```
from statsmodels.tsa.arima.model import ARIMA
import statsmodels.api as sm
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
```

In [20]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from libpysal.weights import KNN
from spreg import GM_Lag
from statsmodels.tsa.api import VAR
```

In [88]:
```
file_path = r"C:\Users\JUMIA-4237\Desktop\Thesisoption\arrest_SPQ.csv"
```

In [89]:
```
SH = pd.read_csv(file_path)
```

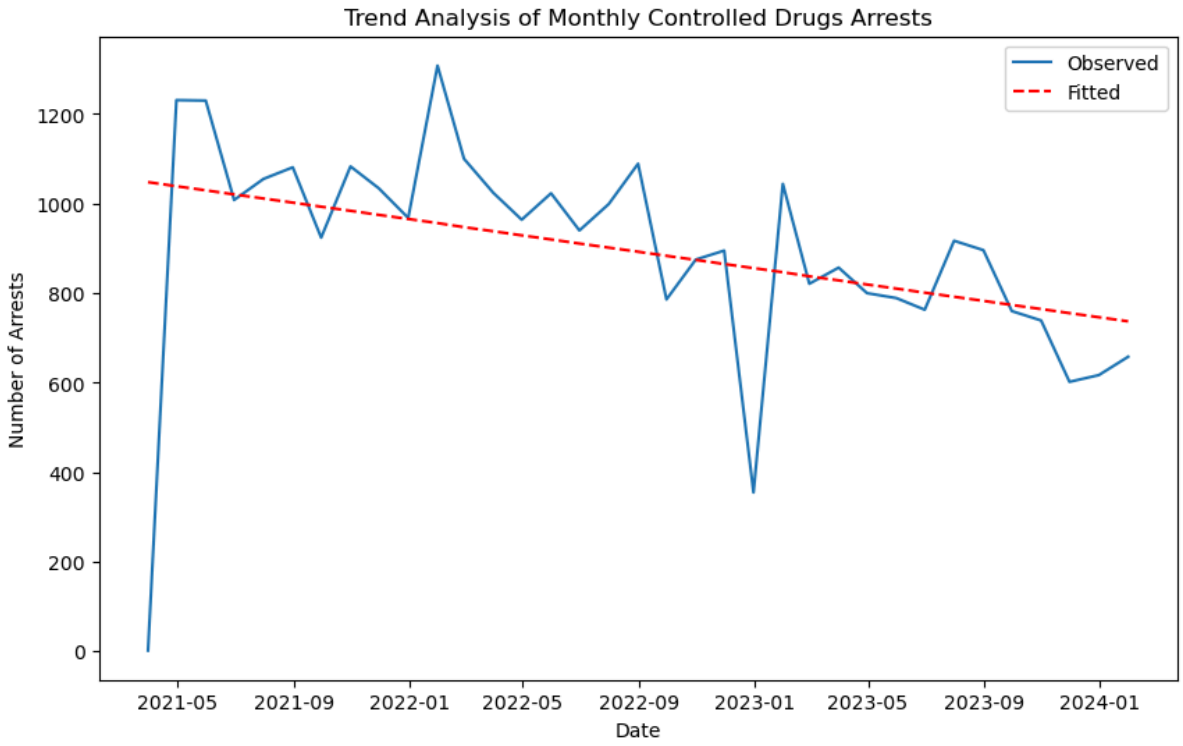
In [90]:
```
SH.head(3)
```

Out[90]:

	Type	Date	Part of a policing operation	Latitude	Longitude	Object of search	Outcome	Anything to threaten or harm anyone	A f cri da
0	Person search	2021-03-31T23:09:00+00:00	False	51.418969	-0.147822	Controlled drugs	Arrest	0	
1	Person search	2021-03-31T23:17:00+00:00	False	51.498727	-0.105172	Evidence of offences under the Act	Arrest	0	
2	Person and Vehicle search	2021-03-31T23:25:00+00:00	False	51.530467	-0.388379	Controlled drugs	Arrest	0	

In [83]:
```
SH['Date'] = pd.to_datetime(SH['Date'])
SH.set_index('Date', inplace=True)

controlled_drugs = SH[SH['Object of search'] == 'Controlled drugs']

monthly_counts = controlled_drugs.resample('M').size().reset_index(name='Arrests')

monthly_counts['Time'] = np.arange(len(monthly_counts))

X = monthly_counts[['Time']]
y = monthly_counts['Arrests']

linear_model = LinearRegression()
linear_model.fit(X, y)

monthly_counts['Fitted'] = linear_model.predict(X)

plt.figure(figsize=(10, 6))
```

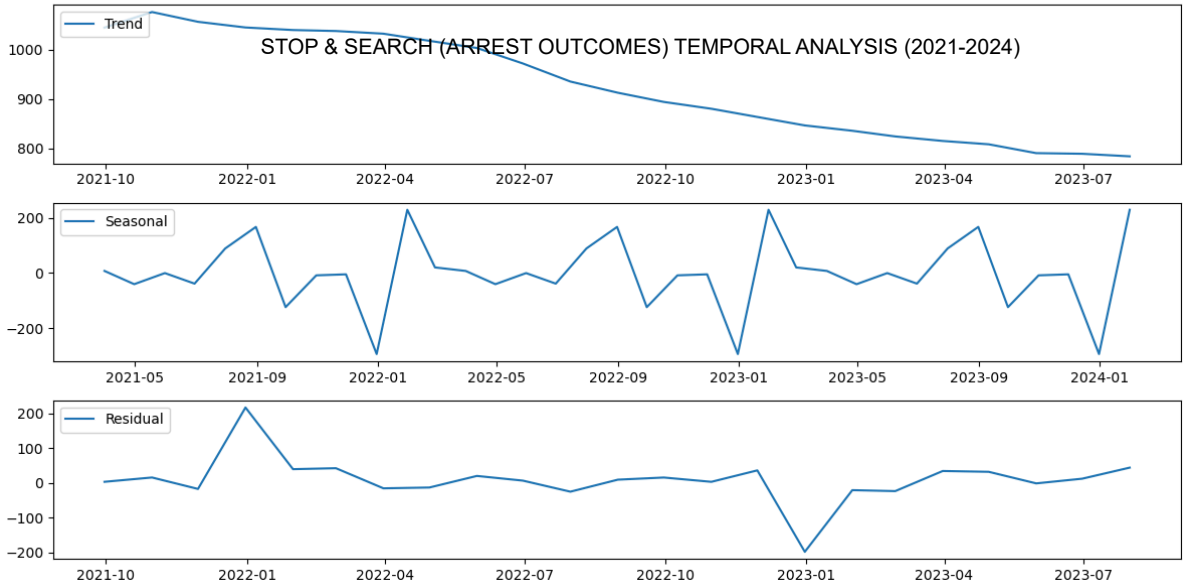
```
plt.show()
print(f"Slope of the regression line: {linear_model.coef_[0]}")
```




```
Slope of the regression line: -9.140896358543417
```

In [74]:
```
SH['Date'] = pd.to_datetime(SH['Date'])
SH.set_index('Date', inplace=True)

controlled_drugs = SH[SH['Object of search'] == 'Controlled drugs']

monthly_counts = controlled_drugs.resample('M').size().reset_index(name='Arrests')

monthly_counts.set_index('Date', inplace=True)

decomposition = seasonal_decompose(monthly_counts['Arrests'], model='additive')
```

In [75]:
```
plt.figure(figsize=(12, 8))
plt.subplot(411)
plt.plot(decomposition.observed, label='Observed')
plt.legend(loc='upper left')
plt.subplot(412)
plt.plot(decomposition.trend, label='Trend')
plt.legend(loc='upper left')
plt.subplot(413)
plt.plot(decomposition.seasonal, label='Seasonal')
plt.legend(loc='upper left')
plt.subplot(414)
plt.plot(decomposition.resid, label='Residual')
plt.legend(loc='upper left')
plt.tight_layout()
plt.show()
```

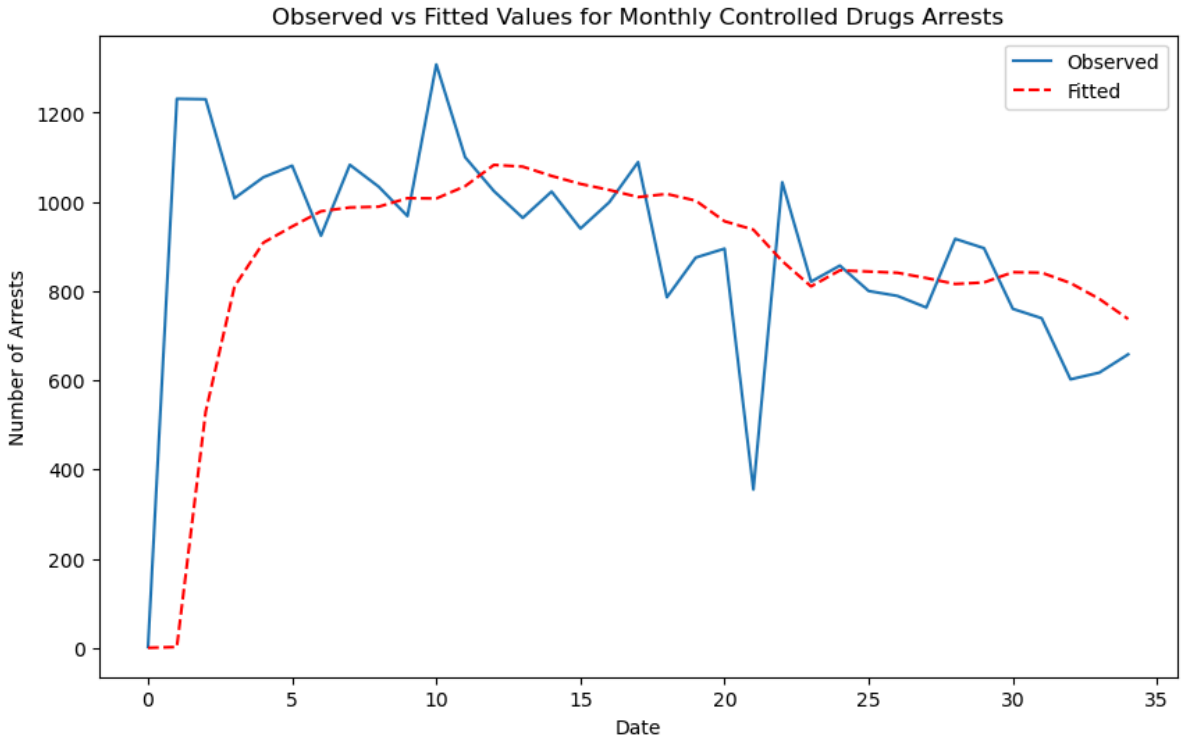


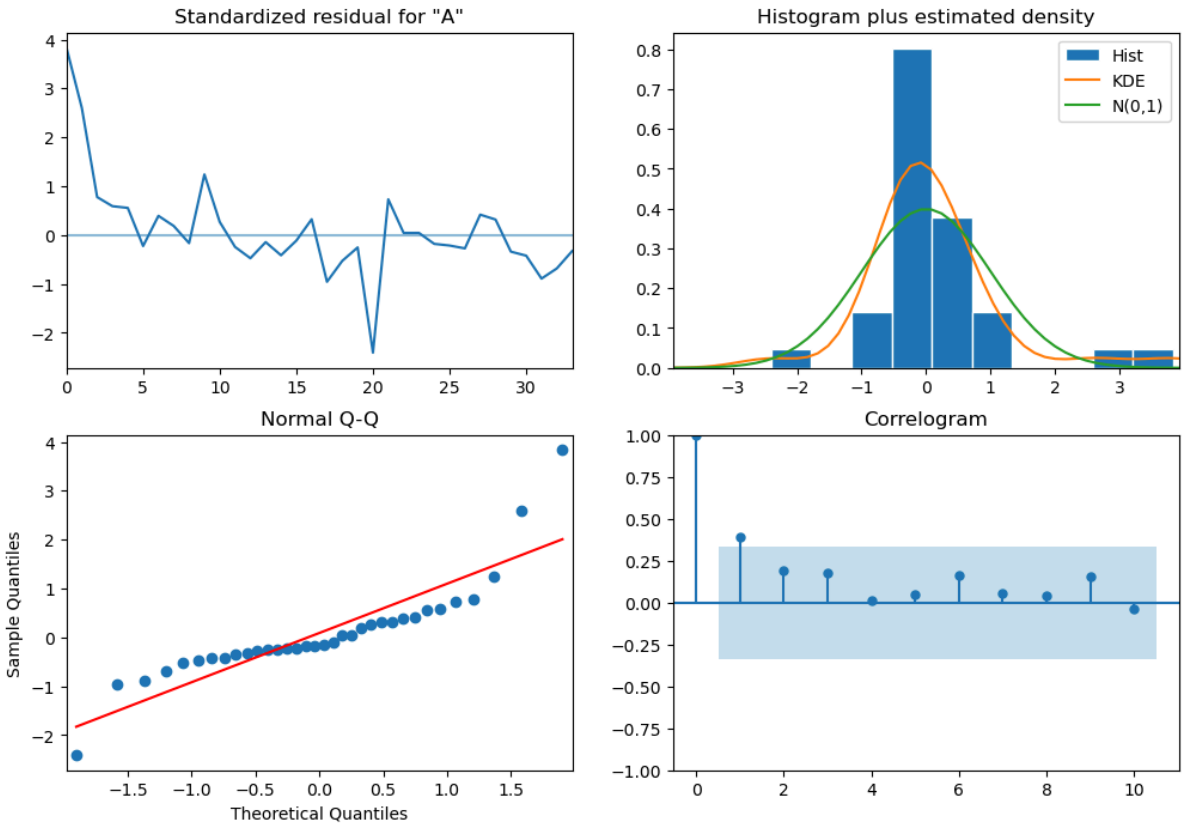
In [84]:
```
model = ARIMA(monthly_counts['Arrests'], order=(1, 1, 1))
arima_result = model.fit()
```

In [85]:
```
print(arima_result.summary())
```

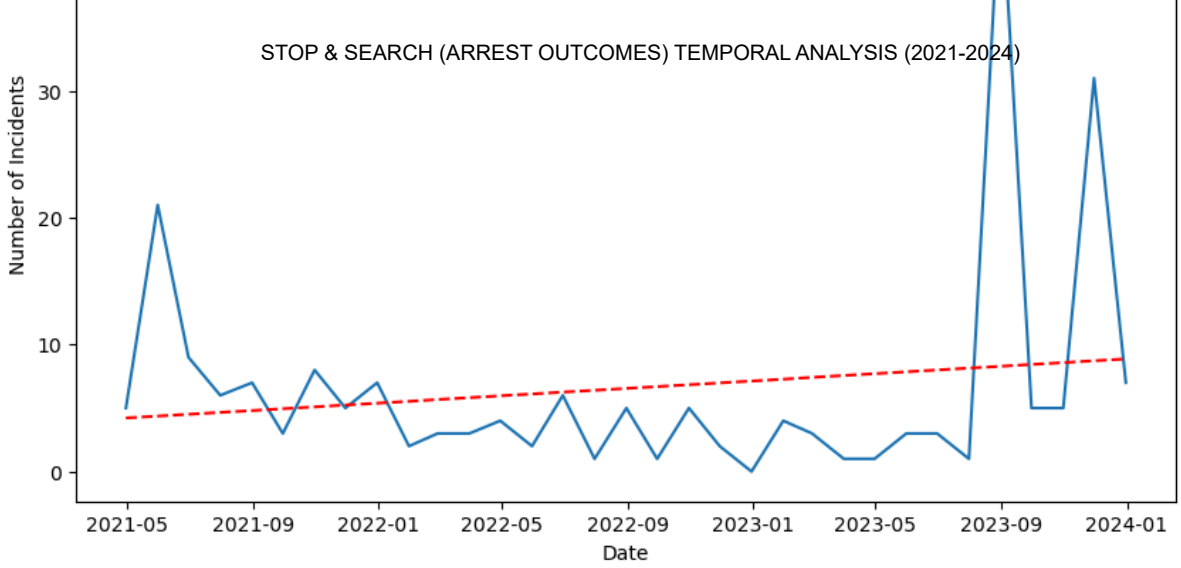
```
                               SARIMAX Results
==============================================================================
Dep. Variable:                Arrests   No. Observations:                   35
Model:                 ARIMA(1, 1, 1)   Log Likelihood                -235.805
Date:                Sun, 09 Jun 2024   AIC                            477.610
Time:                        13:33:01   BIC                            482.189
Sample:                             0   HQIC                           479.172
                                  - 35
Covariance Type:                  opg
==============================================================================
                 coef    std err          z      P>|z|      [0.025      0.975]
------------------------------------------------------------------------------
ar.L1         -0.1486      0.147     -1.009      0.313      -0.437       0.140
ma.L1         -0.7411      0.204     -3.639      0.000      -1.140      -0.342
sigma2      5.863e+04   9396.559      6.240      0.000    4.02e+04    7.71e+04
===================================================================================
=
Ljung-Box (L1) (Q):                   5.67   Jarque-Bera (JB):                 47.1
4
Prob(Q):                              0.02   Prob(JB):                          0.0
0
Heteroskedasticity (H):               0.09   Skew:                              1.4
8
Prob(H) (two-sided):                  0.00   Kurtosis:                          7.9
6
===================================================================================
=

Warnings:
[1] Covariance matrix calculated using the outer product of gradients (complex-ste
p).
```

```
plt.xlabel('Date')
plt.ylabel('Number of Arrests')
plt.title('Observed vs Fitted Values for Monthly Controlled Drugs Arrests')
plt.legend()
plt.show()

arima_result.plot_diagnostics(figsize=(12, 8))
plt.show()
```

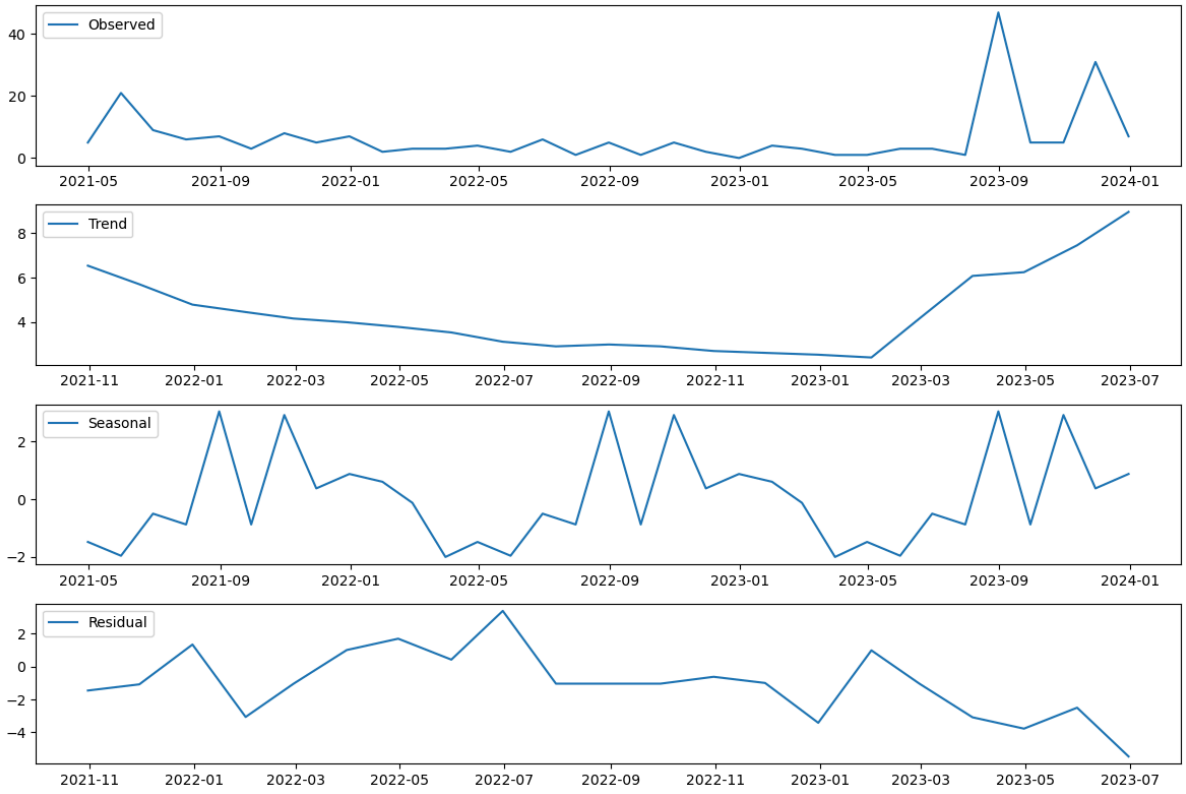


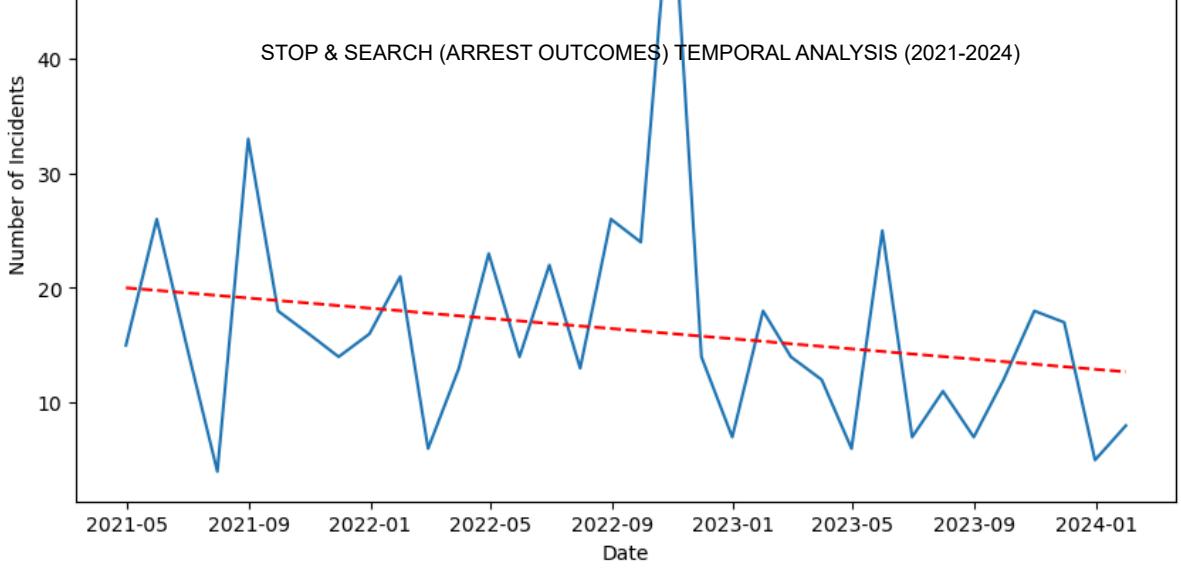


```
    'Anything to threaten or harm anyone',
    'Articles for use in criminal damage',
    'Evidence of offences under the Act',
    'Firearms',
    'Offensive weapons',
    'Stolen goods'
]

for column in columns_to_analyze:
    filtered_data = SH[SH[column] == 1]

    monthly_counts = filtered_data.resample('M').size().reset_index(name='Counts')

    monthly_counts['Time'] = np.arange(len(monthly_counts))

    X = monthly_counts[['Time']]
    y = monthly_counts['Counts']

    linear_model = LinearRegression()
    linear_model.fit(X, y)

    monthly_counts['Fitted'] = linear_model.predict(X)

    plt.figure(figsize=(10, 6))
    plt.plot(monthly_counts['Date'], monthly_counts['Counts'], label='Observed')
    plt.plot(monthly_counts['Date'], monthly_counts['Fitted'], linestyle='--', colo
    plt.xlabel('Date')
    plt.ylabel('Number of Incidents')
    plt.title(f'Trend Analysis of Monthly {column} Incidents')
    plt.legend()
    plt.show()

    print(f"Slope of the regression line for {column}: {linear_model.coef_[0]}")

    monthly_counts.set_index('Date', inplace=True)

    decomposition = seasonal_decompose(monthly_counts['Counts'], model='additive')

    plt.figure(figsize=(12, 8))
    plt.subplot(411)
    plt.plot(decomposition.observed, label='Observed')
    plt.legend(loc='upper left')
    plt.subplot(412)
    plt.plot(decomposition.trend, label='Trend')
    plt.legend(loc='upper left')
    plt.subplot(413)
    plt.plot(decomposition.seasonal, label='Seasonal')
    plt.legend(loc='upper left')
    plt.subplot(414)
    plt.plot(decomposition.resid, label='Residual')
    plt.legend(loc='upper left')
    plt.tight_layout()
    plt.show()
```

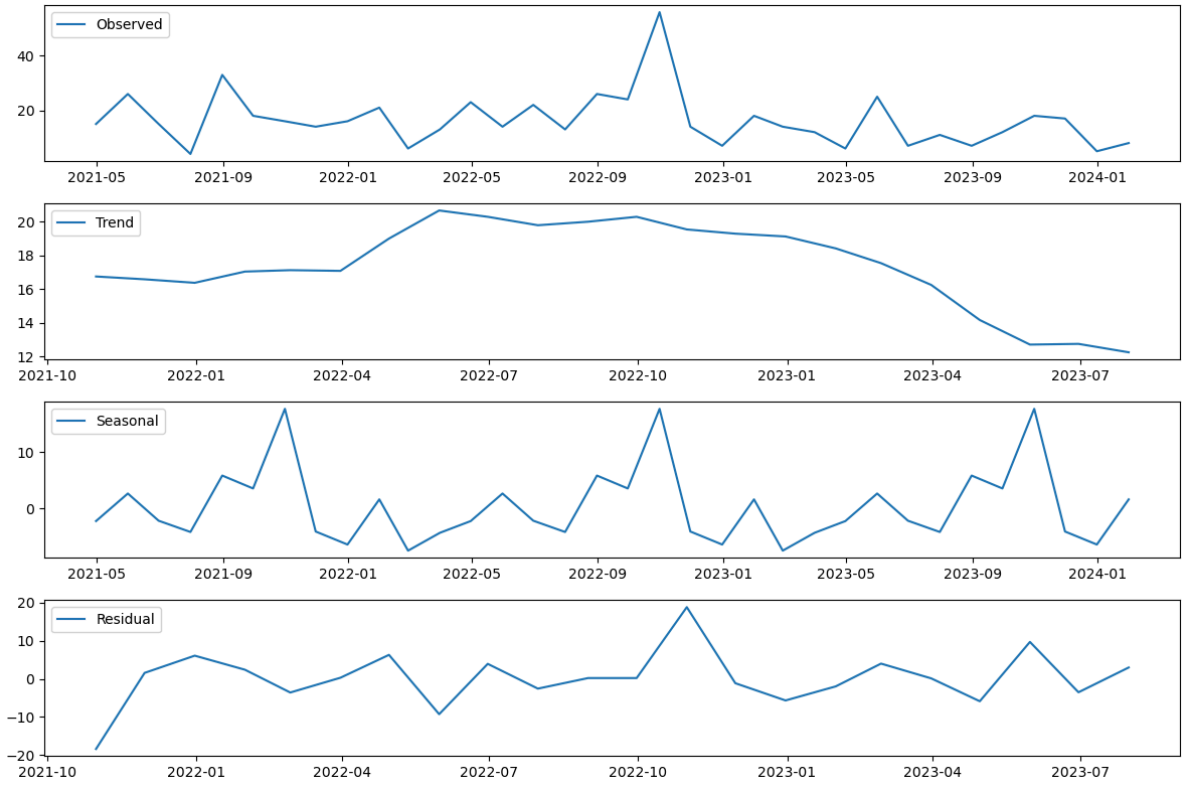



```
Slope of the regression line for Anything to threaten or harm anyone: 0.1453877005
3475936
```

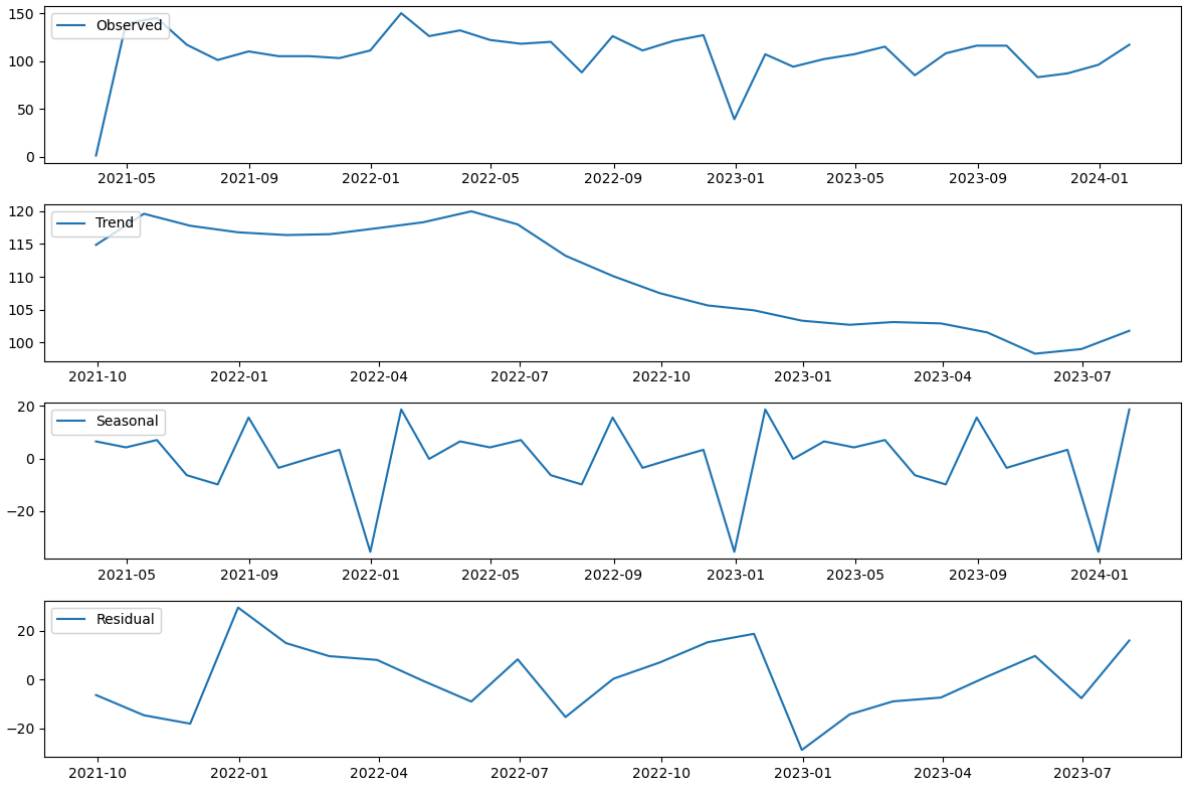


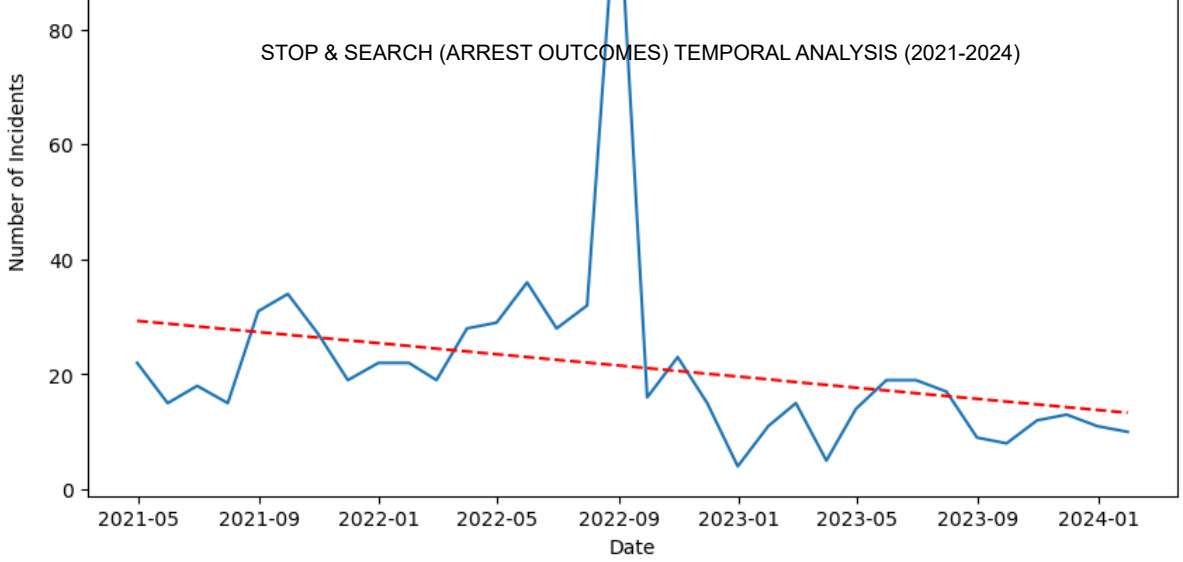



```
Slope of the regression line for Articles for use in criminal damage: -0.221848739
49579825
```

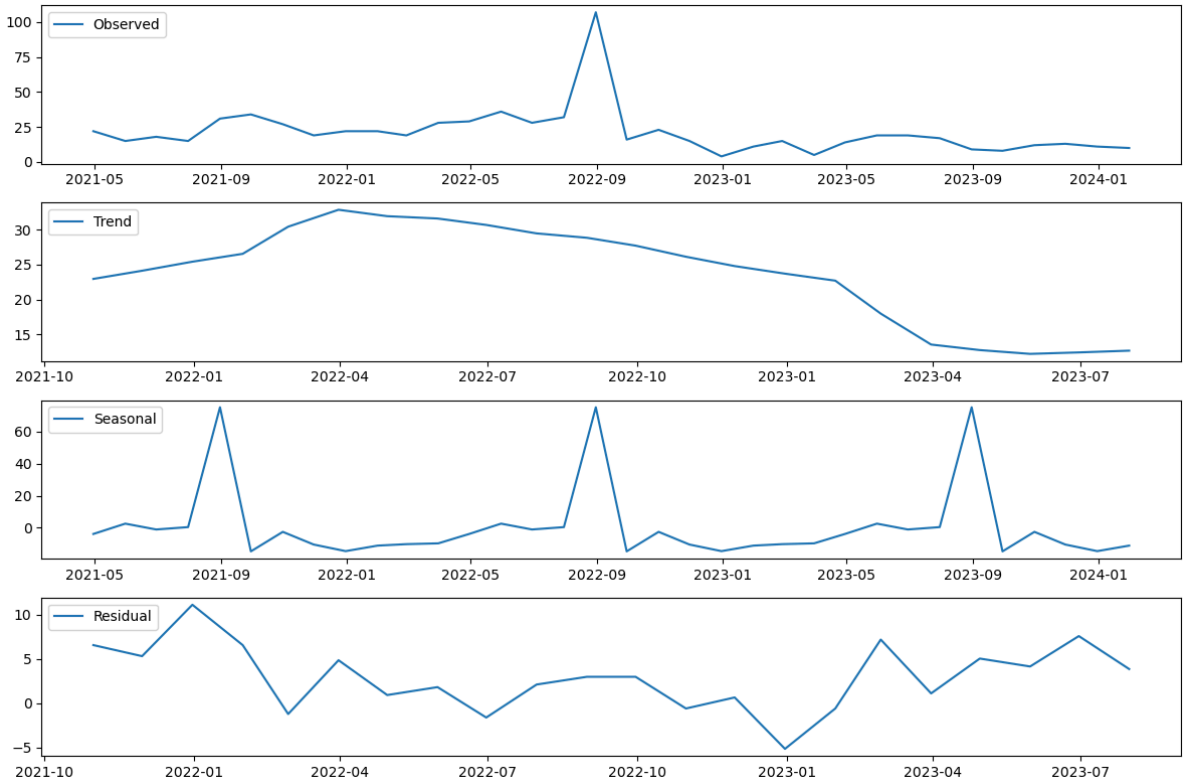


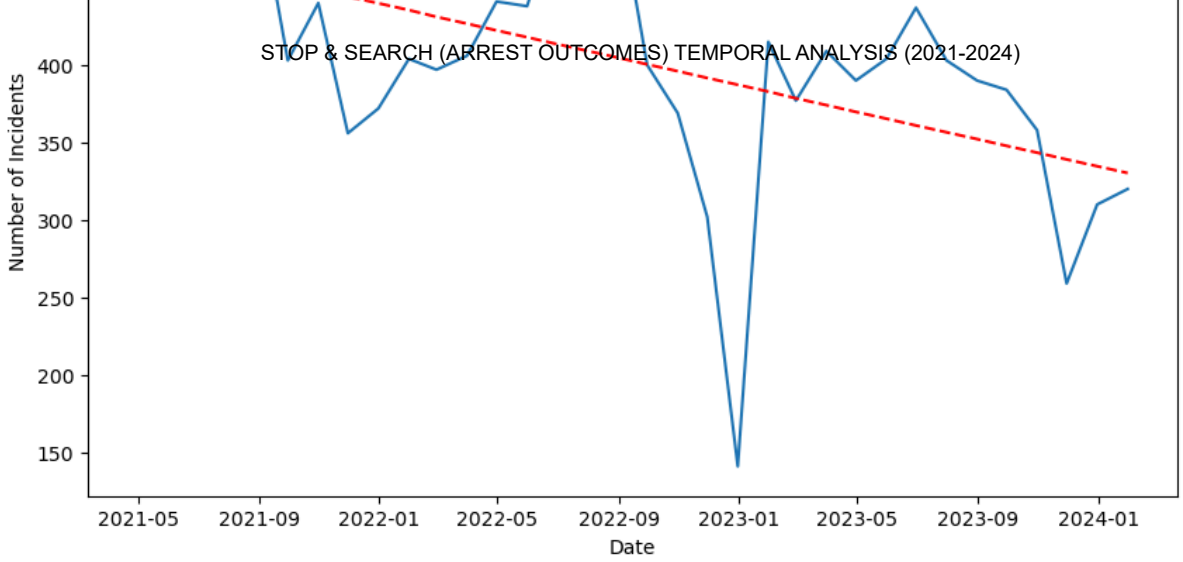

```
Slope of the regression line for Evidence of offences under the Act: -0.2294117647
0588248
```



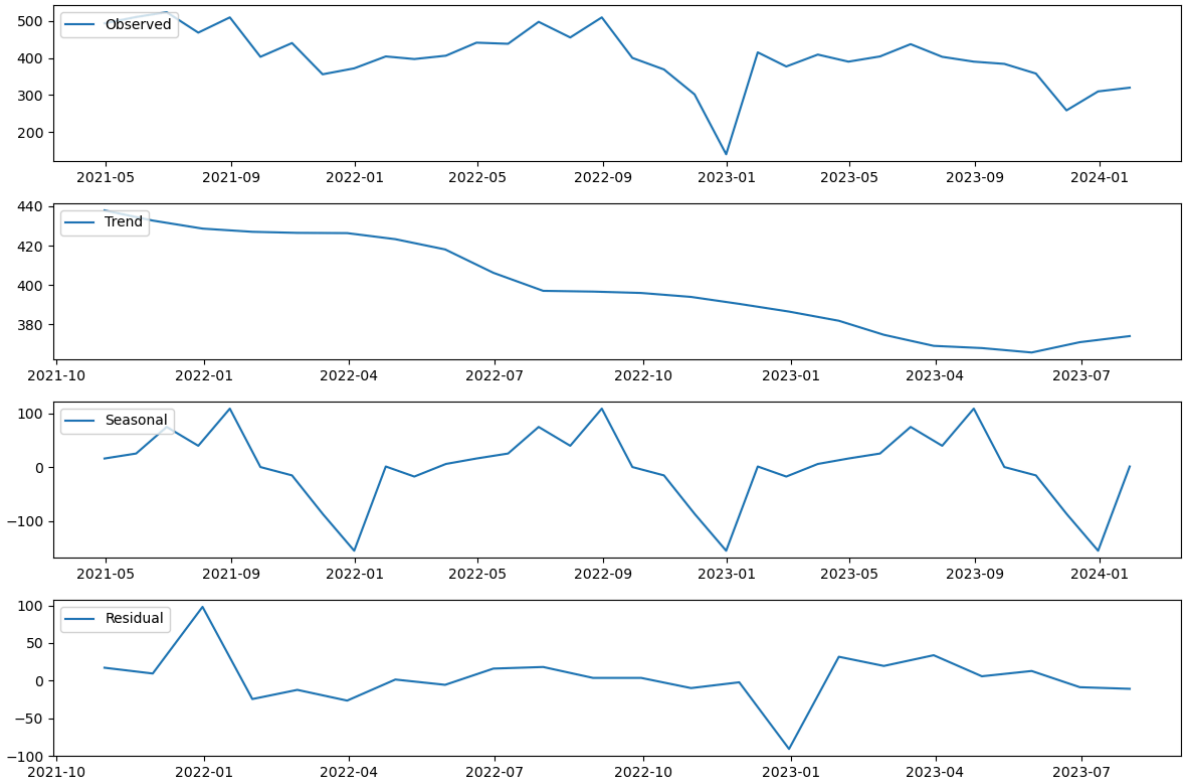


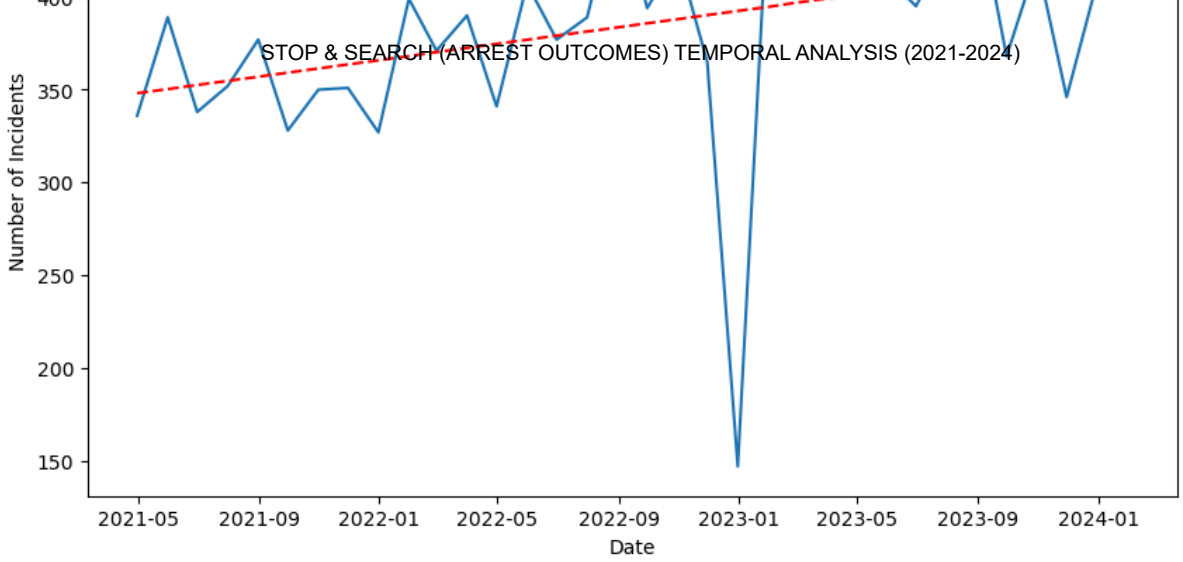

```
Slope of the regression line for Firearms: -0.4844919786096256
```



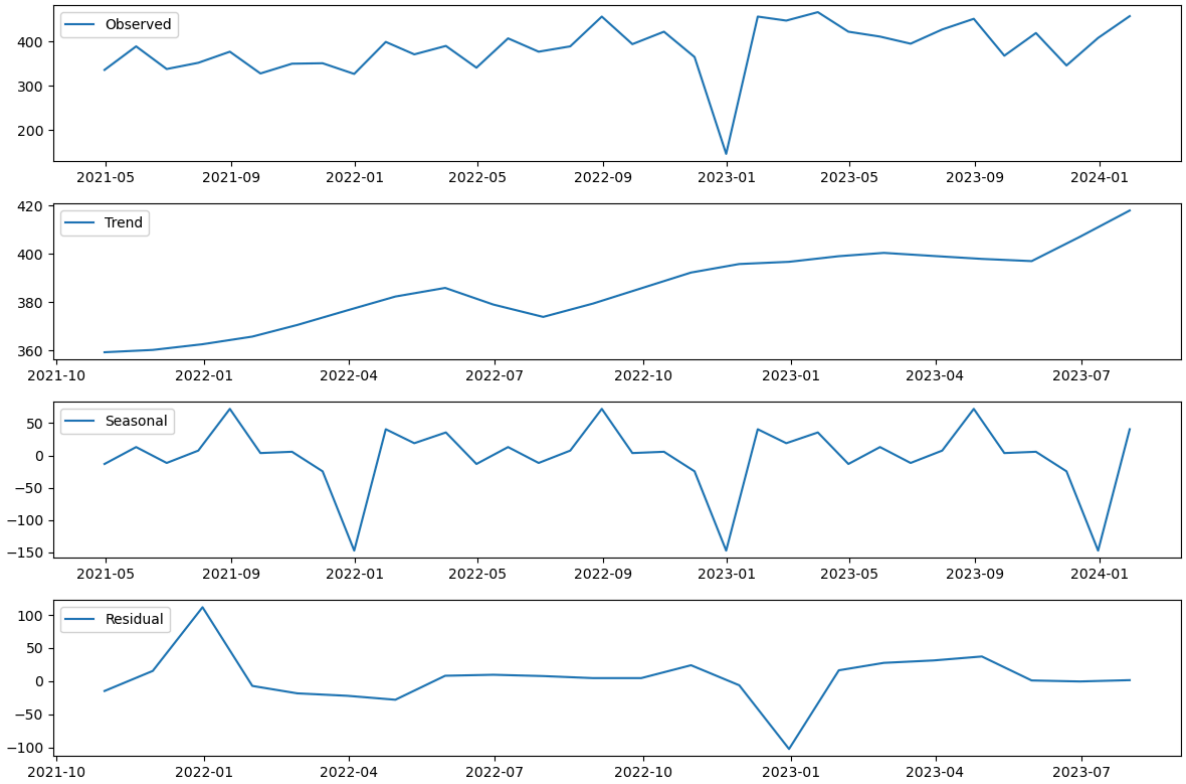



```
Slope of the regression line for Offensive weapons: -4.382123758594346
```






```
Slope of the regression line for Stolen goods: 2.2165011459129103
```



In [ ]: