Terrorist Acts and Arts Market Analysis

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Motivation

The National Counterterrorism Center (NCTC) is a United States government organization responsible for national and international counterterrorism efforts. Their mission is to lead the nation's effort to protect the United States from terrorism by integrating, analyzing, and sharing information to drive whole-of-government action and achieve national counterterrorism objectives. Our team was tasked with finding out if terrorist actors use the global arts and antiquities markets as part of their terrorist financing cycle.

Data and Materials

To find significance between terrorist attacks and the art market, the following data was gathered from publicly available sources:

1. Global Terrorism Database is an open-source database that includes information on terrorist events around the world. From this source we gathered a dataset containing all terrorist attacks from 1970 to 2021.
2. Christie's is the world's biggest art house in terms of lots sold, and archives of past art auctions. These past auctions were scraped, creating a dataset of more than 10,000 art sales mainly coming from London, Hong Kong, and New York.
3. Consumer Confidence index, unemployment rates, and GDP for each country was gathered from the OECD database.

Methodology

-For the first model, logged art sales were used as a dependent variable and terrorist attacks as an independent variable. For Model 1, Christie's data was utilized and a SARIMAX (0,1,1) x (1,0,0,12) model was ran. The team used the natural log of top terroristic acts with dates offset by 1 months, 2 months, and 3 months.

-For the second model, the dependent and independent variables were reversed. The team fit an ARIMAX(0,1,1) model on monthly terrorist acts. Like in the first model, this model was ran three times: one for each of three-month offsets.

- For the Bayesian model, the team set the prior assumptions as the mean of the art sales and terrorist attacks and then created a model that would place sampled data on either end of a switch point in the form of an exponential distribution. The data was sample to create two distributions, one on each side of the switch point, and calculated a tau value that would be used to determine the point(s) with the highest probability of the switch occurring.

Results

For each model, we chose the one with the best results out of the three month-offset iterations.

Model 1 (2-Month Offset):

SARIMAX Results

Dep. Variable:	Sales	No. Observations:	240
Model:	SARIMAX(0, 1, 1)x(1, 0, [], 12)	Log Likelihood	-155.465
Date:	Tue, 06 Dec 2022	AIC	320.930
Time:	23:01:57	BIC	338.312
Sample:	01-01-2000	HQIC	327.934
	- 12-01-2019		
Covariance Type:	opg		

	coef	std err	z	P>|z|	[0.025	0.975]
CCI	8.3403	3.055	2.730	0.006	2.352	14.329
Attacks	0.0520	0.056	0.931	0.352	-0.057	0.161
ma.L1	-0.9824	0.014	-71.495	0.000	-1.009	-0.955
ar.S.L12	0.8619	0.028	30.788	0.000	0.807	0.917
sigma2	0.2000	0.011	18.123	0.000	0.178	0.222

Ljung-Box (L1) (Q):	1.81	Jarque-Bera (JB):	368.12
Prob(Q):	0.18	Prob(JB):	0.00
Heteroskedasticity (H):	1.05	Skew:	-0.48
Prob(H) (two-sided):	0.83	Kurtosis:	9.00

Model 2 (2-Month Offset):

SARIMAX Results

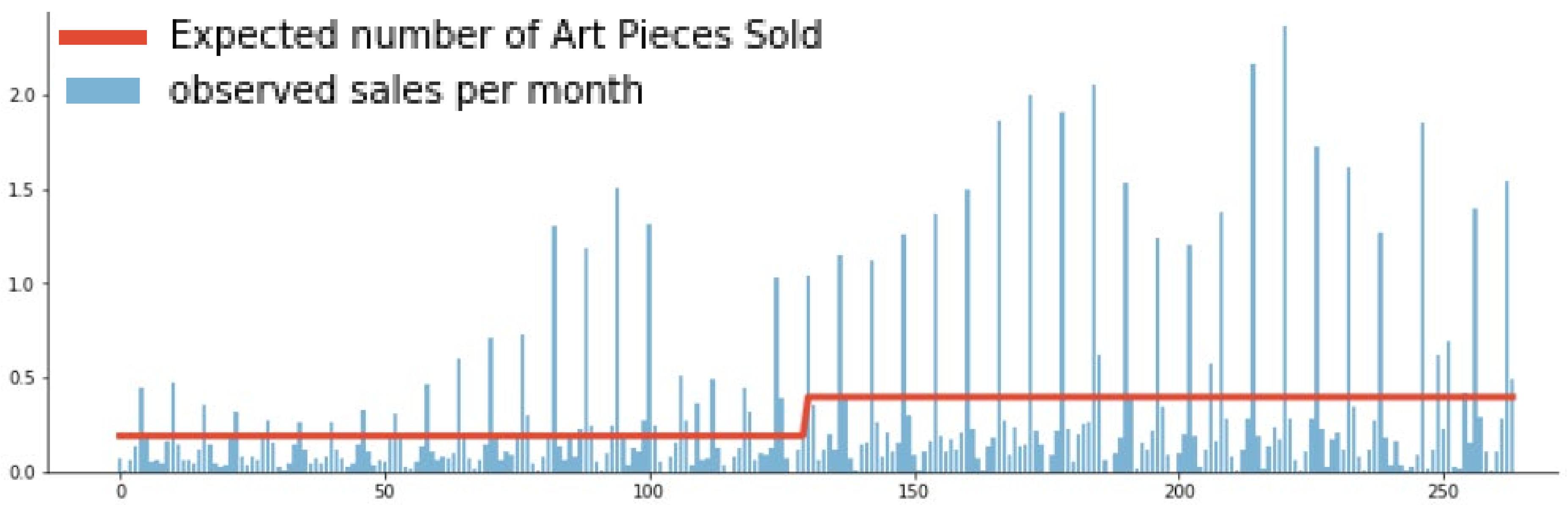
Dep. Variable:	Attacks	No. Observations:	144
Model:	SARIMAX(0, 1, 1)	Log Likelihood	-729.039
Date:	Tue, 06 Dec 2022	AIC	1464.077
Time:	23:43:36	BIC	1472.966
Sample:	01-01-2008	HQIC	1467.689
	- 12-01-2019		
Covariance Type:	opg		

	coef	std err	z	P>|z|	[0.025	0.975]
Sales	5.2057	2.756	1.889	0.059	-0.195	10.606
ma.L1	-0.4688	0.080	-5.852	0.000	-0.626	-0.312
sigma2	1566.8517	167.075	9.378	0.000	1239.390	1894.313

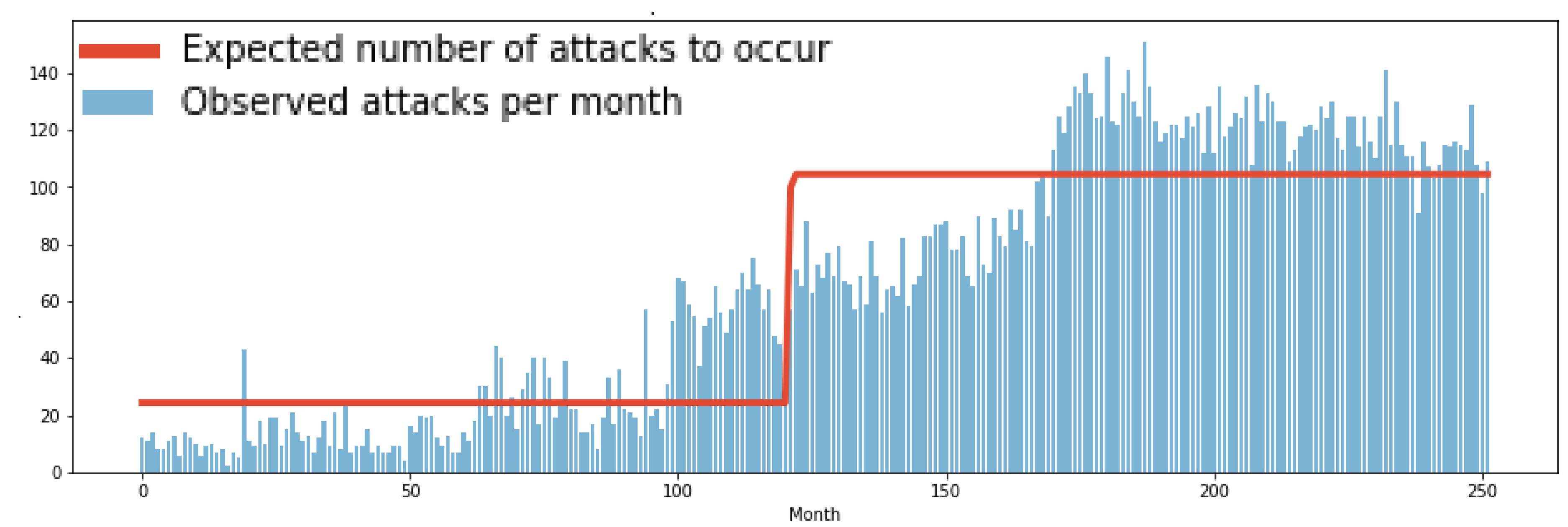
Ljung-Box (L1) (Q):	0.19	Jarque-Bera (JB):	2.77
Prob(Q):	0.66	Prob(JB):	0.25
Heteroskedasticity (H):	2.68	Skew:	0.26
Prob(H) (two-sided):	0.00	Kurtosis:	3.43

Bayesian Analysis

Number of Art Pieces Sold (1/1/2000 – 12/31/2020)



Number of Attacks That Have Occurred (1/1/2000 – 12/31/2020)



Conclusion

While the analysis shows a combination of mirrored trends and an insignificant relationship between art sales and terrorist activity, the relationship between the two becomes weaker as additional variables are incorporated into the analysis. Even though these variables have nearly significant coefficients at a 2-month offset, the team believes that the dataset is not a 100% accurate representation of the larger global population. Therefore, the team believes that the results should be interpreted as while there is a positive correlation between art sales and terrorist activity, there is no significant direct relationship between the two. It could be the case that there are external variables that affect both art sales and terrorist attacks in a similar manner.

Restrictions/Limitations

Currently, open-source art sales data is difficult to acquire. Auction houses do not publicly report their sales to a centralized organization. Without purchasing data, the only option was to scrape it. This proved to be a challenge as the team never felt the dataset was large enough to represent the global art market and collecting that much data was out of the project's scope and timeframe.

Terrorist groups usually launder their art/antiquities through middlemen and private channels. This makes it difficult to gather data that may incriminate them.