02_Visualization

July 14, 2024

1 02_Visualization

In this notebook, we focus on visualizing various aspects of our dataset to gain better insights and understand the relationships between different features. This analysis complements the previous exploratory data analysis (EDA) done in `01_EDA.ipynb`.

We will explore a variety of visualization techniques to highlight key patterns and trends in the data, such as:

1. **Distributions of Numerical Features**: Understanding the distribution of individual numerical features using histograms and KDE plots.
2. **Correlation Heatmap**: Identifying correlations between features to see how they influence each other.
3. **Pair Plots**: Examining pairwise relationships between multiple features.
4. **Box Plots**: Comparing the distribution of numerical features across different categories.
5. **Count Plots**: Visualizing the frequency of different categories in categorical features.
6. **Scatter Plots with Regression Lines**: Exploring relationships between pairs of numerical features with trend lines.
7. **Violin Plots**: Combining aspects of box plots and KDE plots to show distributions of numerical data across different categories.

By examining these visualizations, we aim to uncover patterns that could inform our modeling process, help in making data-driven decisions, and generate hypotheses for further analysis. These insights will be instrumental in guiding the next steps of our data analysis and modeling process.

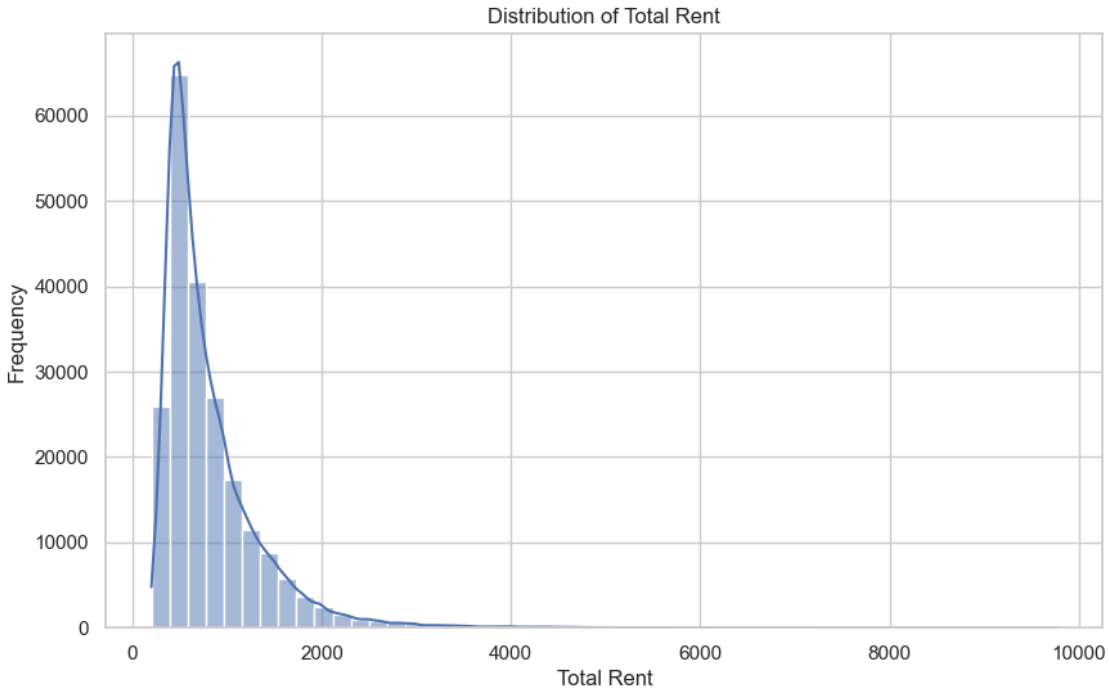
[ ]:
```
# Importing necessary libraries
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

[ ]:
```
# Setting visualisation style
sns.set(style="whitegrid")

# Load the final DataFrame from EDA.ipynb
df = pd.read_pickle('../data/final_df.pkl')
df.head()
```

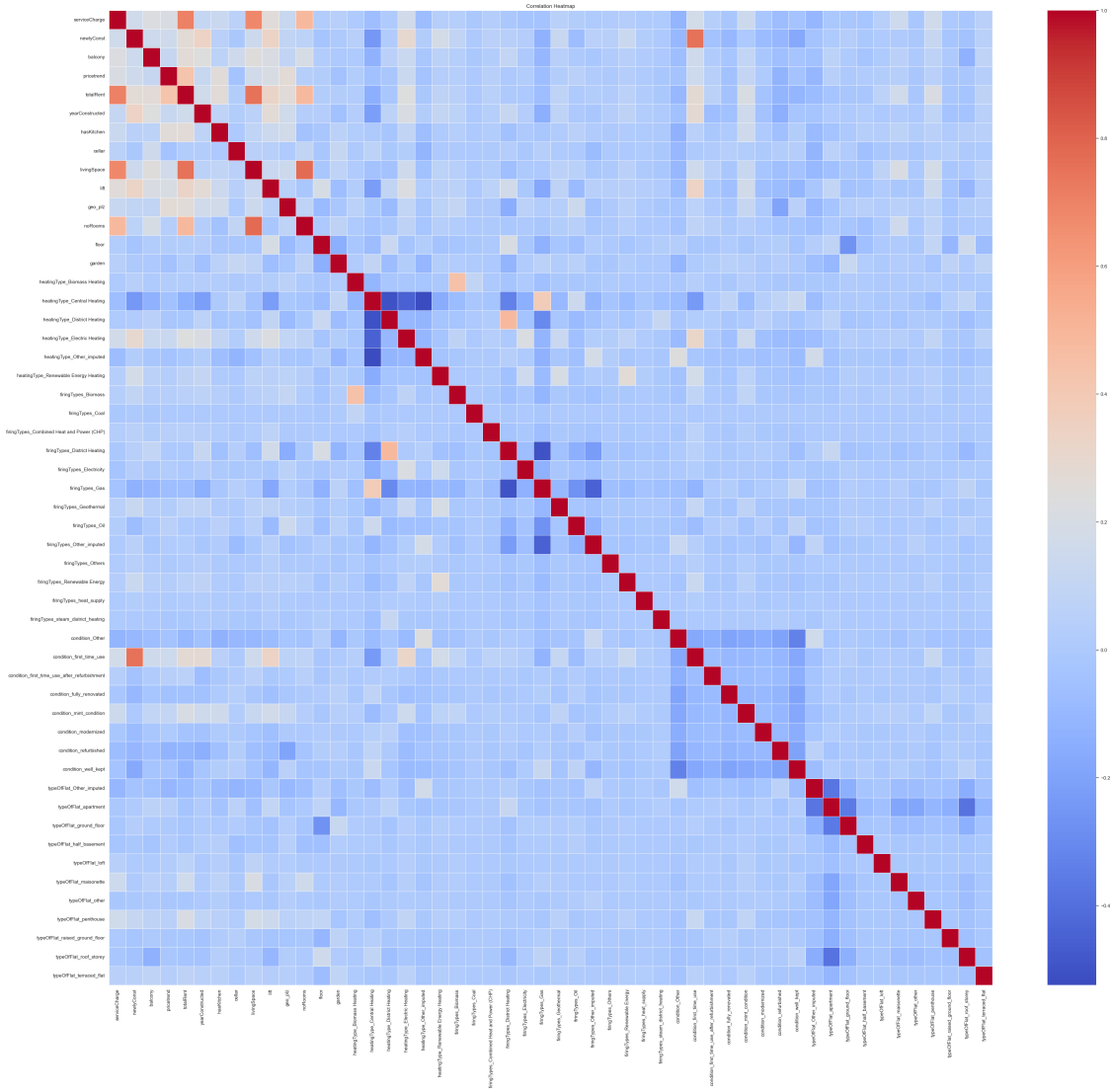
[ ]:
```
   serviceCharge       heatingType  newlyConst  balcony  pricetrend  \
0          245.0   Central Heating       False    False        4.62
```

```
2          255.0  Electric Heating        True     True        2.72
4          138.0   Central Heating       False     True        2.46
6           70.0   Central Heating       False    False        1.01
7           88.0   Central Heating       False     True        1.89

   totalRent  yearConstructed    firingTypes  hasKitchen  cellar  livingSpace  \
0     840.00           1965.0            Oil       False    True        86.00
2    1300.00           2019.0  Other_imputed       False    True        83.80
4     903.00           1950.0            Gas       False   False        84.97
6     380.00           1941.0  Other_imputed       False    True        62.00
7     584.25           1959.0            Gas       False    True        60.30

         condition   lift     typeOfFlat  geo_plz  noRooms  floor  garden
0        well_kept  False   ground_floor    44269      4.0    1.0    True
2   first_time_use   True      apartment     1097      3.0    3.0   False
4      refurbished  False      apartment    28213      3.0    1.0   False
6  fully_renovated  False  Other_imputed     9599      2.0    1.0    True
7            Other  False   ground_floor    28717      3.0    2.0   False
```

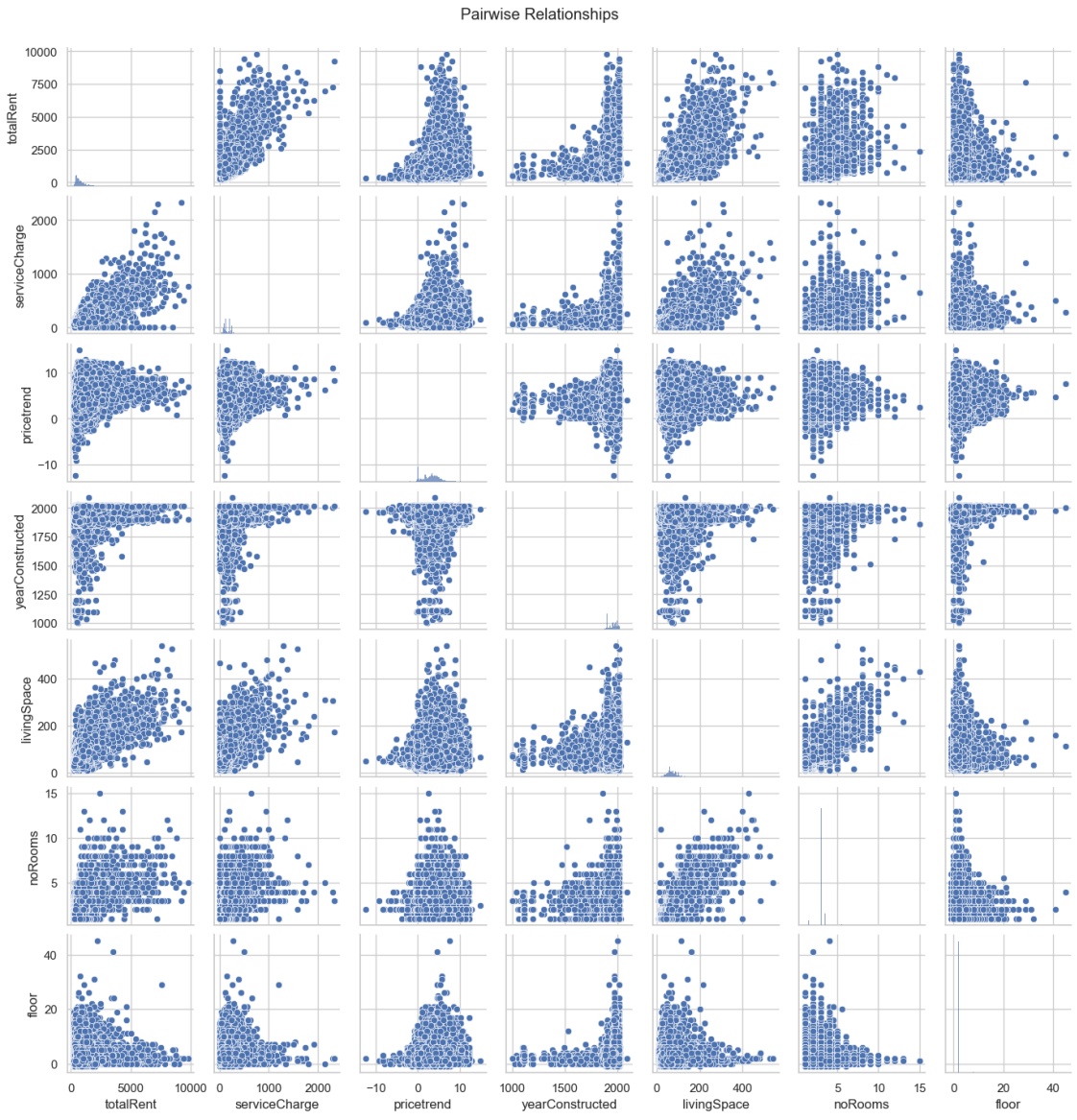
[ ]:
```
# Distribution of Total Rent
plt.figure(figsize=(10, 6))
sns.histplot(df['totalRent'], bins=50, kde=True)
plt.title('Distribution of Total Rent')
plt.xlabel('Total Rent')
plt.ylabel('Frequency')
plt.show()
```



[ ]:
```
# One-hot encode categorical features
df_encoded = pd.get_dummies(df, columns=['heatingType', 'firingTypes',␣
 ↪'condition', 'typeOfFlat'])

# Compute correlation matrix
corr_matrix = df_encoded.corr()

# Plot heatmap
plt.figure(figsize=(45, 40))
sns.heatmap(corr_matrix, annot=False, cmap='coolwarm', fmt=".2f", linewidths=0.
 ↪5)
plt.title('Correlation Heatmap')
plt.show()
```

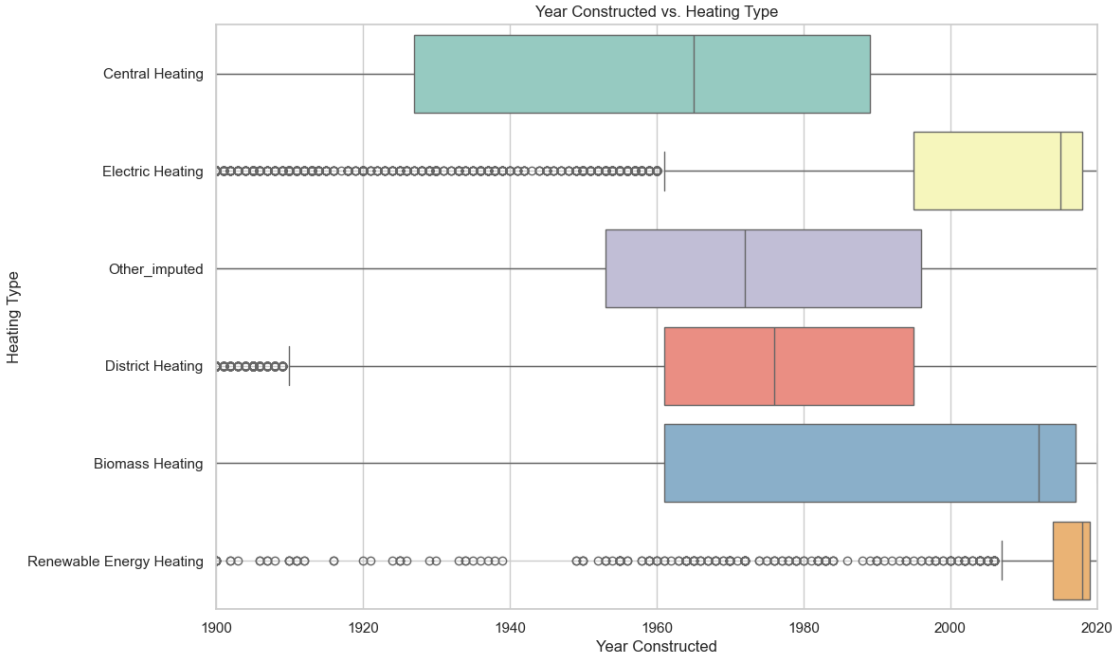


[ ]:
```
# Pair Plot
sns.pairplot(df, vars=['totalRent', 'serviceCharge', 'pricetrend',␣
 ↪'yearConstructed', 'livingSpace', 'noRooms', 'floor'], height=2)
plt.suptitle('Pairwise Relationships', y=1.02)
plt.show()
```

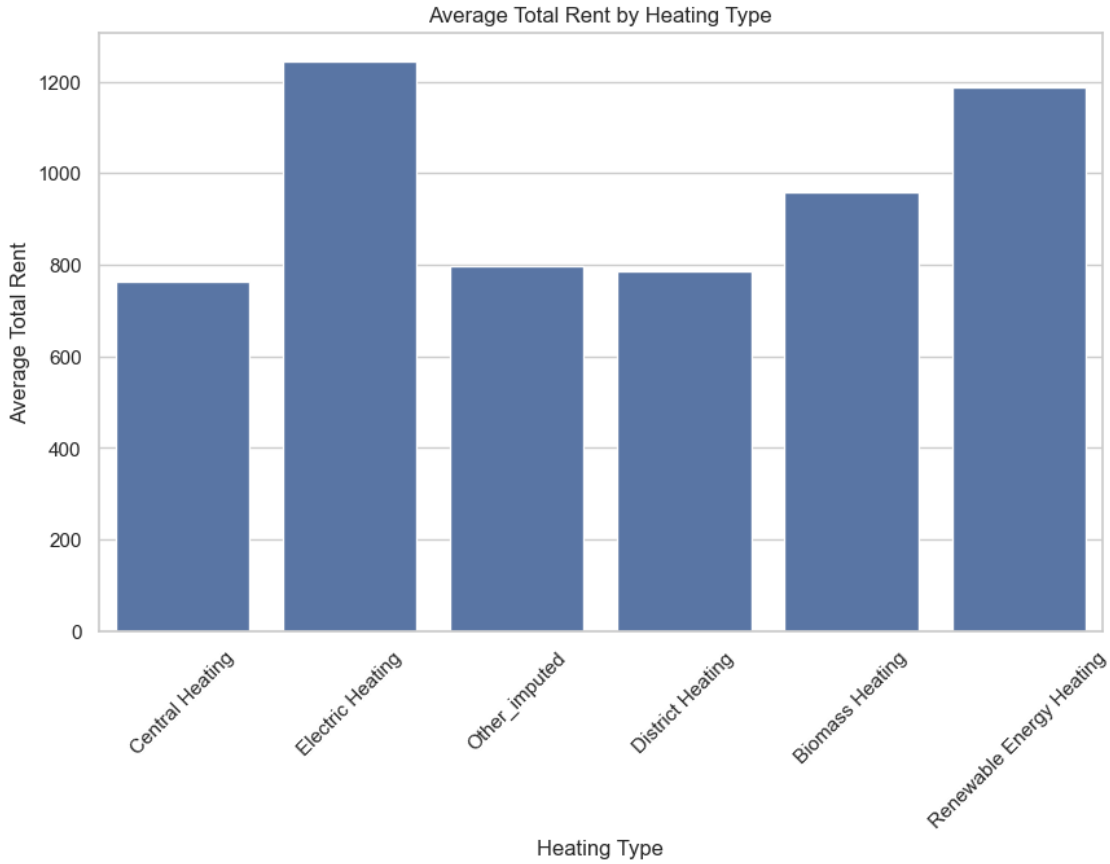


[ ]:
```
# Create a boxplot
plt.figure(figsize=(12, 8))
```

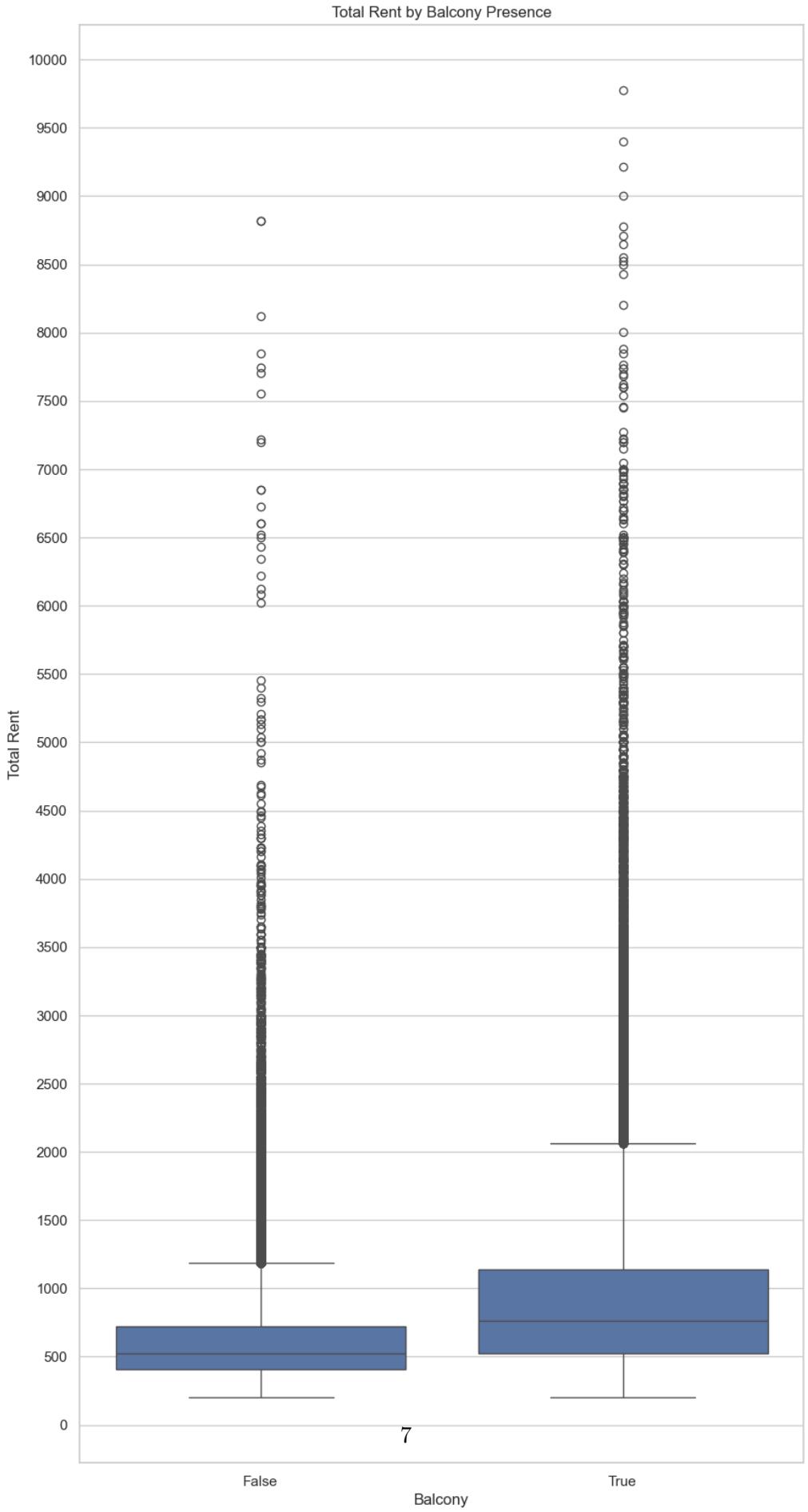
```
sns.boxplot(x='yearConstructed', y='heatingType', data=df, hue='heatingType',␣
 ↪palette="Set3", legend=False)

# Set plot title and labels
plt.title('Year Constructed vs. Heating Type')
plt.xlabel('Year Constructed')
plt.ylabel('Heating Type')

# Set x-axis limits
plt.xlim(1900, 2020)

# Show plot
plt.grid(True)
plt.show()
```



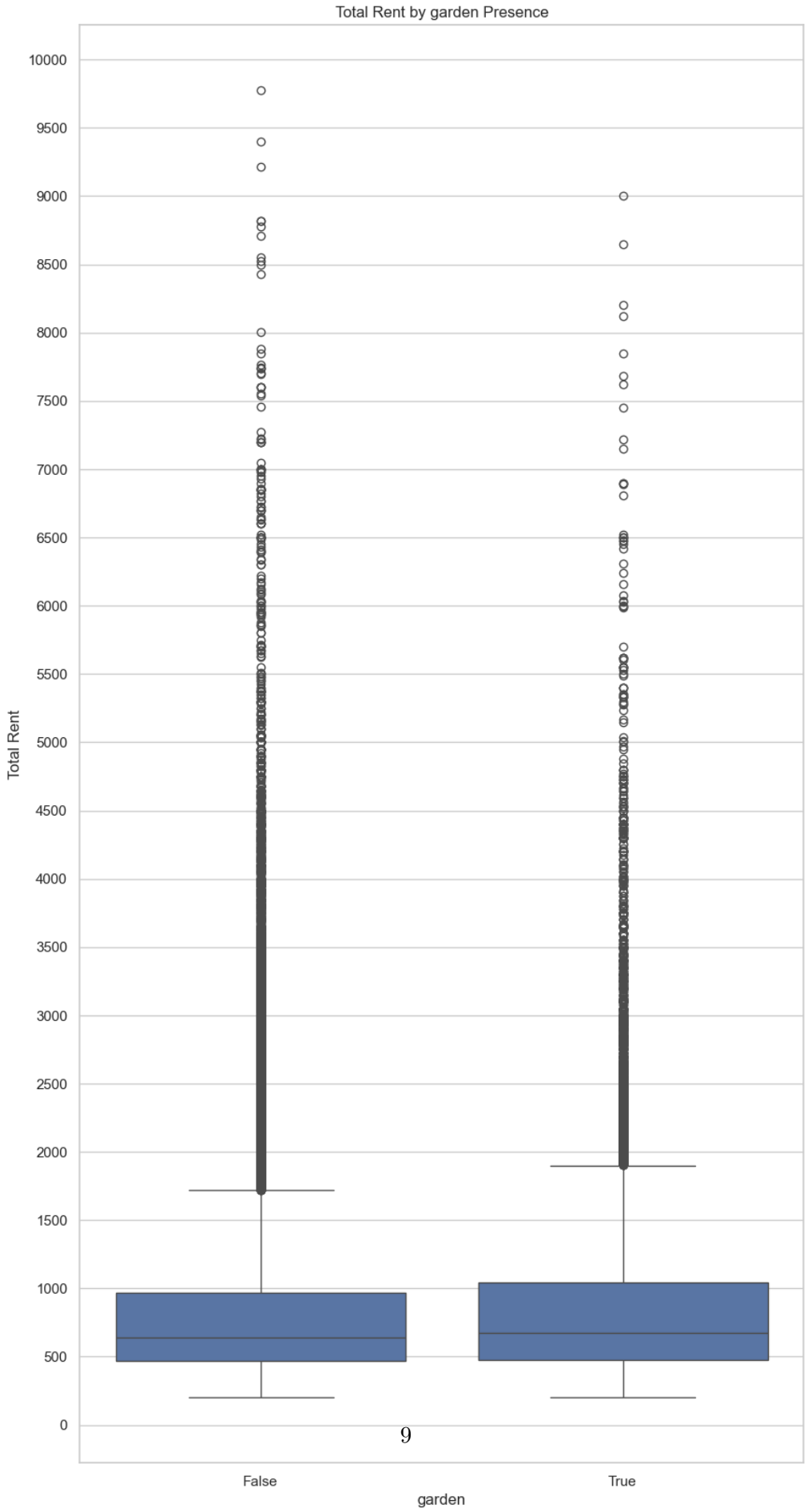
[ ]:
```
# Bar Plot for Heating Type
plt.figure(figsize=(10, 6))
sns.barplot(x='heatingType', y='totalRent', data=df, errorbar=None)
plt.title('Average Total Rent by Heating Type')
plt.xlabel('Heating Type')
plt.ylabel('Average Total Rent')
plt.xticks(rotation=45)
plt.show()
```



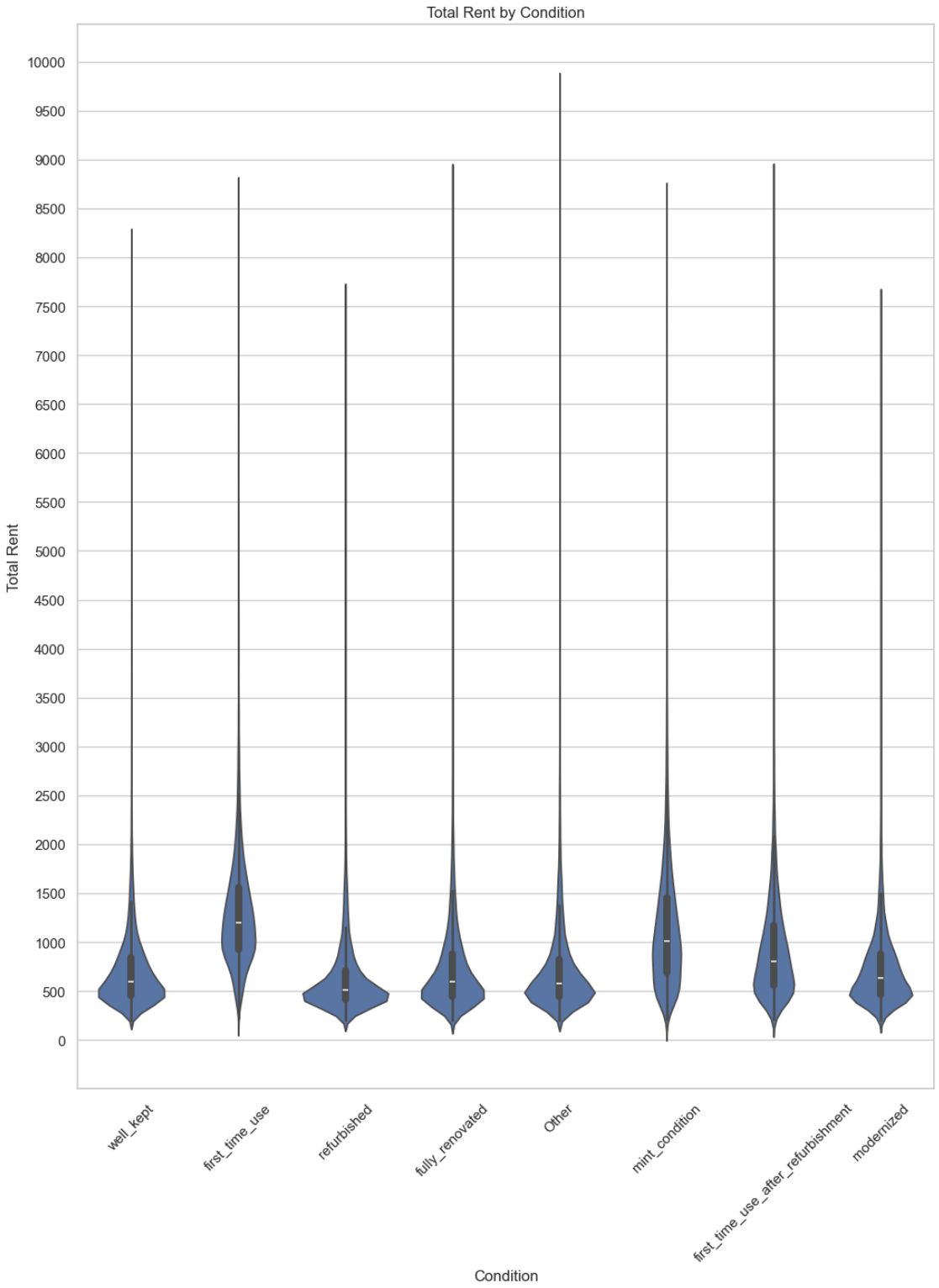
[ ]:
```
plt.figure(figsize=(10, 20))
sns.boxplot(x='balcony', y='totalRent', data=df)
plt.title('Total Rent by Balcony Presence')
plt.xlabel('Balcony')
plt.ylabel('Total Rent')
plt.yticks(range(0, int(df['totalRent'].max()) + 500, 500))
plt.show()
```


Total Rent by Balcony Presence
Total Rent
10000
9500
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
False
True
Balcony

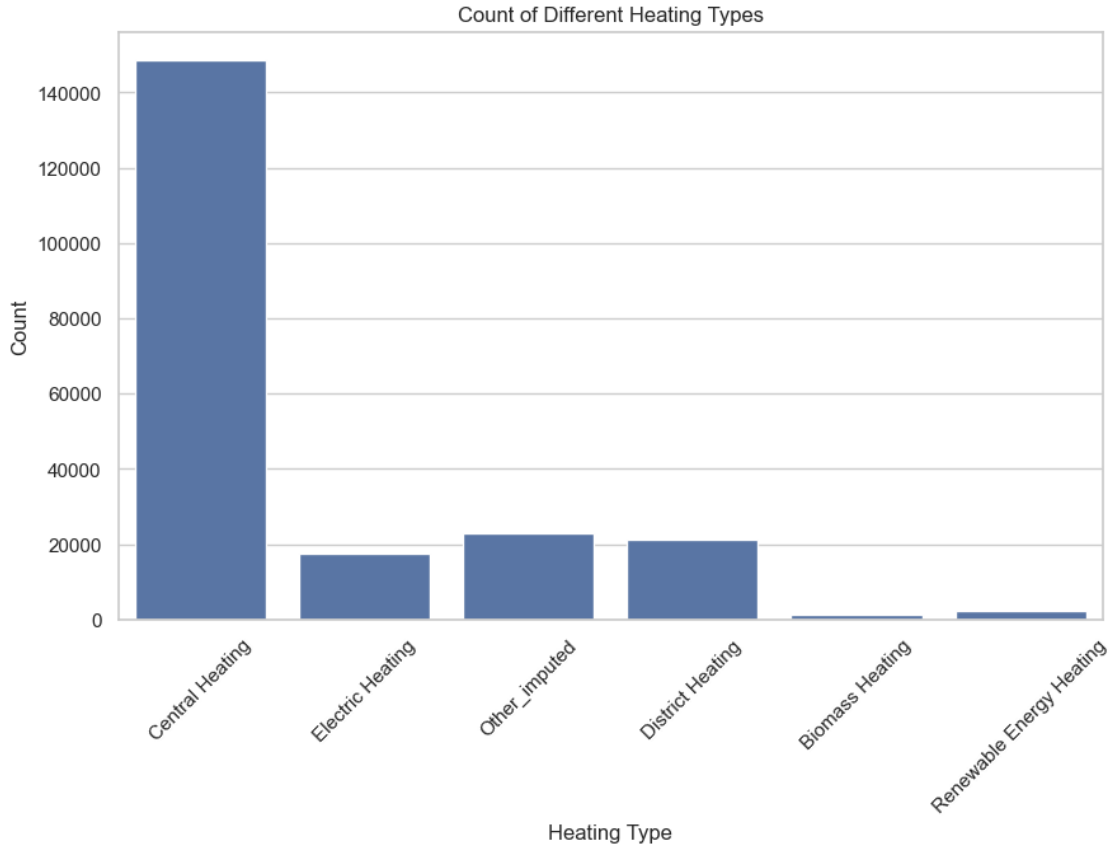
[ ]:
```
plt.figure(figsize=(10, 20))
sns.boxplot(x='garden', y='totalRent', data=df)
plt.title('Total Rent by garden Presence')
plt.xlabel('garden')
plt.ylabel('Total Rent')
plt.yticks(range(0, int(df['totalRent'].max()) + 500, 500))
plt.show()
```


Total Rent by garden Presence
Total Rent
10000
9500
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
False
True
garden

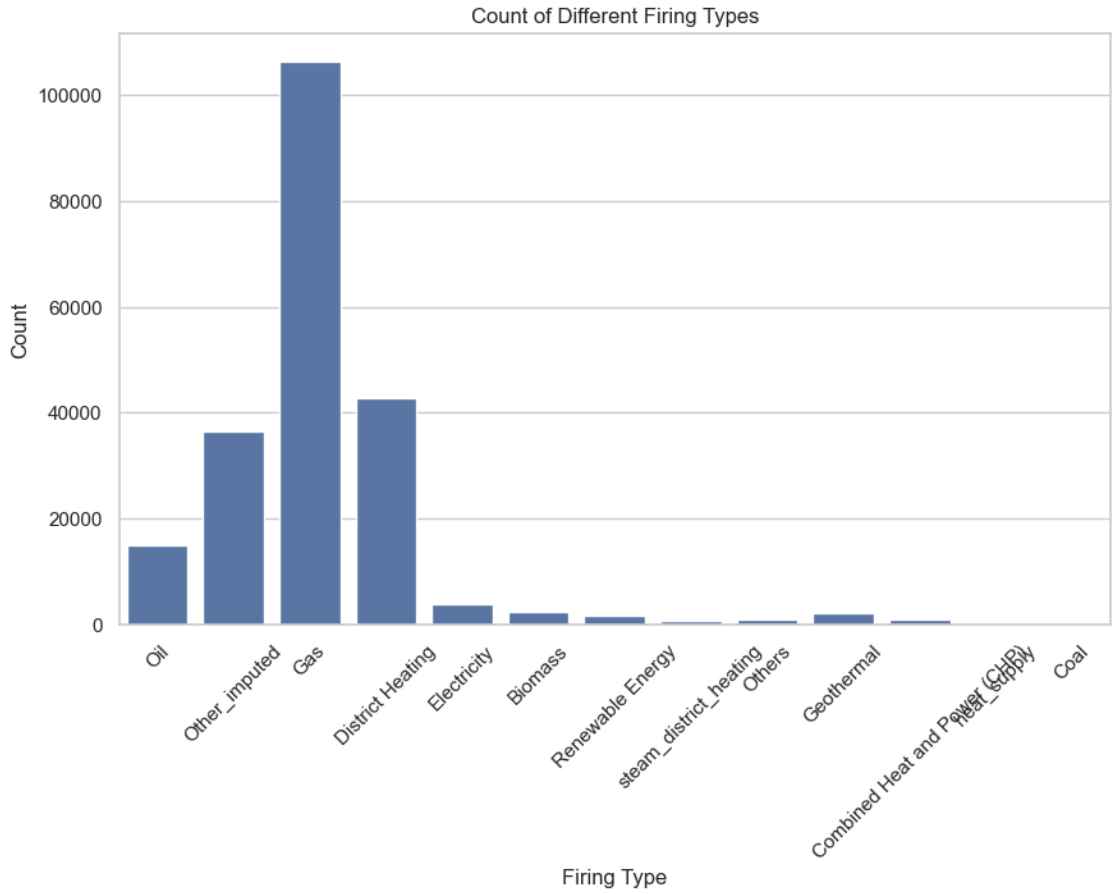
[ ]:
```
# Violin Plot for Condition
plt.figure(figsize=(12, 15))
sns.violinplot(x='condition', y='totalRent', data=df)
plt.title('Total Rent by Condition')
plt.xlabel('Condition')
plt.ylabel('Total Rent')
plt.xticks(rotation=45)
plt.yticks(range(0, int(df['totalRent'].max()) + 500, 500))
plt.show()
```


Total Rent by Condition
Total Rent
10000
9500
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
well_kept
first_time_use
refurbished
fully_renovated
Other
mint_condition
first_time_use_after_refurbishment
modernized
Condition

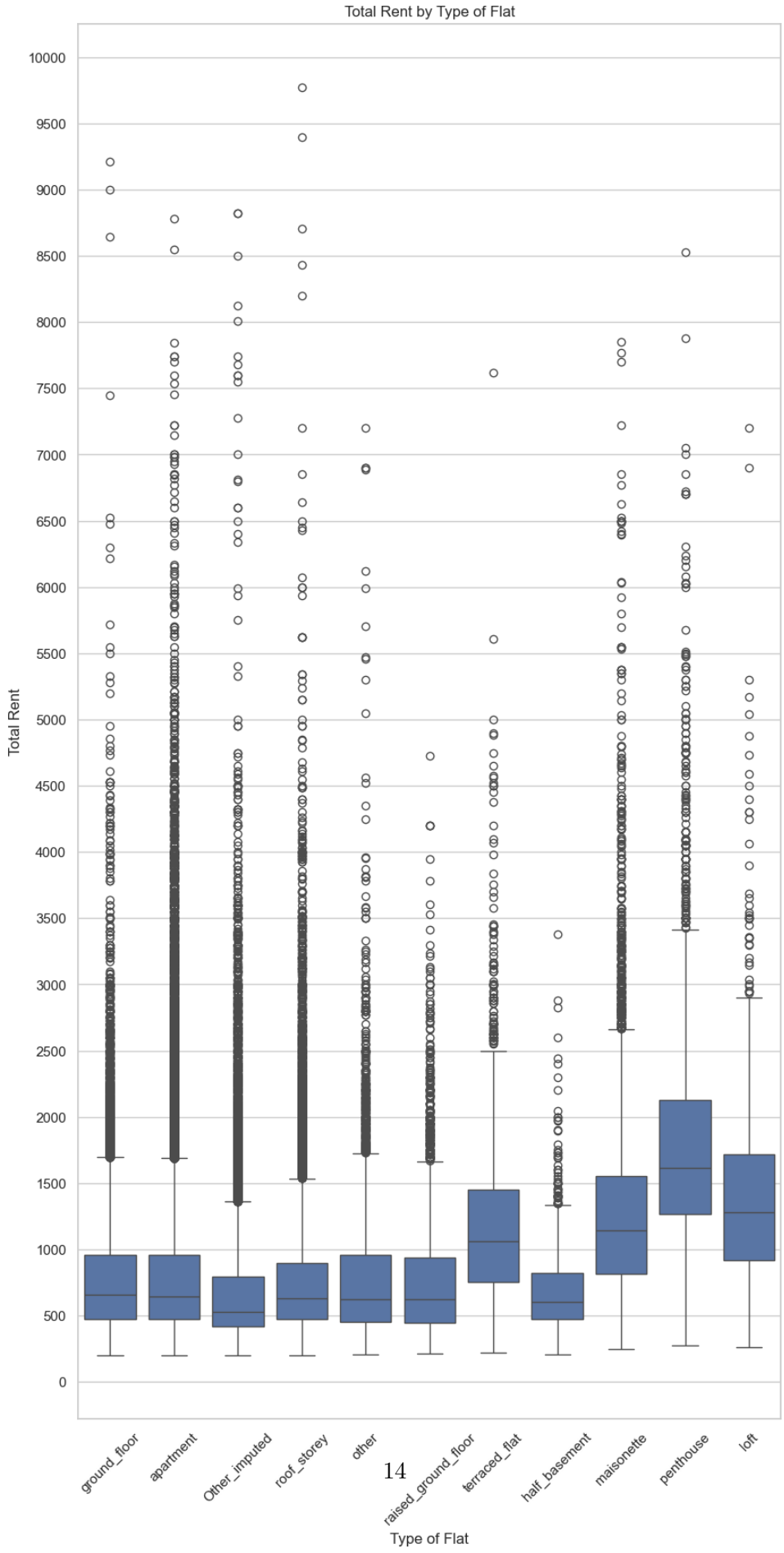
[ ]:
```
# Count Plots for Categorical Features
plt.figure(figsize=(10, 6))
sns.countplot(x='heatingType', data=df)
plt.title('Count of Different Heating Types')
plt.xlabel('Heating Type')
plt.ylabel('Count')
plt.xticks(rotation=45)
plt.show()
```



[ ]:
```
# Count Plots for Categorical Features
plt.figure(figsize=(10, 6))
sns.countplot(x='firingTypes', data=df)
plt.title('Count of Different Firing Types')
plt.xlabel('Firing Type')
plt.ylabel('Count')
plt.xticks(rotation=45)
plt.show()
```



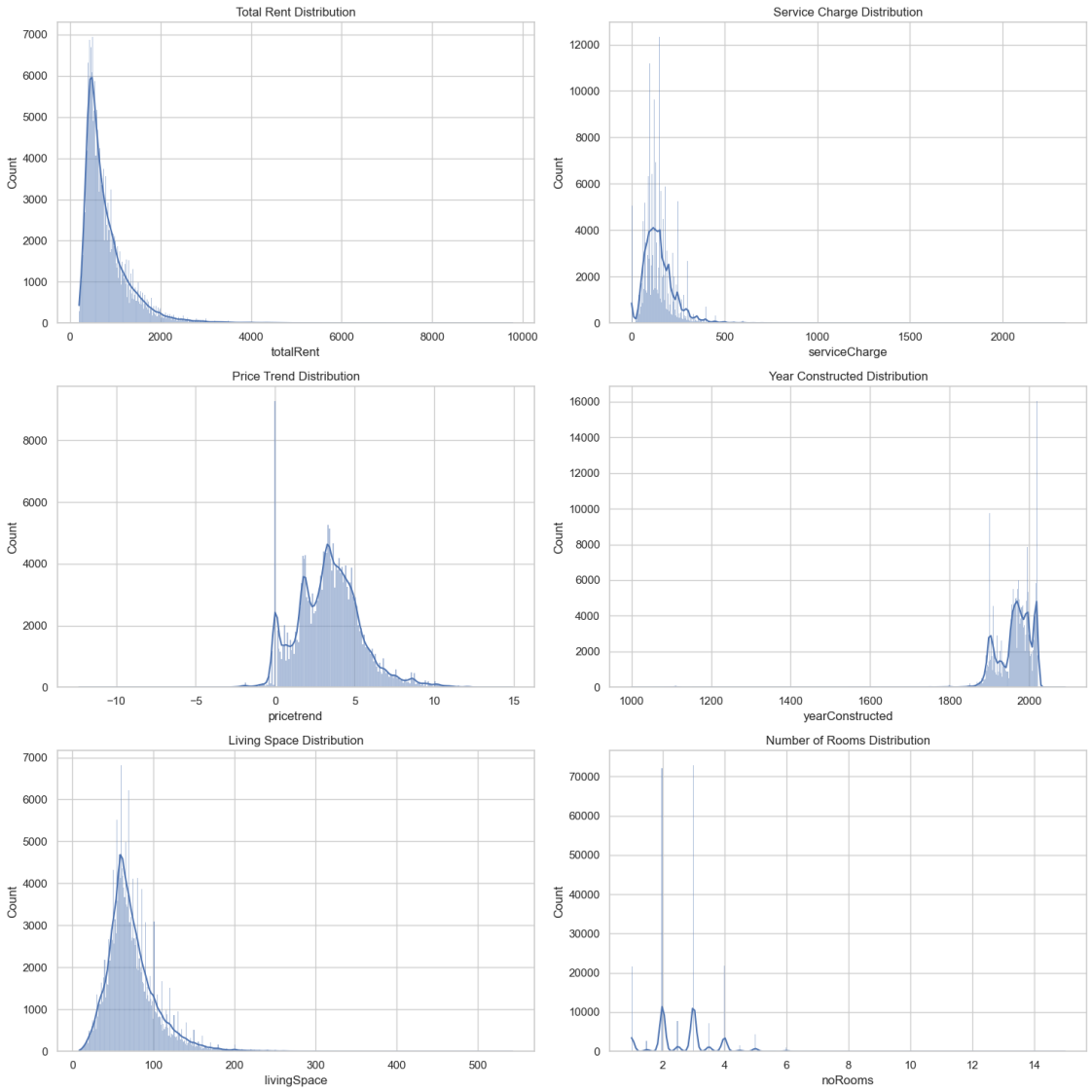
[ ]:
```
# Box Plot for Multiple Categories
plt.figure(figsize=(10, 20))
sns.boxplot(x='typeOfFlat', y='totalRent', data=df)
plt.title('Total Rent by Type of Flat')
plt.xlabel('Type of Flat')
plt.ylabel('Total Rent')
plt.xticks(rotation=45)
plt.yticks(range(0, int(df['totalRent'].max()) + 500, 500))
plt.show()
```


Total Rent by Type of Flat
Total Rent
10000
9500
9000
8500
8000
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
ground_floor
apartment
Other_imputed
roof_storey
other
raised_ground_floor
terraced_flat
half_basement
maisonette
penthouse
loft
Type of Flat

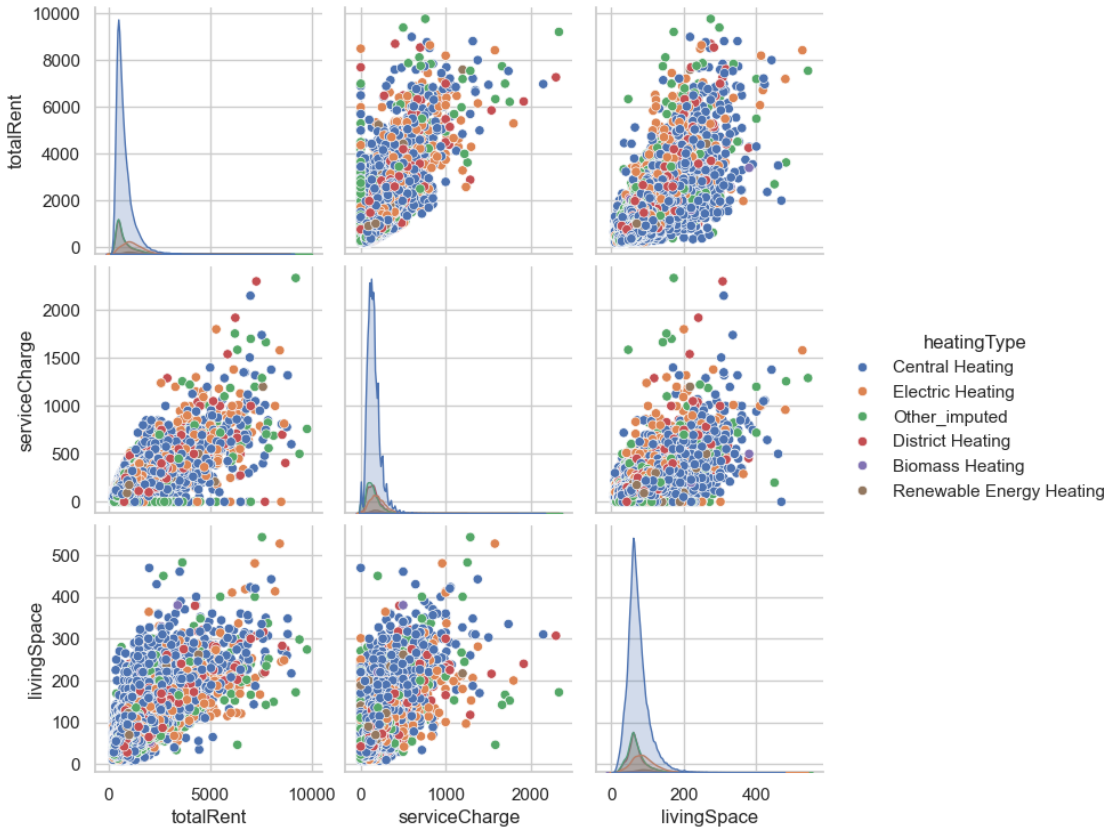
[ ]:
```
# Scatter Plot with Regression Line
plt.figure(figsize=(10, 6))
sns.regplot(x='livingSpace', y='totalRent', data=df)
plt.title('Total Rent vs. Living Space')
plt.xlabel('Living Space')
plt.ylabel('Total Rent')
plt.show()
```

[ ]:
```
# Distribution Plot for Each Categorical Feature
fig, axes = plt.subplots(3, 2, figsize=(15, 15))
sns.histplot(df['totalRent'], kde=True, ax=axes[0, 0])
sns.histplot(df['serviceCharge'], kde=True, ax=axes[0, 1])
sns.histplot(df['pricetrend'], kde=True, ax=axes[1, 0])
sns.histplot(df['yearConstructed'], kde=True, ax=axes[1, 1])
sns.histplot(df['livingSpace'], kde=True, ax=axes[2, 0])
sns.histplot(df['noRooms'], kde=True, ax=axes[2, 1])

axes[0, 0].set_title('Total Rent Distribution')
axes[0, 1].set_title('Service Charge Distribution')
axes[1, 0].set_title('Price Trend Distribution')
axes[1, 1].set_title('Year Constructed Distribution')
```

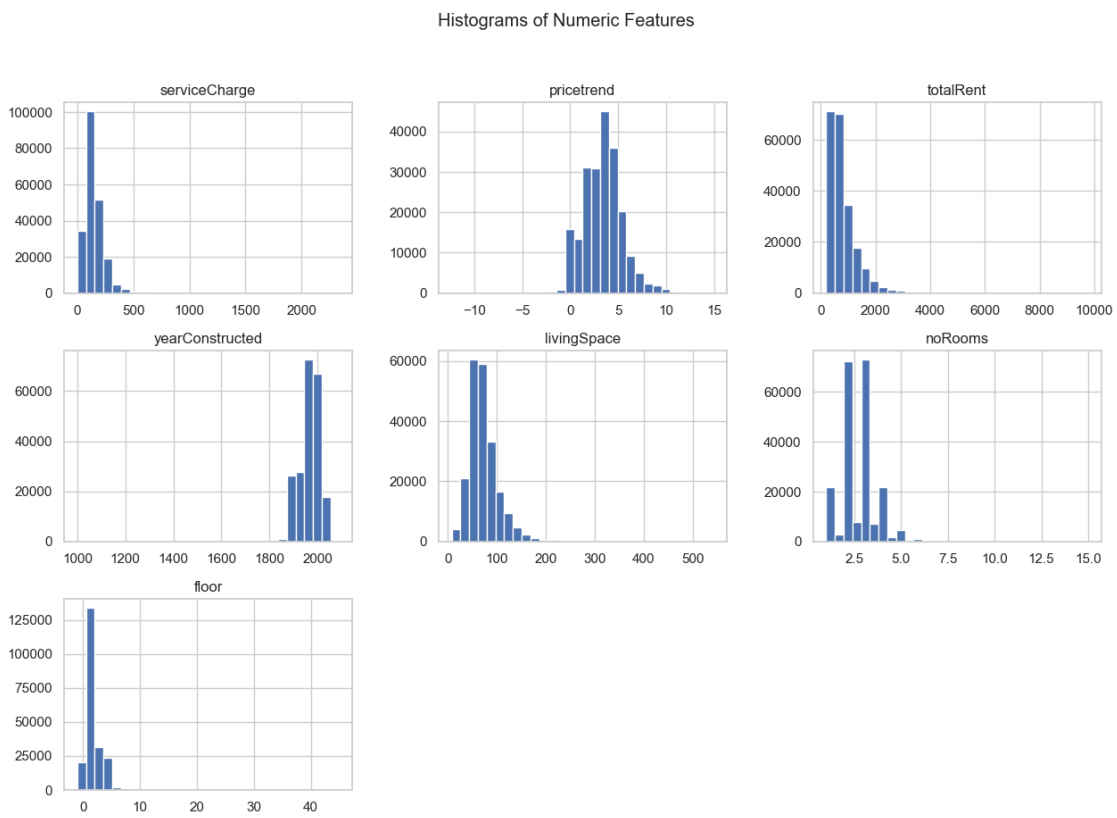
```
axes[2, 0].set_title('Living Space Distribution')
axes[2, 1].set_title('Number of Rooms Distribution')

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



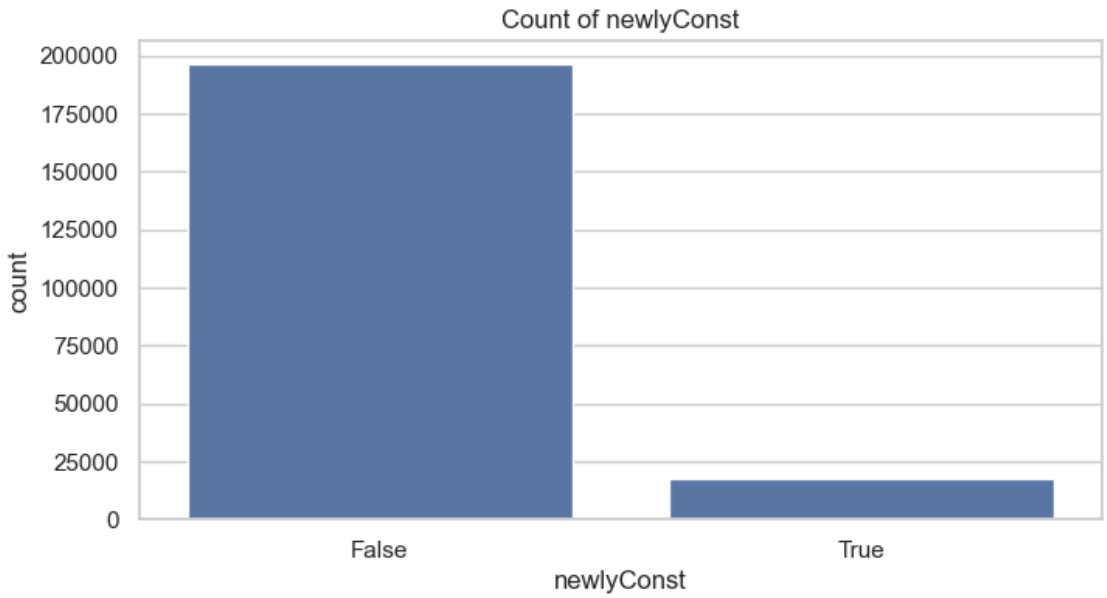
[ ]:
```
# Pair Plots Including Categorical Features
sns.pairplot(df, hue='heatingType', vars=['totalRent', 'serviceCharge',␣
  ↪'livingSpace'])
plt.show()
```

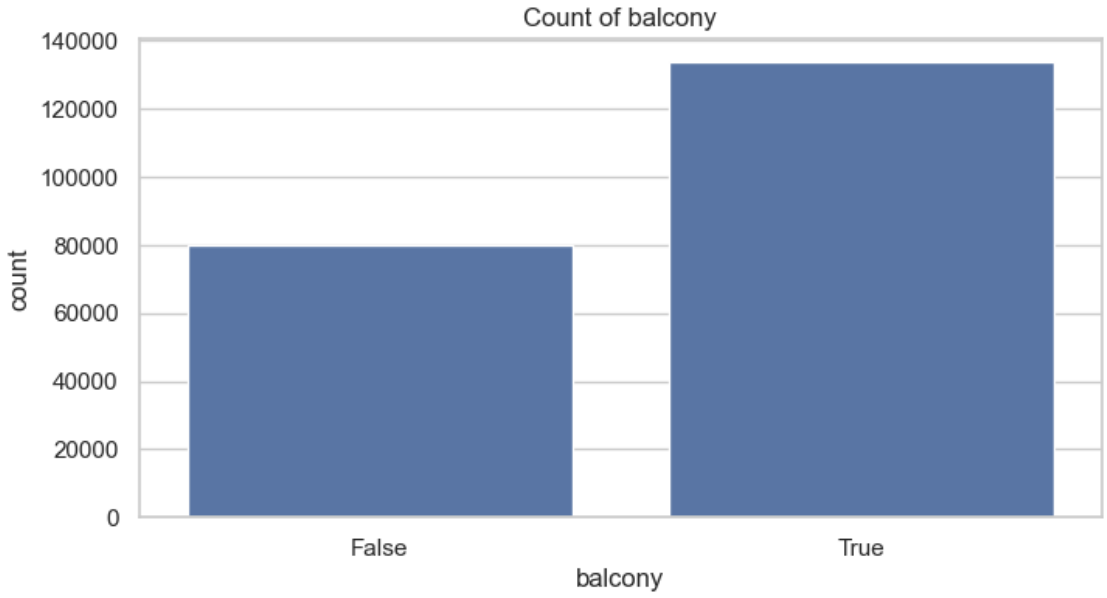


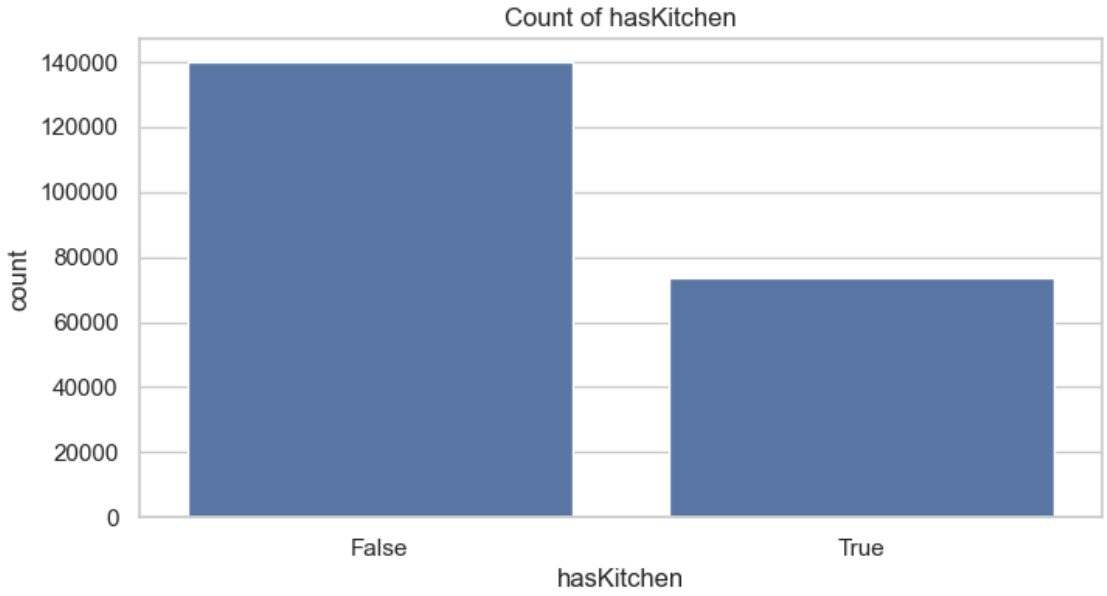
[ ]:
```
# Histogram of Numeric Features
numeric_features = ['serviceCharge', 'pricetrend', 'totalRent',␣
 ↪'yearConstructed', 'livingSpace', 'noRooms', 'floor']
df[numeric_features].hist(bins=30, figsize=(15, 10))
plt.suptitle('Histograms of Numeric Features')
plt.show()
```

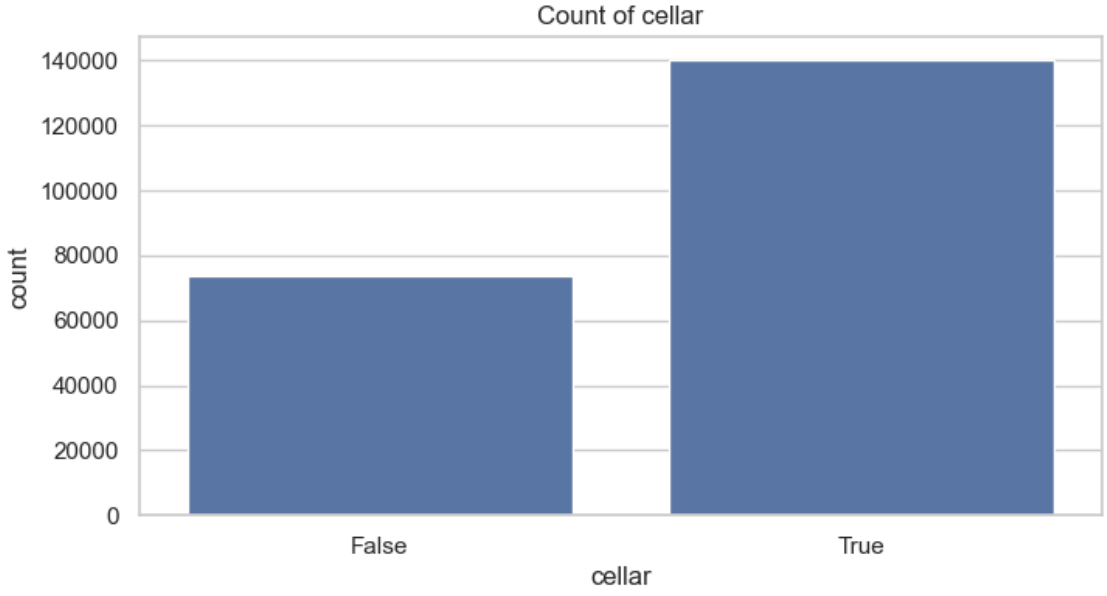


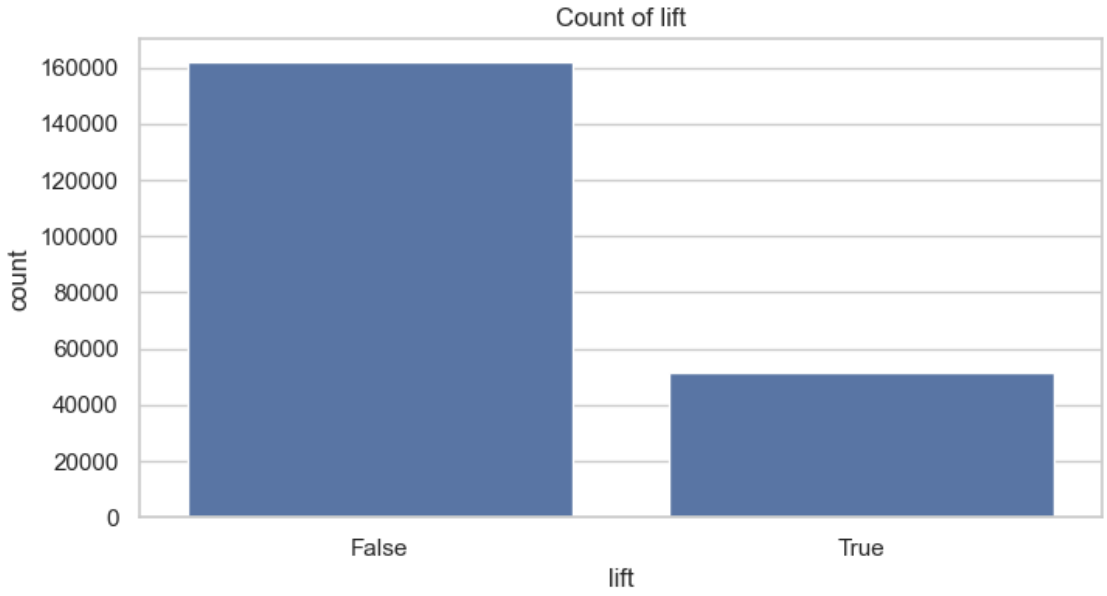
[ ]:
```
# Bar Plot for Boolean Features
boolean_features = ['newlyConst', 'balcony', 'hasKitchen', 'cellar', 'lift',␣
 ↪'garden']
for feature in boolean_features:
    plt.figure(figsize=(8, 4))
    sns.countplot(x=feature, data=df)
    plt.title(f'Count of {feature}')
    plt.show()
```

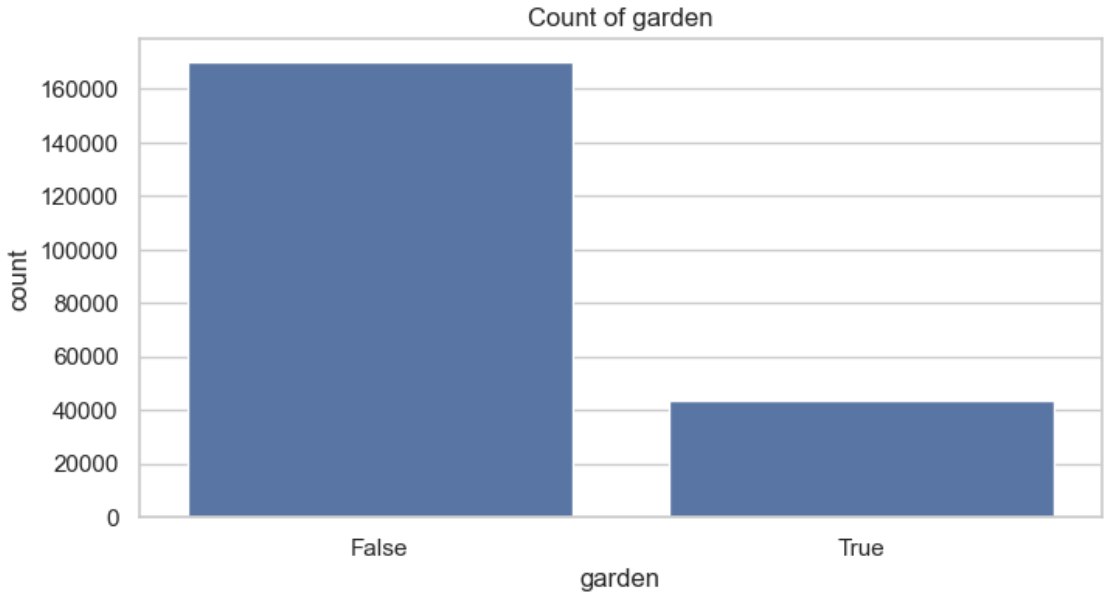

Count of newlyConst
200000
175000
150000
125000
100000
75000
50000
25000
0
count
False
True
newlyConst


Count of balcony
140000
120000
100000
80000
60000
40000
20000
0
count
False
True
balcony

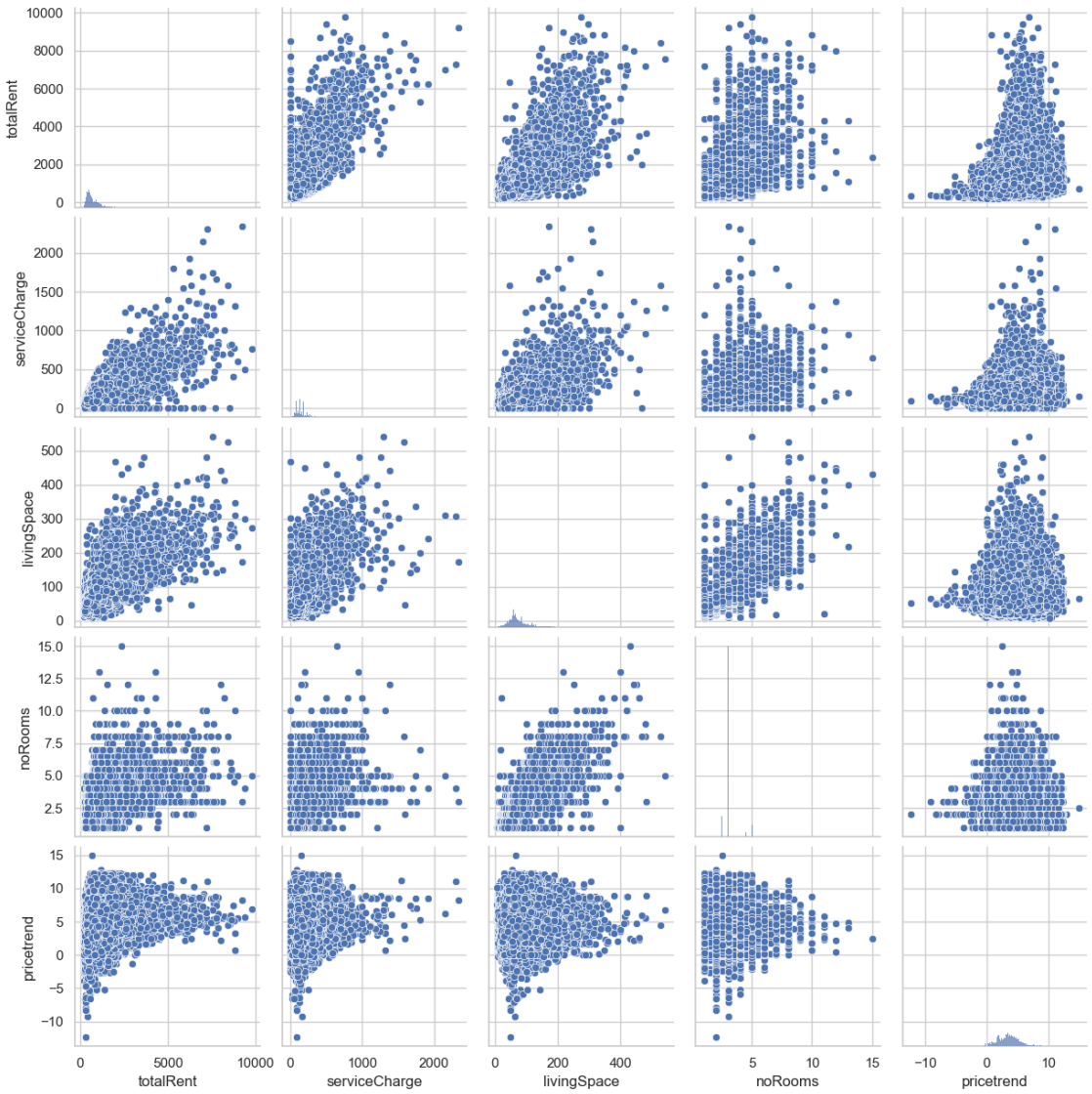

Count of hasKitchen
140000
120000
100000
80000
60000
40000
20000
0
count
False
True
hasKitchen


Count of cellar
140000
120000
100000
80000
60000
40000
20000
0
count
False
True
cellar





[ ]:
```
# Pair Plot for Feature Relationships

sns.pairplot(df, vars=['totalRent', 'serviceCharge', 'livingSpace', 'noRooms',␣
  ↪'pricetrend'])
plt.show()
```


totalRent
serviceCharge
livingSpace
noRooms
pricetrend
totalRent
serviceCharge
livingSpace
noRooms
pricetrend