_ _v.2

April 30, 2023

1

[41]:
```
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import r2_score
import warnings
from statsmodels.tsa.statespace.sarimax import SARIMAX
from statsmodels.graphics.tsaplots import plot_acf, plot_pacf
from statsmodels.tsa.stattools import adfuller
from statsmodels.tsa.seasonal import STL
import statsmodels.api as sm
from IPython.display import Markdown
import time
warnings.filterwarnings('ignore')
```

2

csv.

DataFrame.

[7]:
```
df = pd.read_csv('StockX-Data-Contest-2019-3.csv')
```

[8]:
```
df.head()
```

[8]:
```
  Order Date   Brand                              Sneaker Name  \
0     9/1/17   Yeezy           Adidas-Yeezy-Boost-350-Low-V2-Beluga
1     9/1/17   Yeezy    Adidas-Yeezy-Boost-350-V2-Core-Black-Copper
2     9/1/17   Yeezy     Adidas-Yeezy-Boost-350-V2-Core-Black-Green
3     9/1/17   Yeezy       Adidas-Yeezy-Boost-350-V2-Core-Black-Red
4     9/1/17   Yeezy  Adidas-Yeezy-Boost-350-V2-Core-Black-Red-2017

  Sale Price Retail Price Release Date  Shoe Size  Buyer Region
0     $1,097         $220      9/24/16       11.0    California
1       $685         $220     11/23/16       11.0    California
```

```
2       $690         $220     11/23/16       11.0    California
3     $1,075         $220     11/23/16       11.5      Kentucky
4       $828         $220      2/11/17       11.0  Rhode Island
```

[9]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 99956 entries, 0 to 99955
Data columns (total 8 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   Order Date    99956 non-null  object
 1   Brand         99956 non-null  object
 2   Sneaker Name  99956 non-null  object
 3   Sale Price    99956 non-null  object
 4   Retail Price  99956 non-null  object
 5   Release Date  99956 non-null  object
 6   Shoe Size     99956 non-null  float64
 7   Buyer Region  99956 non-null  object
dtypes: float64(1), object(7)
memory usage: 6.1+ MB
```

[10]:
```
df['Brand'] = df['Brand'].str.strip()
```

info( ) , , (datatime)

[11]:
```
df['Order Date'] = pd.to_datetime(df['Order Date'])
df['Release Date'] = pd.to_datetime(df['Release Date'])
```

head( ) (object) , , , (int)

[12]:
```
df['Sale Price'] = df['Sale Price'].str.replace('$', '', regex=True)
df['Sale Price'] = df['Sale Price'].str.replace(',', '', regex=True)
df['Sale Price'] = df['Sale Price'].astype('int')
```

[13]:
```
df['Retail Price'] = df['Retail Price'].str.replace('$', '', regex=True)
df['Retail Price'] = df['Retail Price'].str.replace(',', '', regex=True)
df['Retail Price'] = df['Retail Price'].astype('int')
```

[14]:
```
df['    '] = df['Sale Price'] - df['Retail Price']
```

, data frame,

[15]:
```
df[df['Buyer Region'].isin(['Wyoming', 'Montana'])]
```

[15]:
```
      Order Date  Brand                                Sneaker Name  \
597   2017-09-26  Yeezy        Adidas-Yeezy-Boost-350-V2-Cream-White
3863  2017-11-25  Yeezy        Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
5854  2017-11-30  Yeezy        Adidas-Yeezy-Boost-350-V2-Cream-White
8059  2017-12-09  Yeezy  Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
8671  2017-12-13  Yeezy        Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
…            …    …                                             …
94443 2019-01-31  Yeezy              Adidas-Yeezy-Boost-350-V2-Zebra
94827 2019-02-01  Yeezy             adidas-Yeezy-Boost-350-V2-Static
95660 2019-02-05  Yeezy  Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
96836 2019-02-07  Yeezy          Adidas-Yeezy-Boost-350-V2-Blue-Tint
98670 2019-02-10  Yeezy             adidas-Yeezy-Boost-350-V2-Butter

       Sale Price  Retail Price Release Date  Shoe Size Buyer Region
597           478           220   2017-04-29       10.5      Wyoming      258
3863          455           220   2017-11-25       11.0      Wyoming      235
5854          450           220   2017-04-29       12.0      Montana      230
8059          670           220   2017-11-18        6.5      Montana      450
8671          352           220   2017-11-25       14.0      Montana      132
…           …           …          …          …          …        …
94443         337           220   2017-02-25       12.0      Montana      117
94827         272           220   2018-12-27       12.0      Wyoming       52
95660         303           220   2017-11-18        5.5      Wyoming       83
96836         350           220   2017-12-16       13.0      Wyoming      130
98670         230           220   2018-06-30        9.0      Wyoming       10

[89 rows x 9 columns]
```

2 “ ”, “ ”

[16]:
```python
df.groupby(['Order Date', 'Buyer Region'], as_index=False).count()
```

[16]:
```
      Order Date Buyer Region  Brand  Sneaker Name  Sale Price  Retail Price  \
0     2017-09-01   California      6             6           6             6
1     2017-09-01      Florida      3             3           3             3
2     2017-09-01       Kansas      1             1           1             1
3     2017-09-01     Kentucky      1             1           1             1
4     2017-09-01     Michigan      3             3           3             3
…          …          …    …           …          …          …
15066 2019-02-13    Tennessee      3             3           3             3
15067 2019-02-13        Texas     17            17          17            17
15068 2019-02-13     Virginia      4             4           4             4
15069 2019-02-13   Washington      3             3           3             3
15070 2019-02-13    Wisconsin      2             2           2             2

       Release Date  Shoe Size
0                 6          6        6
1                 3          3        3
```

```
2                    1           1         1
3                    1           1         1
4                    3           3         3
…               …          …      …
15066                3           3         3
15067               17          17        17
15068                4           4         4
15069                3           3         3
15070                2           2         2

[15071 rows x 9 columns]
```

[17]:

```
df.groupby(['Order Date', 'Buyer Region']).count()
```

[17]:

```
                         Brand  Sneaker Name  Sale Price  Retail Price  \
Order Date Buyer Region
2017-09-01 California        6             6           6             6
           Florida           3             3           3             3
           Kansas            1             1           1             1
           Kentucky          1             1           1             1
           Michigan          3             3           3             3
…                         …           …         …           …
2019-02-13 Tennessee         3             3           3             3
           Texas            17            17          17            17
           Virginia          4             4           4             4
           Washington        3             3           3             3
           Wisconsin         2             2           2             2

                         Release Date  Shoe Size
Order Date Buyer Region
2017-09-01 California               6          6         6
           Florida                  3          3         3
           Kansas                   1          1         1
           Kentucky                 1          1         1
           Michigan                 3          3         3
…                                …        …       …
2019-02-13 Tennessee                3          3         3
           Texas                   17         17        17
           Virginia                 4          4         4
           Washington               3          3         3
           Wisconsin                2          2         2

[15071 rows x 7 columns]
```

[91]:

```
def brand_sezon(model_data, model):
    modell_data = model_data.groupby("Sale Price", as_index = False).count()
    x_data = modell_data['Sale Price']
```

```
    y_data = modell_data['Order Date']
    fig = plt.figure(figsize = (20,5))
    plt.title(f"                                   {model}")
    plt.xticks(rotation=90)
    plt.scatter(x_data, y_data)

    # modell_data = model_data.groupby("Order Date", as_index = False).count()
    x_data = model_data['Order Date']
    y_data = model_data['Sale Price']
    fig = plt.figure(figsize = (20,5))
    plt.title(f"                                   {model}")
    plt.xticks(rotation=90)
    plt.scatter(x_data, y_data, color='g')


def print_sale(brand_data, title):
    '''                                   '''
    month_sale = brand_data.groupby('Order Month', as_index = False).count()
    x_data = month_sale['Order Month']
    y_data = month_sale['Order Date']
    fig = plt.figure(figsize = (20,5))
    plt.title(title)
    plt.xticks(rotation=90)
    plt.bar(x_data, y_data)


def print_all_sale(data, title):
    brand_count = data.groupby("Brand", as_index = False).count()
    x_data = brand_count['Brand']
    y_data = brand_count['Order Date']
    fig = plt.figure(figsize = (20,5))
    plt.title(title)
    plt.xticks(rotation=90)
    plt.bar(x_data, y_data)


def print_heatmap(data, x, y, z, annotion = True):
    sns.set()
    fig, ax = plt.subplots(figsize = (20, 20))
    heatmap = sns.heatmap(data = data.pivot(x, y, z), ax = ax, cmap = 'plasma', annot = annotion)
    plt.show()


def sarima(brand_data):
    '''                '''
```

```python
sales_train_row = brand_data.groupby('Order Date', as_index=False).agg({'Sneaker Name':'count'})
sales_train_row.rename(columns = {'Sneaker Name' :'Retail Count'}, inplace = True)
sales_train_row.set_index(sales_train_row['Order Date'], inplace=True)
sales_index = pd.date_range(start=sales_train_row['Order Date'].index.min(), end=sales_train_row['Order Date'].index.max(), freq='D')
sales_ts = pd.Series(index=sales_index)
sales_ts = sales_ts.combine_first(sales_train_row['Retail Count'])
sales_ts = sales_ts.resample('W').sum()
#
fig = plt.figure(figsize = (20,5))  #
plt.xticks(rotation=90) #             x
plt.title('             ')
plt.plot(sales_ts)
#                    ,
stl = STL(sales_ts, seasonal=13)
res = stl.fit()
fig = plt.figure(figsize = (20,5))  #
plt.xticks(rotation=90) #             x
plt.title('        ')
plt.plot(res.trend)
fig = plt.figure(figsize = (20,5))  #
plt.xticks(rotation=90) #             x
plt.title('          ')
plt.plot(res.seasonal)
#      ACF   PACF
fig, axes = plt.subplots(2, 1, figsize=(10, 8))
plt.title('     ACF   PACF')
plot_acf(sales_ts, ax=axes[0])
plot_pacf(sales_ts, ax=axes[1])
plt.show()
#
display(Markdown('###                      '))
ADF_result = adfuller(sales_ts)
print(f'ADF      :{ADF_result[0]}')
print(f'p-value: {ADF_result[1]}')
print('           :')
for key, value in ADF_result[4].items():
    print(key, value)
#     SARIMA
p = 1
d = 1
q = 1
P = 1
D = 1
Q = 1
```

```
    s = 27
    model = SARIMAX(sales_ts, order=(p, d, q), seasonal_order=(P, D, Q, s))
    results = model.fit()
    forecast = results.predict(start=len(sales_ts), end=len(sales_ts)+54, dynamic=True)
    plt.figure(figsize=(10, 6))
    plt.plot(sales_ts.index, sales_ts.values, label='              ')
    plt.plot(sales_ts.index, sales_ts.values, label='            ')
    plt.plot(forecast.index, forecast.values, label='    ')
    plt.fill_between(forecast.index, forecast.quantile(0), forecast.quantile(1), alpha=0.2, label='            ')
    plt.title('        ')
    plt.xlabel('   ')
    plt.ylabel('          ')
    plt.legend()
    plt.show()
```

```
def analitica_region(region, data):
    display(Markdown('#        '))
    #
    data = data[data['Buyer Region'].isin([region])]
    #
    brands = data['Brand'].unique()
    #
    data['Order Month'] = data['Order Date'].dt.month

    #
    for brand in brands:
        markdown_text = f'#              {brand}'
        display(Markdown(markdown_text))
        #
        brand_data = data[data['Brand'].isin([brand])]
        #
        print_sale(brand_data, f'              {brand}       ')
        #
        models = brand_data['Sneaker Name'].unique()
        #
        count_sales = len(brand_data)
        #
        sarima(brand_data)
```

```
        count_brand = brand_data.groupby(['Order Month', 'Sneaker Name'],␣
↪as_index = False).agg({'Sale Price' : 'count', '     ' : 'sum'})
        size_model = brand_data.groupby(['Shoe Size', 'Sneaker Name'], as_index␣
↪= False).agg({'Sale Price' : 'count', '    ' : 'sum'})
        # index_max = month_sale['Sale Price'].idxmax()
        # display(month_sale.loc[index_max]['Order Month'])
        #
        display(Markdown('###                  '))
        for model in models:
            #
            model_data = brand_data[brand_data['Sneaker Name'].isin([model])]
            if len(model_data['Order Month'].unique()) == 12:
                print(f'         {brand}                -   {model}')
                brand_sezon(model_data, model)
            else:
                print(f'         {brand}                  -   {model}')

        print(f'                         {brand}       ')
        print_heatmap(count_brand, 'Sneaker Name', 'Order Month', "Sale Price")
        print(f'                         {brand}       ')
        print_heatmap(count_brand, 'Sneaker Name', 'Order Month', "    ")
        print(f'                          {brand}          ')
        print_heatmap(size_model, 'Sneaker Name', 'Shoe Size', 'Sale Price')
        print(f'                          {brand}          ')
        print_heatmap(size_model, 'Sneaker Name', 'Shoe Size', '    ', annotion␣
↪= False)

    #
    brand_str = ", ".join(brands)
    print_all_sale(data, f"                    {brand_str}")
```

[90]:
```
analitica_region("California", df)
```

3

4 Yeezy


График временного ряда
600
500
400
300
200
100
0
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03

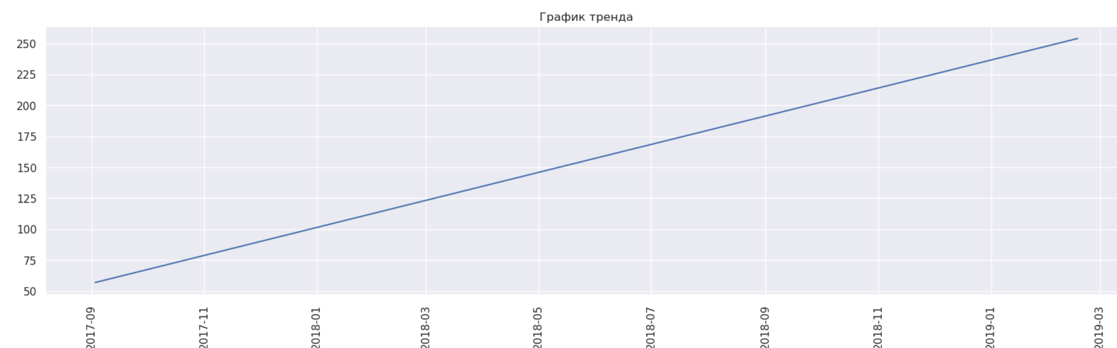
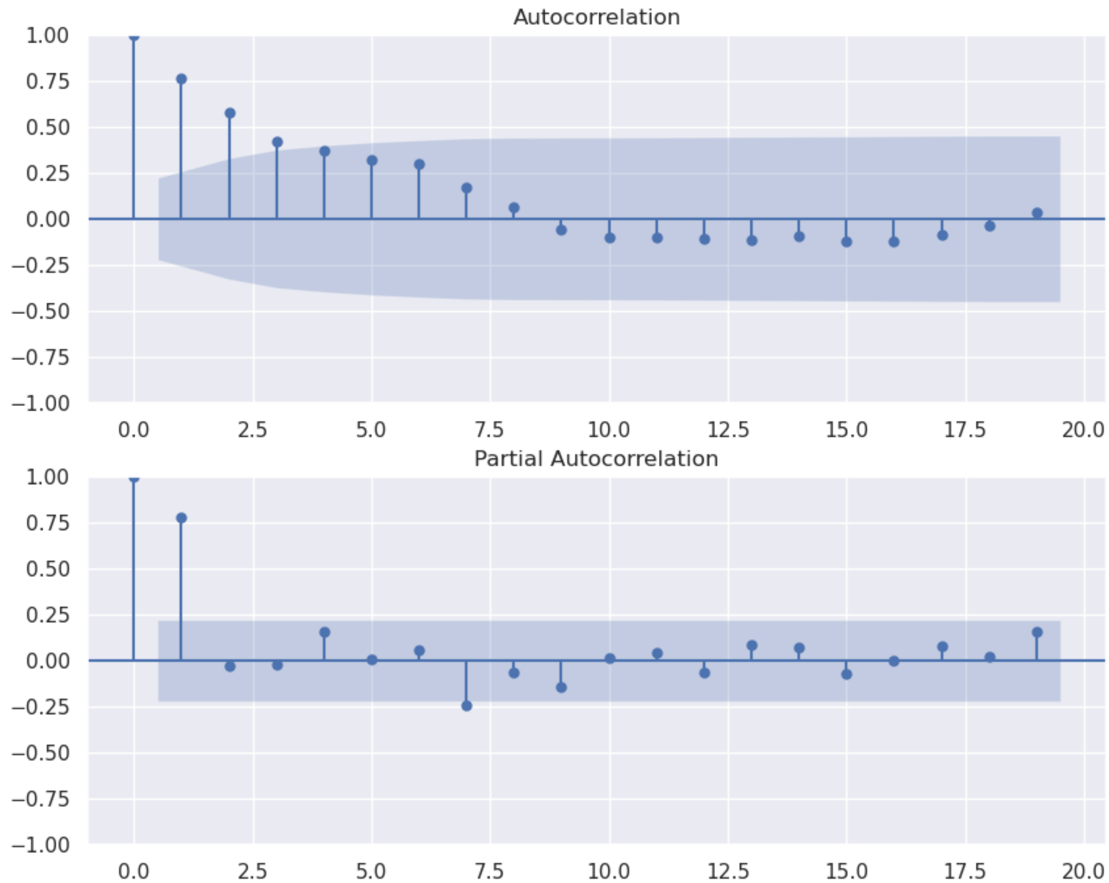


График тренда
250
225
200
175
150
125
100
75
50
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03

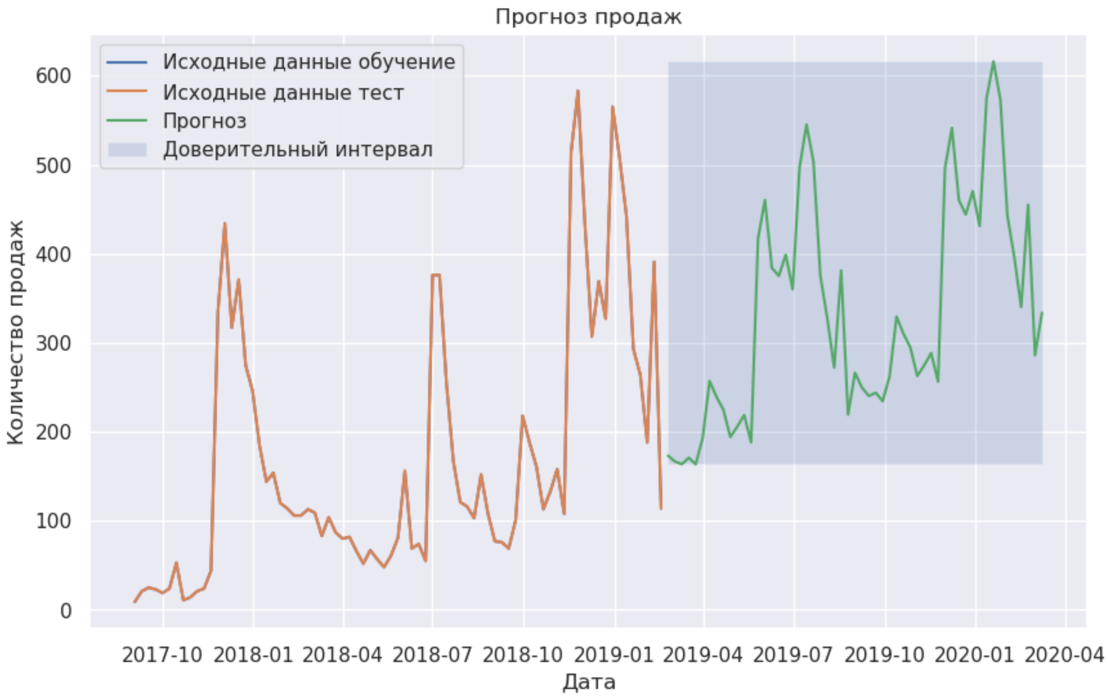

График сезонности
300
200
100
0
−100
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03



4.0.1

```
ADF       :-3.1761944774875244
p-value: 0.021404653667943998
           :
1% -3.5194805351545413
5% -2.9003945086747343
10% -2.5874984279778395
RUNNING THE L-BFGS-B CODE

           * * *

Machine precision = 2.220D-16
 N =            5     M =           10

At X0         0 variables are exactly at the bounds

At iterate    0    f=  4.00198D+00    |proj g|=  1.03075D-01

 This problem is unconstrained.
```

```
At iterate    5    f=  3.98161D+00    |proj g|=  5.21194D-03

At iterate   10    f=  3.97982D+00    |proj g|=  1.74104D-03

At iterate   15    f=  3.97706D+00    |proj g|=  1.54426D-02

At iterate   20    f=  3.96672D+00    |proj g|=  3.64833D-04

At iterate   25    f=  3.96671D+00    |proj g|=  8.91724D-04

At iterate   30    f=  3.96667D+00    |proj g|=  1.02909D-03

At iterate   35    f=  3.96662D+00    |proj g|=  2.48054D-03

At iterate   40    f=  3.96658D+00    |proj g|=  1.74391D-03

At iterate   45    f=  3.96651D+00    |proj g|=  9.32063D-04

At iterate   50    f=  3.96649D+00    |proj g|=  5.03136D-04

           * * *

Tit   = total number of iterations
Tnf   = total number of function evaluations
Tnint = total number of segments explored during Cauchy searches
Skip  = number of BFGS updates skipped
Nact  = number of active bounds at final generalized Cauchy point
Projg = norm of the final projected gradient
F     = final function value

           * * *

   N    Tit     Tnf  Tnint  Skip  Nact     Projg        F
    5     50     62      1     0     0   5.031D-04   3.966D+00
  F =   3.9664907594093148

STOP: TOTAL NO. of ITERATIONS REACHED LIMIT
```



4.0.2

Yeezy - Adidas-Yeezy-Boost-350-Low-V2-Beluga

Yeezy - Adidas-Yeezy-Boost-350-V2-Core-Black-Copper

Yeezy - Adidas-Yeezy-Boost-350-V2-Core-Black-Green

Yeezy - Adidas-Yeezy-Boost-350-V2-Core-Black-White

Yeezy - Adidas-Yeezy-Boost-350-V2-Zebra

Yeezy - Adidas-Yeezy-Boost-350-V2-Cream-White

Yeezy - Adidas-Yeezy-Boost-350-V2-Core-Black-Red-2017

Yeezy - Adidas-Yeezy-Boost-350-V2-Core-Black-Red

Yeezy - Adidas-Yeezy-Boost-350-Low-Turtledove

Yeezy - Adidas-Yeezy-Boost-350-Low-Moonrock

Yeezy - Adidas-Yeezy-Boost-350-Low-Pirate-Black-2015

Yeezy - Adidas-Yeezy-Boost-350-Low-Pirate-Black-2016

Yeezy - Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
Yeezy - Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
Yeezy - Adidas-Yeezy-Boost-350-Low-Oxford-Tan
Yeezy - Adidas-Yeezy-Boost-350-V2-Blue-Tint
Yeezy - adidas-Yeezy-Boost-350-V2-Butter
Yeezy - Adidas-Yeezy-Boost-350-V2-Sesame
Yeezy - adidas-Yeezy-Boost-350-V2-Static
Yeezy - adidas-Yeezy-Boost-350-V2-Static-Reflective
Yeezy

График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Core-Black-Green

График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Core-Black-Green

График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Core-Black-White

График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Core-Black-White


График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Zebra
0
20
40
60
80
300
400
500
600
700
800
900


График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Zebra
300
400
500
600
700
800
900
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Cream-White
0
20
40
60
80
100
120
200
300
400
500
600
700


График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Cream-White
700
600
500
400
300
200
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Core-Black-Red-2017
17.5
15.0
12.5
10.0
7.5
5.0
2.5
800
1000
1200
1400


График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Core-Black-Red-2017
1400
1200
1000
800
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-Low-Pirate-Black-2016
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
800
900
1000
1100
1200
1300

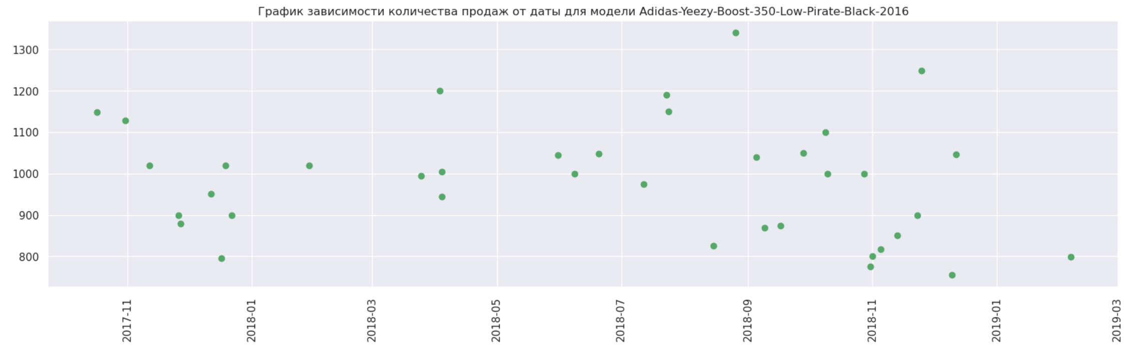


График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-Low-Pirate-Black-2016
1300
1200
1100
1000
900
800
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
14
12
10
8
6
4
2
200
400
600
800
1000
1200

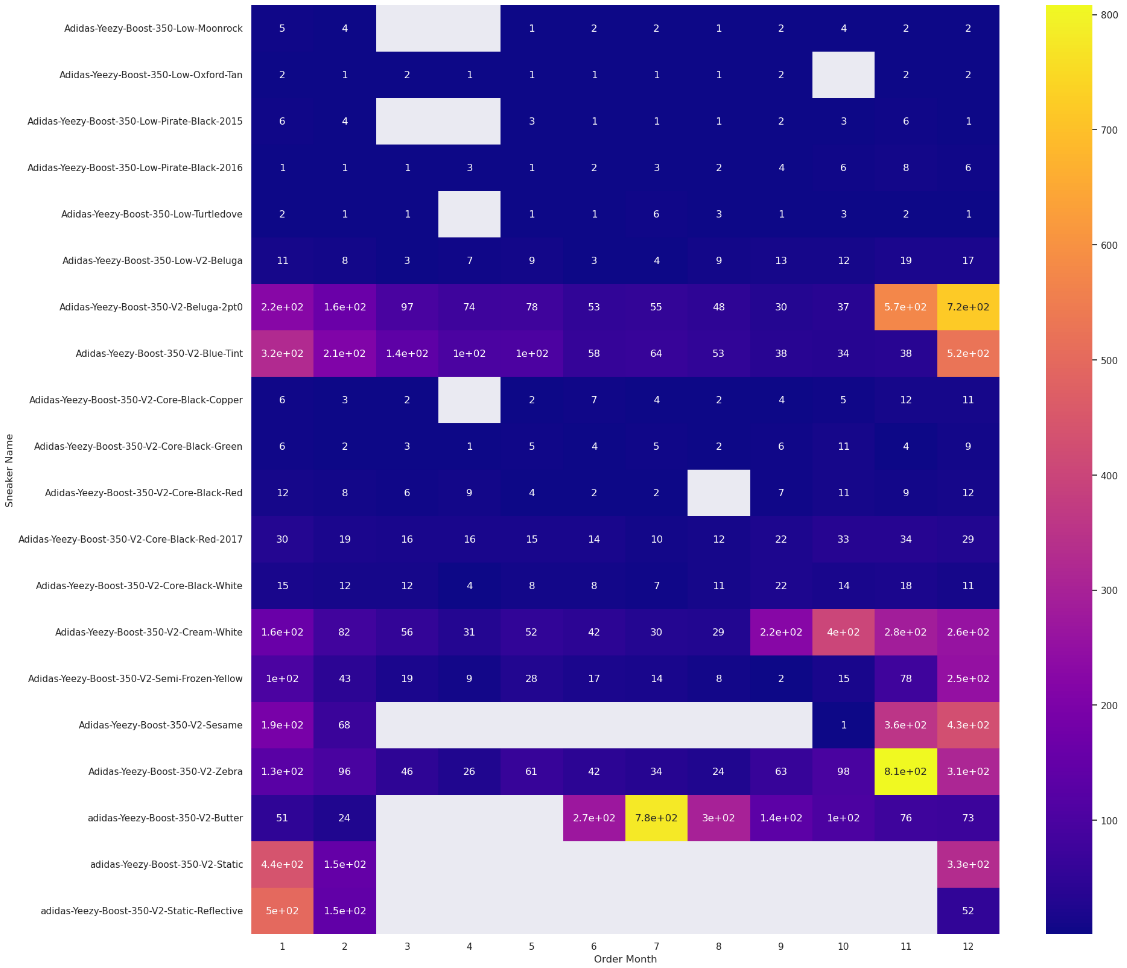

График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
1200
1000
800
600
400
200
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
0
10
20
30
40
50
60
70
80
300
400
500
600
700

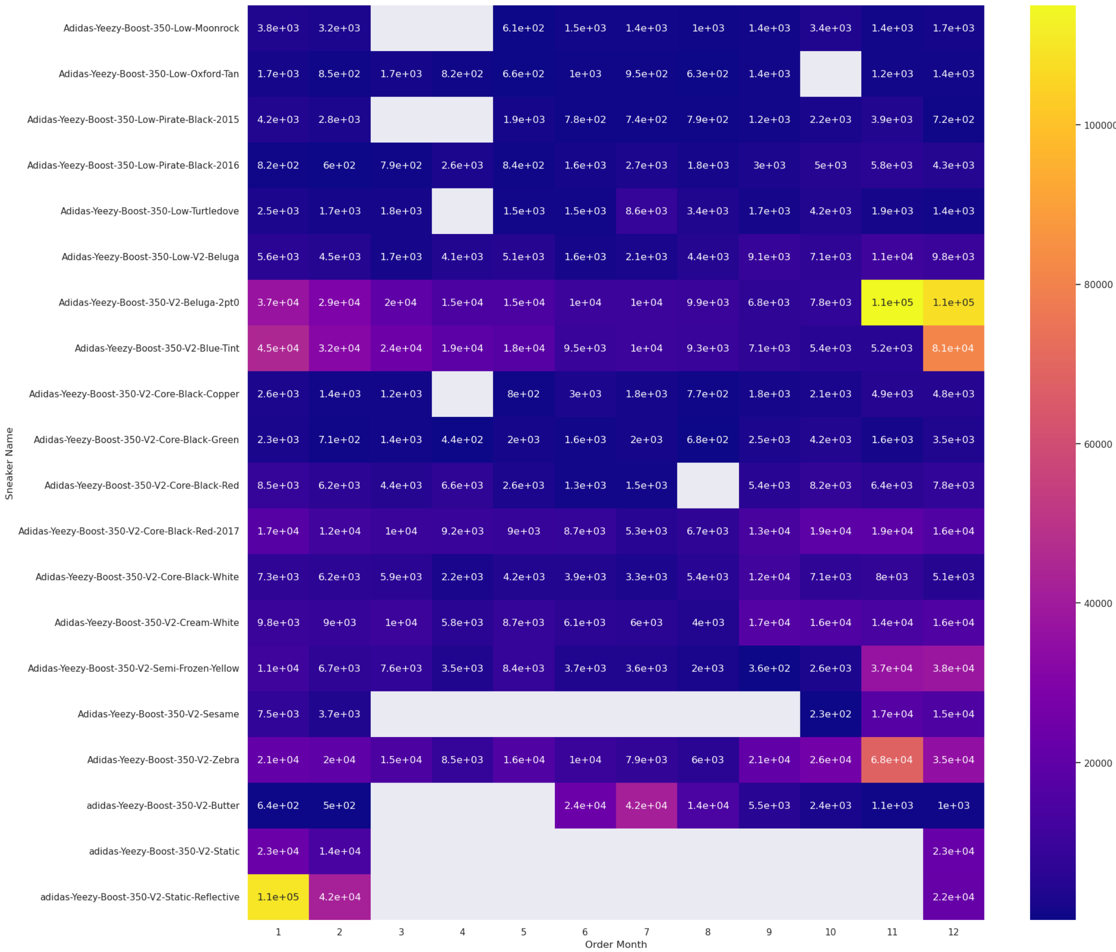

График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
300
400
500
600
700
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Adidas-Yeezy-Boost-350-V2-Blue-Tint
0
10
20
30
40
50
60
70
80
300
350
400
450
500
550

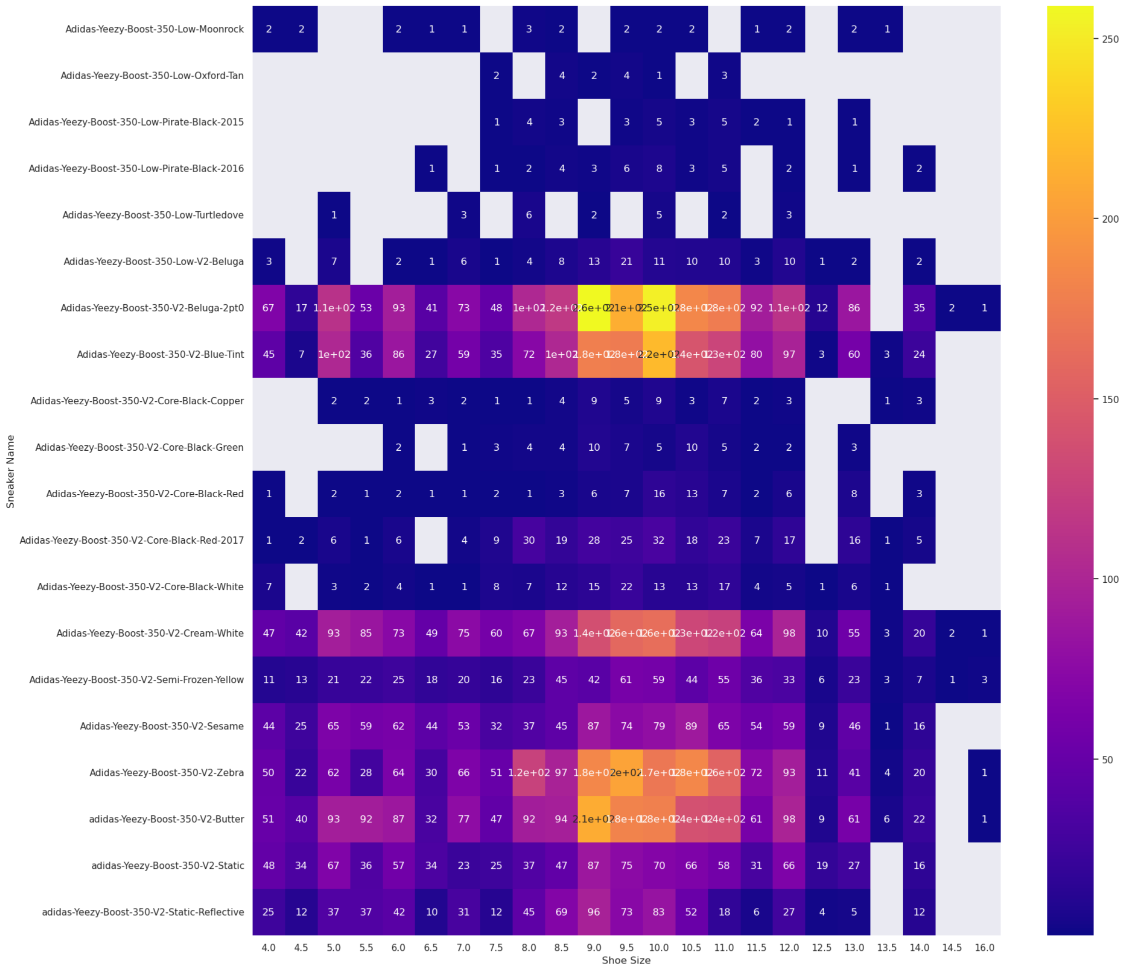

График зависимости количества продаж от даты для модели Adidas-Yeezy-Boost-350-V2-Blue-Tint
300
350
400
450
500
550
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


Sneaker Name
Order Month
Adidas-Yeezy-Boost-350-Low-Moonrock
Adidas-Yeezy-Boost-350-Low-Oxford-Tan
Adidas-Yeezy-Boost-350-Low-Pirate-Black-2015
Adidas-Yeezy-Boost-350-Low-Pirate-Black-2016
Adidas-Yeezy-Boost-350-Low-Turtledove
Adidas-Yeezy-Boost-350-Low-V2-Beluga
Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
Adidas-Yeezy-Boost-350-V2-Blue-Tint
Adidas-Yeezy-Boost-350-V2-Core-Black-Copper
Adidas-Yeezy-Boost-350-V2-Core-Black-Green
Adidas-Yeezy-Boost-350-V2-Core-Black-Red
Adidas-Yeezy-Boost-350-V2-Core-Black-Red-2017
Adidas-Yeezy-Boost-350-V2-Core-Black-White
Adidas-Yeezy-Boost-350-V2-Cream-White
Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
Adidas-Yeezy-Boost-350-V2-Sesame
Adidas-Yeezy-Boost-350-V2-Zebra
adidas-Yeezy-Boost-350-V2-Butter
adidas-Yeezy-Boost-350-V2-Static
adidas-Yeezy-Boost-350-V2-Static-Reflective
1 2 3 4 5 6 7 8 9 10 11 12
100 200 300 400 500 600 700 800

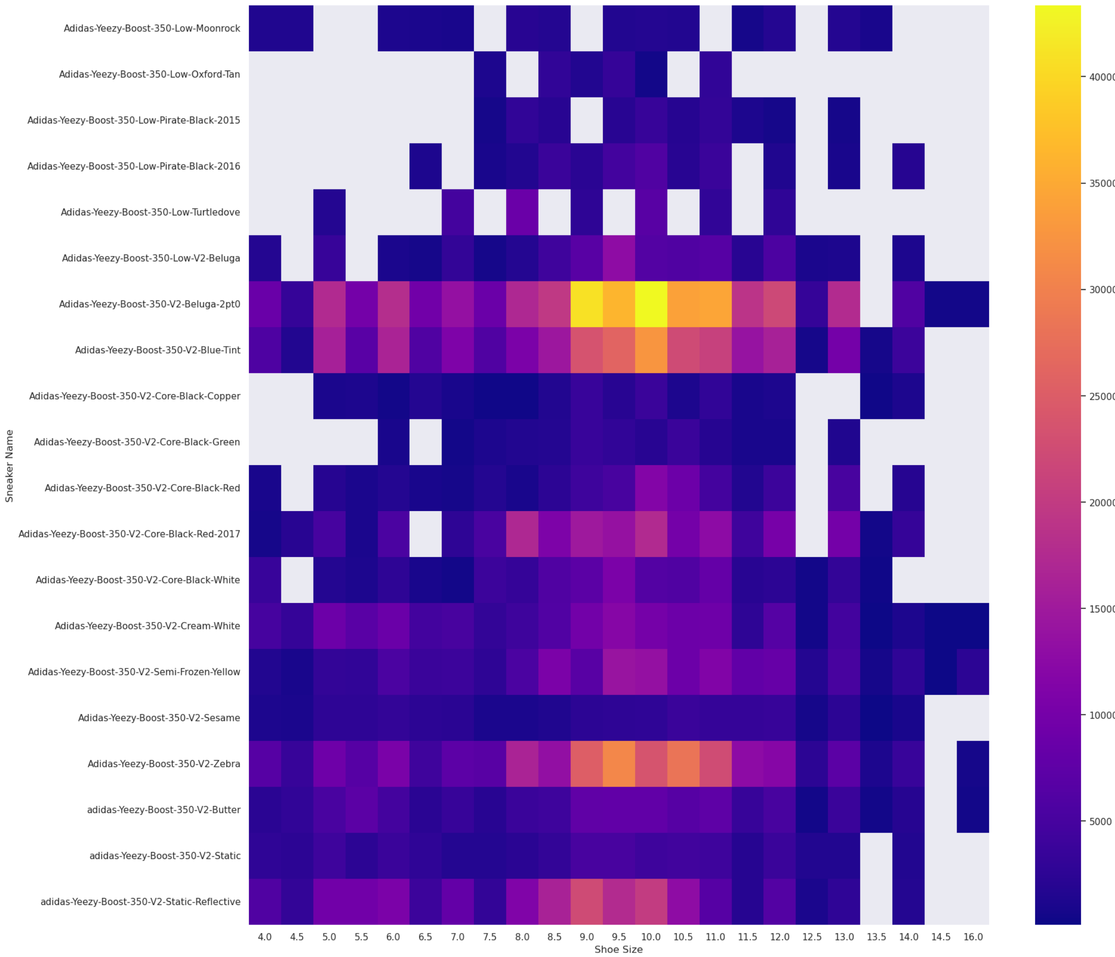
Yeezy


Sneaker Name
Adidas-Yeezy-Boost-350-Low-Moonrock
Adidas-Yeezy-Boost-350-Low-Oxford-Tan
Adidas-Yeezy-Boost-350-Low-Pirate-Black-2015
Adidas-Yeezy-Boost-350-Low-Pirate-Black-2016
Adidas-Yeezy-Boost-350-Low-Turtledove
Adidas-Yeezy-Boost-350-Low-V2-Beluga
Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
Adidas-Yeezy-Boost-350-V2-Blue-Tint
Adidas-Yeezy-Boost-350-V2-Core-Black-Copper
Adidas-Yeezy-Boost-350-V2-Core-Black-Green
Adidas-Yeezy-Boost-350-V2-Core-Black-Red
Adidas-Yeezy-Boost-350-V2-Core-Black-Red-2017
Adidas-Yeezy-Boost-350-V2-Core-Black-White
Adidas-Yeezy-Boost-350-V2-Cream-White
Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
Adidas-Yeezy-Boost-350-V2-Sesame
Adidas-Yeezy-Boost-350-V2-Zebra
adidas-Yeezy-Boost-350-V2-Butter
adidas-Yeezy-Boost-350-V2-Static
adidas-Yeezy-Boost-350-V2-Static-Reflective
1 2 3 4 5 6 7 8 9 10 11 12
Order Month
100000
80000
60000
40000
20000

Yeezy



Yeezy


Adidas-Yeezy-Boost-350-Low-Moonrock
Adidas-Yeezy-Boost-350-Low-Oxford-Tan
Adidas-Yeezy-Boost-350-Low-Pirate-Black-2015
Adidas-Yeezy-Boost-350-Low-Pirate-Black-2016
Adidas-Yeezy-Boost-350-Low-Turtledove
Adidas-Yeezy-Boost-350-Low-V2-Beluga
Adidas-Yeezy-Boost-350-V2-Beluga-2pt0
Adidas-Yeezy-Boost-350-V2-Blue-Tint
Adidas-Yeezy-Boost-350-V2-Core-Black-Copper
Adidas-Yeezy-Boost-350-V2-Core-Black-Green
Adidas-Yeezy-Boost-350-V2-Core-Black-Red
Adidas-Yeezy-Boost-350-V2-Core-Black-Red-2017
Adidas-Yeezy-Boost-350-V2-Core-Black-White
Adidas-Yeezy-Boost-350-V2-Cream-White
Adidas-Yeezy-Boost-350-V2-Semi-Frozen-Yellow
Adidas-Yeezy-Boost-350-V2-Sesame
Adidas-Yeezy-Boost-350-V2-Zebra
adidas-Yeezy-Boost-350-V2-Butter
adidas-Yeezy-Boost-350-V2-Static
adidas-Yeezy-Boost-350-V2-Static-Reflective
Sneaker Name
4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5 16.0
Shoe Size
40000
35000
30000
25000
20000
15000
10000
5000

5 Off-White

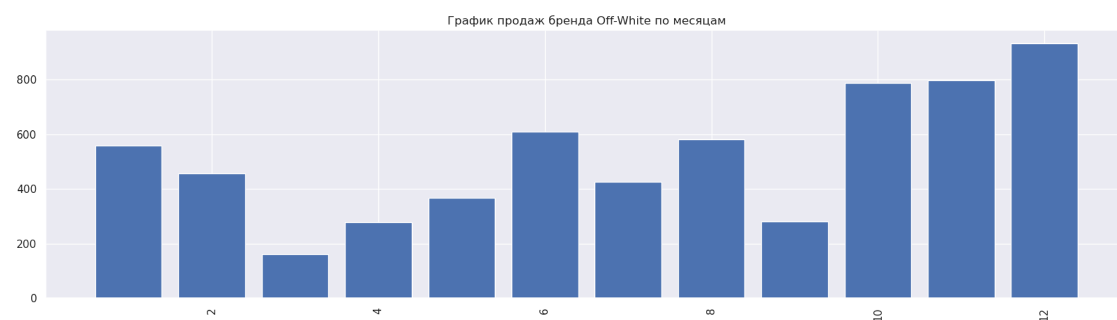


График продаж бренда Off-White по месяцам
0
200
400
600
800
2
4
6
8
10
12


График временного ряда
250
200
150
100
50
0
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03

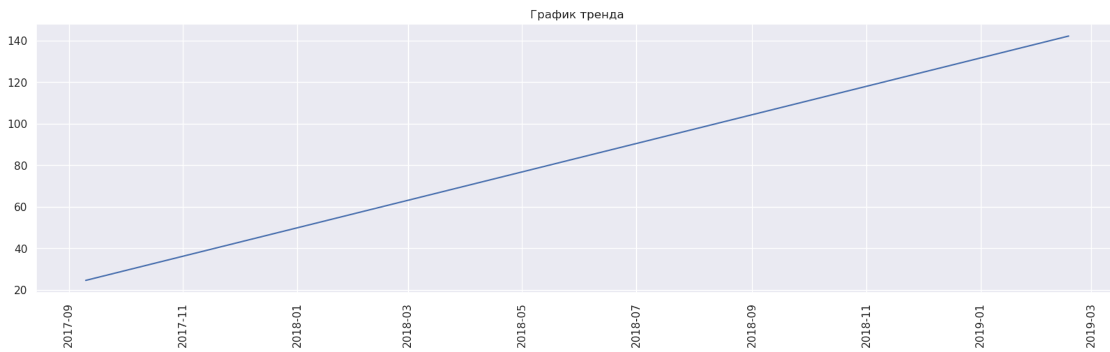
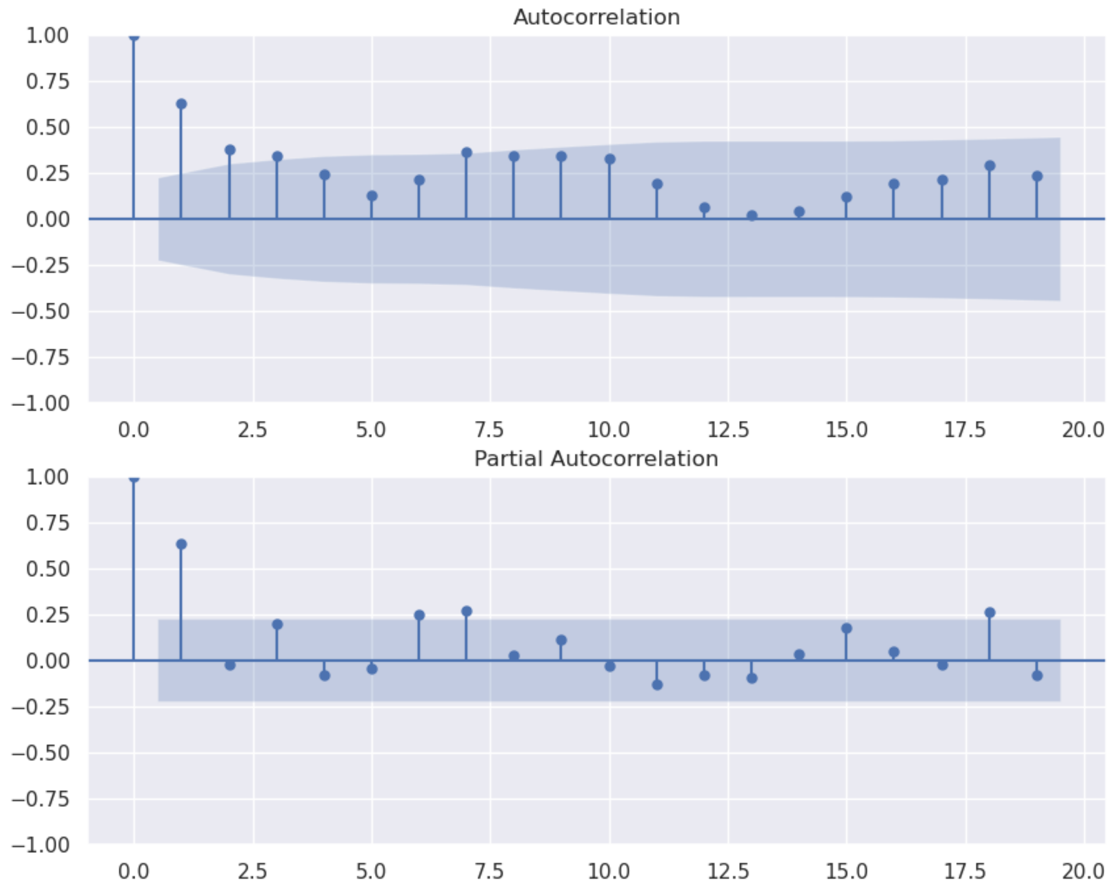


График тренда
140
120
100
80
60
40
20
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03

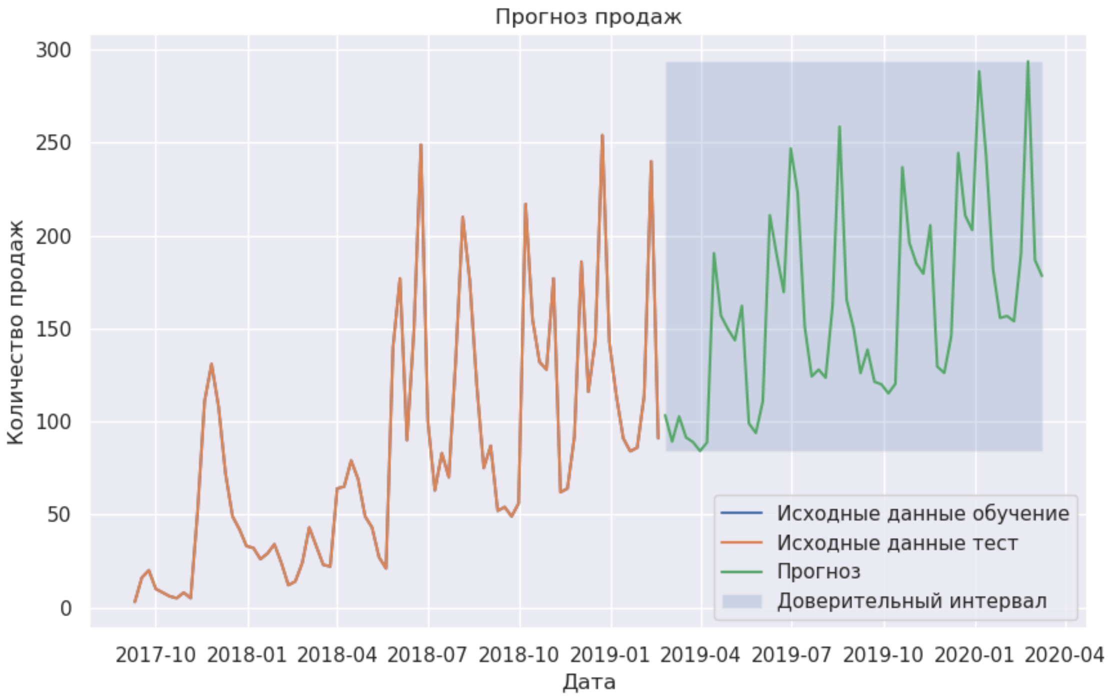

График сезонности
150
100
50
0
−50
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03



5.0.1

```
ADF       :-1.8397153931046681
p-value: 0.3609298773712718
           :
1% -3.528889992207215
5% -2.9044395987933362
10% -2.589655654274312
RUNNING THE L-BFGS-B CODE

           * * *

Machine precision = 2.220D-16
 N =              5     M =           10

At X0         0 variables are exactly at the bounds

At iterate    0    f=  3.47638D+00    |proj g|=  9.95138D-02

 This problem is unconstrained.
```

```
At iterate    5    f=  3.44120D+00    |proj g|=  6.86528D-03

At iterate   10    f=  3.43457D+00    |proj g|=  1.50240D-02

At iterate   15    f=  3.41830D+00    |proj g|=  8.67628D-04

At iterate   20    f=  3.41743D+00    |proj g|=  1.96293D-02

At iterate   25    f=  3.41491D+00    |proj g|=  1.51508D-04

At iterate   30    f=  3.41491D+00    |proj g|=  4.14626D-04

At iterate   35    f=  3.41490D+00    |proj g|=  4.02367D-04

At iterate   40    f=  3.41490D+00    |proj g|=  3.83251D-04

At iterate   45    f=  3.41489D+00    |proj g|=  1.33798D-04

At iterate   50    f=  3.41489D+00    |proj g|=  3.42082D-04

           * * *

Tit   = total number of iterations
Tnf   = total number of function evaluations
Tnint = total number of segments explored during Cauchy searches
Skip  = number of BFGS updates skipped
Nact  = number of active bounds at final generalized Cauchy point
Projg = norm of the final projected gradient
F     = final function value

           * * *

   N    Tit     Tnf  Tnint  Skip  Nact     Projg        F
    5     50     66      1     0     0   3.421D-04   3.415D+00
  F =   3.4148854465621774

STOP: TOTAL NO. of ITERATIONS REACHED LIMIT
```



5.0.2

Off-White - Nike-Air-Max-90-Off-White
Off-White - Nike-Air-Presto-Off-White
Off-White - Nike-Air-VaporMax-Off-White
Off-White - Nike-Blazer-Mid-Off-White
Off-White - Air-Jordan-1-Retro-High-Off-White-Chicago
Off-White - Nike-Air-Force-1-Low-Off-White
Off-White - Nike-Air-Force-1-Low-Virgil-Abloh-Off-White-AF100
Off-White - Nike-Air-Max-97-Off-White
Off-White - Nike-Zoom-Fly-Off-White
Off-White - Nike-React-Hyperdunk-2017-Flyknit-Off-White
Off-White - Nike-Air-VaporMax-Off-White-2018
Off-White - Air-Jordan-1-Retro-High-Off-White-White
Off-White - Nike-Air-VaporMax-Off-White-Black
Off-White - Nike-Air-Presto-Off-White-Black-2018

Off-White - Air-Jordan-1-Retro-High-Off-White-University-Blue

Off-White - Nike-Zoom-Fly-Mercurial-Off-White-Black

Off-White - Nike-Zoom-Fly-Mercurial-Off-White-Total-Orange

Off-White - Nike-Air-Presto-Off-White-White-2018

Off-White - Nike-Air-Max-97-Off-White-Elemental-Rose-Queen

Off-White - Nike-Blazer-Mid-Off-White-All-Hallows-Eve

Off-White - Nike-Blazer-Mid-Off-White-Grim-Reaper

Off-White - Nike-Blazer-Mid-Off-White-Wolf-Grey

Off-White - Nike-Air-Max-97-Off-White-Black

Off-White - Nike-Air-Max-97-Off-White-Menta

Off-White - Nike-Zoom-Fly-Off-White-Black-Silver

Off-White - Nike-Zoom-Fly-Off-White-Pink

Off-White - Nike-Air-Force-1-Low-Off-White-Volt

Off-White - Nike-Air-Force-1-Low-Off-White-Black-White

Off-White - Nike-Air-Max-90-Off-White-Black

Off-White - Nike-Air-Max-90-Off-White-Desert-Ore

Off-White


График зависимости количества продаж от даты для модели Nike-Air-Max-90-Off-White


График зависимости количества продаж от цены для модели Nike-Air-Presto-Off-White


График зависимости количества продаж от даты для модели Nike-Air-Presto-Off-White

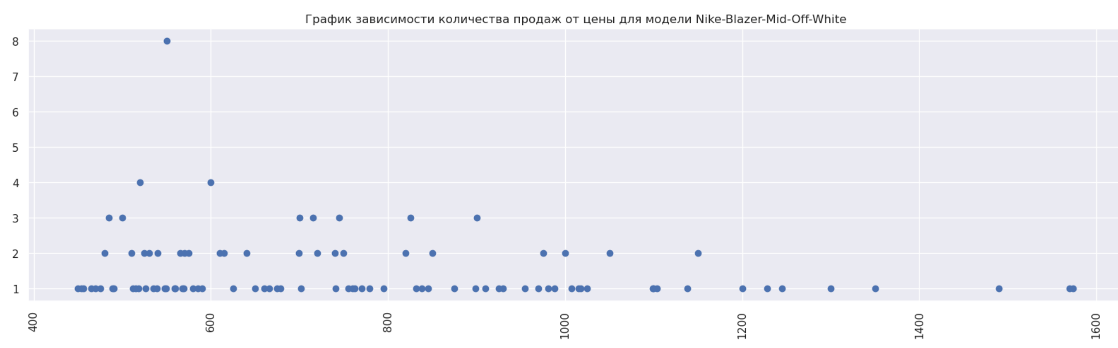


График зависимости количества продаж от цены для модели Nike-Blazer-Mid-Off-White


График зависимости количества продаж от даты для модели Nike-Blazer-Mid-Off-White
1600
1400
1200
1000
800
600
400
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Air-Jordan-1-Retro-High-Off-White-Chicago
9
8
7
6
5
4
3
2
1
1000
1500
2000
2500
3000
3500


График зависимости количества продаж от даты для модели Air-Jordan-1-Retro-High-Off-White-Chicago
3500
3000
2500
2000
1500
1000
2017-09
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Nike-Air-Force-1-Low-Off-White
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
400
600
800
1000
1200
1400


График зависимости количества продаж от даты для модели Nike-Air-Force-1-Low-Off-White
1400
1200
1000
800
600
400
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03


График зависимости количества продаж от цены для модели Nike-Air-Max-97-Off-White
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
400
500
600
700
800
900
1000

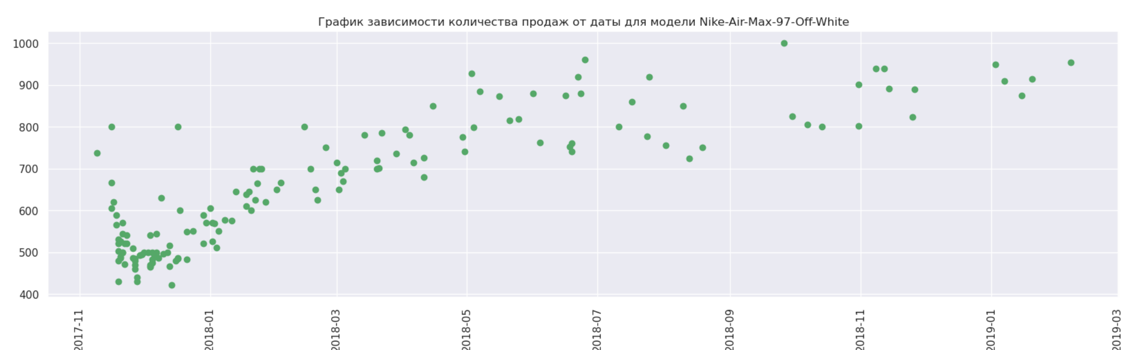


График зависимости количества продаж от даты для модели Nike-Air-Max-97-Off-White
1000
900
800
700
600
500
400
2017-11
2018-01
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01
2019-03

График зависимости количества продаж от цены для модели Nike-Zoom-Fly-Off-White

График зависимости количества продаж от даты для модели Nike-Zoom-Fly-Off-White

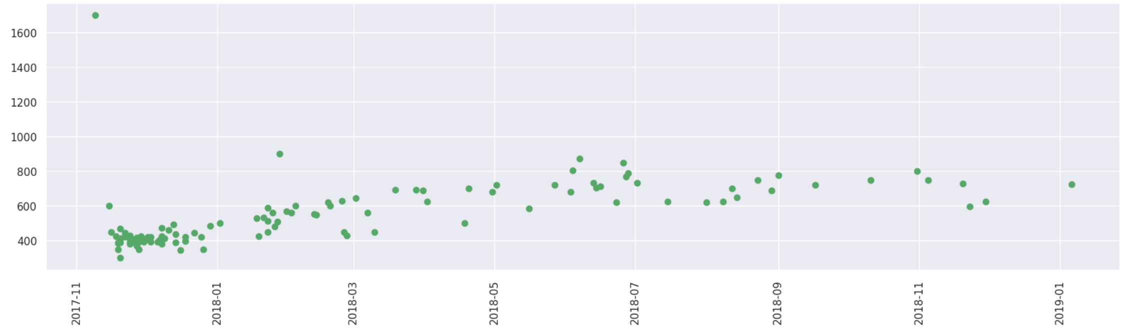


График зависимости количества продаж от цены для модели Nike-Air-VaporMax-Off-White-2018

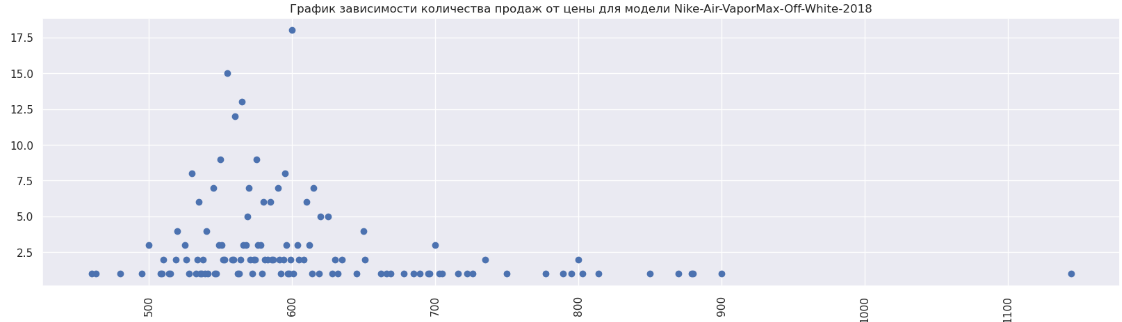


График зависимости количества продаж от даты для модели Nike-Air-VaporMax-Off-White-2018
1100
1000
900
800
700
600
500
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01

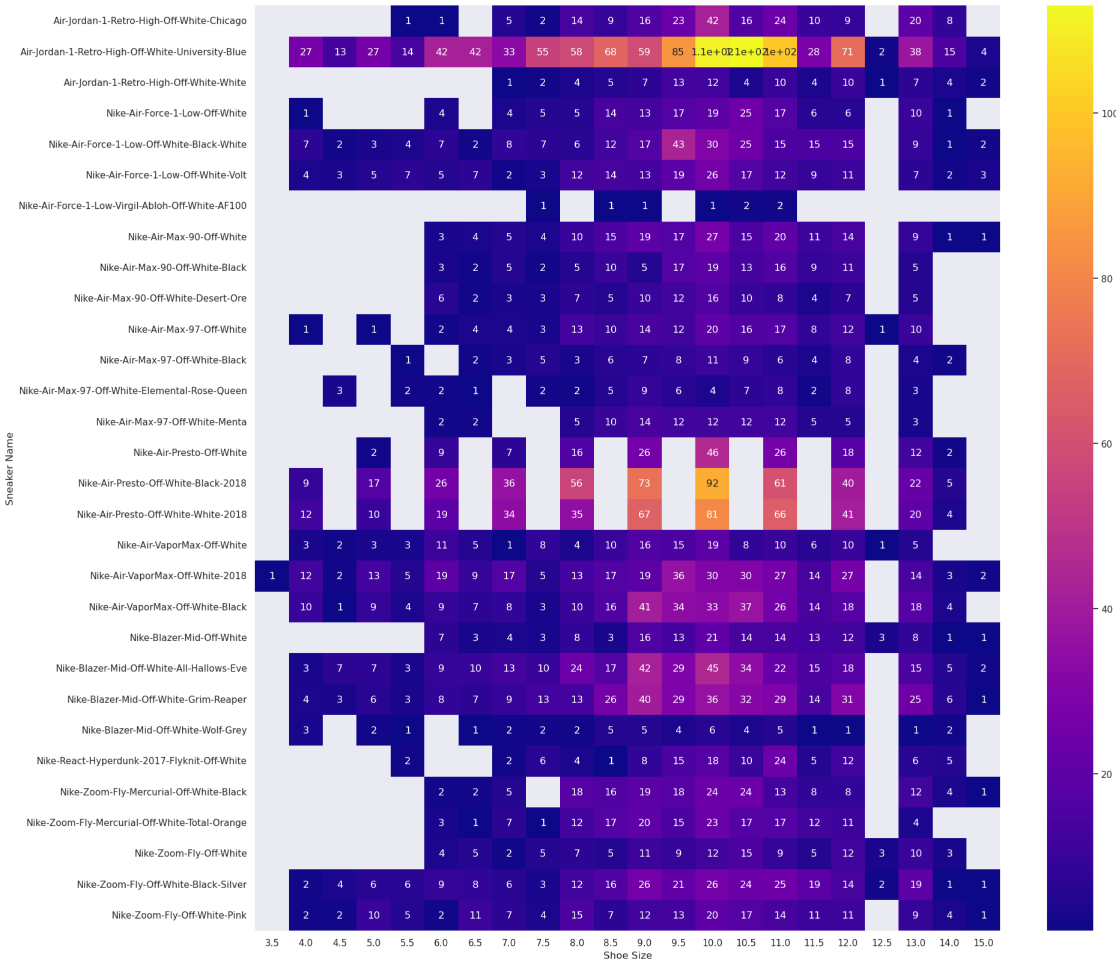
График зависимости количества продаж от цены для модели Nike-Air-VaporMax-Off-White-Black
14
12
10
8
6
4
2
500
600
700
800
900
1000

График зависимости количества продаж от даты для модели Nike-Air-VaporMax-Off-White-Black
1000
900
800
700
600
500
2018-03
2018-05
2018-07
2018-09
2018-11
2019-01

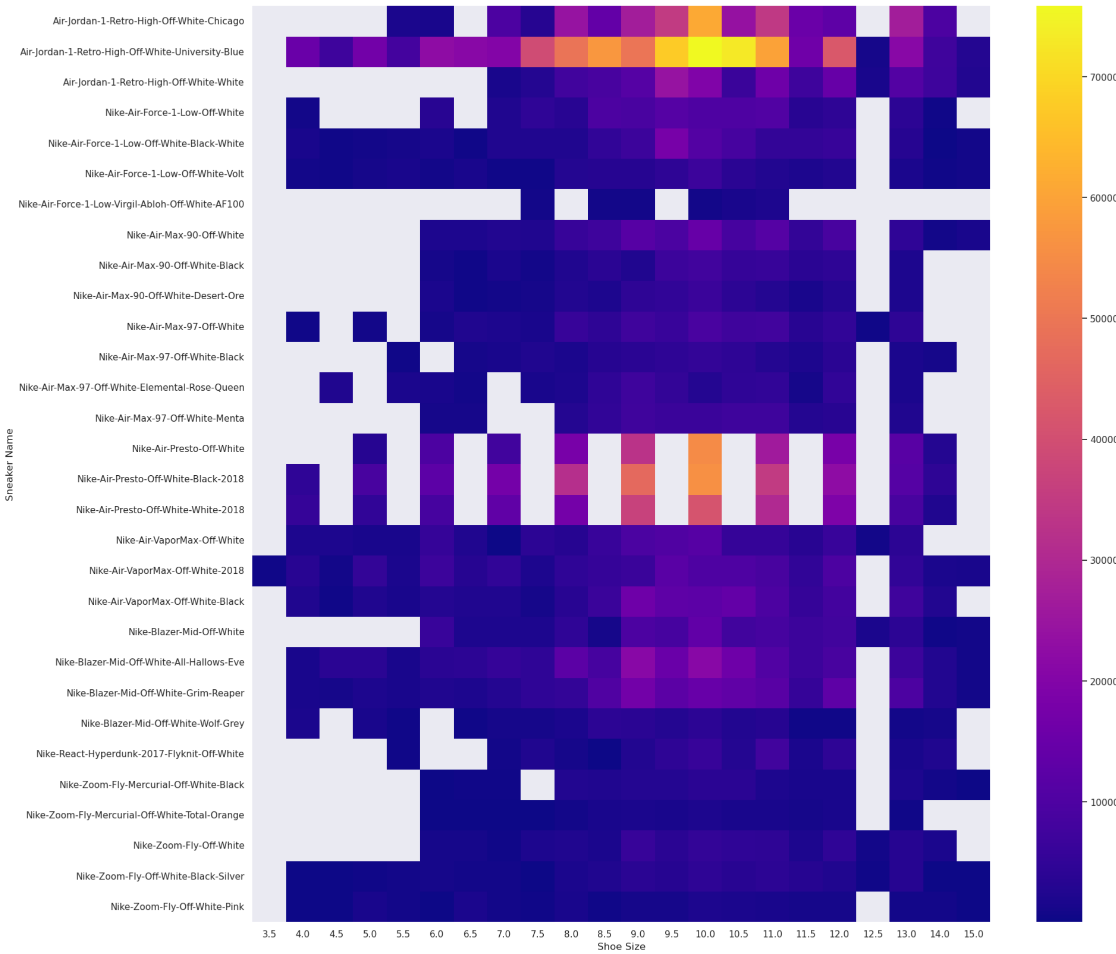
Off-White

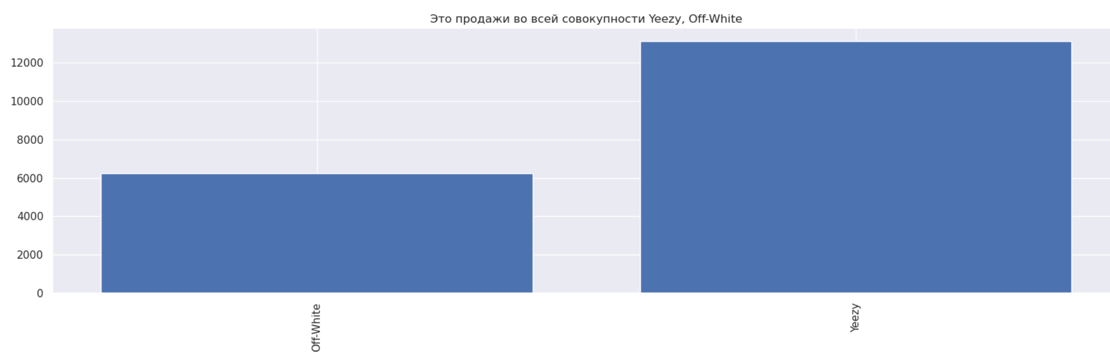

Air-Jordan-1-Retro-High-Off-White-Chicago 3.5e+04 3.1e+04 2e+04 1.1e+04 7.9e+03 8.3e+03 6.7e+03 1.4e+04 3.1e+04 8.5e+03 6.6e+04 6.1e+04
Air-Jordan-1-Retro-High-Off-White-University-Blue 2.1e+04 1.4e+04 1.9e+05 2e+05 7.2e+04 6.5e+04 3.9e+04 2.8e+04 2.6e+04 2.5e+04
Air-Jordan-1-Retro-High-Off-White-White 6.9e+03 1.4e+04 4.8e+04 1.9e+04 1.4e+04 4.3e+03 1.1e+04 9.9e+03 4.2e+03 6.1e+03 3.9e+03
Nike-Air-Force-1-Low-Off-White 1.1e+04 5.9e+03 4e+03 1.9e+03 5.5e+03 4.9e+03 1.5e+03 1.3e+04 3.2e+03 5.5e+03 1.9e+04 1.1e+04
Nike-Air-Force-1-Low-Off-White-Black-White 3.1e+04 1.4e+04 3.7e+04
Nike-Air-Force-1-Low-Off-White-Volt 1.4e+04 4.7e+03 2.3e+04
Nike-Air-Force-1-Low-Virgil-Abloh-Off-White-AF100 1.1e+03 3.8e+03 1.4e+03
Nike-Air-Max-90-Off-White 7.3e+03 7e+03 6.2e+03 6e+03 1.5e+03 3.7e+03 5.7e+03 1.3e+03 1.3e+04 8.9e+03 2.5e+04 1.2e+04
Nike-Air-Max-90-Off-White-Black 9.9e+03 3.8e+04
Nike-Air-Max-90-Off-White-Desert-Ore 9.3e+03 2.8e+04
Nike-Air-Max-97-Off-White 1.1e+04 4.3e+03 5.8e+03 4.5e+03 4e+03 5.8e+03 2.6e+03 2.3e+03 1.4e+03 2.5e+03 1.5e+04 9.9e+03
Nike-Air-Max-97-Off-White-Black 1.2e+03 1.7e+03 2.4e+04 9e+03 2.7e+03
Nike-Air-Max-97-Off-White-Elemental-Rose-Queen 6.3e+02 6.8e+02 2.2e+04 1e+04 7.4e+03 4e+03 1.4e+03
Nike-Air-Max-97-Off-White-Menta 1.3e+04 6.9e+03 1.6e+04 9.3e+03 8.2e+03
Nike-Air-Presto-Off-White 2.1e+04 1.8e+04 1.5e+04 1.1e+04 7.5e+03 1.3e+04 8.8e+03 6e+03 9.6e+03 1.1e+04 4.1e+04 2.2e+04
Nike-Air-Presto-Off-White-Black-2018 8.1e+03 6.4e+03 1.3e+03 7e+04 8e+04 2.3e+04 3.2e+04 1.8e+04 1.1e+04
Nike-Air-Presto-Off-White-White-2018 5.9e+03 5.3e+03 3.4e+03 1.8e+04 9.7e+04 1.9e+04 1.8e+04 1.2e+04 9e+03
Nike-Air-VaporMax-Off-White 1.1e+04 3.7e+03 7.9e+03 5.8e+03 3.9e+03 2.2e+03 4.8e+03 8.6e+03 7.1e+03 1.7e+04 1.2e+04
Nike-Air-VaporMax-Off-White-2018 4.9e+03 3e+03 3.2e+03 3.8e+04 1.4e+04 9.6e+03 7e+03 9.7e+03 4e+03 9e+03 4.5e+03 1.3e+03
Nike-Air-VaporMax-Off-White-Black 3.1e+03 1.3e+03 1.8e+04 3.8e+04 1.3e+04 7.1e+03 7.3e+03 5.8e+03 2.1e+03 6.4e+03 4.4e+03 5.7e+03
Nike-Blazer-Mid-Off-White 8.2e+03 7.5e+03 5.6e+03 9.7e+02 4e+03 7e+03 3.3e+03 6.9e+03 7.3e+03 3e+03 2.2e+04 1.1e+04
Nike-Blazer-Mid-Off-White-All-Hallows-Eve 9.1e+03 3.1e+03 8e+03 1.1e+05 1.7e+04 1.2e+04
Nike-Blazer-Mid-Off-White-Grim-Reaper 7.6e+03 4.3e+03 7.4e+03 7.9e+04 2.3e+04 1.2e+04
Nike-Blazer-Mid-Off-White-Wolf-Grey 1.3e+03 1.4e+03 2e+04 5.2e+03 3.8e+03
Nike-React-Hyperdunk-2017-Flyknit-Off-White 6.2e+03 3.9e+03 1.9e+03 4.5e+02 2.9e+03 1.8e+03 2.5e+03 9.8e+02 8.7e+02 1.1e+04 5.8e+03
Nike-Zoom-Fly-Mercurial-Off-White-Black 6.7e+02 1.1e+02 1.4e+04 5.1e+03 2.1e+03 1.5e+03 9e+02 1e+03 9.5e+02
Nike-Zoom-Fly-Mercurial-Off-White-Total-Orange 1.1e+02 55 7.5e+03 2.4e+03 1.1e+03 9e+02 8.8e+02 2.8e+02 1.8e+02
Nike-Zoom-Fly-Off-White 5.1e+03 3.5e+03 2.7e+03 1.8e+03 1.5e+03 5.8e+03 1e+03 3e+03 1.2e+03 1.2e+03 1.1e+04 5.4e+03
Nike-Zoom-Fly-Off-White-Black-Silver 5.7e+03 2.7e+03 5.7e+03 2.3e+04
Nike-Zoom-Fly-Off-White-Pink 1.9e+03 1.2e+03 7.2e+03 8.3e+03
Sneaker Name
1 2 3 4 5 6 7 8 9 10 11 12
Order Month
175000
150000
125000
100000
75000
50000
25000

Off-White


Air-Jordan-1-Retro-High-Off-White-Chicago
Air-Jordan-1-Retro-High-Off-White-University-Blue
Air-Jordan-1-Retro-High-Off-White-White
Nike-Air-Force-1-Low-Off-White
Nike-Air-Force-1-Low-Off-White-Black-White
Nike-Air-Force-1-Low-Off-White-Volt
Nike-Air-Force-1-Low-Virgil-Abloh-Off-White-AF100
Nike-Air-Max-90-Off-White
Nike-Air-Max-90-Off-White-Black
Nike-Air-Max-90-Off-White-Desert-Ore
Nike-Air-Max-97-Off-White
Nike-Air-Max-97-Off-White-Black
Nike-Air-Max-97-Off-White-Elemental-Rose-Queen
Nike-Air-Max-97-Off-White-Menta
Nike-Air-Presto-Off-White
Nike-Air-Presto-Off-White-Black-2018
Nike-Air-Presto-Off-White-White-2018
Nike-Air-VaporMax-Off-White
Nike-Air-VaporMax-Off-White-2018
Nike-Air-VaporMax-Off-White-Black
Nike-Blazer-Mid-Off-White
Nike-Blazer-Mid-Off-White-All-Hallows-Eve
Nike-Blazer-Mid-Off-White-Grim-Reaper
Nike-Blazer-Mid-Off-White-Wolf-Grey
Nike-React-Hyperdunk-2017-Flyknit-Off-White
Nike-Zoom-Fly-Mercurial-Off-White-Black
Nike-Zoom-Fly-Mercurial-Off-White-Total-Orange
Nike-Zoom-Fly-Off-White
Nike-Zoom-Fly-Off-White-Black-Silver
Nike-Zoom-Fly-Off-White-Pink
Sneaker Name
3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 14.0 15.0
Shoe Size
100
80
60
40
20

Off-White


Air-Jordan-1-Retro-High-Off-White-Chicago
Air-Jordan-1-Retro-High-Off-White-University-Blue
Air-Jordan-1-Retro-High-Off-White-White
Nike-Air-Force-1-Low-Off-White
Nike-Air-Force-1-Low-Off-White-Black-White
Nike-Air-Force-1-Low-Off-White-Volt
Nike-Air-Force-1-Low-Virgil-Abloh-Off-White-AF100
Nike-Air-Max-90-Off-White
Nike-Air-Max-90-Off-White-Black
Nike-Air-Max-90-Off-White-Desert-Ore
Nike-Air-Max-97-Off-White
Nike-Air-Max-97-Off-White-Black
Nike-Air-Max-97-Off-White-Elemental-Rose-Queen
Nike-Air-Max-97-Off-White-Menta
Nike-Air-Presto-Off-White
Nike-Air-Presto-Off-White-Black-2018
Nike-Air-Presto-Off-White-White-2018
Nike-Air-VaporMax-Off-White
Nike-Air-VaporMax-Off-White-2018
Nike-Air-VaporMax-Off-White-Black
Nike-Blazer-Mid-Off-White
Nike-Blazer-Mid-Off-White-All-Hallows-Eve
Nike-Blazer-Mid-Off-White-Grim-Reaper
Nike-Blazer-Mid-Off-White-Wolf-Grey
Nike-React-Hyperdunk-2017-Flyknit-Off-White
Nike-Zoom-Fly-Mercurial-Off-White-Black
Nike-Zoom-Fly-Mercurial-Off-White-Total-Orange
Nike-Zoom-Fly-Off-White
Nike-Zoom-Fly-Off-White-Black-Silver
Nike-Zoom-Fly-Off-White-Pink
Sneaker Name
3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5 13.0 14.0 15.0
Shoe Size
70000
60000
50000
40000
30000
20000
10000


Это продажи во всей совокупности Yeezy, Off-White
12000
10000
8000
6000
4000
2000
0
Off-White
Yeezy

[ ]: