IN14/2021 SARA SAPUNDŽIJA

TIME SERIES: ONLINE RETAIL

SADRŽAJ

SKUP PODATAKA

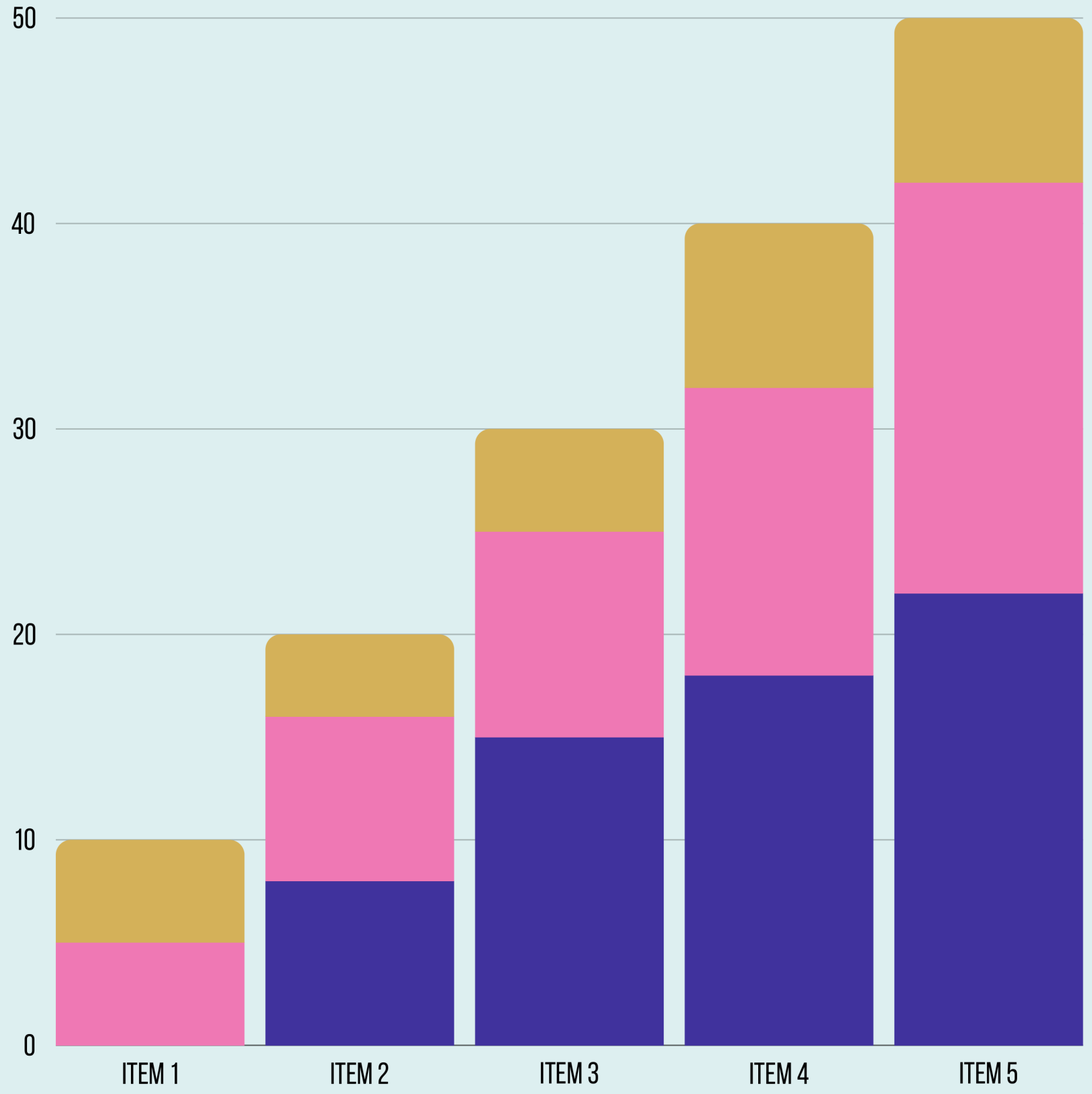
PROCESIRANJE PODATAKA

ANALIZE

PROBLEMI 🙃

SKUP PODATAKA

This Online Retail II data set contains all the transactions occurring for a UK-based and registered, non-store online retail between 01/12/2009 and 09/12/2011.The company mainly sells unique all-occasion gift-ware. Many customers of the company are wholesalers.

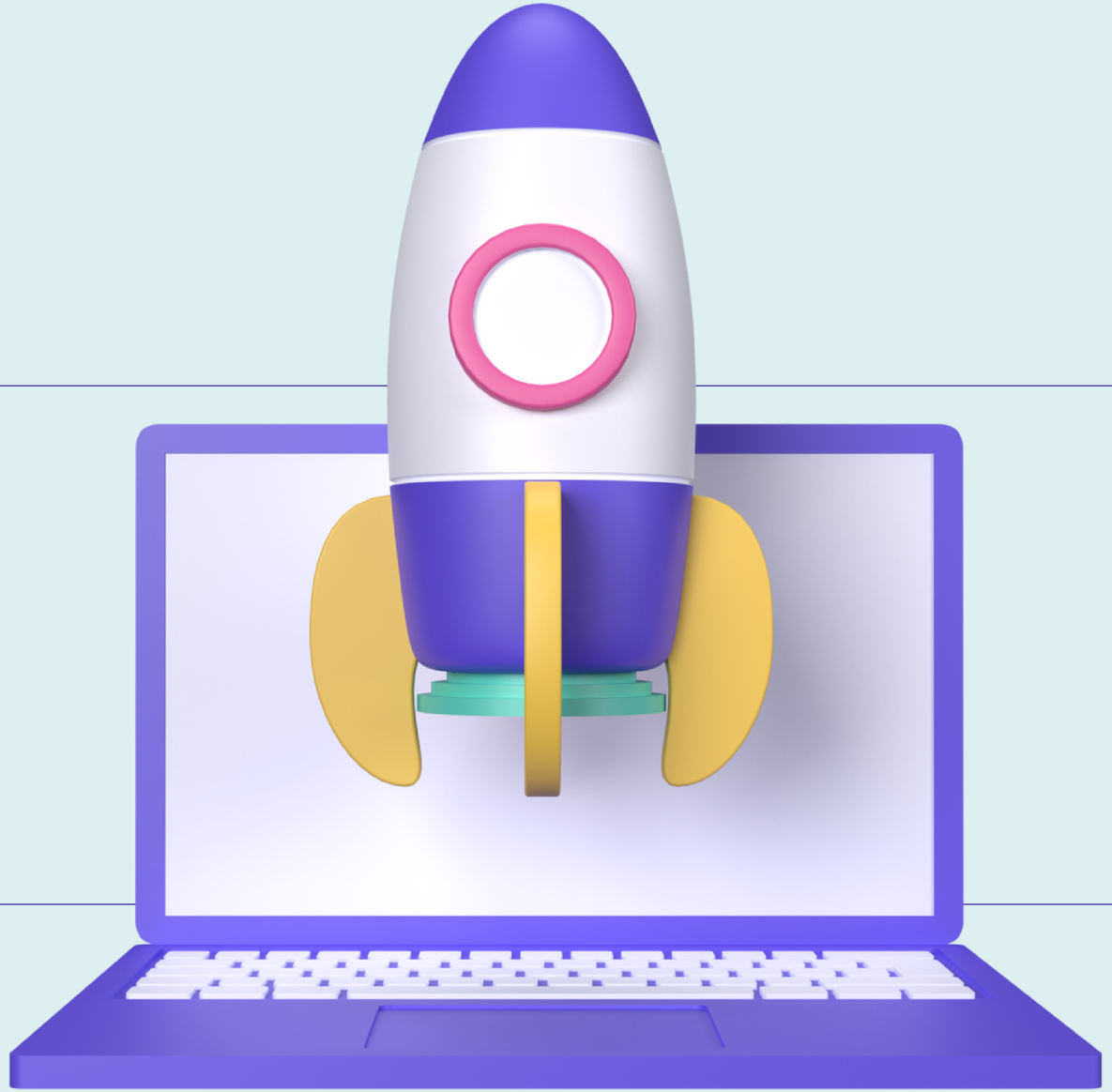


STEP ONE

Učitavanje

STEP TWO

Ispitivanje podataka



STEP TREE

Manipulacija podacima

STEP FOUR

Modeli

```
df.dtypes
```

```
Invoice          object
StockCode        object
Description      object
Quantity          int64
InvoiceDate      object
Price           float64
Customer ID     float64
Country          object
dtype: object
```

```
df['StockCode'].unique()
```

```
array(['85048', '79323P', '79323W', ..., '23609', '23617', '23843'],
      dtype=object)
```

```
df['StockCode'].nunique()
```

```
5305
```

```
df['Description'].unique()
```

```
array(['15CM CHRISTMAS GLASS BALL 20 LIGHTS', 'PINK CHERRY LIGHTS',
       ' WHITE CHERRY LIGHTS', ..., 'mixed up',
       'CREAM HANGING HEART T-LIGHT HOLDER',
       'PAPER CRAFT , LITTLE BIRDIE'], dtype=object)
```

```
df['Description'].nunique()
```

```
5698
```

```
df.head()
```

Python

	Invoice	StockCode	Description	Quantity	InvoiceDate	Price	Customer ID	Country
0	489434	85048	15CM CHRISTMAS GLASS BALL 20 LIGHTS	12	2009-12-01 07:45:00	6.95	13085.0	United Kingdom
1	489434	79323P	PINK CHERRY LIGHTS	12	2009-12-01 07:45:00	6.75	13085.0	United Kingdom
2	489434	79323W	WHITE CHERRY LIGHTS	12	2009-12-01 07:45:00	6.75	13085.0	United Kingdom
3	489434	22041	RECORD FRAME 7" SINGLE SIZE	48	2009-12-01 07:45:00	2.10	13085.0	United Kingdom
4	489434	21232	STRAWBERRY CERAMIC TRINKET BOX	24	2009-12-01 07:45:00	1.25	13085.0	United Kingdom

```
df.duplicated().sum()
```

```
34335
```

```
df.drop_duplicates(inplace = True)
```

```
df.duplicated().sum()
```

```
0
```

```
df.isnull().sum()
```

```
Invoice           0
StockCode         0
Description    4275
Quantity          0
InvoiceDate       0
Price             0
Customer ID       0
Country           0
dtype: int64
```

```
df.dropna(inplace = True)
```

IZBACIVANJE DUPLIKATA I NULL VREDNOSTI

```
#Formiranje TotalPrice labele


df['TotalPrice'] = df['Quantity'] * df['Price']


df[df['TotalPrice']<=0].count()
```

TotalPrice - cena svake transakcije

DODAVANJE YEAR/MONTH KOLONE

```
df['year_month'] = df['Year'].astype(str) + '-' + df['Month'].astype(str)

# Convert 'year_month' to datetime
df['year_month'] = pd.to_datetime(df['year_month'], format='%Y-%m')
```

```
df.head()
```

	Invoice	StockCode	Description	Quantity	InvoiceDate	Price	Customer ID	Country	TotalPrice	Day	Month	Year	year_month
0	489434	85048	15CM CHRISTMAS GLASS BALL 20 LIGHTS	12	2009-12-01 07:45:00	6.95	13085.0	United Kingdom	83.4	1	12	2009	2009-12-01
1	489434	79323P	PINK CHERRY LIGHTS	12	2009-12-01 07:45:00	6.75	13085.0	United Kingdom	81.0	1	12	2009	2009-12-01
2	489434	79323W	WHITE CHERRY LIGHTS	12	2009-12-01 07:45:00	6.75	13085.0	United Kingdom	81.0	1	12	2009	2009-12-01
3	489434	22041	RECORD FRAME 7" SINGLE SIZE	48	2009-12-01 07:45:00	2.10	13085.0	United Kingdom	100.8	1	12	2009	2009-12-01
4	489434	21232	STRAWBERRY CERAMIC TRINKET BOX	24	2009-12-01 07:45:00	1.25	13085.0	United Kingdom	30.0	1	12	2009	2009-12-01

```
df=df.set_index('year_month')
```

SKRAĆIVANJE DATA SETA

```
proizvodi=df['StockCode'].unique()
type(proizvodi)
duzina=len(proizvodi)//3
pola_proizvoda=proizvodi[:duzina]
df = df[df['StockCode'].isin(pola_proizvoda)]
```

⚠SPOILER DATA SET JE PREVELIK

```python
# Izračunajte 80% kvantil za TotalPrice
threshold_amount = df['TotalPrice'].quantile(0.8)

# Pronađite kupce čije su ukupne kupovine veće od 80% kvantila
wholesale_customers = df.groupby('Customer ID')['TotalPrice'].sum()
wholesale_customers = wholesale_customers[wholesale_customers > threshold_amount]
```

```python
#Analiza koliko često obavljaju takve kupovine:
```

```python
# Pretvorite InvoiceDate u datetime format
df['InvoiceDate'] = pd.to_datetime(df['InvoiceDate'])


# Grupišite po kupcima i analizirajte vremenski raspon između transakcija
wholesale_purchase_frequency = df[df['Customer ID'].isin(wholesale_customers.index)]
wholesale_purchase_frequency = wholesale_purchase_frequency.groupby('Customer ID')['InvoiceDate'].diff().mean()
```

```python
wholesale_purchase_frequency
```

```
Timedelta('1 days 18:17:44.074336911')
```

WHOLESALERS

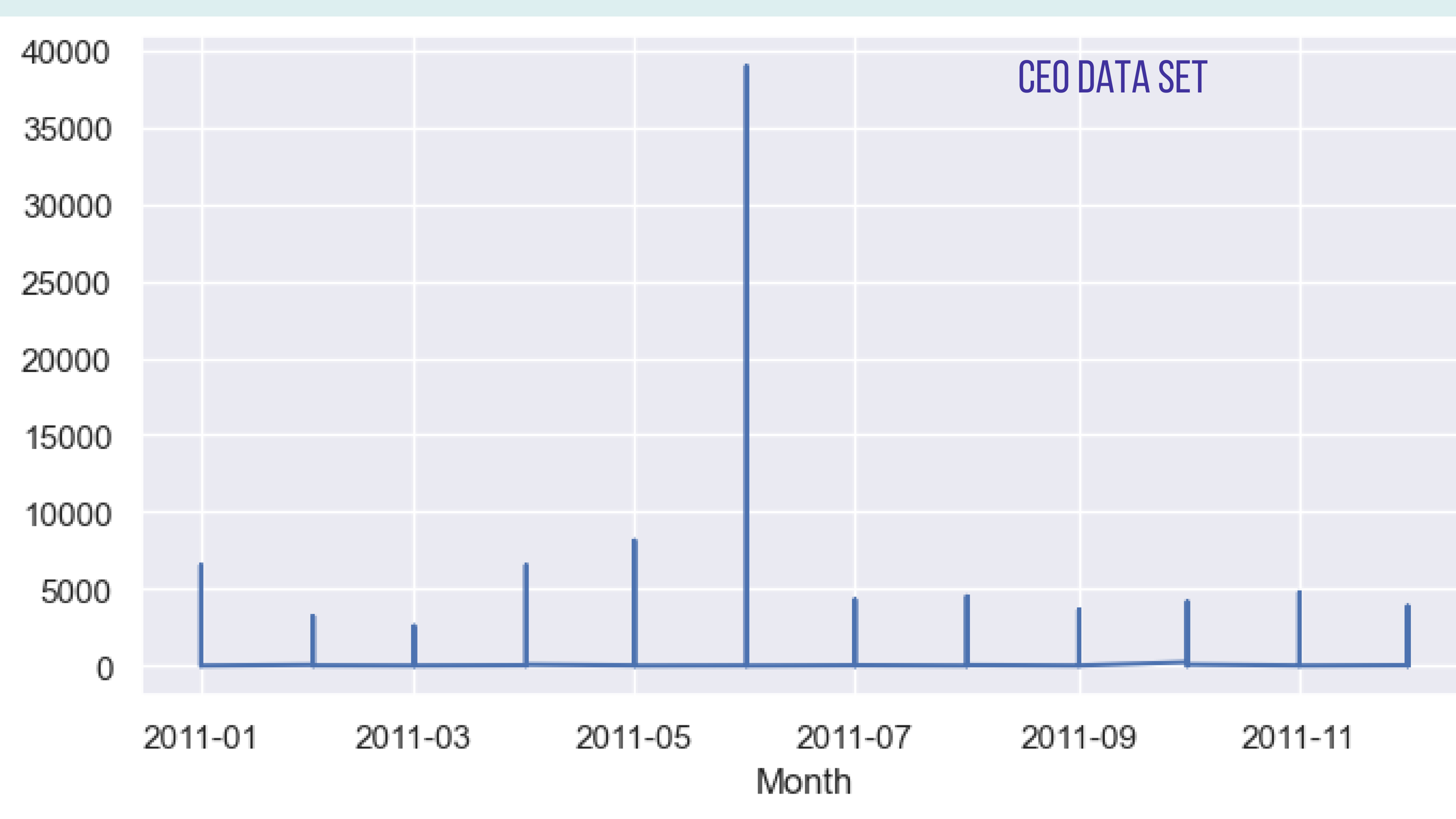
```python
#Pronalaženje redovnih kupaca:
```

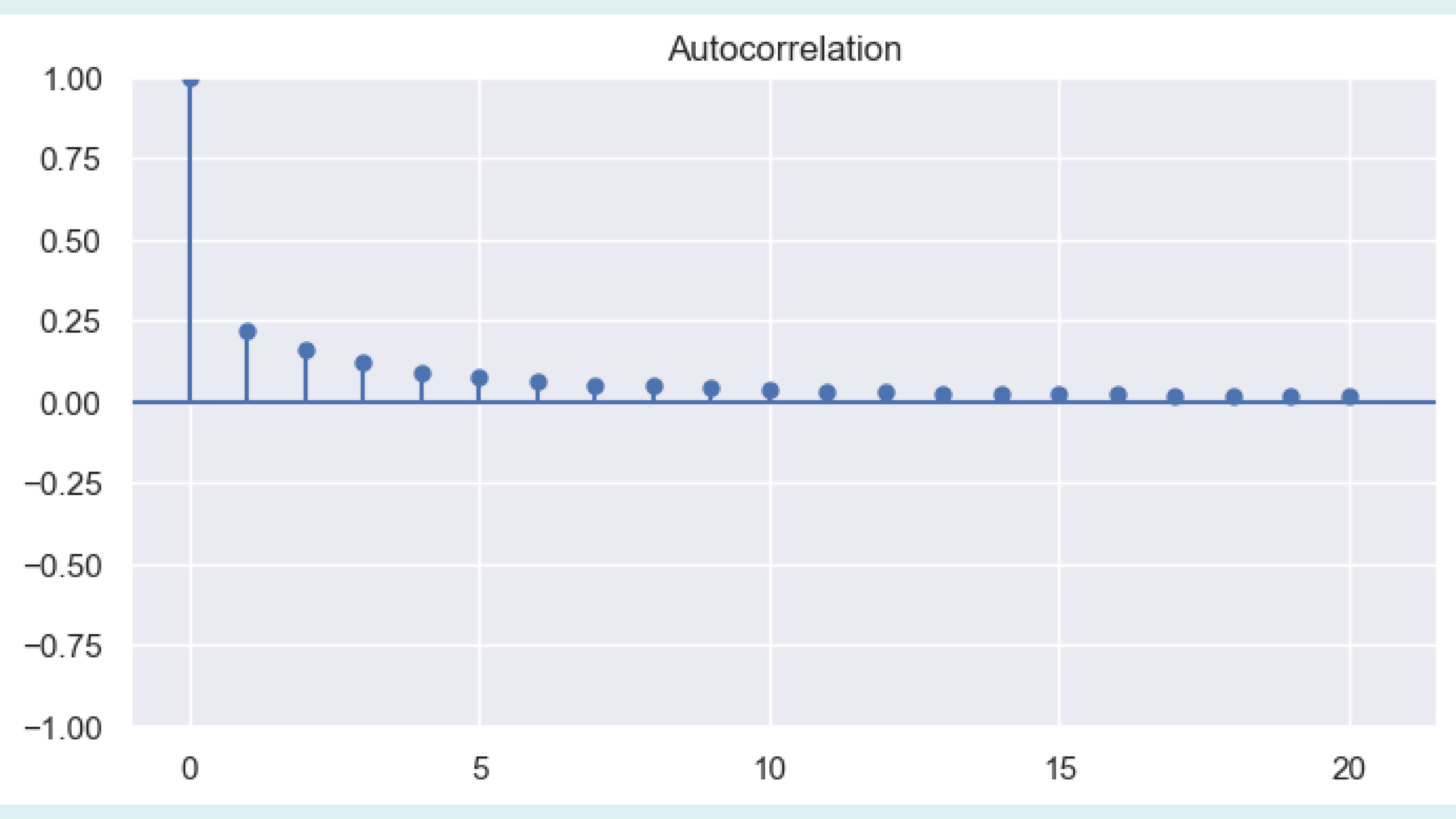
```python
transaction_counts = df['Customer ID'].value_counts()
print(transaction_counts.describe())
```

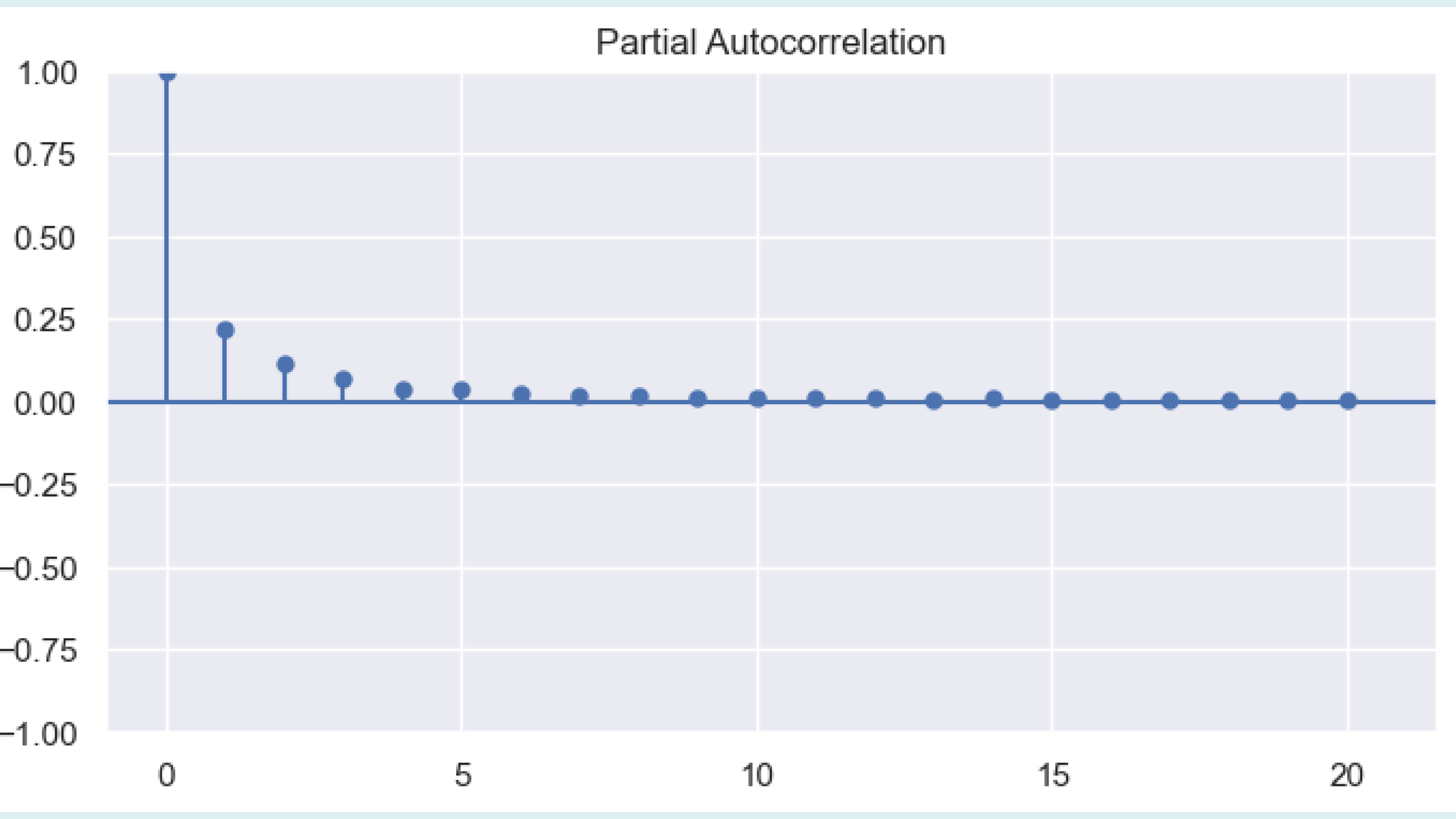
```
count     4153.000000
mean        66.156032
std       1077.240394
min          1.000000
25%          9.000000
50%         22.000000
75%         54.000000
max      69018.000000
Name: count, dtype: float64
```

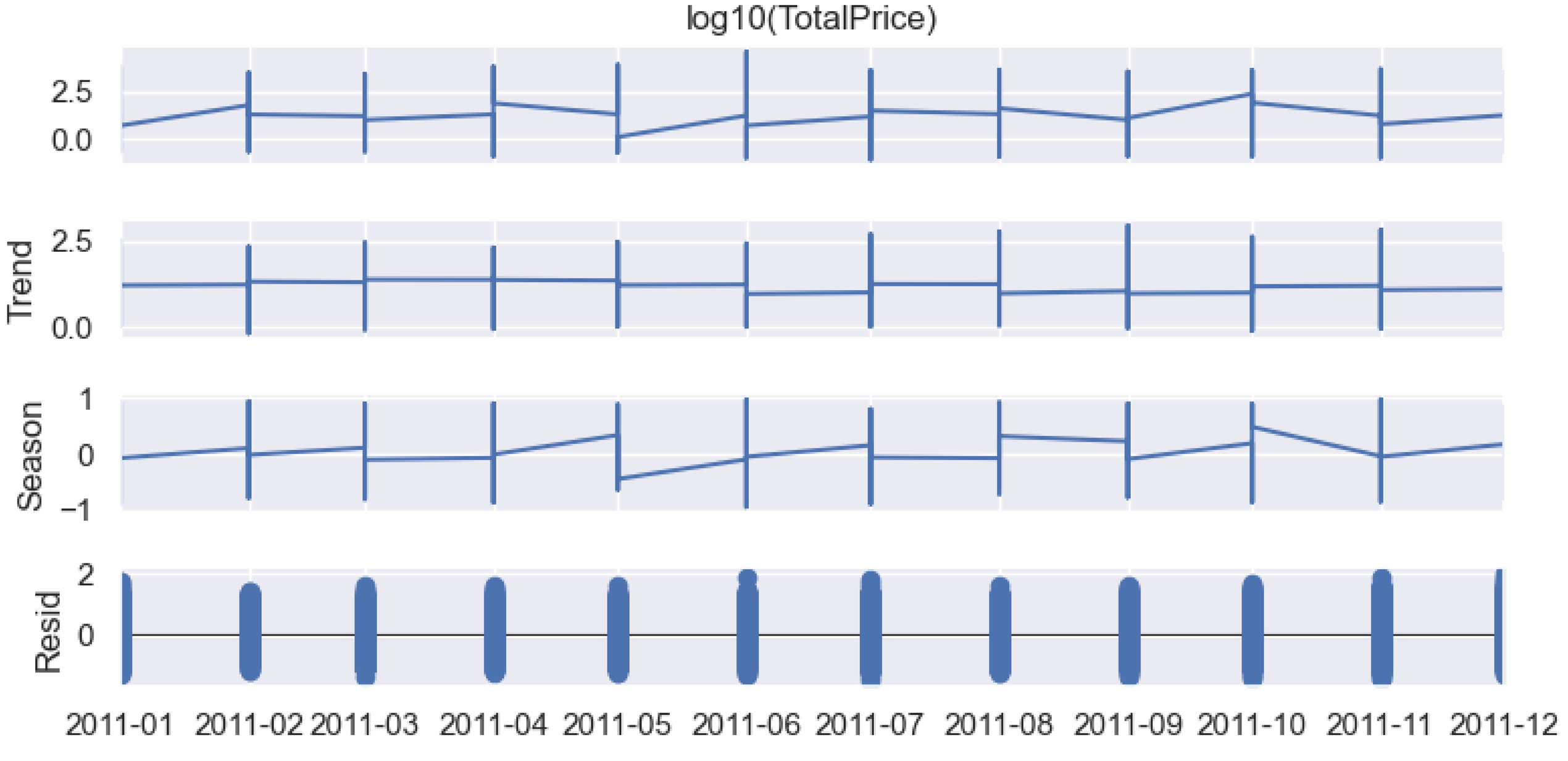
```python
#Analiza onih koji su kupovali samo jednom:
```

```python
one_time_customers = df['Customer ID'].value_counts()
one_time_customers = one_time_customers[one_time_customers == 1]
```


CEO DATA SET
40000
35000
30000
25000
20000
15000
10000
5000
0
2011-01
2011-03
2011-05
2011-07
2011-09
2011-11
Month


Autocorrelation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
5
10
15
20

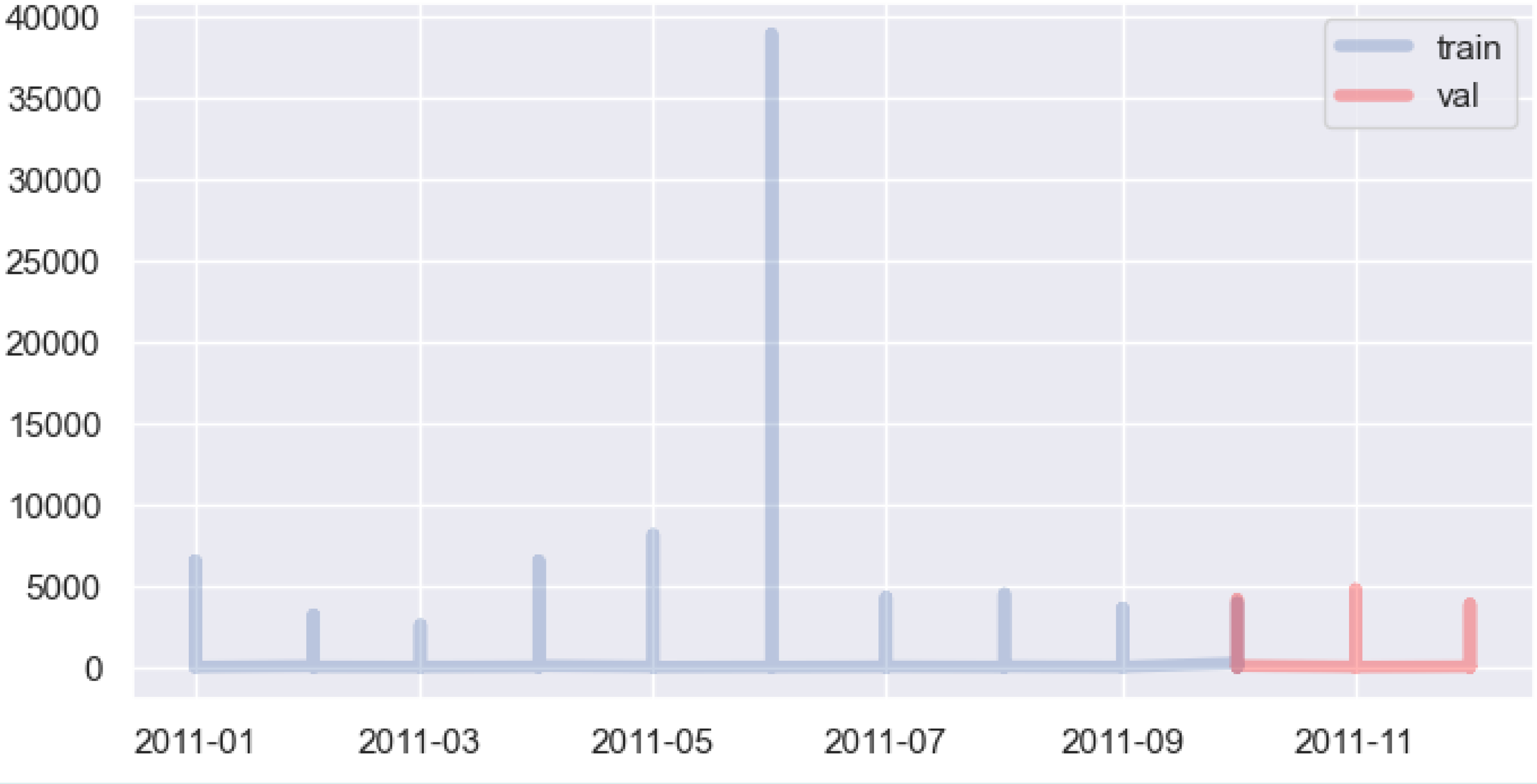

Partial Autocorrelation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
5
10
15
20

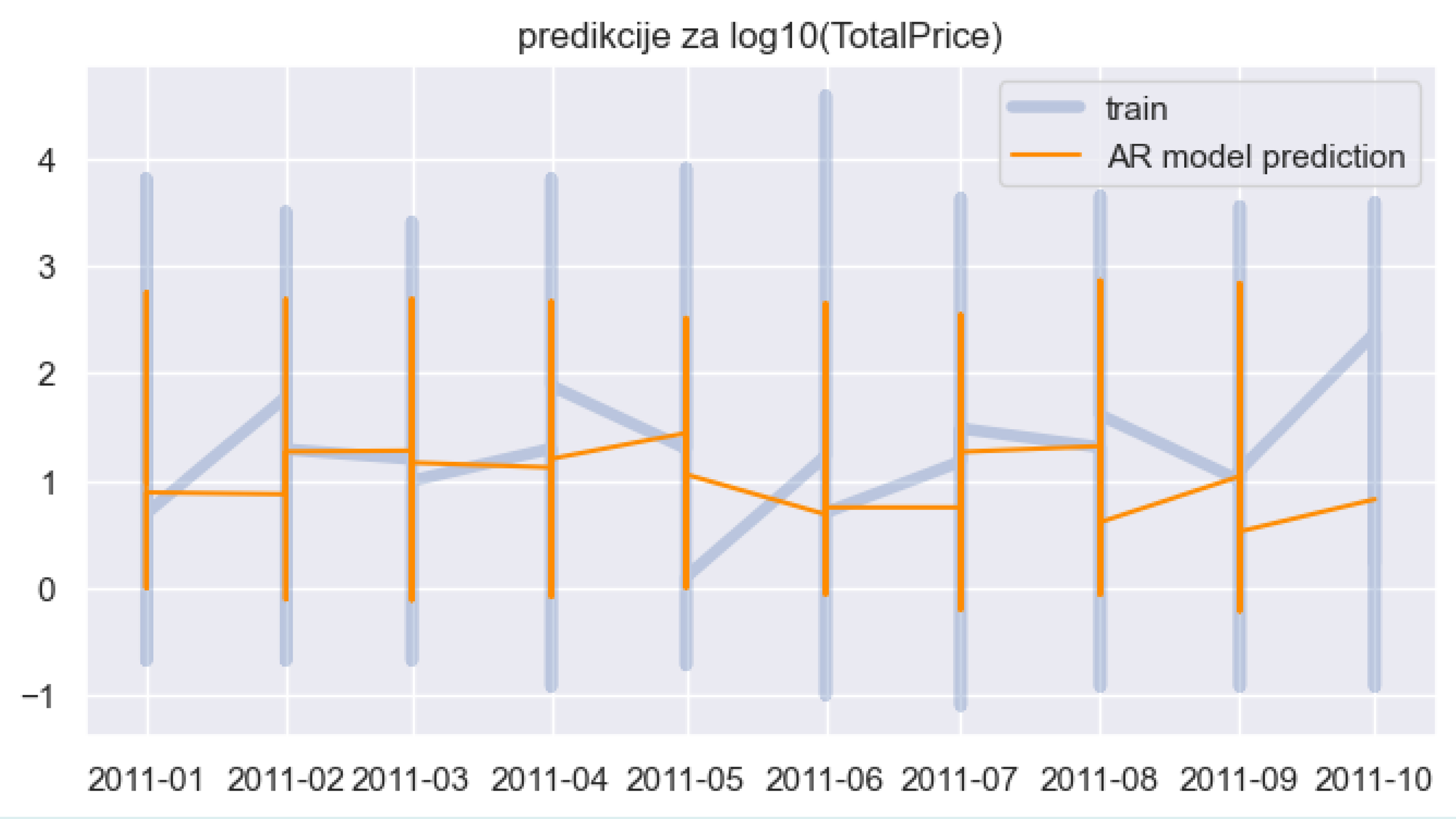

log10(TotalPrice)
2.5
0.0
Trend
2.5
0.0
Season
1
0
−1
Resid
2
0
2011-01
2011-02
2011-03
2011-04
2011-05
2011-06
2011-07
2011-08
2011-09
2011-10
2011-11
2011-12

```
df['log10(TotalPrice)'].plot();
from statsmodels.tsa.stattools import adfuller
adf_value = adfuller(df['log10(TotalPrice)'])[0]
p_value = adfuller(df['log10(TotalPrice)'])[1]
print(f'{adf_value=:.2f}, {p_value=:.2f}')

if p_value <= 0.05: print('postoji stacionarnost')
else: print('ne postoji stacionarnost')
```

```
adf_value=-42.08, p_value=0.00
postoji stacionarnost
```

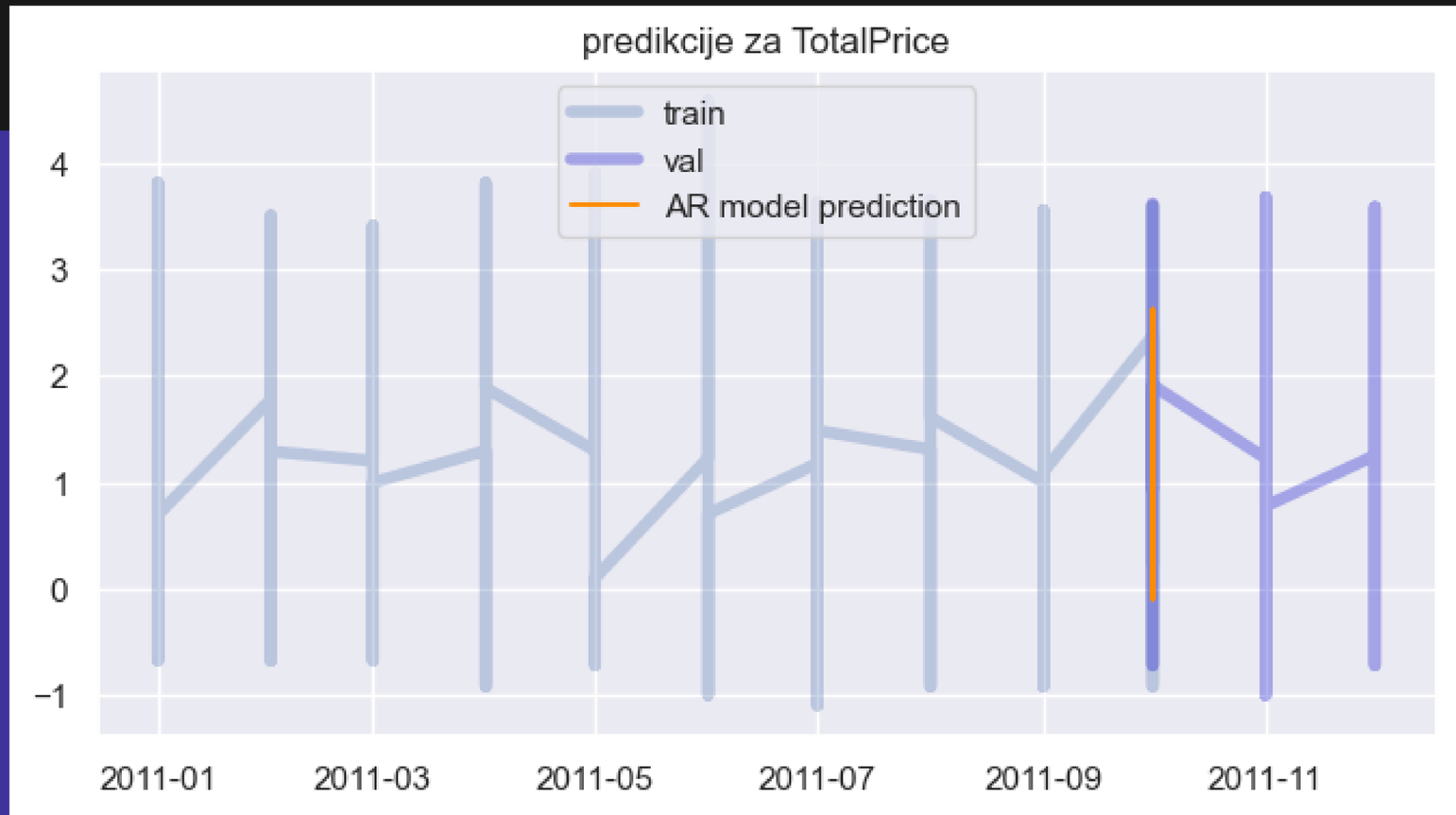

40000
35000
30000
25000
20000
15000
10000
5000
0
2011-01
2011-03
2011-05
2011-07
2011-09
2011-11
train
val

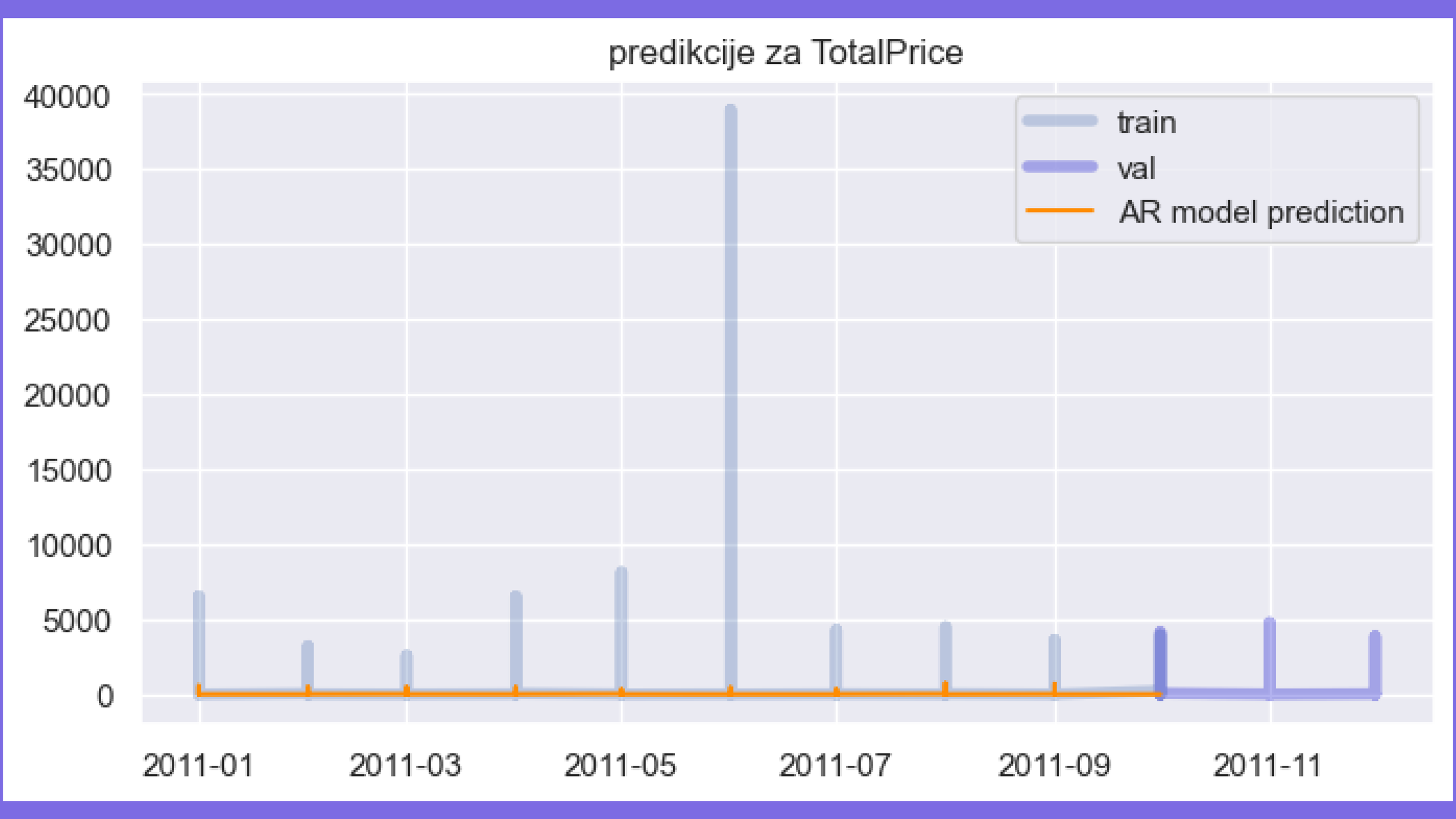

predikcije za log10(TotalPrice)
train
AR model prediction
4
3
2
1
0
−1
2011-01
2011-02
2011-03
2011-04
2011-05
2011-06
2011-07
2011-08
2011-09
2011-10

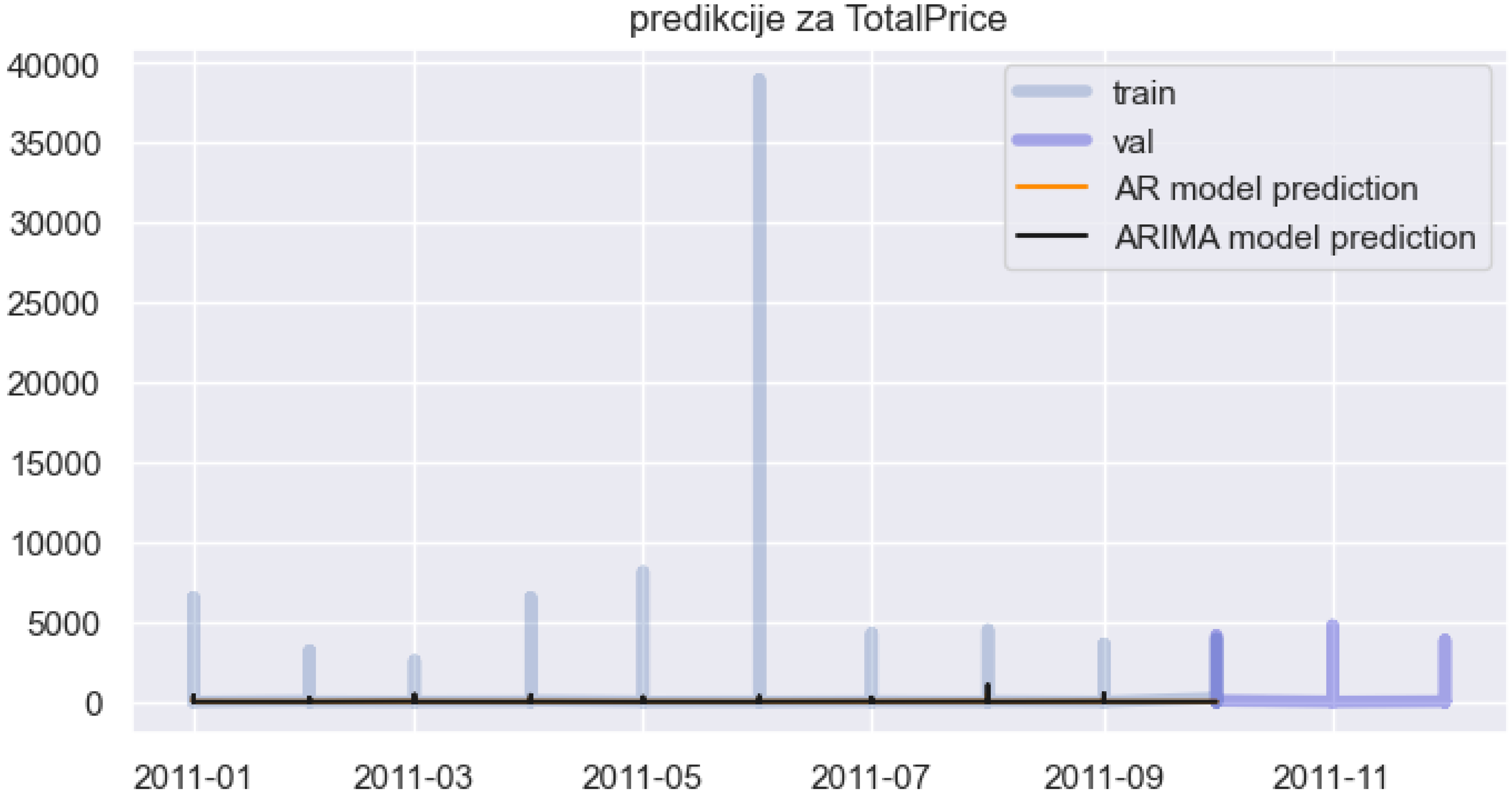
```python
val_df['log10(TotalPrice)'] = np.log10(val_df['TotalPrice'])
y_val_pred = ar_model.predict(start=val_df.index[0])

plt.plot(train_df['log10(TotalPrice)'], color='b', linewidth=4, alpha=0.3, label='train')
plt.plot(val_df['log10(TotalPrice)'], color='mediumblue', linewidth=4, alpha=0.3, label='val')

plt.plot(y_val_pred, color='darkorange', label='AR model prediction')
plt.title('predikcije za TotalPrice')
plt.legend()
plt.show()
```




predikcije za TotalPrice
40000
35000
30000
25000
20000
15000
10000
5000
0
2011-01
2011-03
2011-05
2011-07
2011-09
2011-11
train
val
AR model prediction


predikcije za TotalPrice
40000
35000
30000
25000
20000
15000
10000
5000
0
2011-01
2011-03
2011-05
2011-07
2011-09
2011-11
train
val
AR model prediction
ARIMA model prediction

```
AR model evaluacija nad validacionim skupom:
mse(actual, ar_pred)=9304.11 mae(actual, ar_pred)=18.21

ARIMA model evaluacija nad validacionim skupom:
mse(actual, arima_pred)=9575.12 mae(actual, arima_pred)=19.26
```

PROBLEMI

MEMORYERROR

```
df.shape
```

```
(1067371, 8)
```

```
import gc
gc.collect()
```

HVALA NA PAŽNJI