01_Exploratory_Analysis

September 24, 2020

1 flats-in-cracow exploratory data analysis

1.1 Imports

[1]:
```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np

from sklearn.impute import KNNImputer
from pylab import rcParams
from pathlib import Path
```

1.2 Setup

[2]:
```
# Create directory for images
Path("img").mkdir(parents=True, exist_ok=True)

# Set default figure size
rcParams['figure.figsize'] = (4, 4)

# Tell pandas how to display floats
pd.options.display.float_format = "{:,.2f}".format
```

1.3 Data loading

[3]:
```
path = '../flats-data/cleaned_data.csv'
```

[4]:
```
data = pd.read_csv(path, lineterminator='\n')
```

[5]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4102 entries, 0 to 4101
Data columns (total 17 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   District   4102 non-null   object
```

```
 1   Amount      4102 non-null   int64
 2   Seller      4102 non-null   object
 3   Area        4102 non-null   int64
 4   Rooms       4102 non-null   int64
 5   Bathrooms   4102 non-null   int64
 6   Parking     4102 non-null   object
 7   Garden      4102 non-null   bool
 8   Balcony     4102 non-null   bool
 9   Terrace     4102 non-null   bool
 10  Floor       4102 non-null   bool
 11  New         4102 non-null   bool
 12  Estate      4102 non-null   bool
 13  Townhouse   4102 non-null   bool
 14  Apartment   4102 non-null   bool
 15  Land        4102 non-null   bool
 16  Studio      4102 non-null   bool
dtypes: bool(10), int64(4), object(3)
memory usage: 264.5+ KB
```

[6]:
```
data.head()
```

[6]:

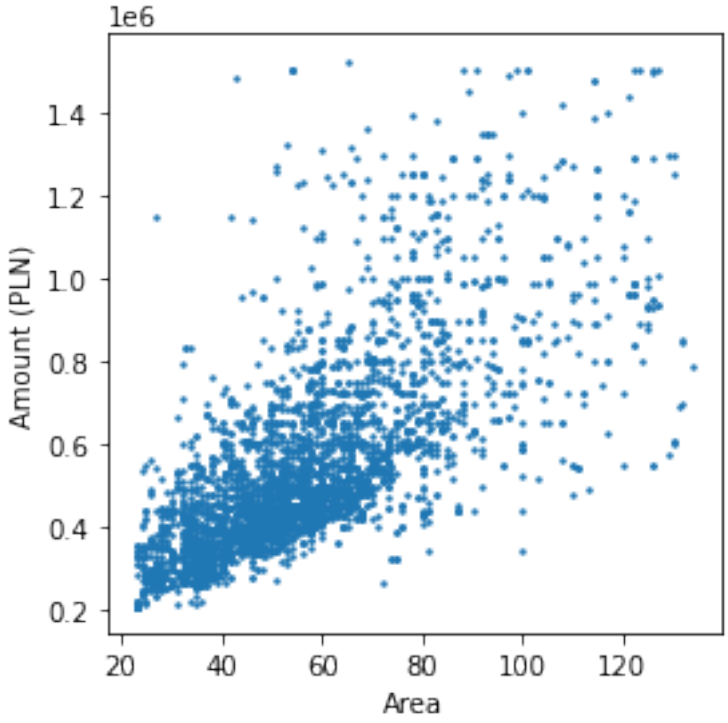
	District	Amount	Seller	Area	Rooms	Bathrooms	Parking	Garden	\
0	biezanow	439082	realtor	56	3	1	covered	True	
1	podgorze	845000	realtor	132	5	2	no parking	False	
2	podgorze	360000	realtor	41	2	1	no parking	False	
3	krowodrza	1190000	realtor	81	3	1	no parking	True	
4	debniki	990000	realtor	93	4	2	street	False	

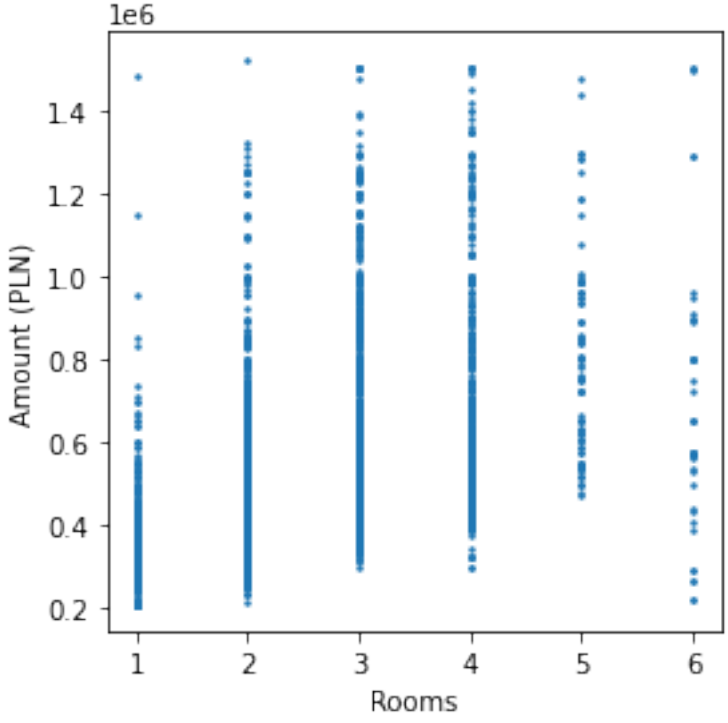
	Balcony	Terrace	Floor	New	Estate	Townhouse	Apartment	Land	Studio
0	True	False	True	True	False	False	True	True	False
1	False	True	False	False	False	False	True	False	False
2	True	False	False	False	False	False	False	False	False
3	False	True	True	True	False	False	True	True	False
4	False	False	False	False	False	False	False	False	False

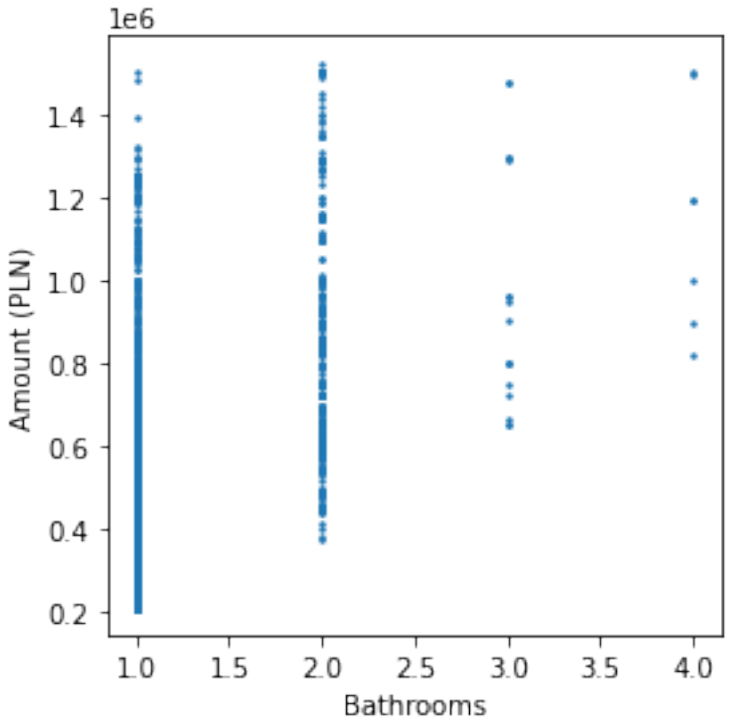
1.4 Numeric features

To visually inspect the data we are going to make histograms for each of the numeric columns.

[7]:
```
numeric = list(data.select_dtypes('number').columns)
for col in numeric:
    if col != 'Amount':
        plt.scatter(data[col], data['Amount'], s=2)
        plt.xlabel(f'{col}')
        plt.ylabel(f'Amount (PLN)')
        plt.tight_layout()
        plt.show()
```


1e6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Amount (PLN)
20
40
60
80
100
120
Area


1e6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Amount (PLN)
1
2
3
4
5
6
Rooms



[8]:
```
data.select_dtypes('number').corr()
```

[8]:

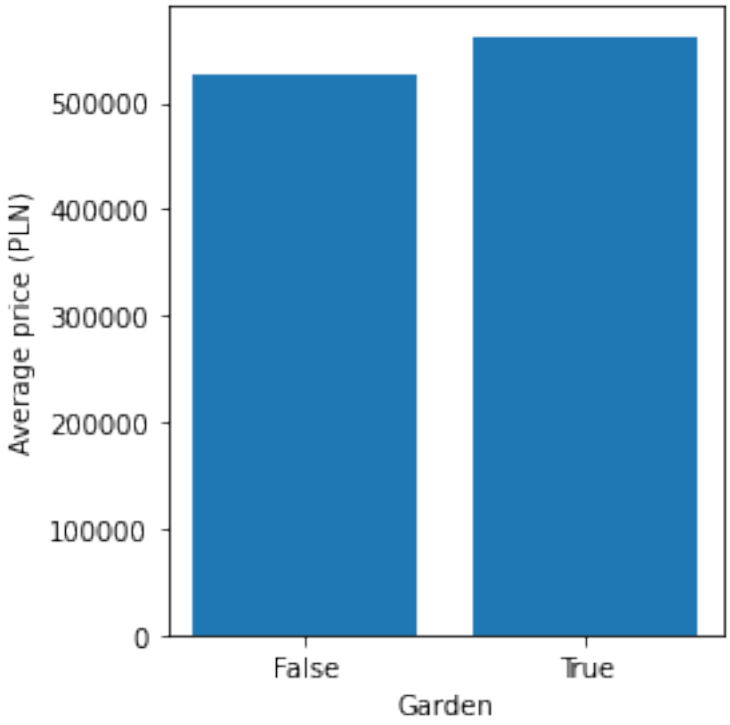
	Amount	Area	Rooms	Bathrooms
Amount	1.00	0.71	0.46	0.44
Area	0.71	1.00	0.74	0.46
Rooms	0.46	0.74	1.00	0.35
Bathrooms	0.44	0.46	0.35	1.00

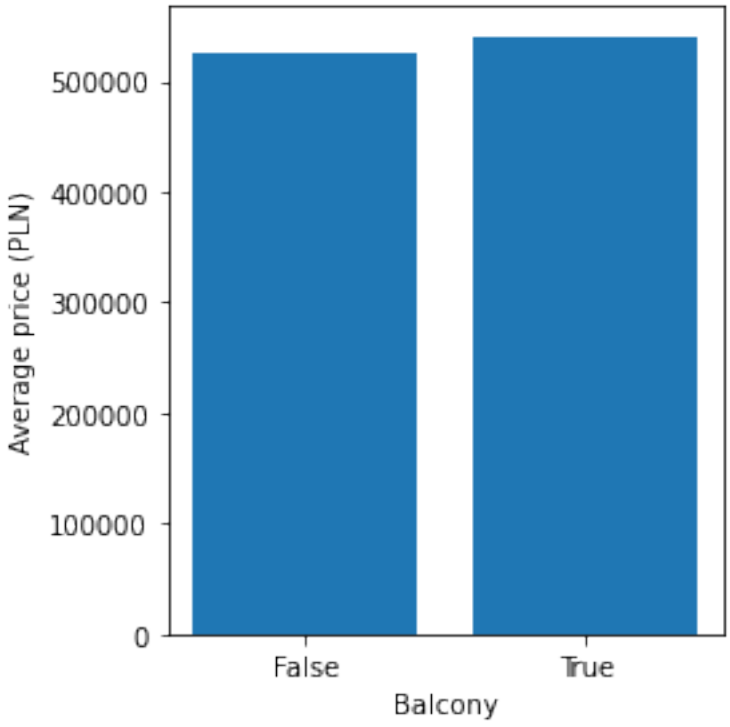
1.5 Binary features

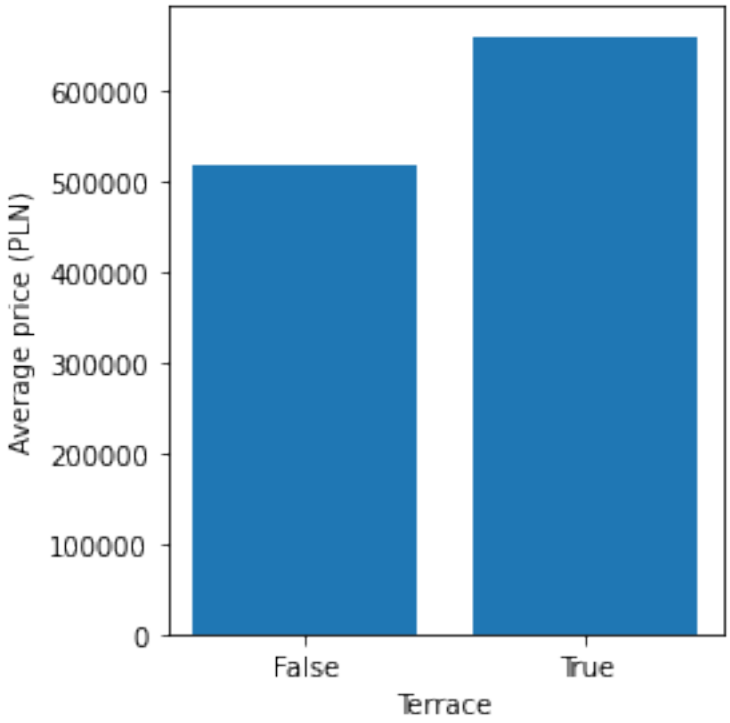
We are going to group the data and compare averages.

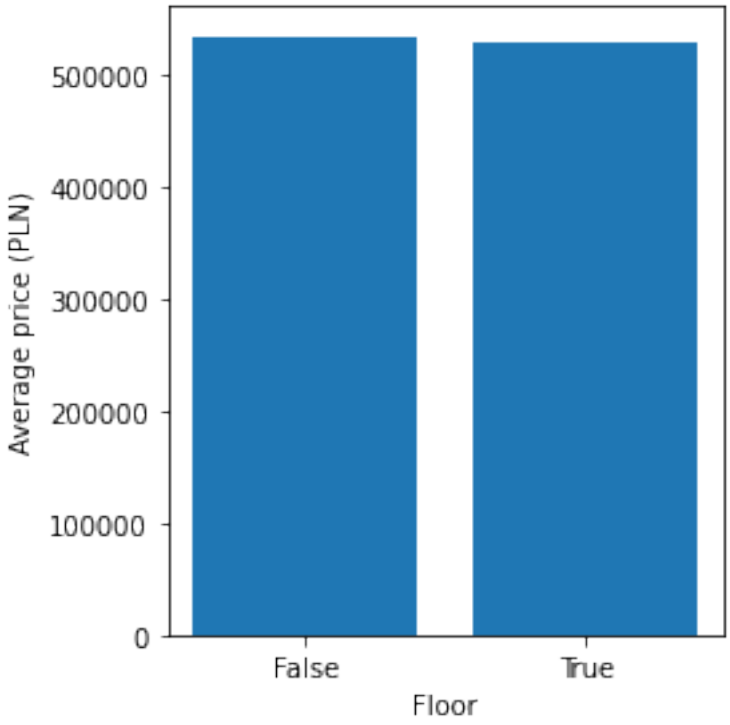
[9]:
```
binary = list(data.select_dtypes(bool).columns)
for col in binary:
    group = data[[col, 'Amount']]
    group = group.groupby([col], as_index=False)
    group = group.mean()
    group = group.sort_values('Amount', ascending=False)
    plt.bar(group[col], height=group['Amount'])
    plt.xticks(ticks=group[col].to_list(),
               labels=group[col].to_list())
    plt.ylabel('Average price (PLN)')
    plt.xlabel(f'{col}')
```

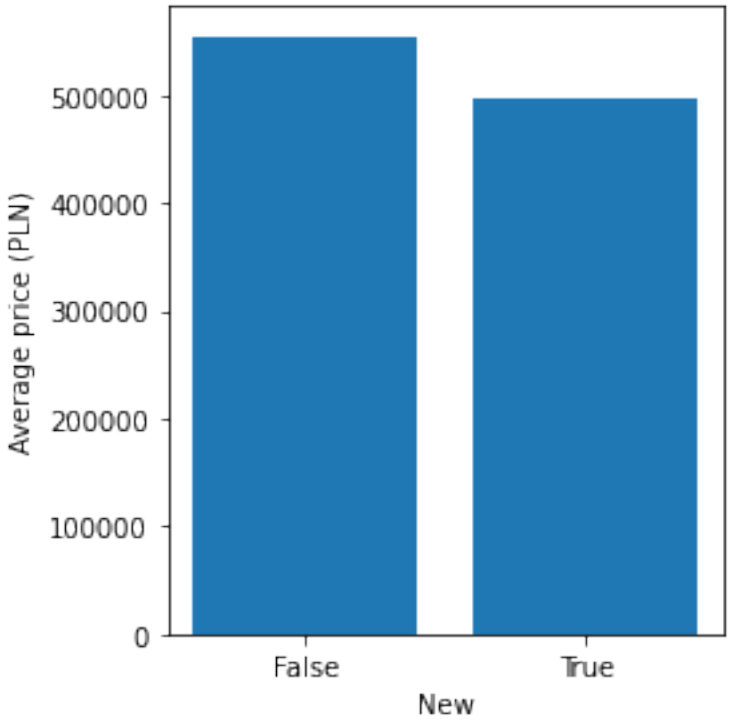
```
    plt.tight_layout()
    plt.show()
```

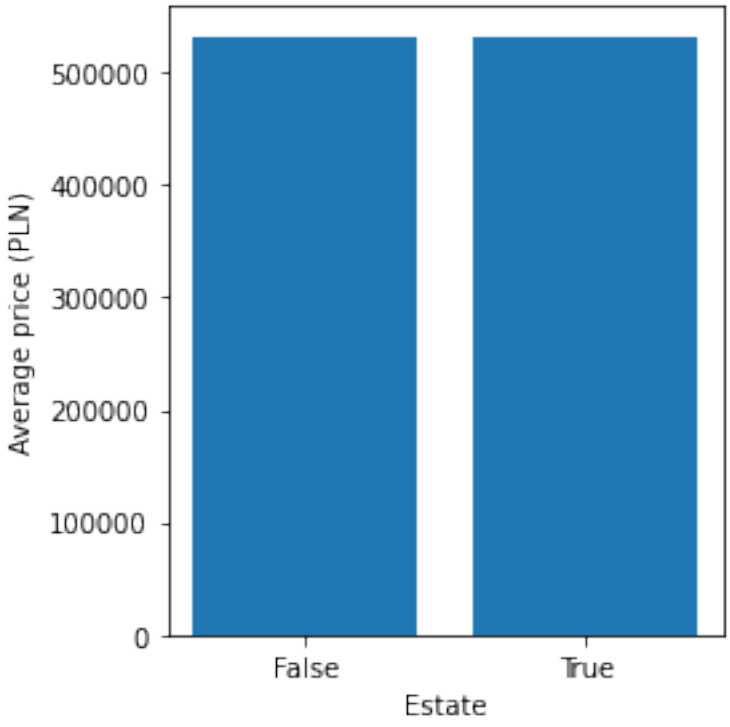


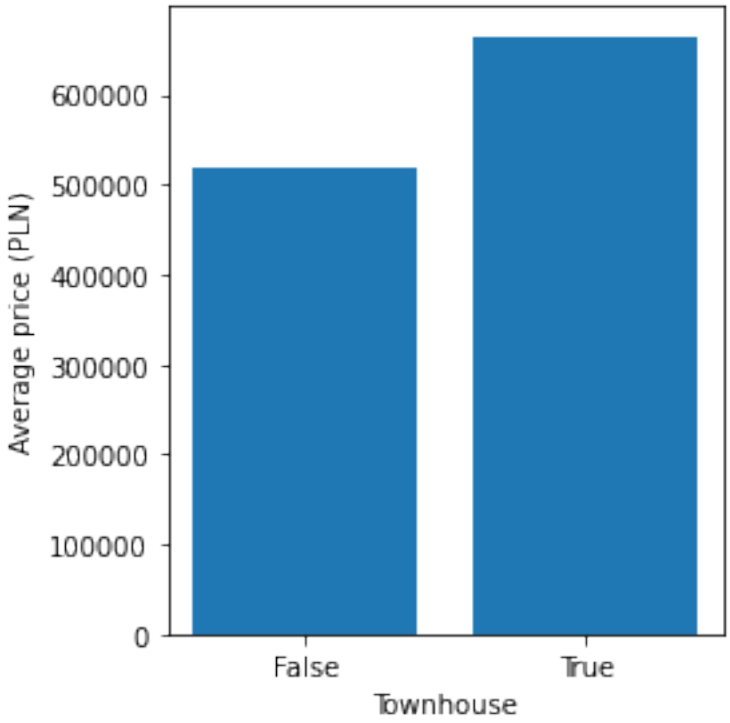


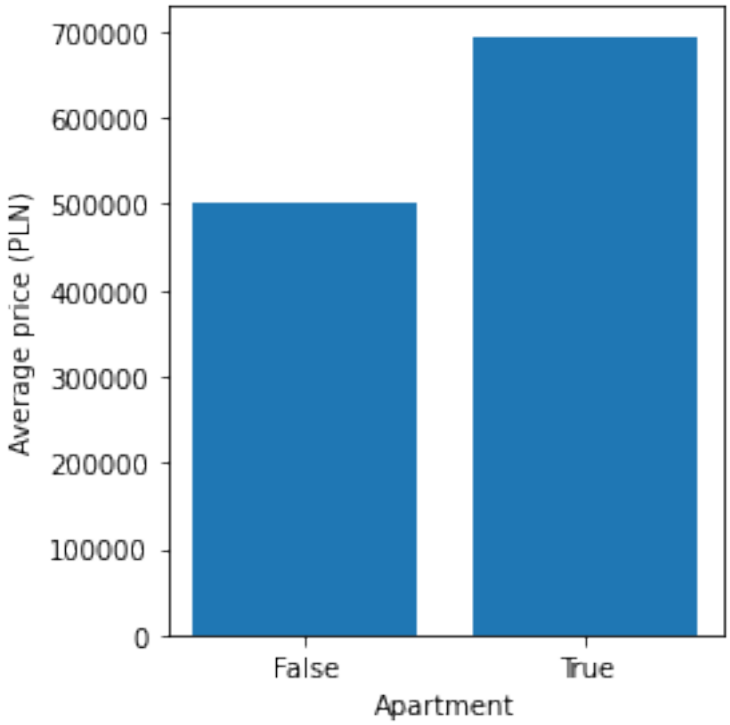

600000
500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
Terrace

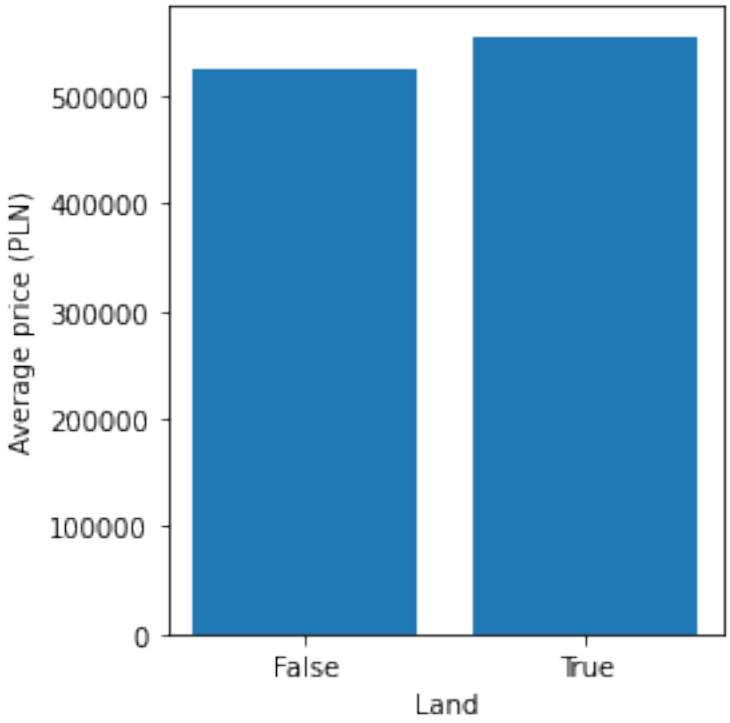

500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
Floor

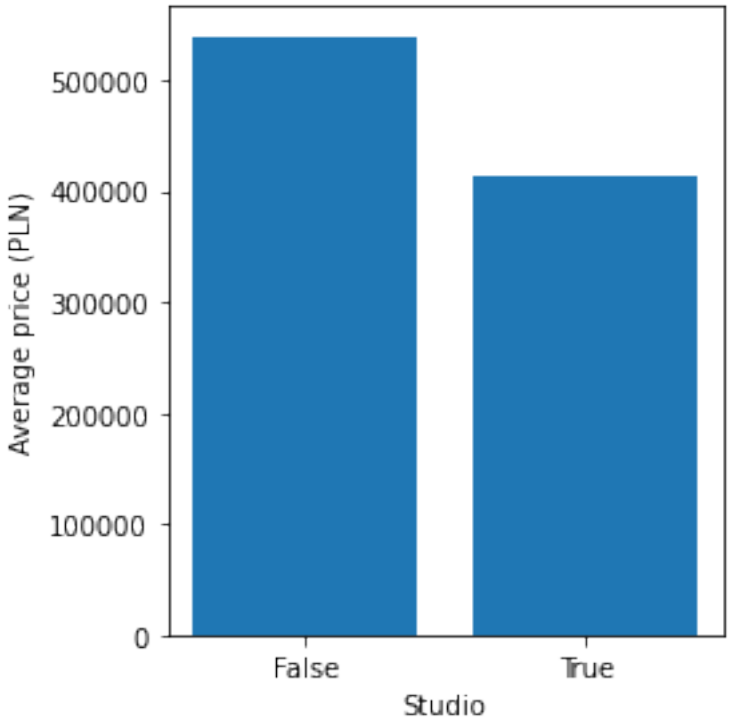

500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
New


500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
Estate


600000
500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
Townhouse


700000
600000
500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
Apartment


500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
Land


500000
400000
300000
200000
100000
0
Average price (PLN)
False
True
Studio

We check correlation of binary columns with `Amount`.

[10]:
```
C = data[binary].corrwith(data['Amount'])
C.name = 'Correlation'
C = C.to_frame()
C = C.sort_values('Correlation', ascending=False)
C = C.reset_index()
C = C.rename(columns={'index': 'Column'})
C
```

[10]:

	Column	Correlation
0	Apartment	0.32
1	Townhouse	0.20
2	Terrace	0.19
3	Garden	0.06
4	Land	0.06
5	Balcony	0.04
6	Estate	-0.00
7	Floor	-0.01
8	New	-0.13
9	Studio	-0.14

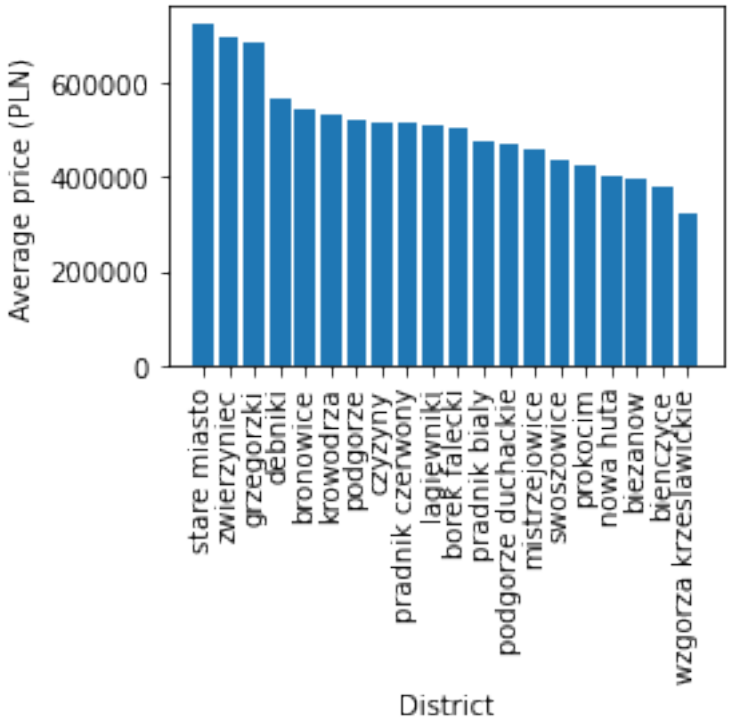
1.6 Categorical features

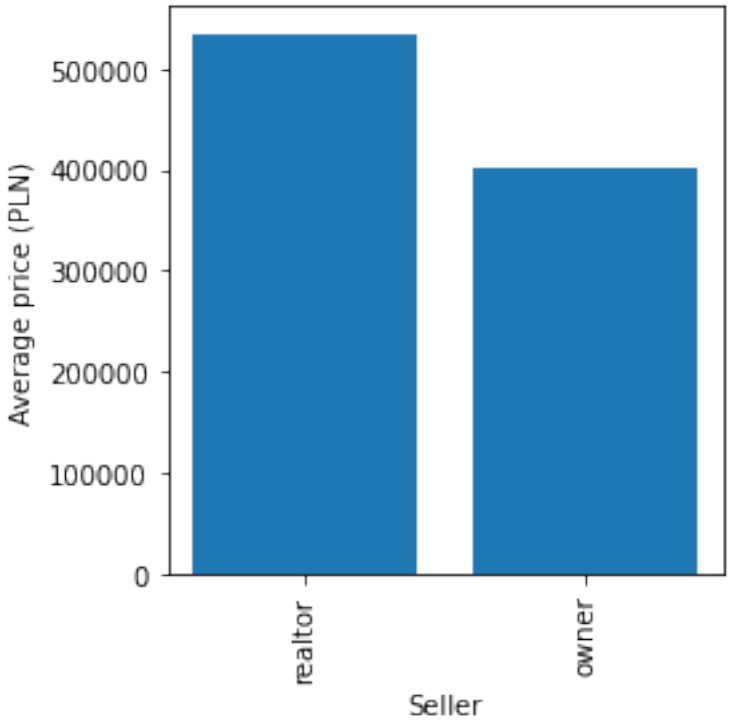
Again, we group the rows and compare averages.

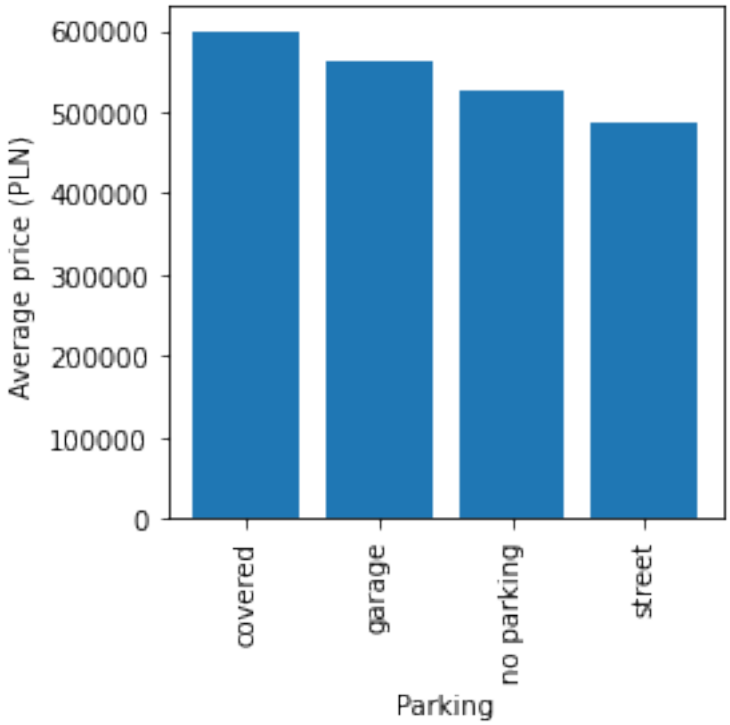
[11]:
```
categorical = list(data.select_dtypes('object').columns)
for col in categorical:
    group = data[[col, 'Amount']]
    group = group.groupby([col], as_index=False)
    group = group.mean()
    group = group.sort_values('Amount', ascending=False)

    plt.bar(group[col], group['Amount'])
    plt.ylabel('Average price (PLN)')
    plt.xlabel(f'{col}')
    plt.xticks(rotation=90)

    plt.tight_layout()
    plt.show()
```


Average price (PLN)
0
200000
400000
600000
stare miasto
zwierzyniec
grzegorzki
debniki
bronowice
krowodrza
podgorze
czyzyny
pradnik czerwony
lagiewniki
borek falecki
pradnik bialy
podgorze duchackie
mistrzejowice
swoszowice
prokocim
nowa huta
biezanow
bienczyce
wzgorza krzeslawickie
District


Average price (PLN)
0
100000
200000
300000
400000
500000
realtor
owner
Seller


600000
500000
400000
300000
200000
100000
0
Average price (PLN)
covered
garage
no parking
street
Parking