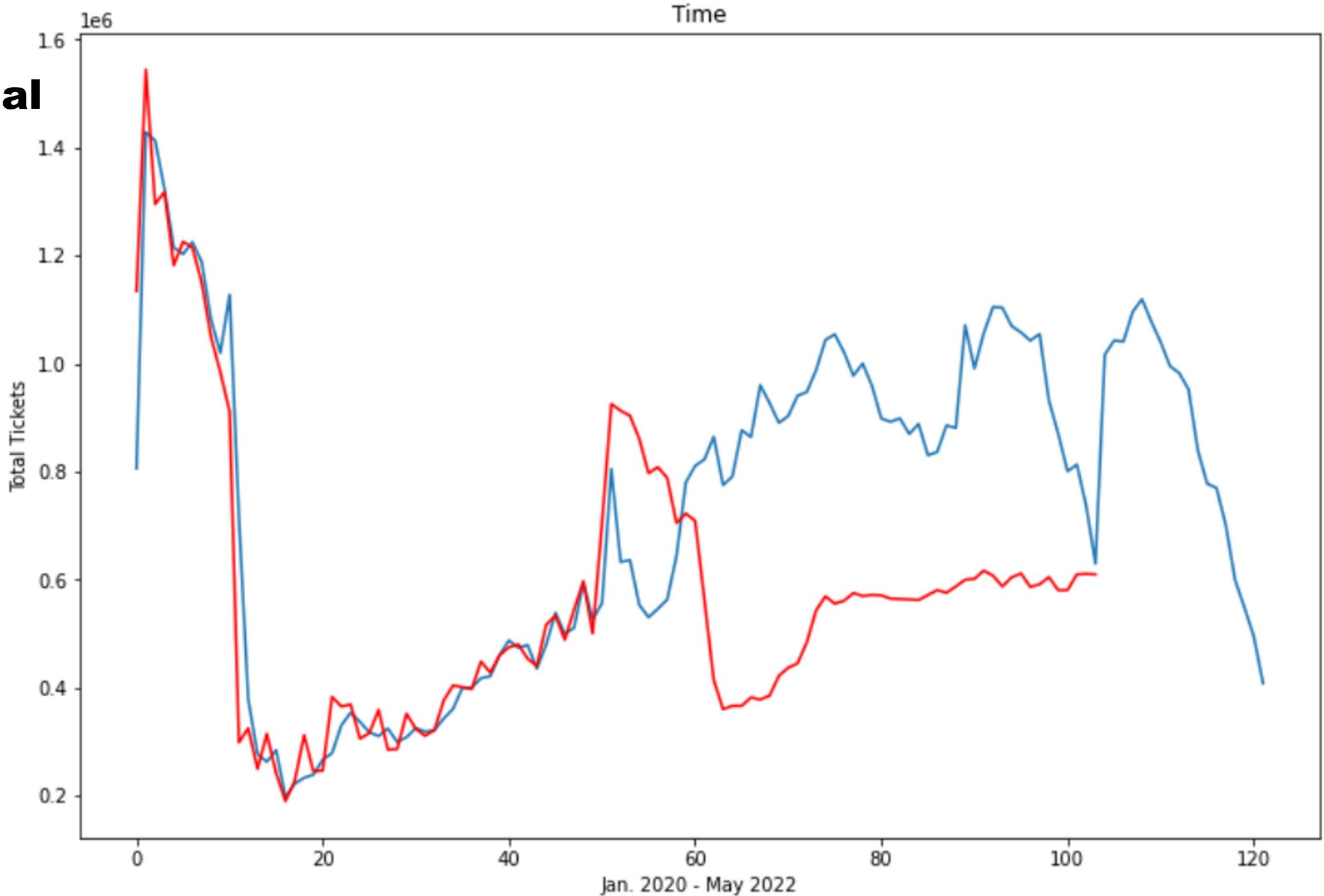
## Domestic



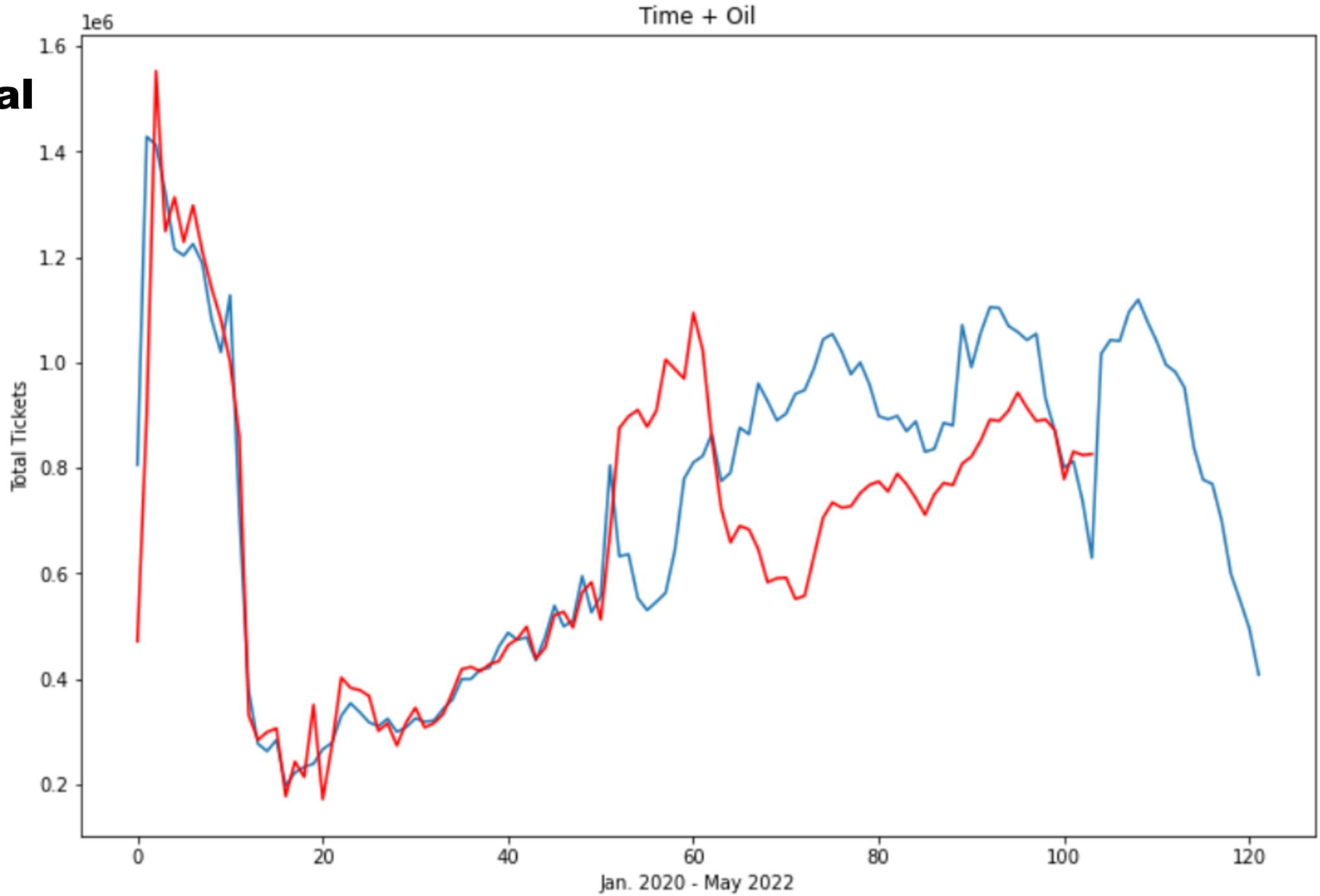
# US Domestic



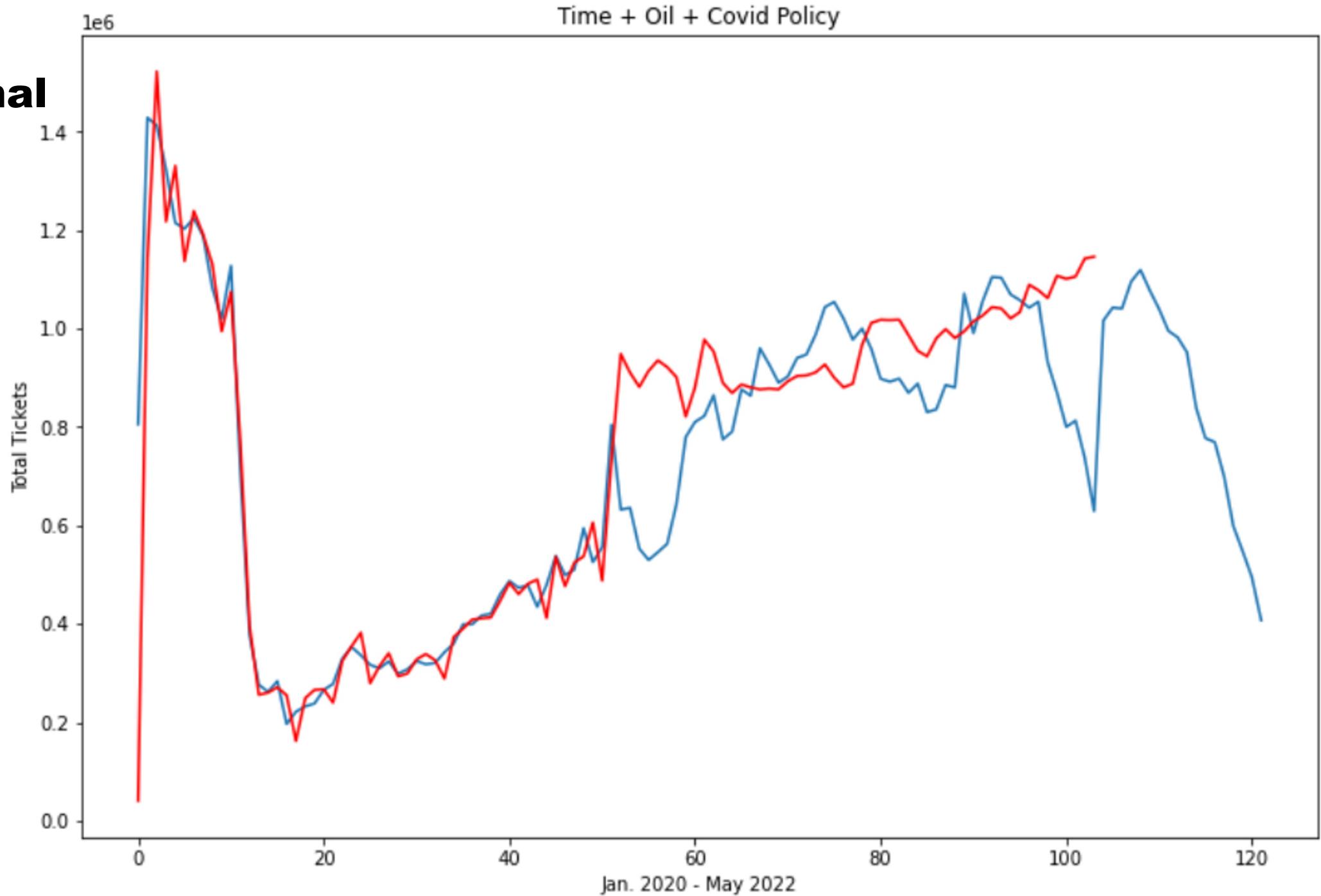
# US International



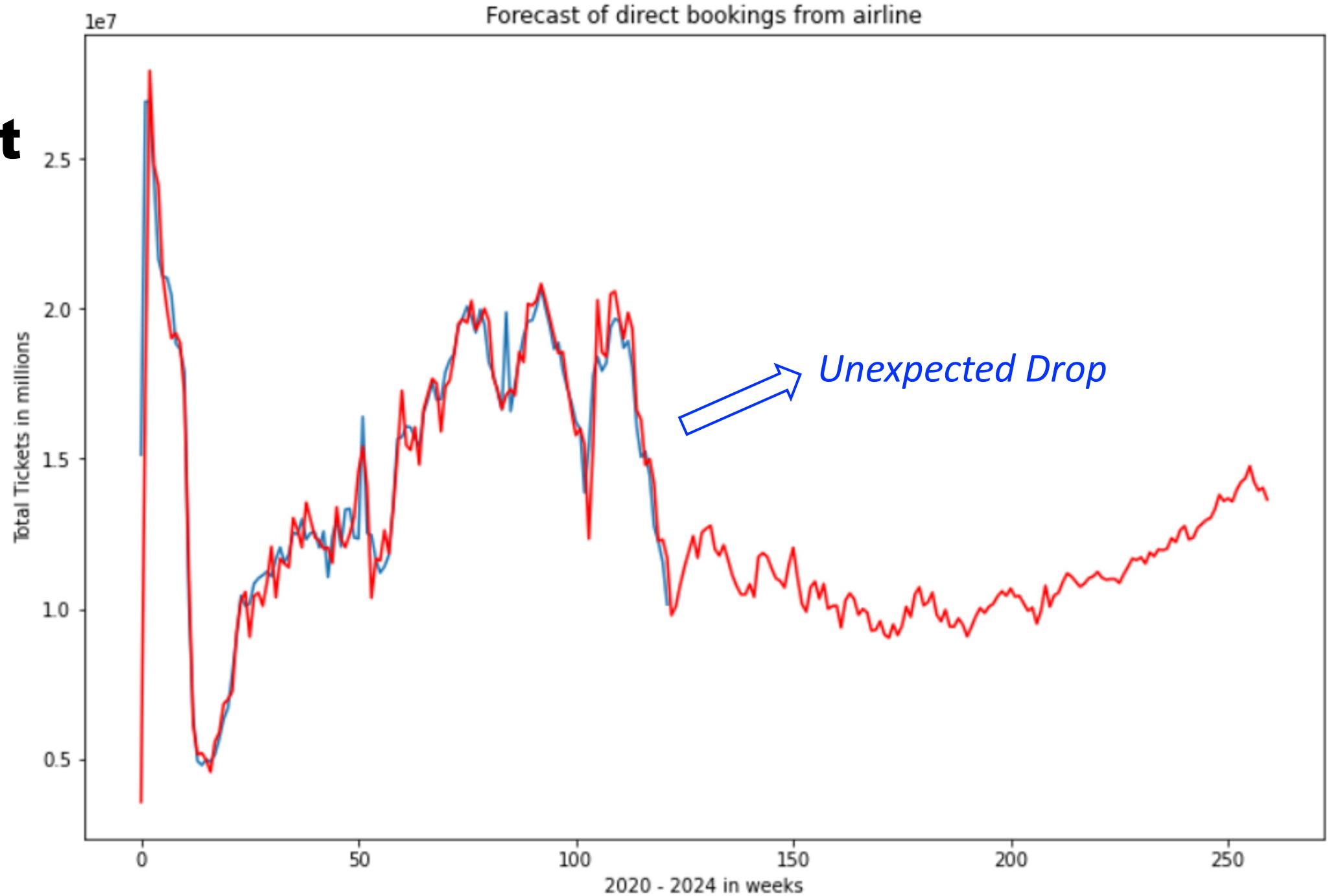
# US International



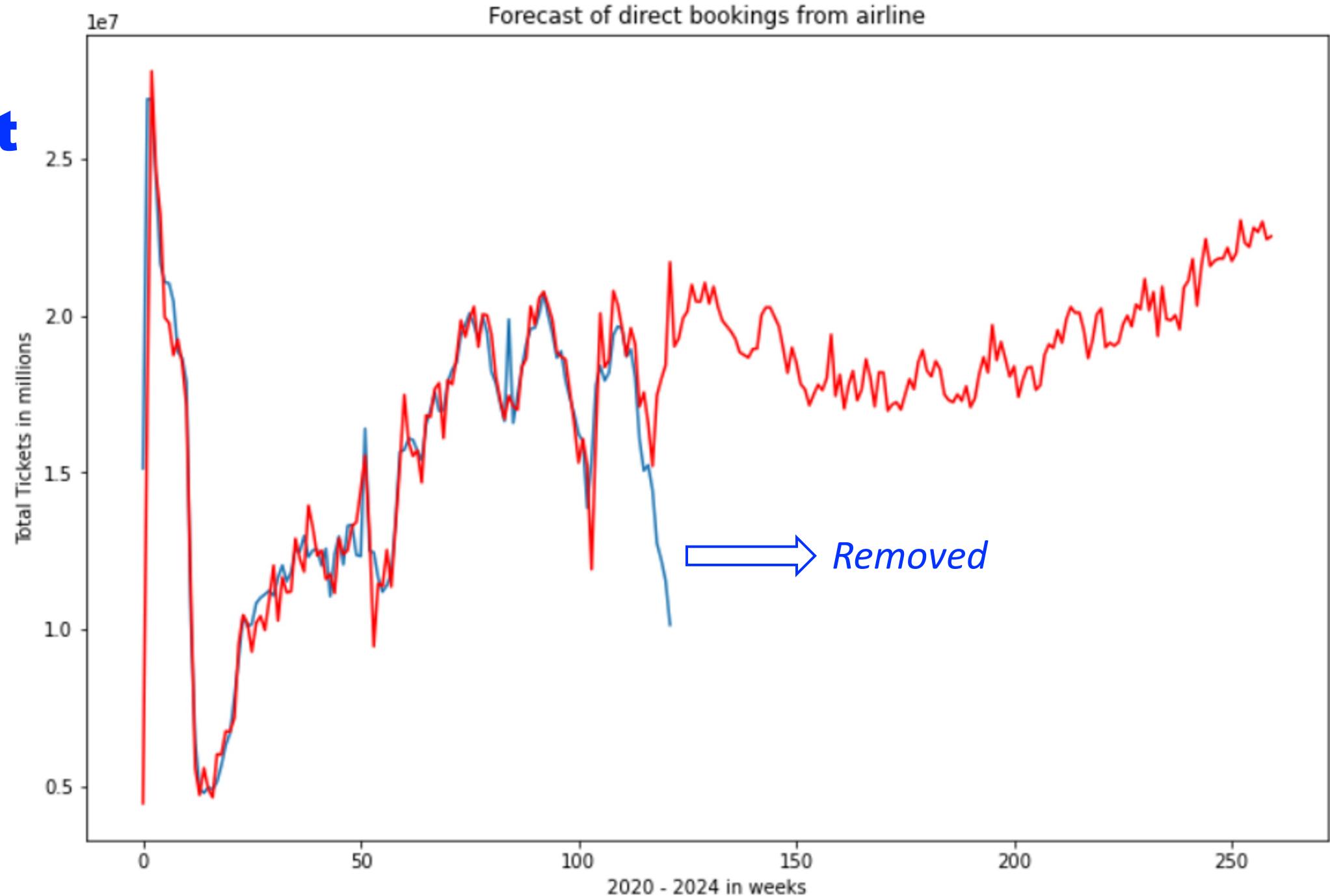
# US International



# Initial Forecast



# Better Forecast





5

## INSIGHTS & RECOMMENDATIONS



Combining oil price, covid policy and segmentations together can assist with post-covid ticket forecast.



Domestic vs international, business vs leisure and different country travelers have distinctive trends.



Tickets are likely to bounce back to pre-covid level at the end of 2024.



# CHALLENGES & WORKAROUNDS

# **Static and Smoothing models are not enough!**

- Sophisticated learning-based model

## **Scope of the problem!**

- Focus on most important segments
- Support of external data



**THANKS**

