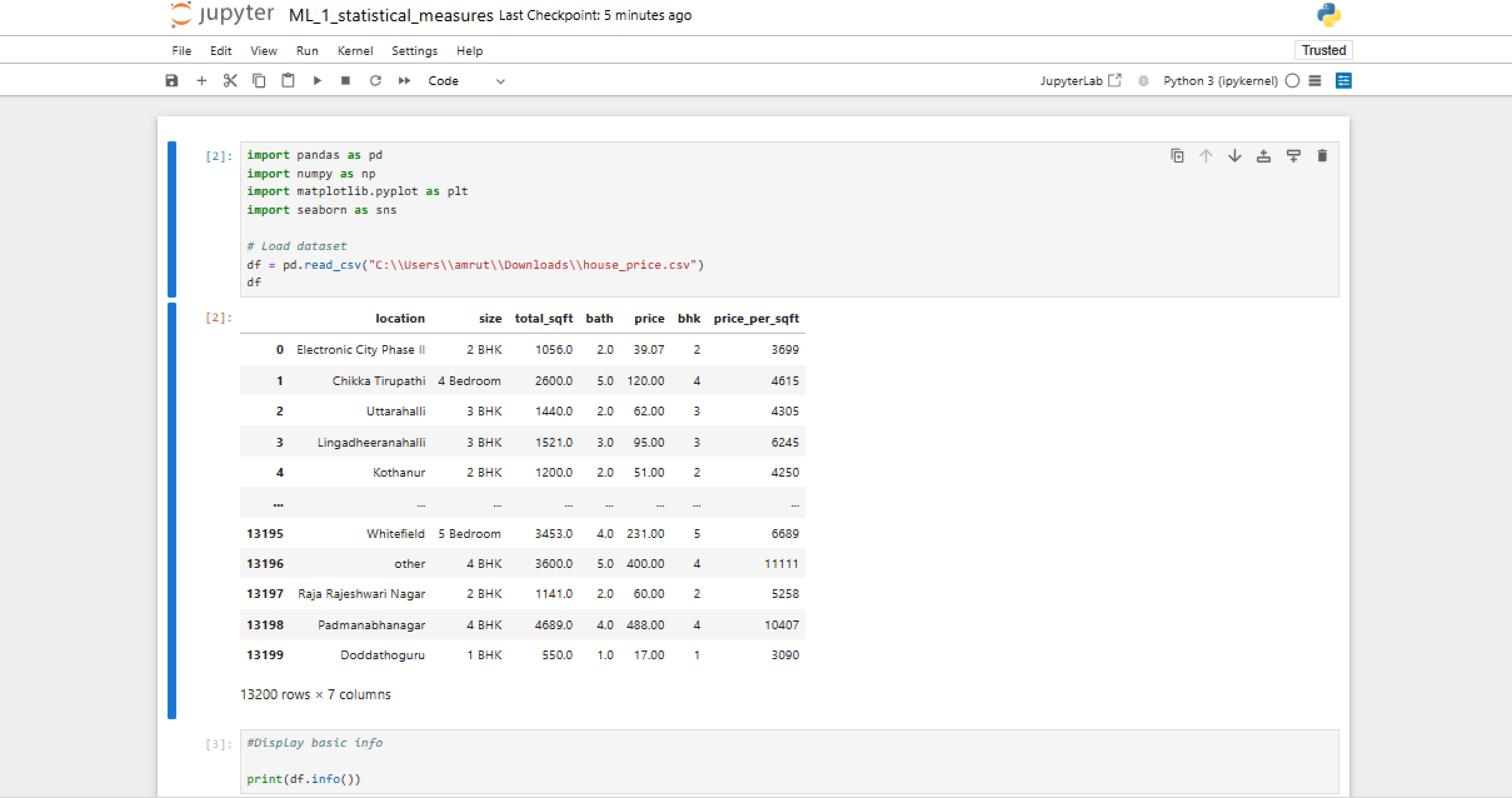


[2]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# Load dataset
df = pd.read_csv("C:\\Users\\amrut\\Downloads\\house_price.csv")
df
```

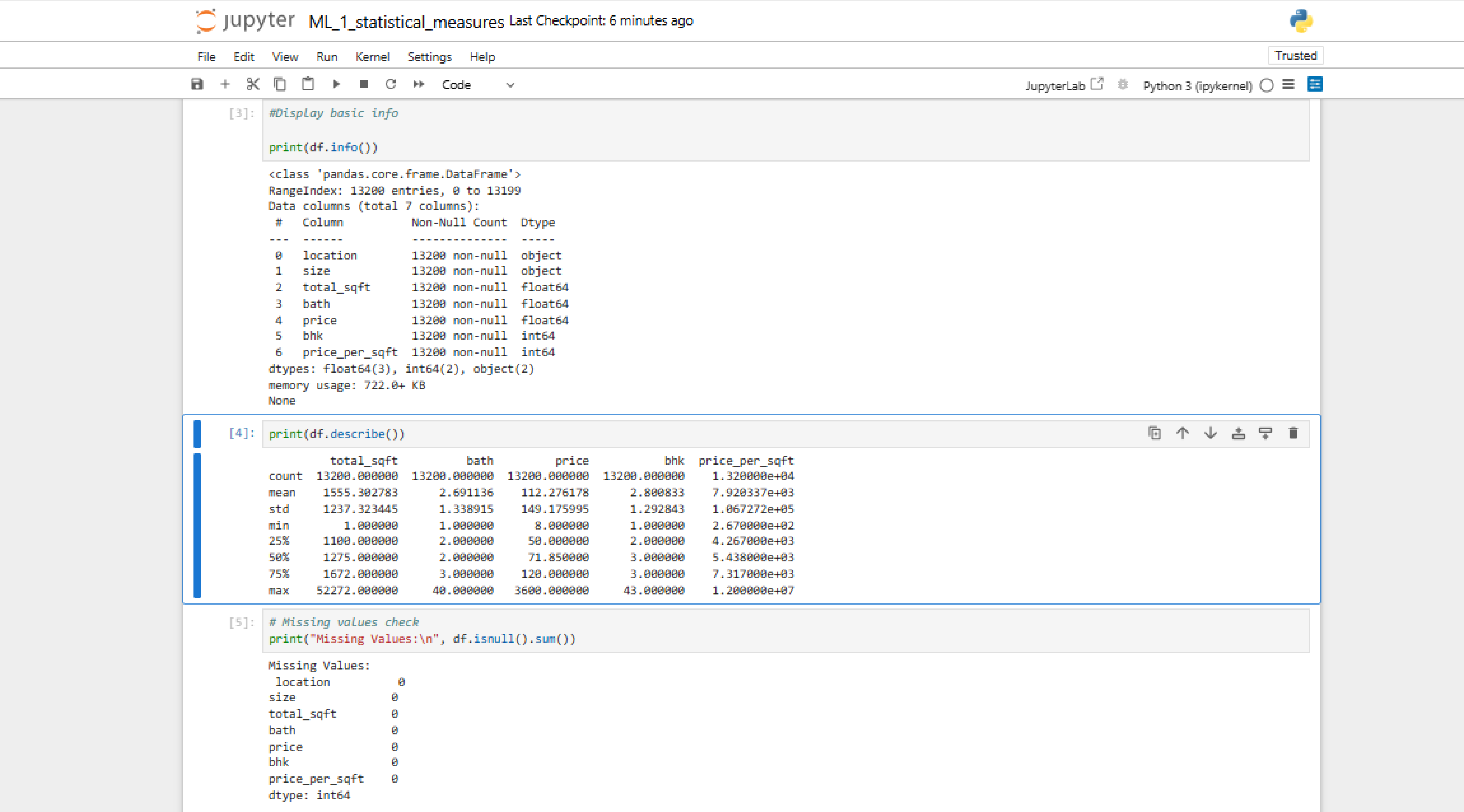
[2]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2	3699
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4	4615
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3	4305
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3	6245
4	Kothanur	2 BHK	1200.0	2.0	51.00	2	4250
...	...	...	...	...	...	...	...
13195	Whitefield	5 Bedroom	3453.0	4.0	231.00	5	6689
13196	other	4 BHK	3600.0	5.0	400.00	4	11111
13197	Raja Rajeshwari Nagar	2 BHK	1141.0	2.0	60.00	2	5258
13198	Padmanabhanagar	4 BHK	4689.0	4.0	488.00	4	10407
13199	Doddathoguru	1 BHK	550.0	1.0	17.00	1	3090

13200 rows × 7 columns

[3]:

```
#Display basic info

print(df.info())
```



[3]:

```
#Display basic info

print(df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 13200 entries, 0 to 13199
Data columns (total 7 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   location        13200 non-null  object 
 1   size            13200 non-null  object 
 2   total_sqft      13200 non-null  float64
 3   bath            13200 non-null  float64
 4   price           13200 non-null  float64
 5   bhk             13200 non-null  int64  
 6   price_per_sqft  13200 non-null  int64  
dtypes: float64(3), int64(2), object(2)
memory usage: 722.0+ KB
None
```

[4]:

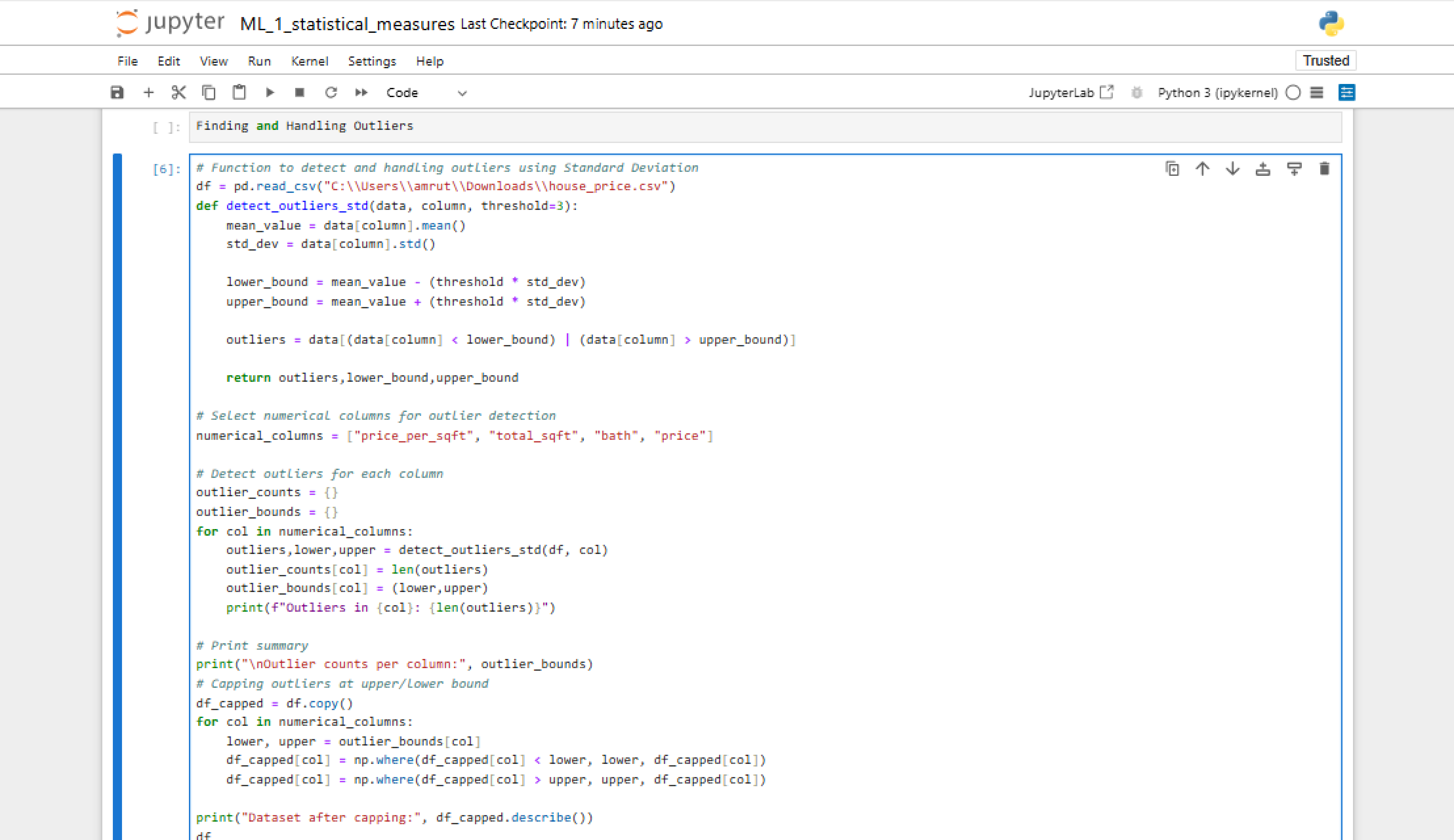
```
print(df.describe())
```

```
         total_sqft          bath         price           bhk  price_per_sqft
count  13200.000000  13200.000000  13200.000000  13200.000000    1.320000e+04
mean    1555.302783      2.691136    112.276178      2.800833    7.920337e+03
std     1237.323445      1.338915    149.175995      1.292843    1.067272e+05
min        1.000000      1.000000      8.000000      1.000000    2.670000e+02
25%     1100.000000      2.000000     50.000000      2.000000    4.267000e+03
50%     1275.000000      2.000000     71.850000      3.000000    5.438000e+03
75%     1672.000000      3.000000    120.000000      3.000000    7.317000e+03
max    52272.000000     40.000000   3600.000000     43.000000    1.200000e+07
```

[5]:

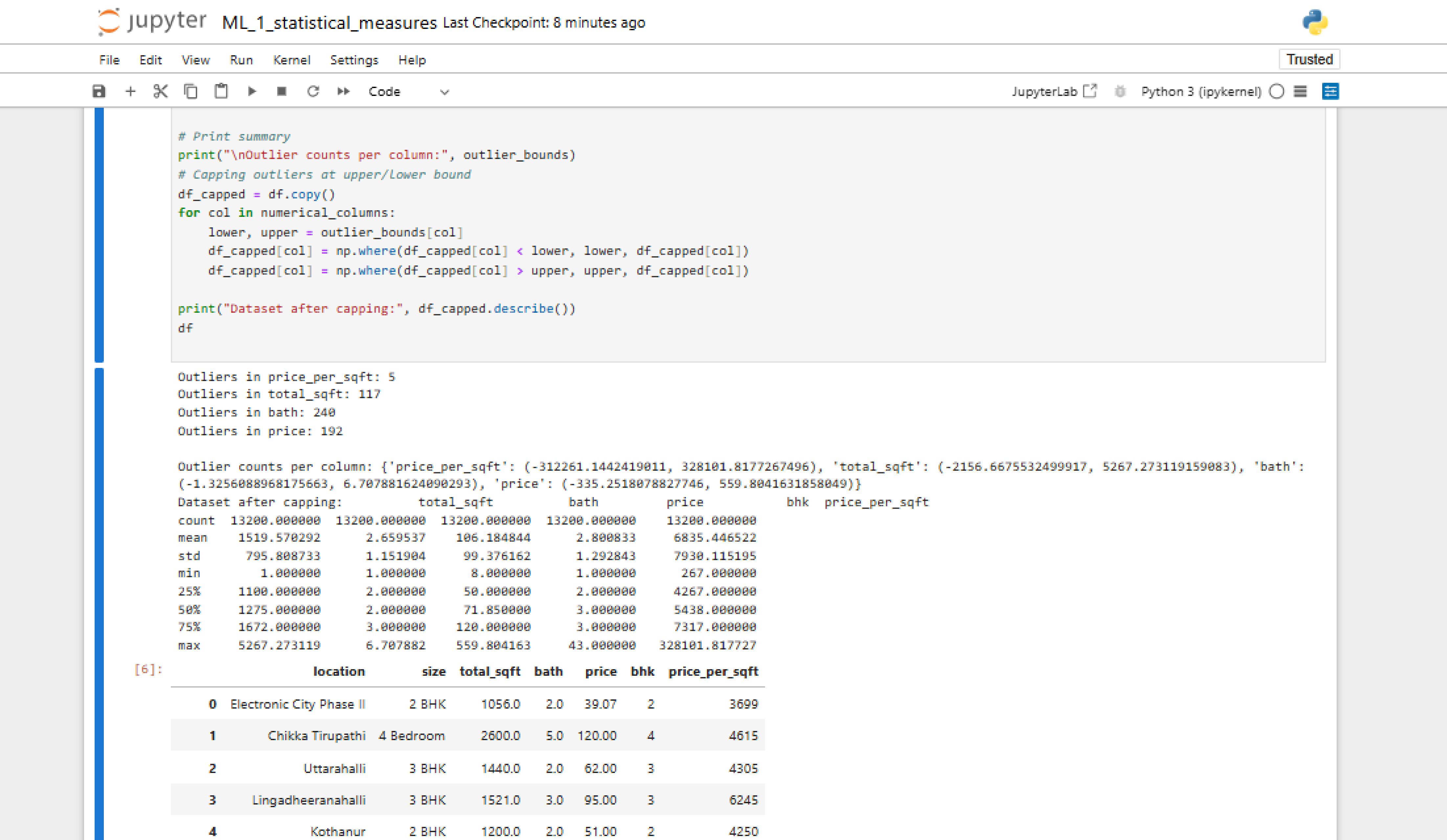
```
# Missing values check
print("Missing Values:\n", df.isnull().sum())
```

```
Missing Values:
 location          0
size              0
total_sqft        0
bath              0
price             0
bhk               0
price_per_sqft    0
dtype: int64
```



```
Finding and Handling Outliers
```

```python
# Function to detect and handling outliers using Standard Deviation
df = pd.read_csv("C:\\Users\\amrut\\Downloads\\house_price.csv")
def detect_outliers_std(data, column, threshold=3):
    mean_value = data[column].mean()
    std_dev = data[column].std()

    lower_bound = mean_value - (threshold * std_dev)
    upper_bound = mean_value + (threshold * std_dev)

    outliers = data[(data[column] < lower_bound) | (data[column] > upper_bound)]

    return outliers,lower_bound,upper_bound

# Select numerical columns for outlier detection
numerical_columns = ["price_per_sqft", "total_sqft", "bath", "price"]

# Detect outliers for each column
outlier_counts = {}
outlier_bounds = {}
for col in numerical_columns:
    outliers,lower,upper = detect_outliers_std(df, col)
    outlier_counts[col] = len(outliers)
    outlier_bounds[col] = (lower,upper)
    print(f"Outliers in {col}: {len(outliers)}")

# Print summary
print("\nOutlier counts per column:", outlier_bounds)
# Capping outliers at upper/lower bound
df_capped = df.copy()
for col in numerical_columns:
    lower, upper = outlier_bounds[col]
    df_capped[col] = np.where(df_capped[col] < lower, lower, df_capped[col])
    df_capped[col] = np.where(df_capped[col] > upper, upper, df_capped[col])

print("Dataset after capping:", df_capped.describe())
df
```

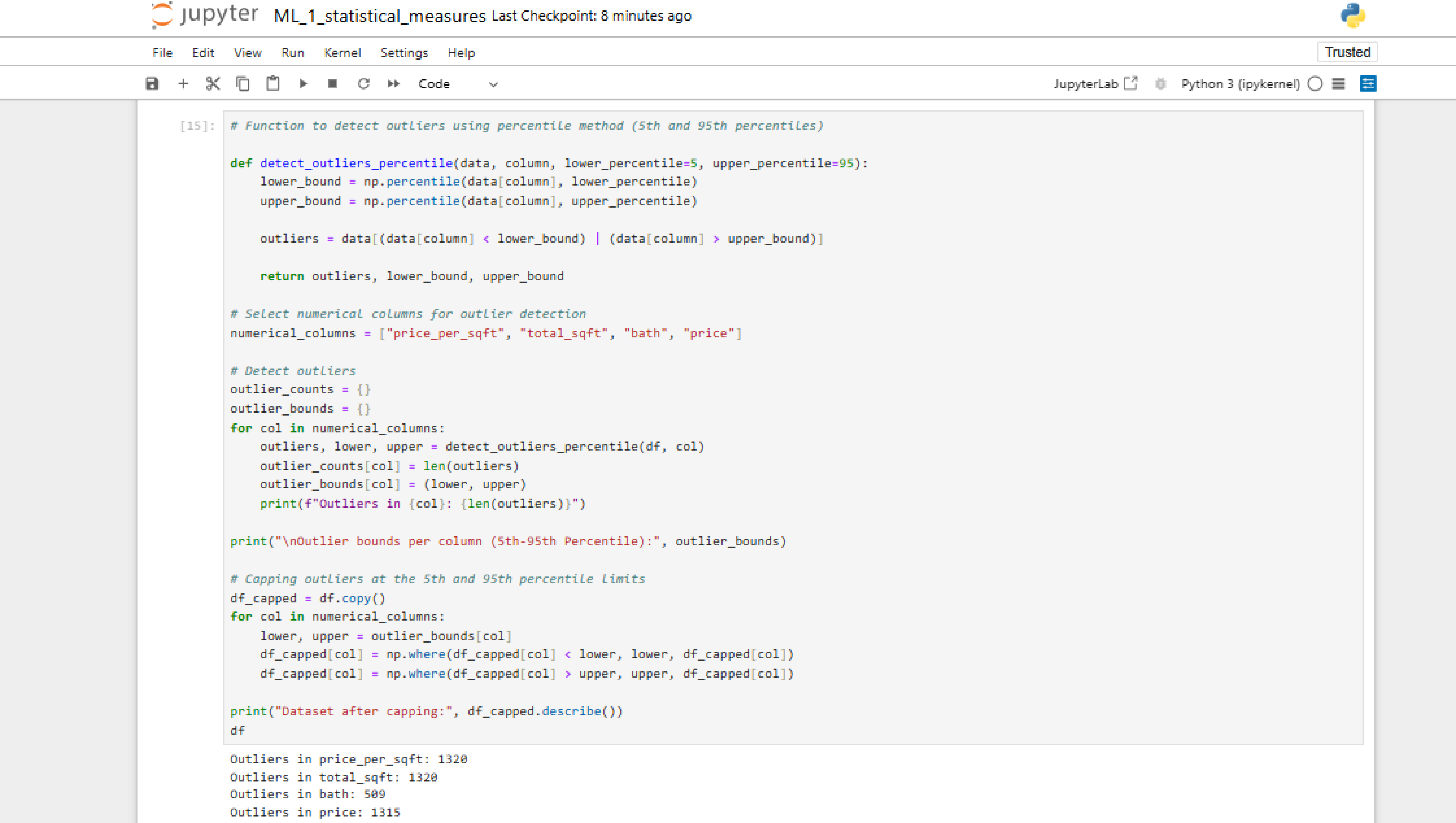


```python
# Print summary
print("\nOutlier counts per column:", outlier_bounds)
# Capping outliers at upper/lower bound
df_capped = df.copy()
for col in numerical_columns:
    lower, upper = outlier_bounds[col]
    df_capped[col] = np.where(df_capped[col] < lower, lower, df_capped[col])
    df_capped[col] = np.where(df_capped[col] > upper, upper, df_capped[col])

print("Dataset after capping:", df_capped.describe())
df
```

```
Outliers in price_per_sqft: 5
Outliers in total_sqft: 117
Outliers in bath: 240
Outliers in price: 192

Outlier counts per column: {'price_per_sqft': (-312261.1442419011, 328101.8177267496), 'total_sqft': (-2156.6675532499917, 5267.273119159083), 'bath':
(-1.3256088968175663, 6.707881624090293), 'price': (-335.2518078827746, 559.8041631858049)}
Dataset after capping:          total_sqft          bath         price          bhk  price_per_sqft
count  13200.000000  13200.000000  13200.000000  13200.000000    13200.000000
mean    1519.570292      2.659537    106.184844      2.800833     6835.446522
std      795.808733      1.151904     99.376162      1.292843     7930.115195
min        1.000000      1.000000      8.000000      1.000000      267.000000
25%     1100.000000      2.000000     50.000000      2.000000     4267.000000
50%     1275.000000      2.000000     71.850000      3.000000     5438.000000
75%     1672.000000      3.000000    120.000000      3.000000     7317.000000
max     5267.273119      6.707882    559.804163     43.000000   328101.817727
```

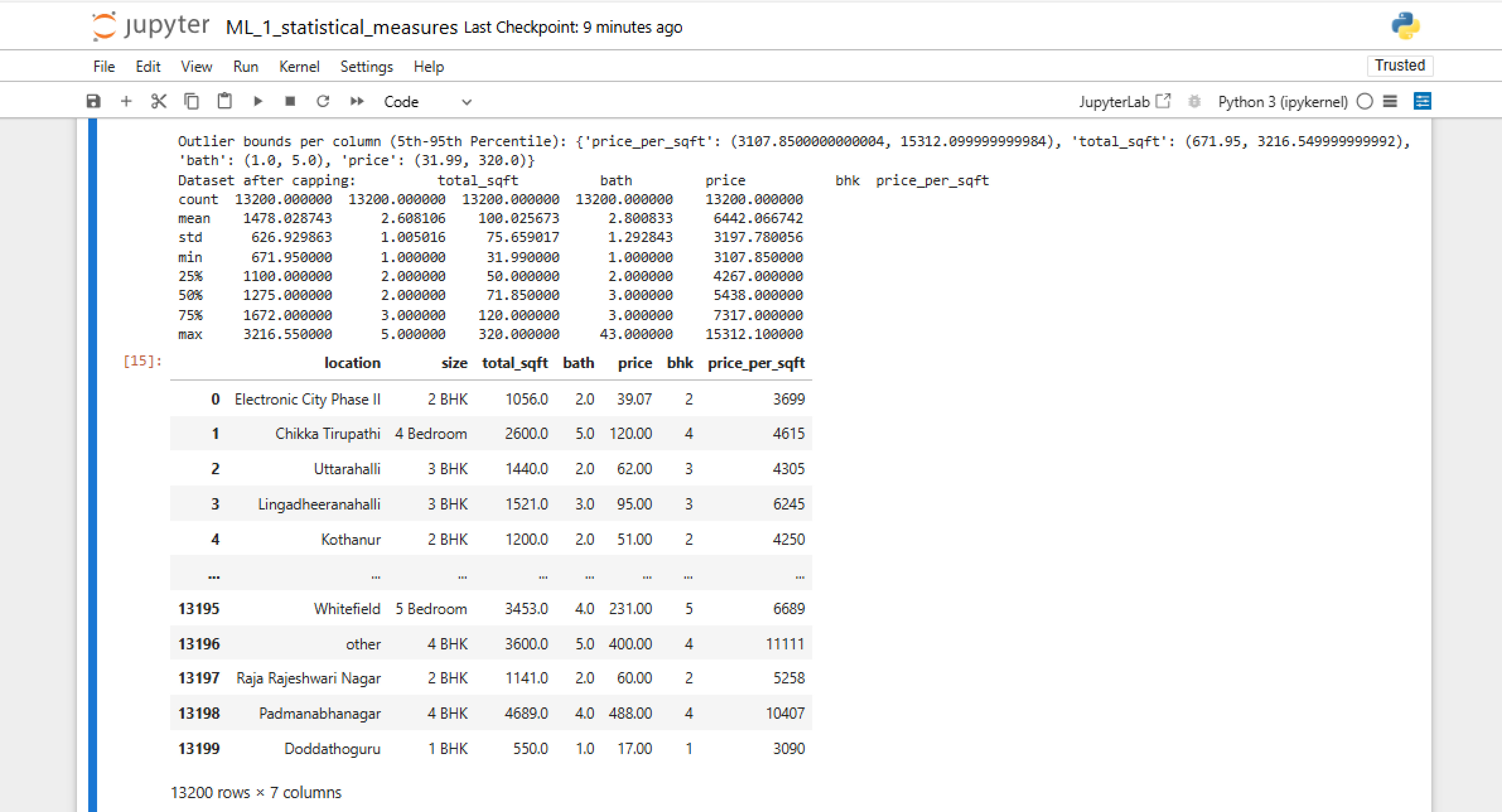
[6]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2	3699
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4	4615
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3	4305
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3	6245
4	Kothanur	2 BHK	1200.0	2.0	51.00	2	4250



```python
# Function to detect outliers using percentile method (5th and 95th percentiles)

def detect_outliers_percentile(data, column, lower_percentile=5, upper_percentile=95):
    lower_bound = np.percentile(data[column], lower_percentile)
    upper_bound = np.percentile(data[column], upper_percentile)

    outliers = data[(data[column] < lower_bound) | (data[column] > upper_bound)]

    return outliers, lower_bound, upper_bound

# Select numerical columns for outlier detection
numerical_columns = ["price_per_sqft", "total_sqft", "bath", "price"]

# Detect outliers
outlier_counts = {}
outlier_bounds = {}
for col in numerical_columns:
    outliers, lower, upper = detect_outliers_percentile(df, col)
    outlier_counts[col] = len(outliers)
    outlier_bounds[col] = (lower, upper)
    print(f"Outliers in {col}: {len(outliers)}")

print("\nOutlier bounds per column (5th-95th Percentile):", outlier_bounds)

# Capping outliers at the 5th and 95th percentile limits
df_capped = df.copy()
for col in numerical_columns:
    lower, upper = outlier_bounds[col]
    df_capped[col] = np.where(df_capped[col] < lower, lower, df_capped[col])
    df_capped[col] = np.where(df_capped[col] > upper, upper, df_capped[col])

print("Dataset after capping:", df_capped.describe())
df
```

```
Outliers in price_per_sqft: 1320
Outliers in total_sqft: 1320
Outliers in bath: 509
Outliers in price: 1315
```

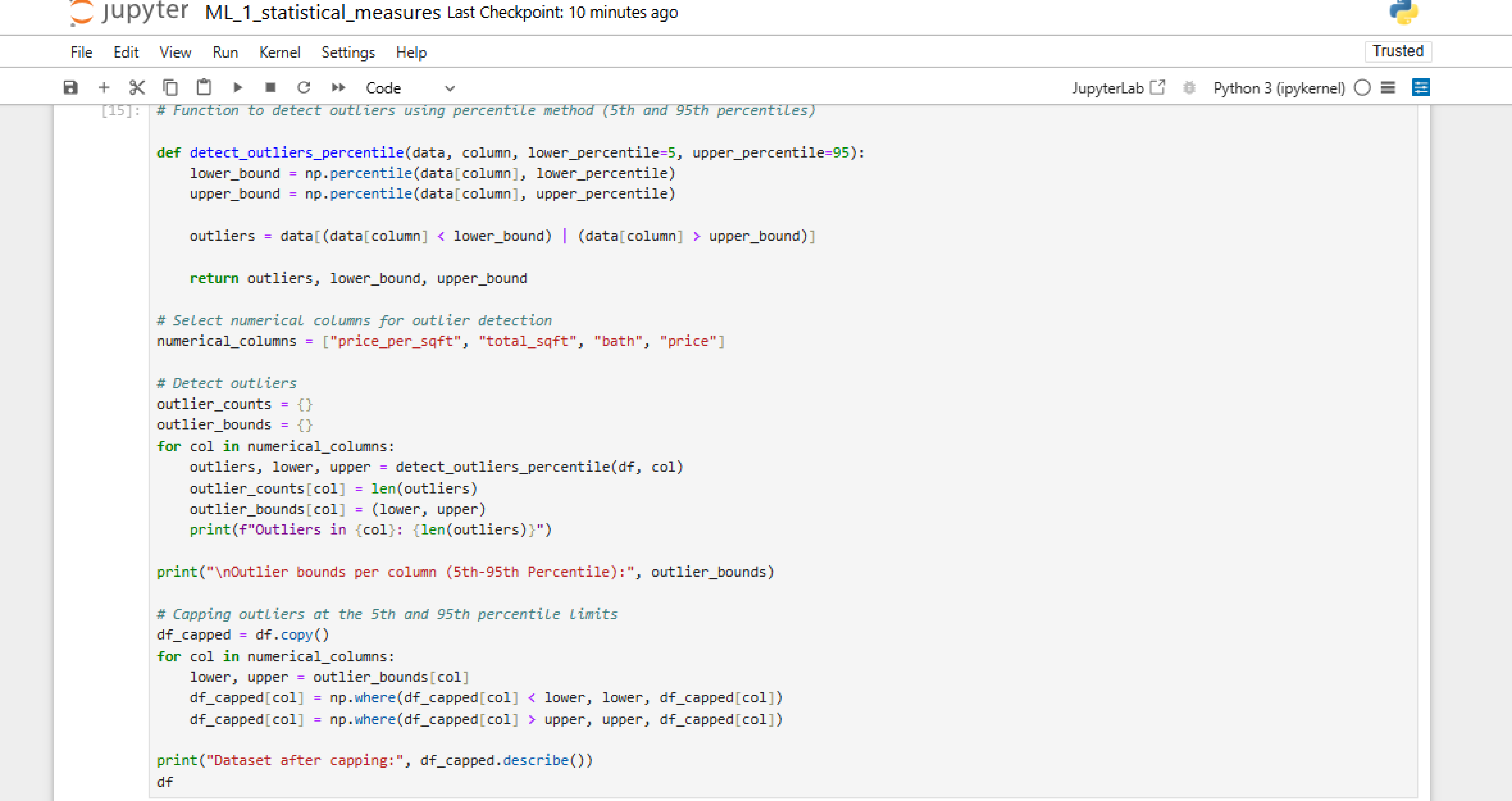


```
Outlier bounds per column (5th-95th Percentile): {'price_per_sqft': (3107.8500000000004, 15312.099999999984), 'total_sqft': (671.95, 3216.549999999992),
'bath': (1.0, 5.0), 'price': (31.99, 320.0)}
Dataset after capping:          total_sqft          bath         price          bhk  price_per_sqft
count  13200.000000  13200.000000  13200.000000  13200.000000    13200.000000
mean    1478.028743      2.608106    100.025673      2.800833     6442.066742
std      626.929863      1.005016     75.659017      1.292843     3197.780056
min      671.950000      1.000000     31.990000      1.000000     3107.850000
25%     1100.000000      2.000000     50.000000      2.000000     4267.000000
50%     1275.000000      2.000000     71.850000      3.000000     5438.000000
75%     1672.000000      3.000000    120.000000      3.000000     7317.000000
max     3216.550000      5.000000    320.000000     43.000000    15312.100000
```

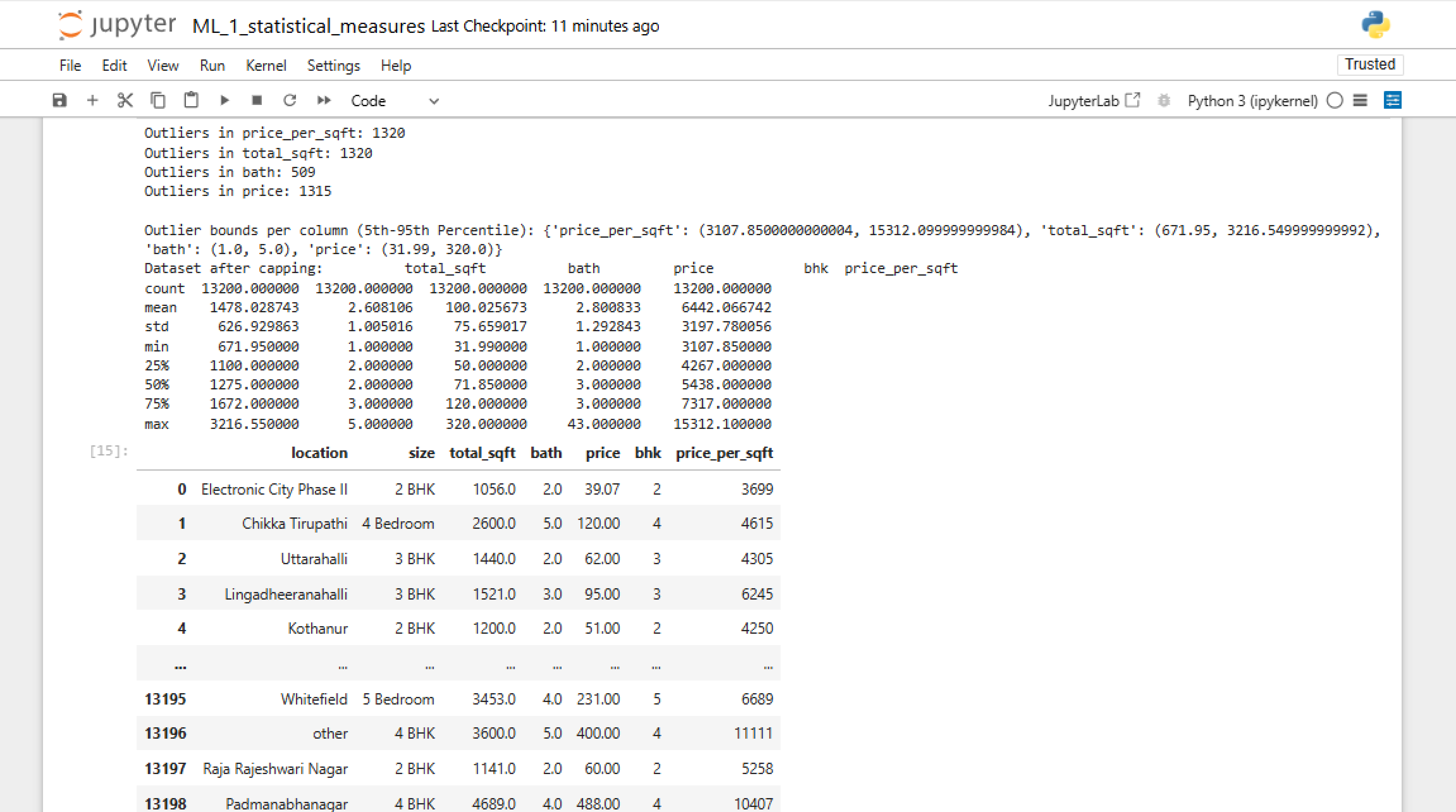
[15]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2	3699
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4	4615
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3	4305
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3	6245
4	Kothanur	2 BHK	1200.0	2.0	51.00	2	4250
...	...	...	...	...	...	...	...
13195	Whitefield	5 Bedroom	3453.0	4.0	231.00	5	6689
13196	other	4 BHK	3600.0	5.0	400.00	4	11111
13197	Raja Rajeshwari Nagar	2 BHK	1141.0	2.0	60.00	2	5258
13198	Padmanabhanagar	4 BHK	4689.0	4.0	488.00	4	10407
13199	Doddathoguru	1 BHK	550.0	1.0	17.00	1	3090

13200 rows × 7 columns



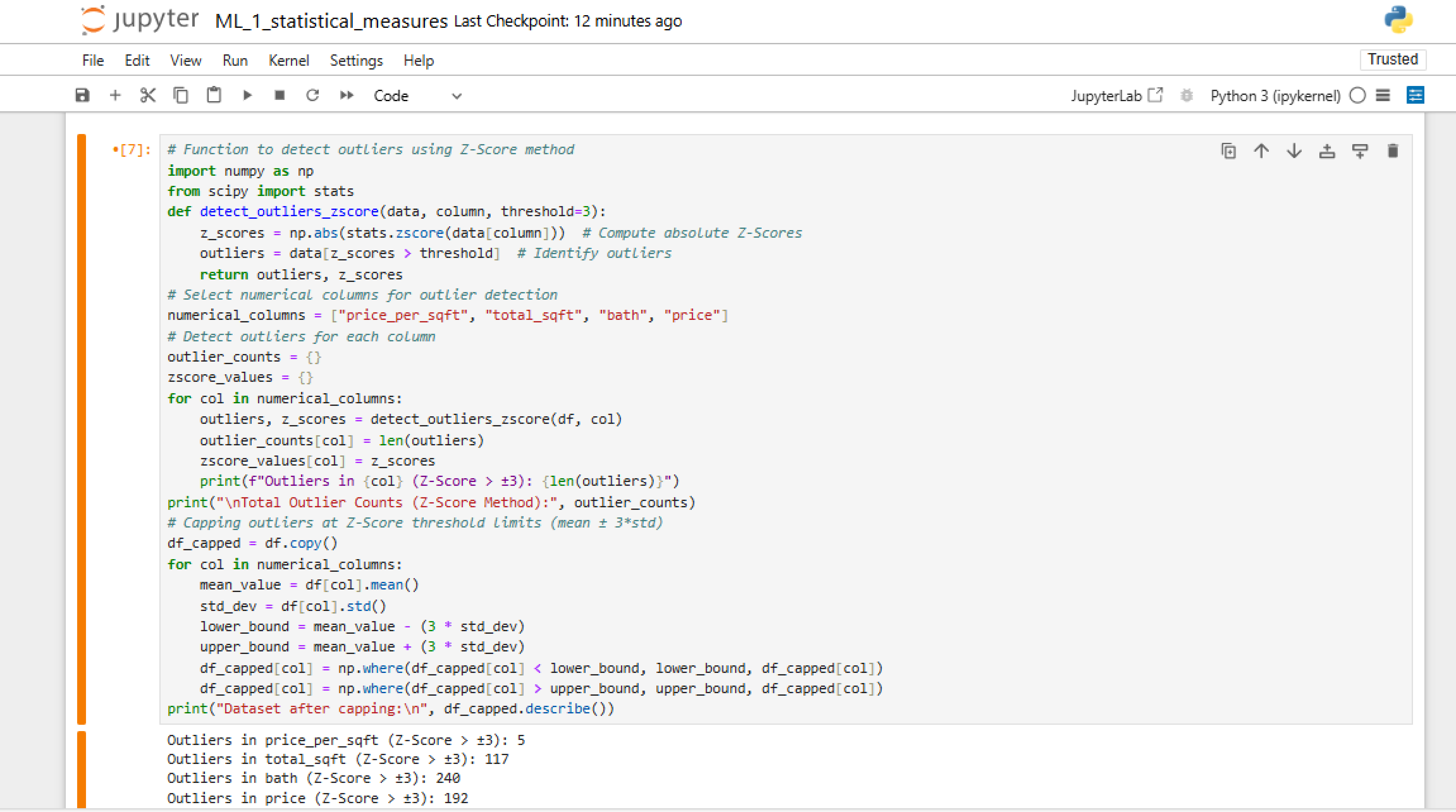
```
# Function to detect outliers using percentile method (5th and 95th percentiles)

def detect_outliers_percentile(data, column, lower_percentile=5, upper_percentile=95):
    lower_bound = np.percentile(data[column], lower_percentile)
    upper_bound = np.percentile(data[column], upper_percentile)

    outliers = data[(data[column] < lower_bound) | (data[column] > upper_bound)]

    return outliers, lower_bound, upper_bound

# Select numerical columns for outlier detection
numerical_columns = ["price_per_sqft", "total_sqft", "bath", "price"]

# Detect outliers
outlier_counts = {}
outlier_bounds = {}
for col in numerical_columns:
    outliers, lower, upper = detect_outliers_percentile(df, col)
    outlier_counts[col] = len(outliers)
    outlier_bounds[col] = (lower, upper)
    print(f"Outliers in {col}: {len(outliers)}")

print("\nOutlier bounds per column (5th-95th Percentile):", outlier_bounds)

# Capping outliers at the 5th and 95th percentile limits
df_capped = df.copy()
for col in numerical_columns:
    lower, upper = outlier_bounds[col]
    df_capped[col] = np.where(df_capped[col] < lower, lower, df_capped[col])
    df_capped[col] = np.where(df_capped[col] > upper, upper, df_capped[col])

print("Dataset after capping:", df_capped.describe())
df
```



```
Outliers in price_per_sqft: 1320
Outliers in total_sqft: 1320
Outliers in bath: 509
Outliers in price: 1315

Outlier bounds per column (5th-95th Percentile): {'price_per_sqft': (3107.8500000000004, 15312.099999999984), 'total_sqft': (671.95, 3216.549999999992),
'bath': (1.0, 5.0), 'price': (31.99, 320.0)}
Dataset after capping:          total_sqft          bath         price          bhk  price_per_sqft
count  13200.000000  13200.000000  13200.000000  13200.000000   13200.000000
mean    1478.028743      2.608106    100.025673      2.800833    6442.066742
std      626.929863      1.005016     75.659017      1.292843    3197.780056
min      671.950000      1.000000     31.990000      1.000000    3107.850000
25%     1100.000000      2.000000     50.000000      2.000000    4267.000000
50%     1275.000000      2.000000     71.850000      3.000000    5438.000000
75%     1672.000000      3.000000    120.000000      3.000000    7317.000000
max     3216.550000      5.000000    320.000000     43.000000   15312.100000
```

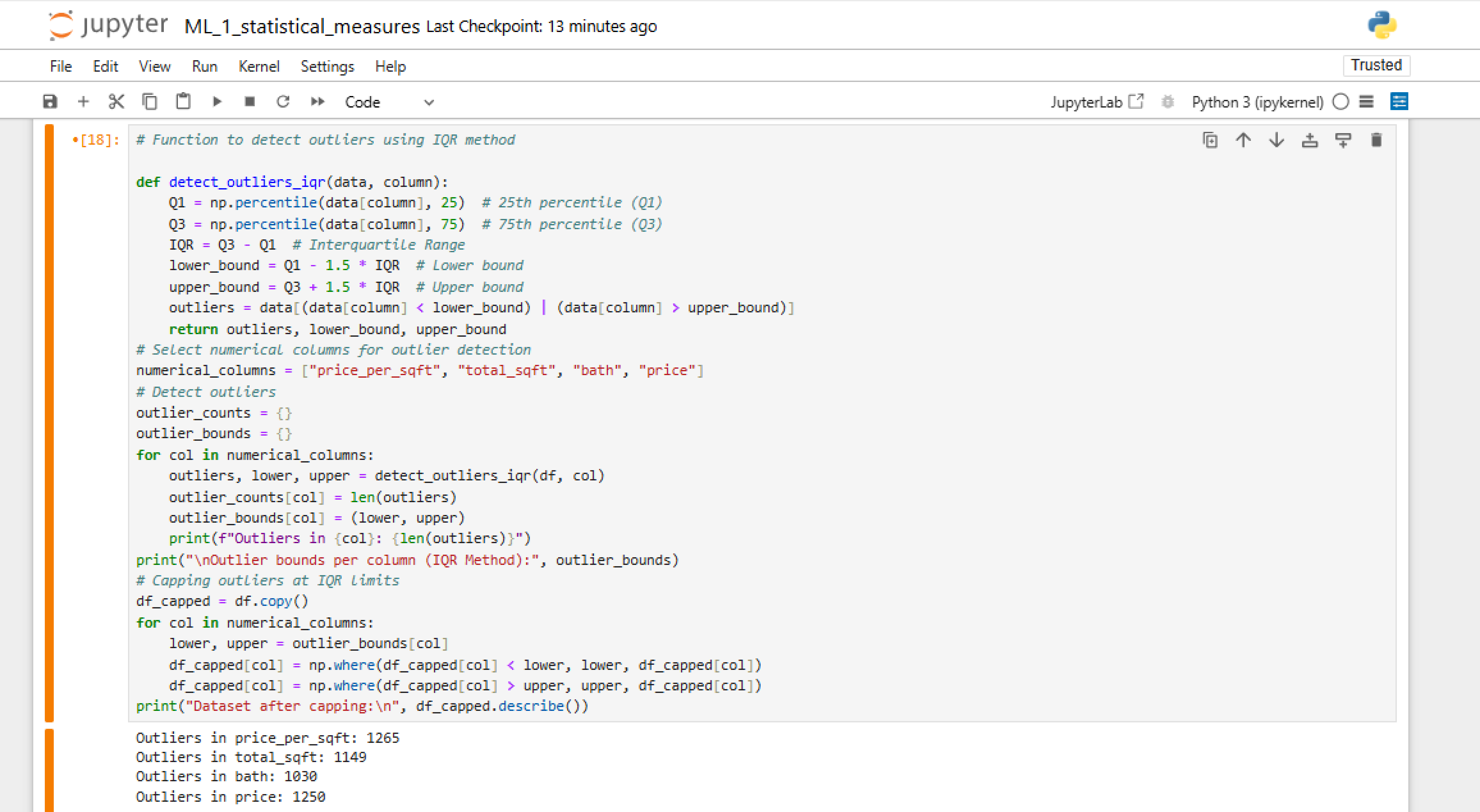
[15]:

	location	size	total_sqft	bath	price	bhk	price_per_sqft
0	Electronic City Phase II	2 BHK	1056.0	2.0	39.07	2	3699
1	Chikka Tirupathi	4 Bedroom	2600.0	5.0	120.00	4	4615
2	Uttarahalli	3 BHK	1440.0	2.0	62.00	3	4305
3	Lingadheeranahalli	3 BHK	1521.0	3.0	95.00	3	6245
4	Kothanur	2 BHK	1200.0	2.0	51.00	2	4250
...	...	...	...	...	...	...	...
13195	Whitefield	5 Bedroom	3453.0	4.0	231.00	5	6689
13196	other	4 BHK	3600.0	5.0	400.00	4	11111
13197	Raja Rajeshwari Nagar	2 BHK	1141.0	2.0	60.00	2	5258
13198	Padmanabhanagar	4 BHK	4689.0	4.0	488.00	4	10407



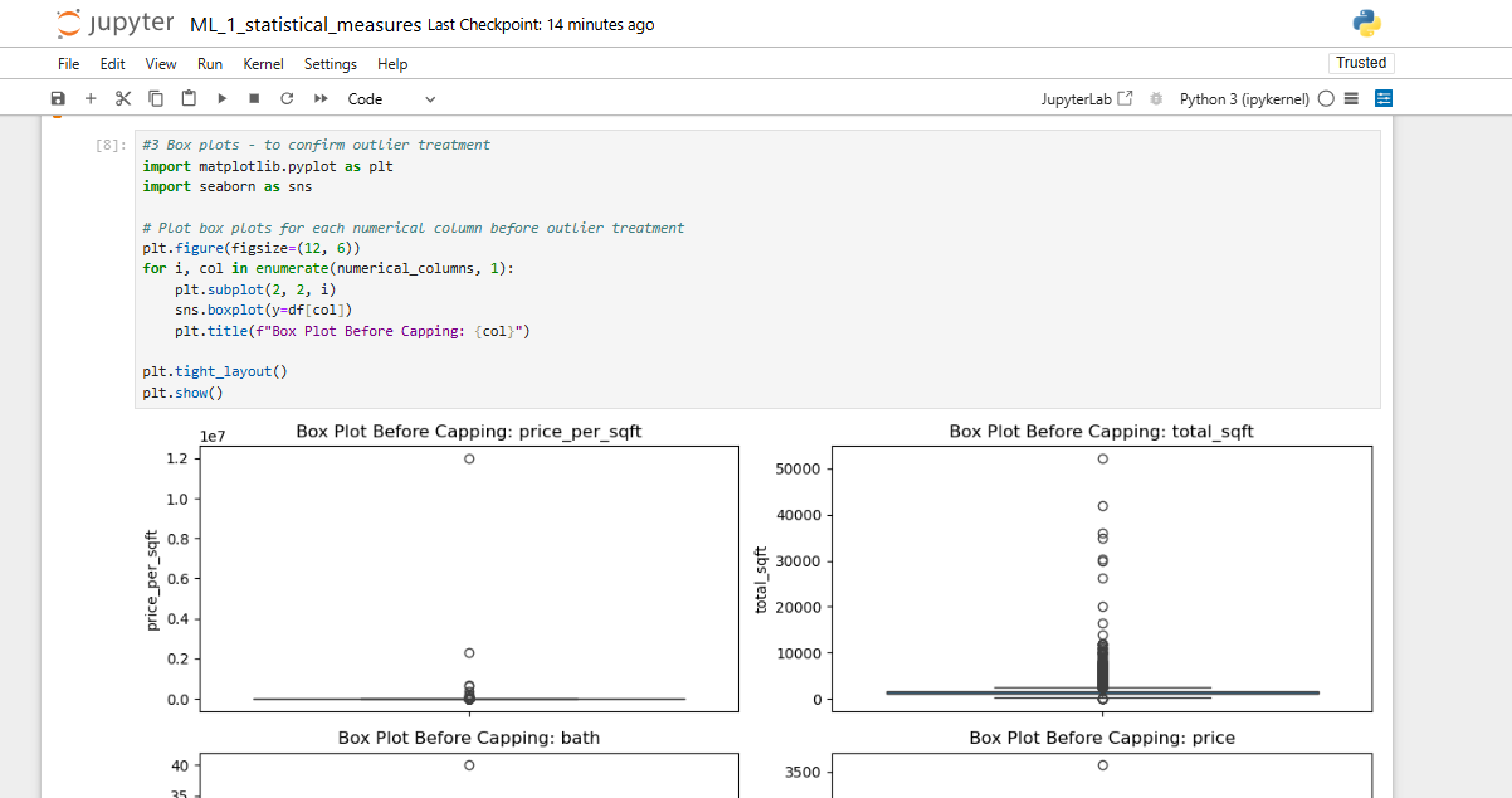
```
# Function to detect outliers using Z-Score method
import numpy as np
from scipy import stats
def detect_outliers_zscore(data, column, threshold=3):
    z_scores = np.abs(stats.zscore(data[column]))  # Compute absolute Z-Scores
    outliers = data[z_scores > threshold]  # Identify outliers
    return outliers, z_scores
# Select numerical columns for outlier detection
numerical_columns = ["price_per_sqft", "total_sqft", "bath", "price"]
# Detect outliers for each column
outlier_counts = {}
zscore_values = {}
for col in numerical_columns:
    outliers, z_scores = detect_outliers_zscore(df, col)
    outlier_counts[col] = len(outliers)
    zscore_values[col] = z_scores
    print(f"Outliers in {col} (Z-Score > ±3): {len(outliers)}")
print("\nTotal Outlier Counts (Z-Score Method):", outlier_counts)
# Capping outliers at Z-Score threshold limits (mean ± 3*std)
df_capped = df.copy()
for col in numerical_columns:
    mean_value = df[col].mean()
    std_dev = df[col].std()
    lower_bound = mean_value - (3 * std_dev)
    upper_bound = mean_value + (3 * std_dev)
    df_capped[col] = np.where(df_capped[col] < lower_bound, lower_bound, df_capped[col])
    df_capped[col] = np.where(df_capped[col] > upper_bound, upper_bound, df_capped[col])
print("Dataset after capping:\n", df_capped.describe())
```

```
Outliers in price_per_sqft (Z-Score > ±3): 5
Outliers in total_sqft (Z-Score > ±3): 117
Outliers in bath (Z-Score > ±3): 240
Outliers in price (Z-Score > ±3): 192
```


jupyter ML_1_statistical_measures Last Checkpoint: 13 minutes ago
File Edit View Run Kernel Settings Help
Trusted
Code
JupyterLab
Python 3 (ipykernel)
•[18]:

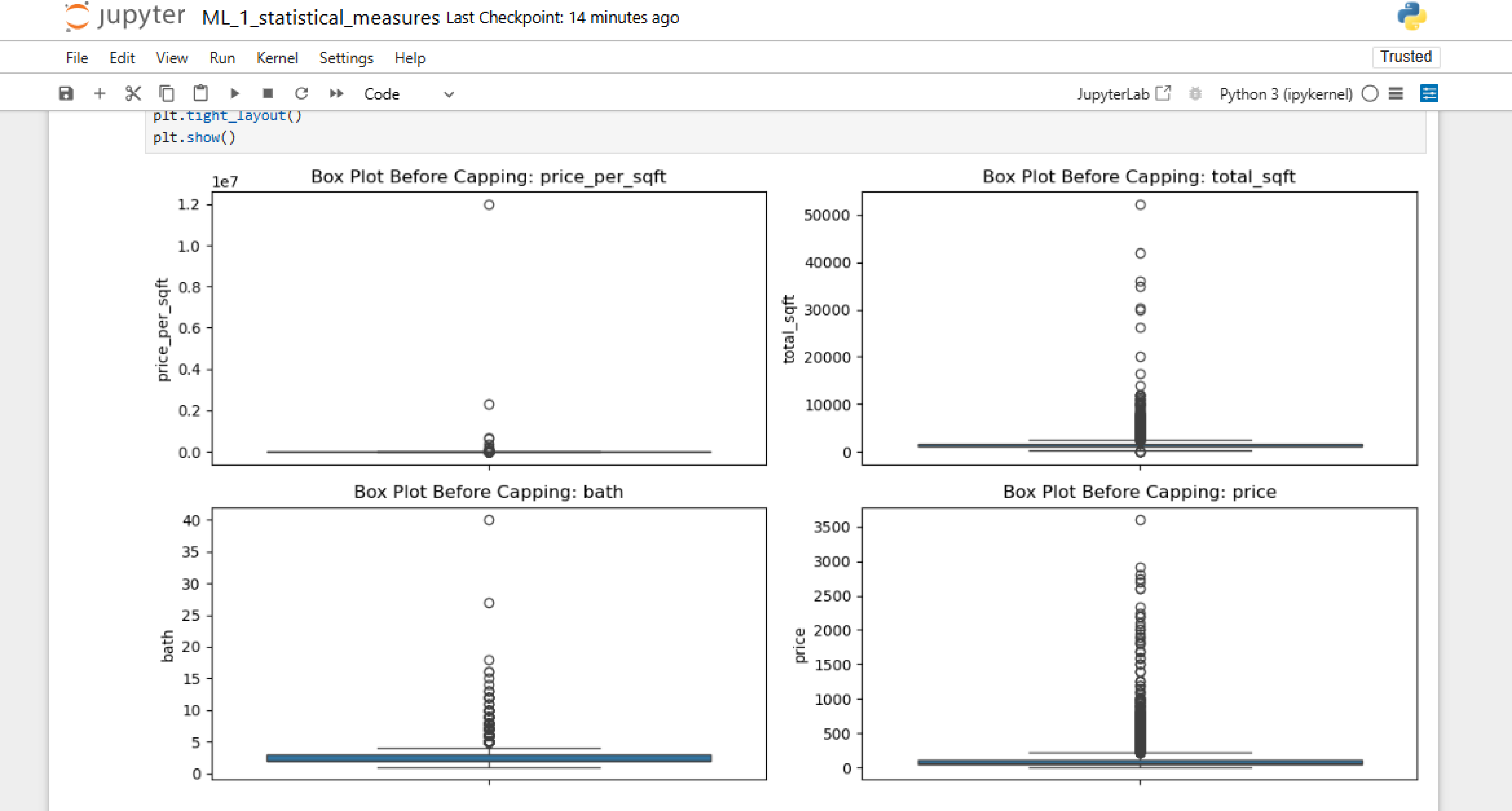
```
# Function to detect outliers using IQR method

def detect_outliers_iqr(data, column):
    Q1 = np.percentile(data[column], 25)  # 25th percentile (Q1)
    Q3 = np.percentile(data[column], 75)  # 75th percentile (Q3)
    IQR = Q3 - Q1  # Interquartile Range
    lower_bound = Q1 - 1.5 * IQR  # Lower bound
    upper_bound = Q3 + 1.5 * IQR  # Upper bound
    outliers = data[(data[column] < lower_bound) | (data[column] > upper_bound)]
    return outliers, lower_bound, upper_bound
# Select numerical columns for outlier detection
numerical_columns = ["price_per_sqft", "total_sqft", "bath", "price"]
# Detect outliers
outlier_counts = {}
outlier_bounds = {}
for col in numerical_columns:
    outliers, lower, upper = detect_outliers_iqr(df, col)
    outlier_counts[col] = len(outliers)
    outlier_bounds[col] = (lower, upper)
    print(f"Outliers in {col}: {len(outliers)}")
print("\nOutlier bounds per column (IQR Method):", outlier_bounds)
# Capping outliers at IQR limits
df_capped = df.copy()
for col in numerical_columns:
    lower, upper = outlier_bounds[col]
    df_capped[col] = np.where(df_capped[col] < lower, lower, df_capped[col])
    df_capped[col] = np.where(df_capped[col] > upper, upper, df_capped[col])
print("Dataset after capping:\n", df_capped.describe())
```

```
Outliers in price_per_sqft: 1265
Outliers in total_sqft: 1149
Outliers in bath: 1030
Outliers in price: 1250
```


jupyter ML_1_statistical_measures Last Checkpoint: 14 minutes ago
File Edit View Run Kernel Settings Help
Trusted
Code
JupyterLab
Python 3 (ipykernel)
[8]:

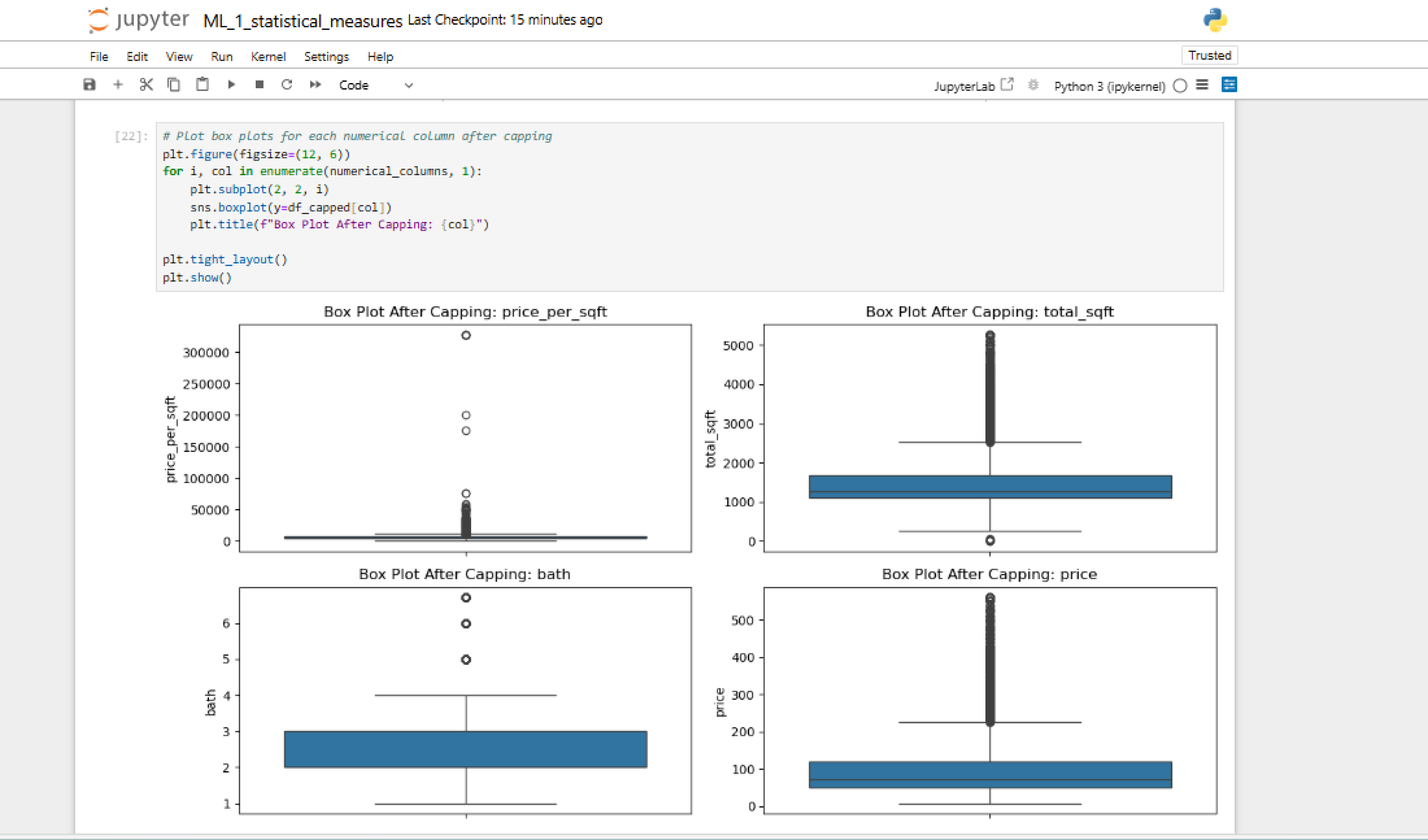
```python
#3 Box plots - to confirm outlier treatment
import matplotlib.pyplot as plt
import seaborn as sns

# Plot box plots for each numerical column before outlier treatment
plt.figure(figsize=(12, 6))
for i, col in enumerate(numerical_columns, 1):
    plt.subplot(2, 2, i)
    sns.boxplot(y=df[col])
    plt.title(f"Box Plot Before Capping: {col}")

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

Box Plot Before Capping: price_per_sqft
1e7
1.2
1.0
0.8
0.6
0.4
0.2
0.0
price_per_sqft
Box Plot Before Capping: total_sqft
50000
40000
30000
20000
10000
0
total_sqft
Box Plot Before Capping: bath
40
35
Box Plot Before Capping: price
3500

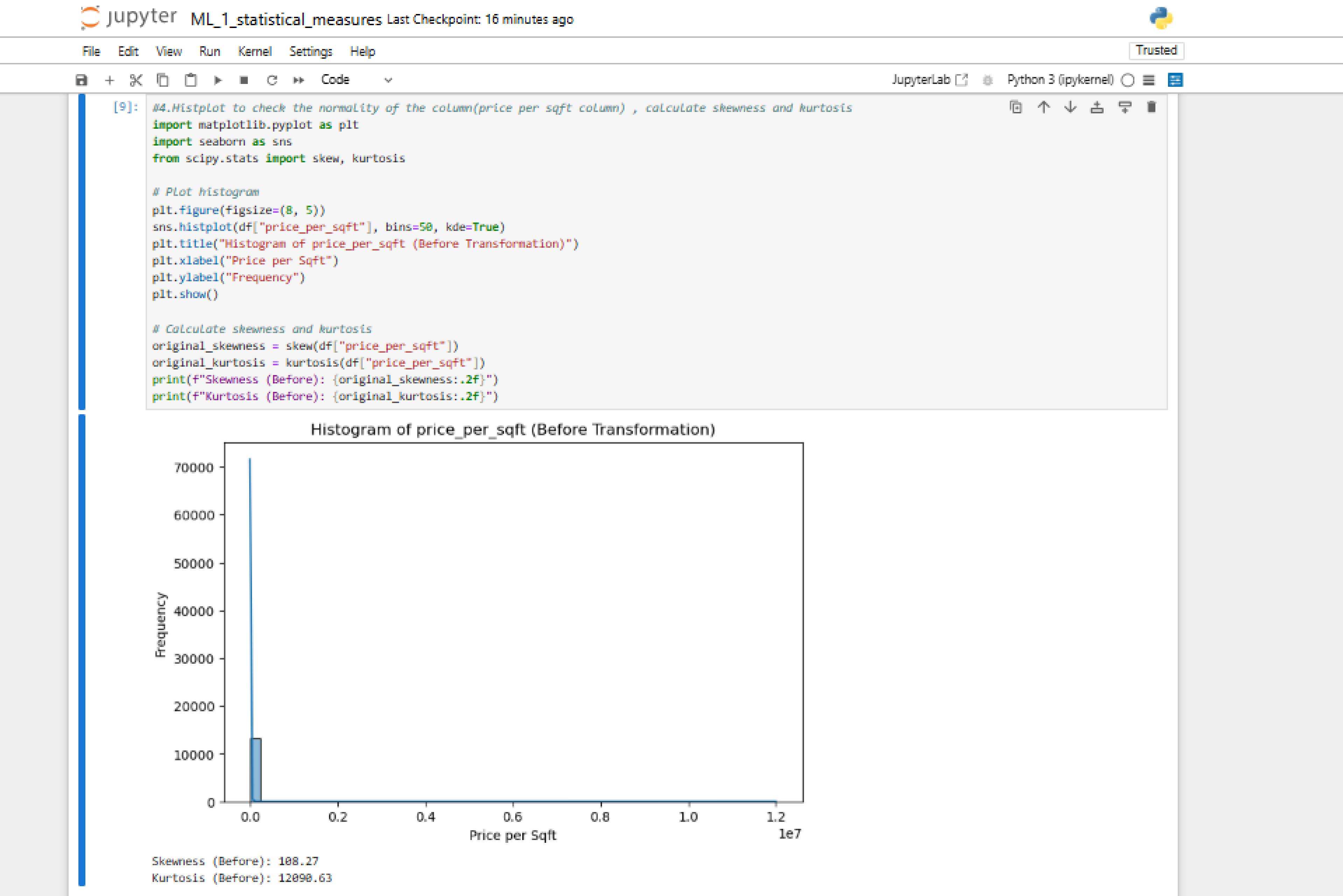


```
plt.tight_layout()
plt.show()
```

Box Plot Before Capping: price_per_sqft
1e7
1.2
1.0
0.8
0.6
0.4
0.2
0.0
price_per_sqft
Box Plot Before Capping: total_sqft
50000
40000
30000
20000
10000
0
total_sqft
Box Plot Before Capping: bath
40
35
30
25
20
15
10
5
0
bath
Box Plot Before Capping: price
3500
3000
2500
2000
1500
1000
500
0
price

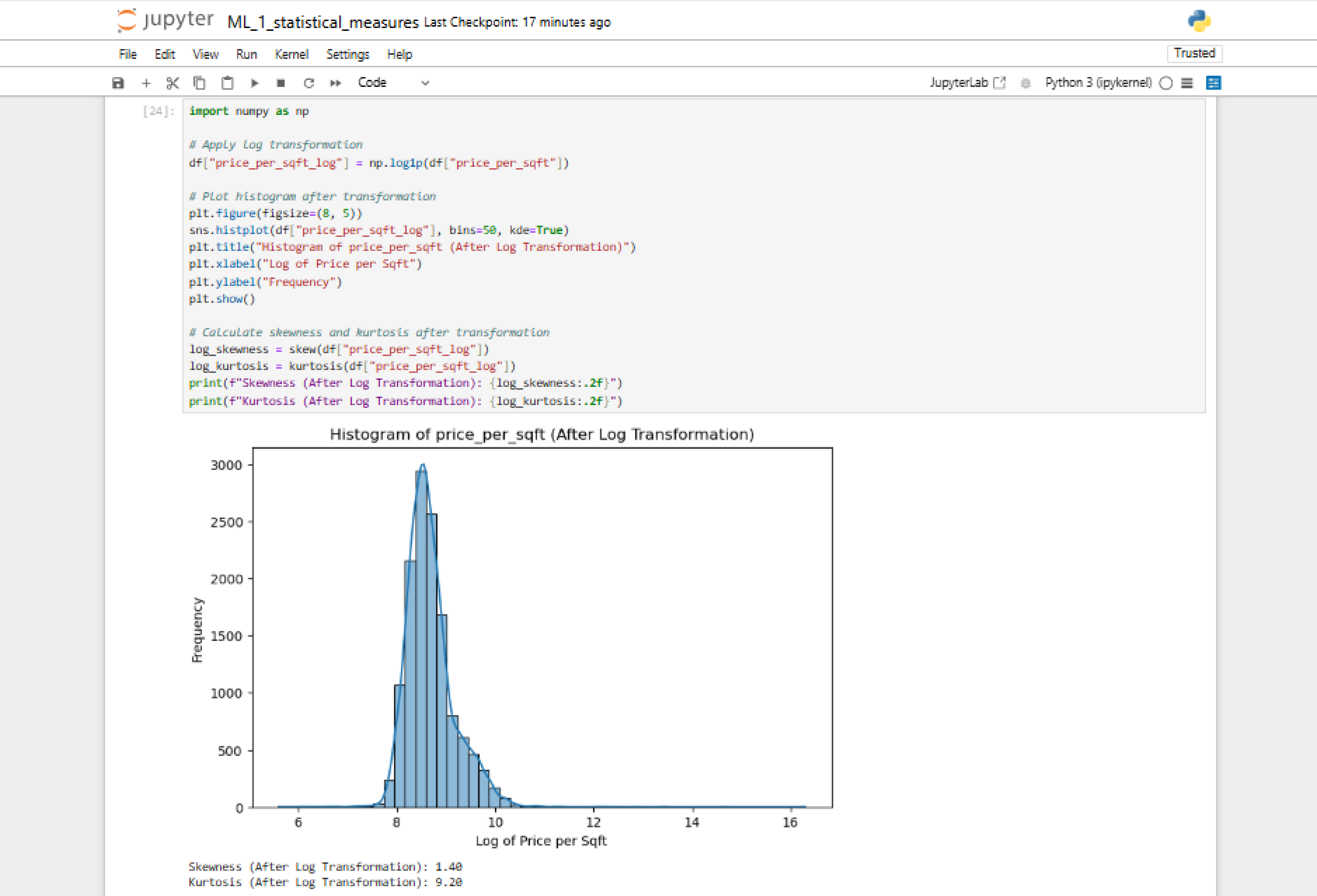


```python
# Plot box plots for each numerical column after capping
plt.figure(figsize=(12, 6))
for i, col in enumerate(numerical_columns, 1):
    plt.subplot(2, 2, i)
    sns.boxplot(y=df_capped[col])
    plt.title(f"Box Plot After Capping: {col}")

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



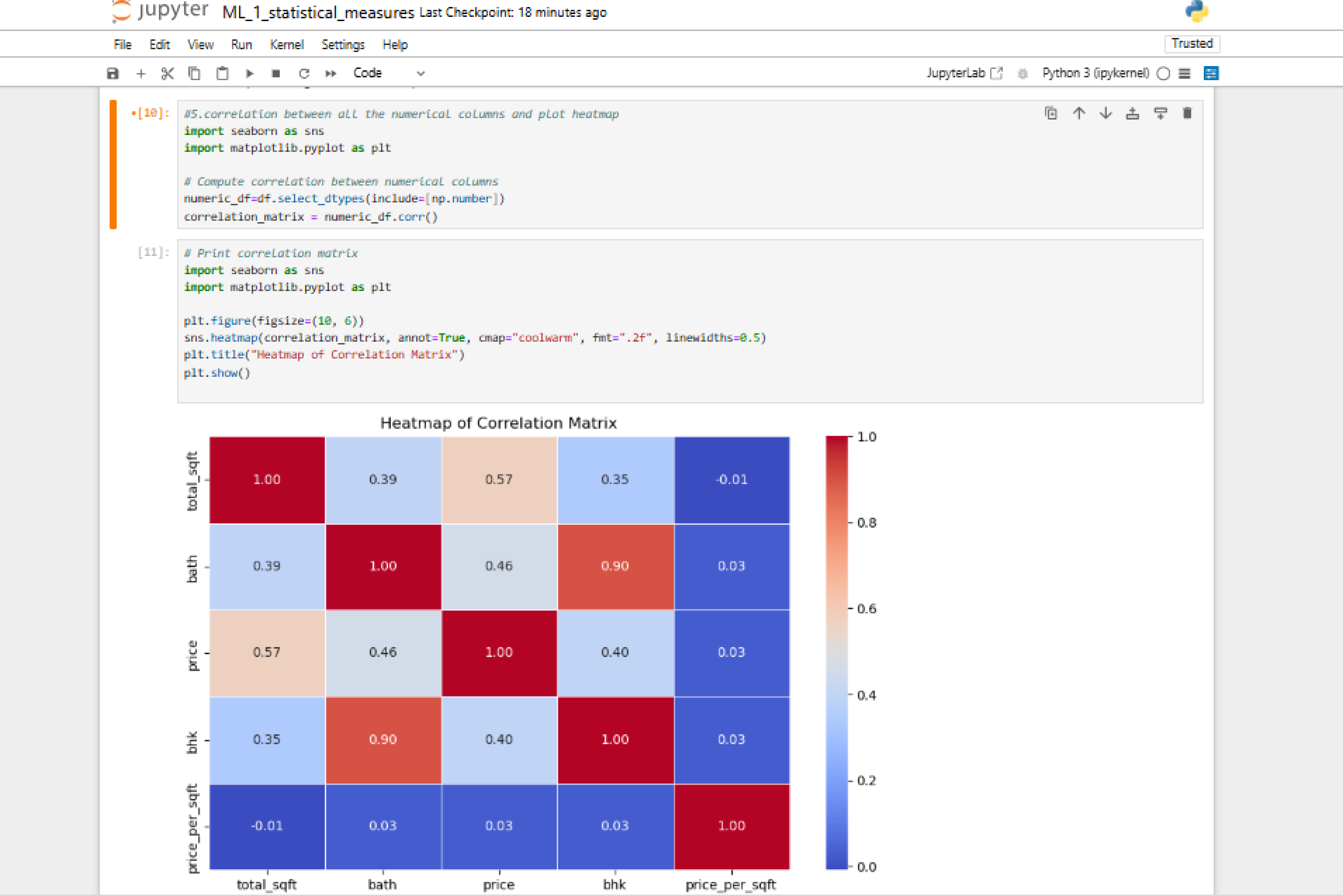
```
#4.Histplot to check the normality of the column(price per sqft column) , calculate skewness and kurtosis
import matplotlib.pyplot as plt
import seaborn as sns
from scipy.stats import skew, kurtosis

# Plot histogram
plt.figure(figsize=(8, 5))
sns.histplot(df["price_per_sqft"], bins=50, kde=True)
plt.title("Histogram of price_per_sqft (Before Transformation)")
plt.xlabel("Price per Sqft")
plt.ylabel("Frequency")
plt.show()

# Calculate skewness and kurtosis
original_skewness = skew(df["price_per_sqft"])
original_kurtosis = kurtosis(df["price_per_sqft"])
print(f"Skewness (Before): {original_skewness:.2f}")
print(f"Kurtosis (Before): {original_kurtosis:.2f}")
```

```
Skewness (Before): 108.27
Kurtosis (Before): 12090.63
```



```python
import numpy as np

# Apply log transformation
df["price_per_sqft_log"] = np.log1p(df["price_per_sqft"])

# Plot histogram after transformation
plt.figure(figsize=(8, 5))
sns.histplot(df["price_per_sqft_log"], bins=50, kde=True)
plt.title("Histogram of price_per_sqft (After Log Transformation)")
plt.xlabel("Log of Price per Sqft")
plt.ylabel("Frequency")
plt.show()

# Calculate skewness and kurtosis after transformation
log_skewness = skew(df["price_per_sqft_log"])
log_kurtosis = kurtosis(df["price_per_sqft_log"])
print(f"Skewness (After Log Transformation): {log_skewness:.2f}")
print(f"Kurtosis (After Log Transformation): {log_kurtosis:.2f}")
```

```
Skewness (After Log Transformation): 1.40
Kurtosis (After Log Transformation): 9.20
```



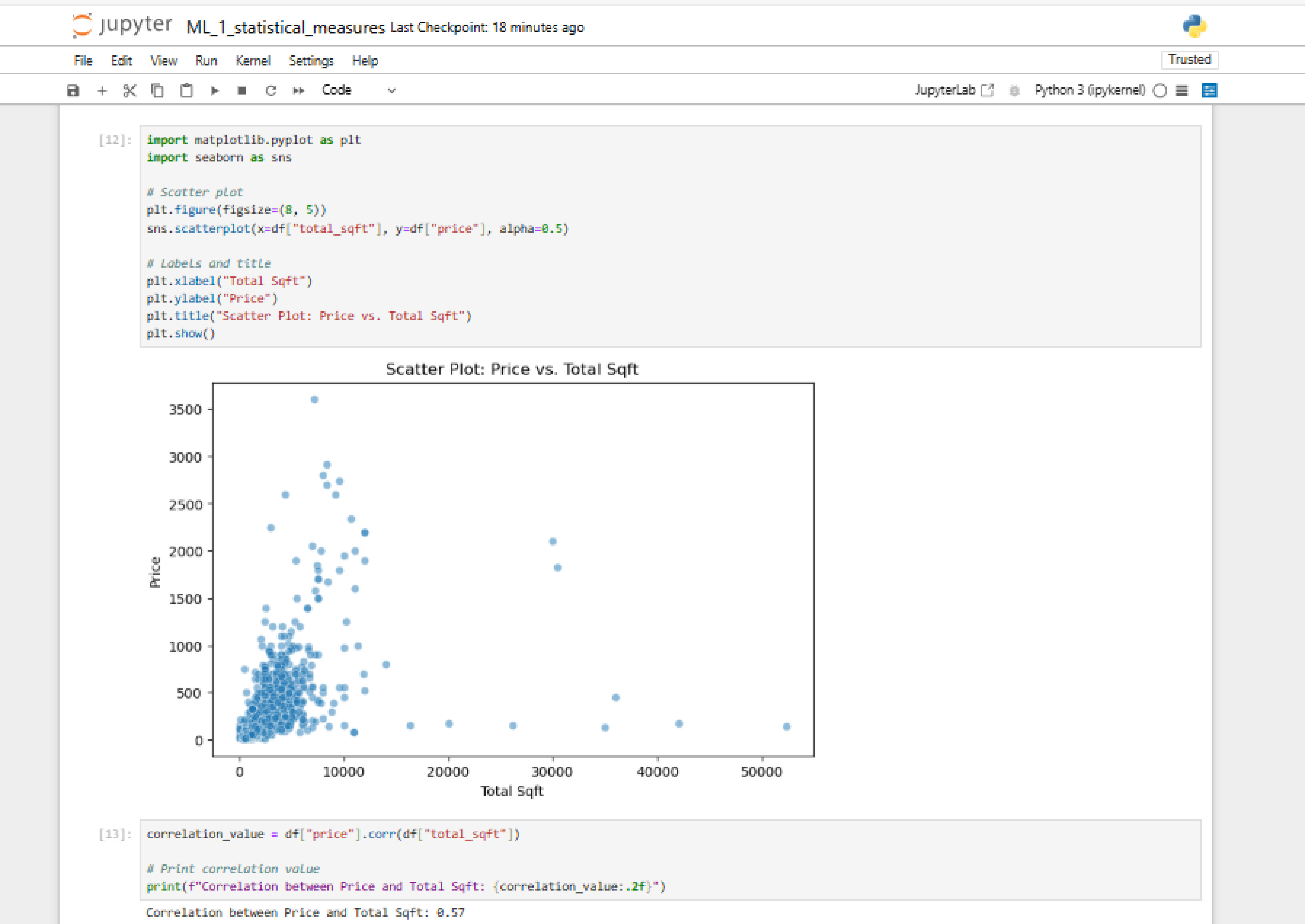
ML_1_statistical_measures Last Checkpoint: 18 minutes ago

•[10]:
```
#5.correlation between all the numerical columns and plot heatmap
import seaborn as sns
import matplotlib.pyplot as plt

# Compute correlation between numerical columns
numeric_df=df.select_dtypes(include=[np.number])
correlation_matrix = numeric_df.corr()
```

[11]:
```
# Print correlation matrix
import seaborn as sns
import matplotlib.pyplot as plt

plt.figure(figsize=(10, 6))
sns.heatmap(correlation_matrix, annot=True, cmap="coolwarm", fmt=".2f", linewidths=0.5)
plt.title("Heatmap of Correlation Matrix")
plt.show()
```

Heatmap of Correlation Matrix

	total_sqft	bath	price	bhk	price_per_sqft
total_sqft	1.00	0.39	0.57	0.35	-0.01
bath	0.39	1.00	0.46	0.90	0.03
price	0.57	0.46	1.00	0.40	0.03
bhk	0.35	0.90	0.40	1.00	0.03
price_per_sqft	-0.01	0.03	0.03	0.03	1.00



```
import matplotlib.pyplot as plt
import seaborn as sns

# Scatter plot
plt.figure(figsize=(8, 5))
sns.scatterplot(x=df["total_sqft"], y=df["price"], alpha=0.5)

# Labels and title
plt.xlabel("Total Sqft")
plt.ylabel("Price")
plt.title("Scatter Plot: Price vs. Total Sqft")
plt.show()
```

```
correlation_value = df["price"].corr(df["total_sqft"])

# Print correlation value
print(f"Correlation between Price and Total Sqft: {correlation_value:.2f}")
```

```
Correlation between Price and Total Sqft: 0.57
```