

## Appendix A: General Analyzation (before hypothesis testing)

Figure 1: Bar chart; Type of houses frequency in the dataset

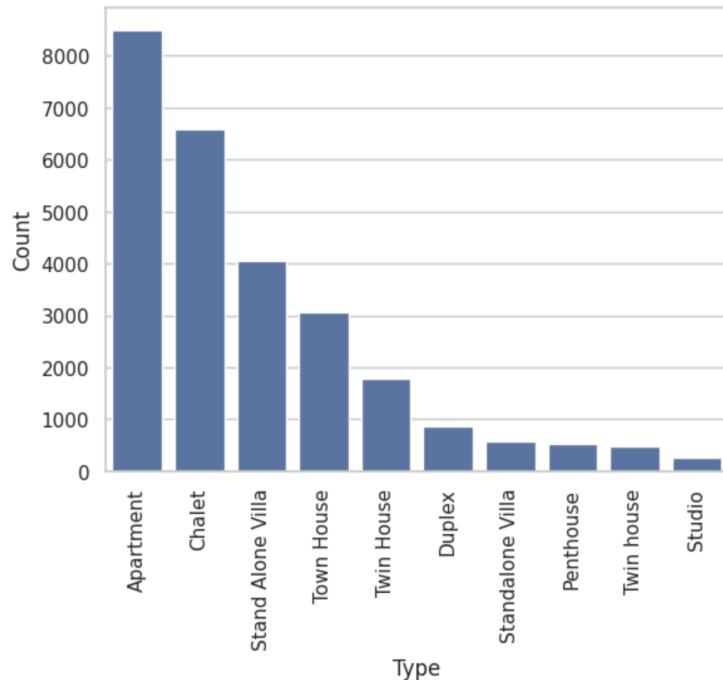


Figure 2: Graph; Level density of all houses in the dataset

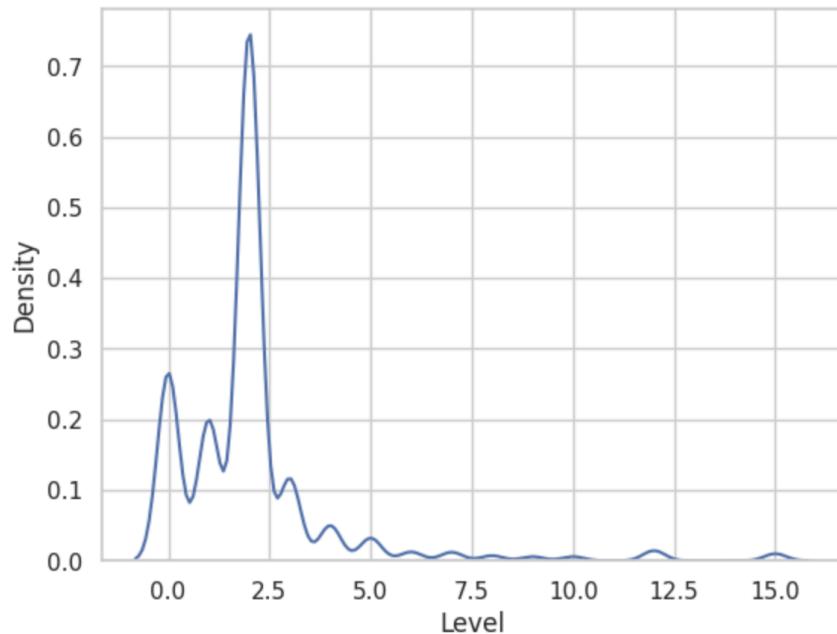


Figure 3: Heatmap; correlation between features (beds,baths, area) and price

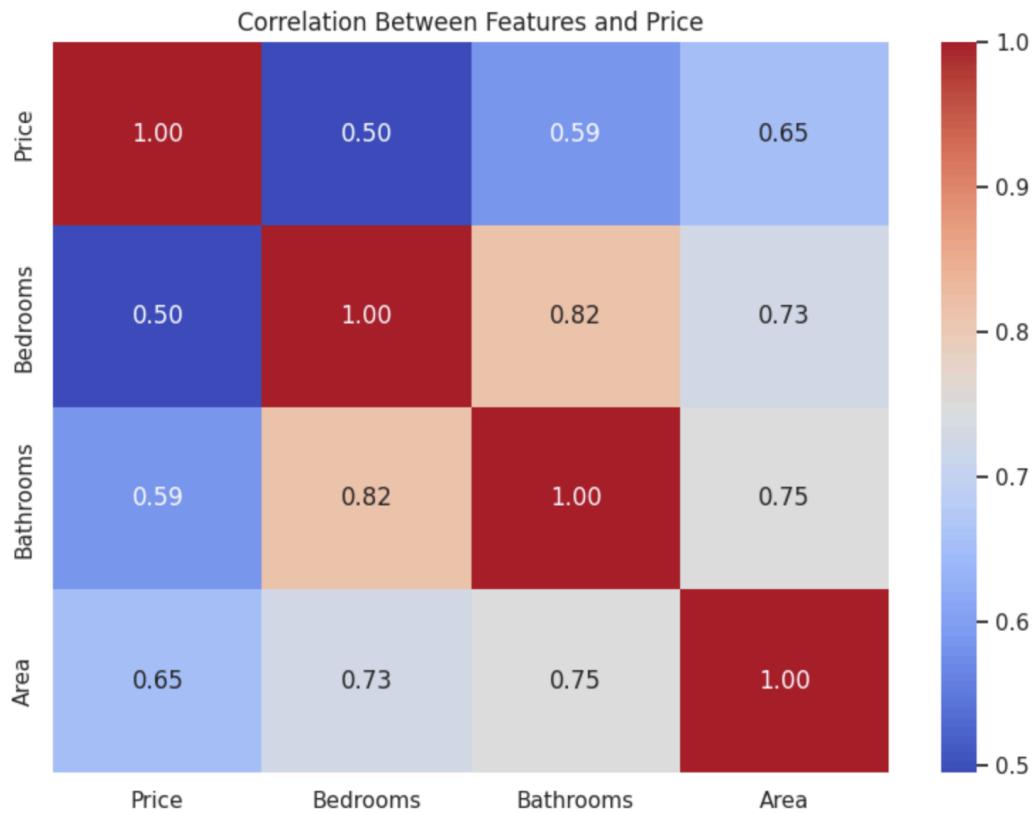


Figure 4: Bar chart; Average property price in the top 5 cities (El Tagamoa, Sheikh Zayed, 6th of October, North Coast, Ain Sukhna)

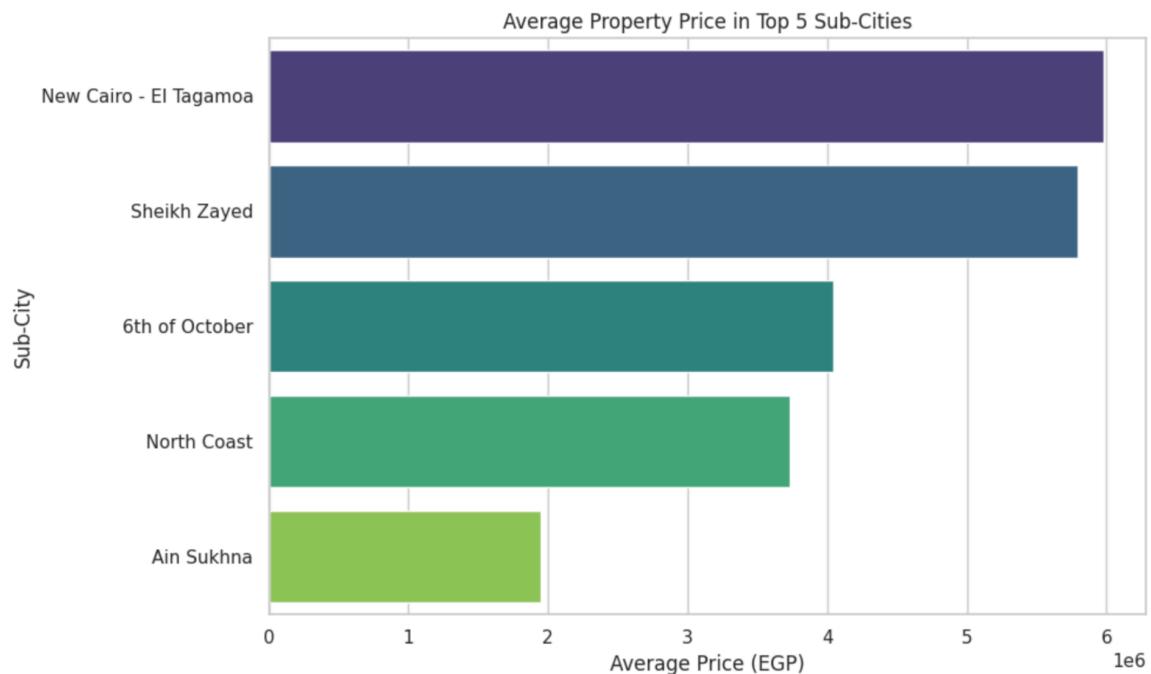


Figure 5: Box plot chart; Prices by number of bedrooms

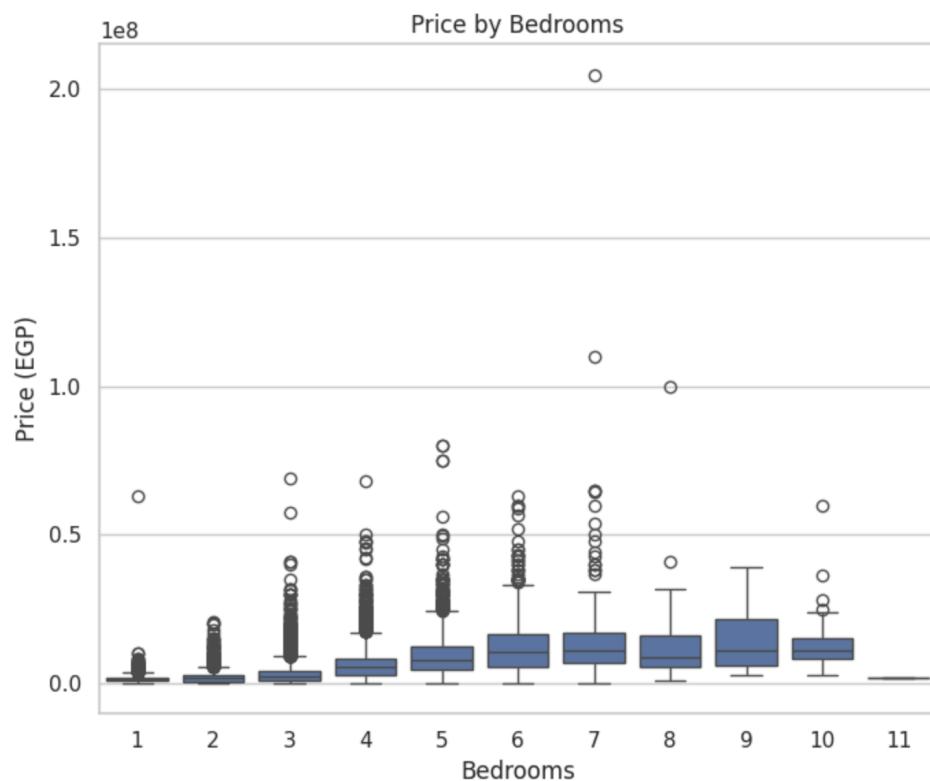


Figure 6: Box plot chart; Prices by number of bathrooms

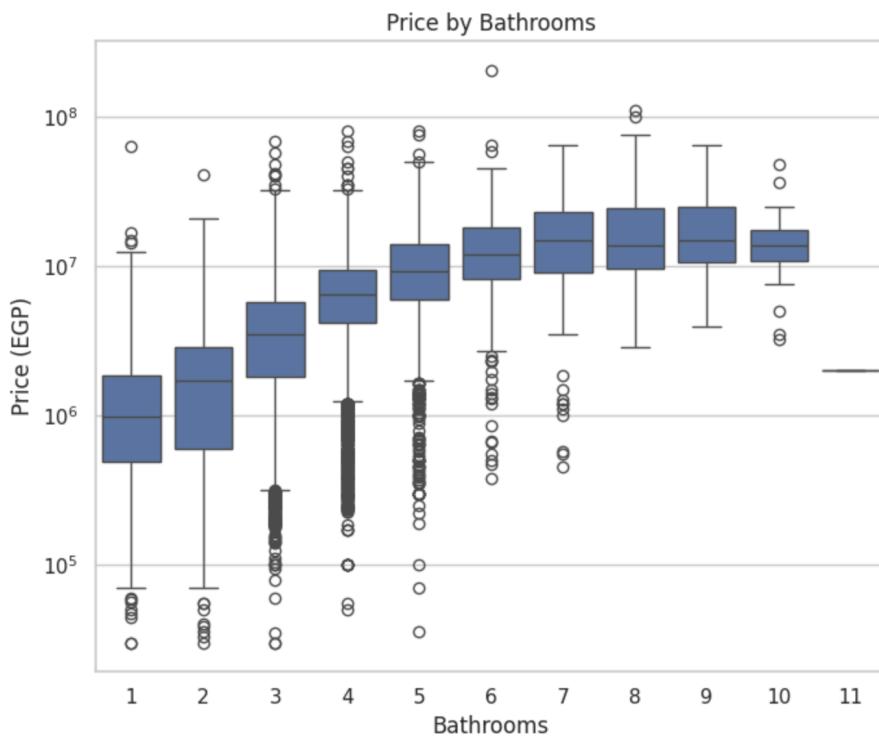


Figure 7: points on graph; Price vs Area (colored by city)

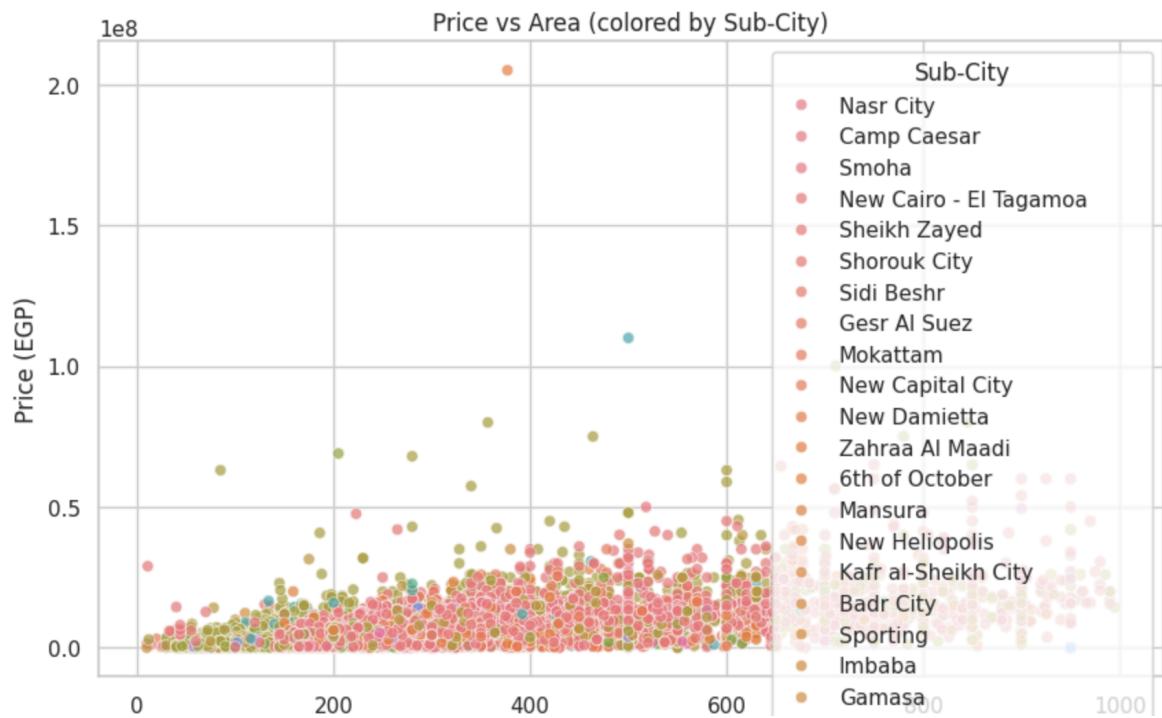


Figure 8: Butterfly chart; distribution of Prices in the top 5 cities (El Tagamoia, Sheikh Zayed, 6th of October, North Coast, Ain Sukhna)

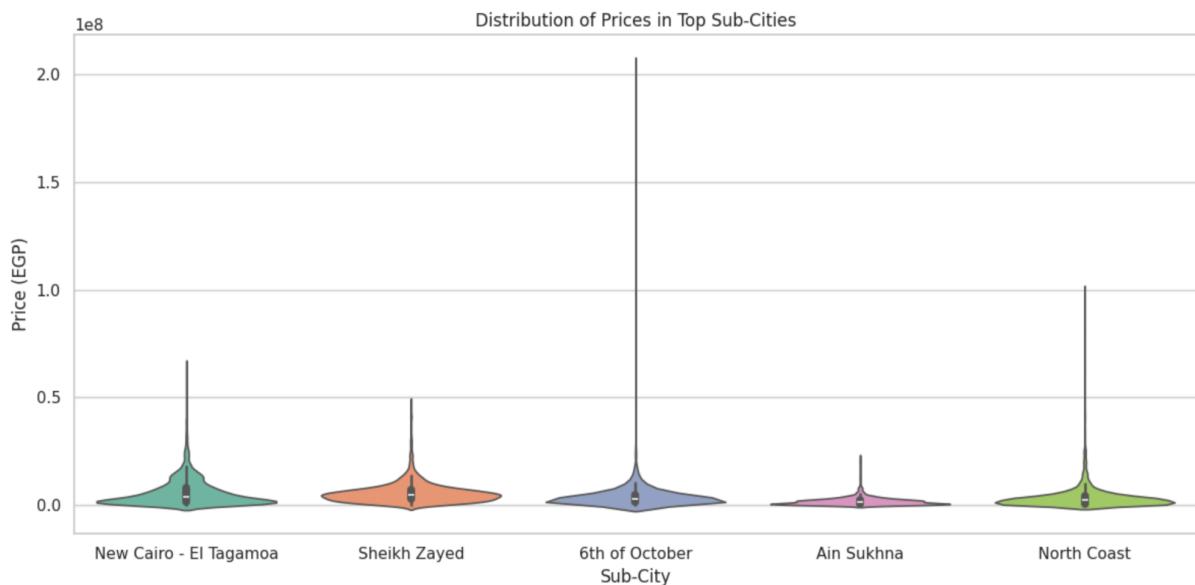


Figure 9: Pairwise graph; Features by top 5 cities (El Tagamo, Sheikh Zayed, 6th of October, North Coast, Ain Sukhna)

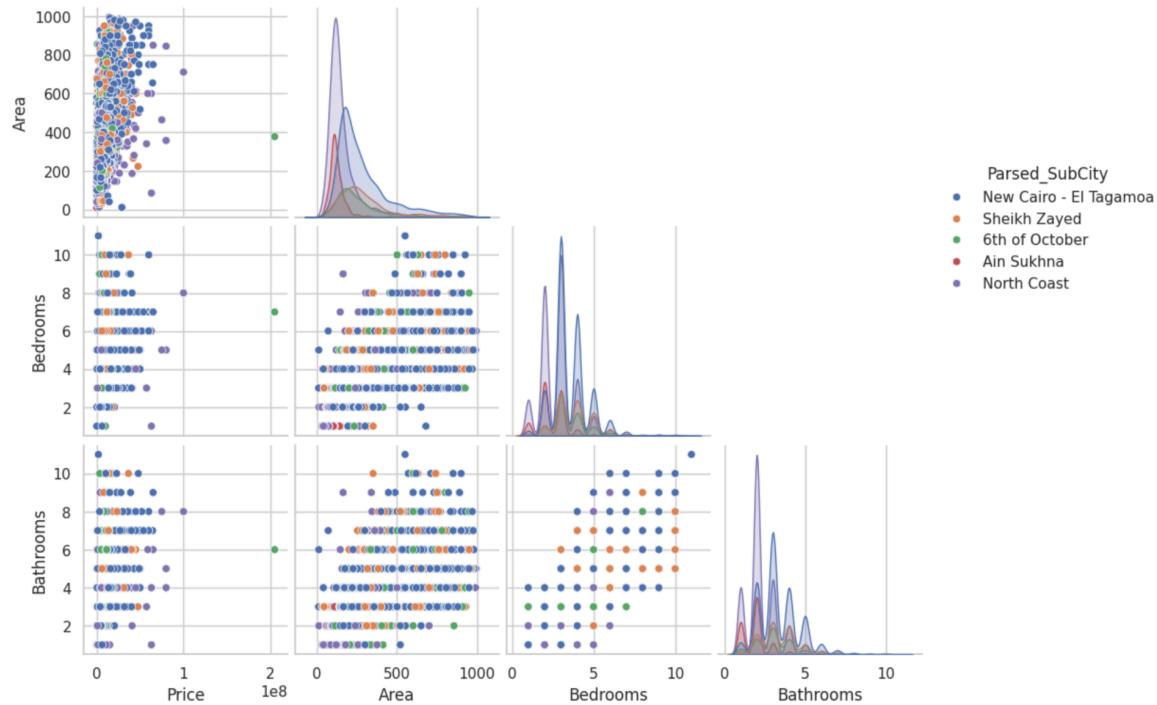


Figure 10: points graph; Log-Price vs Area in cities (Reveals skewed price distribution to the right))

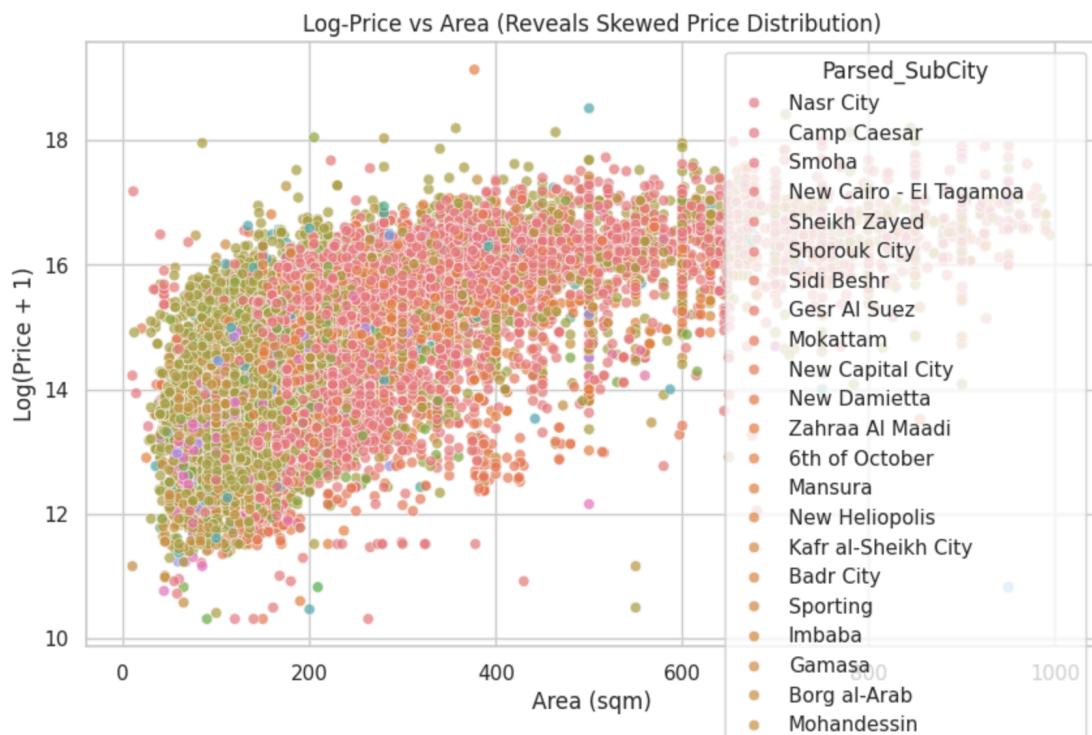


Figure 11: points graph; Area vs Price (full dataset)

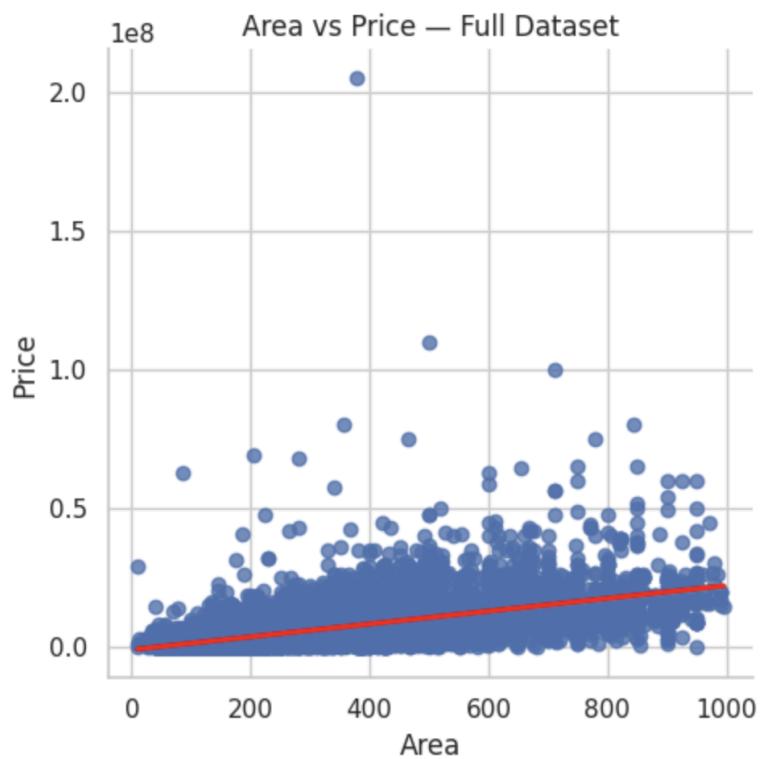


Figure 12: points graph; Bedrooms vs Price (full dataset)

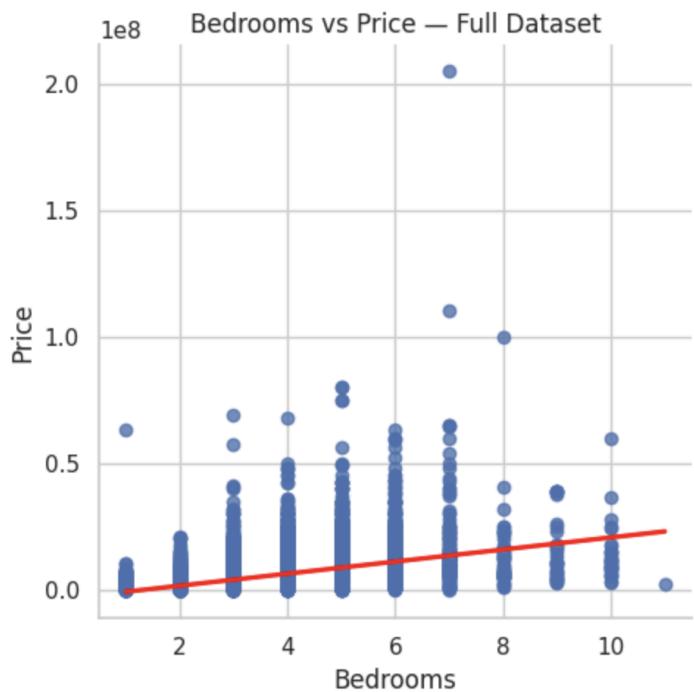
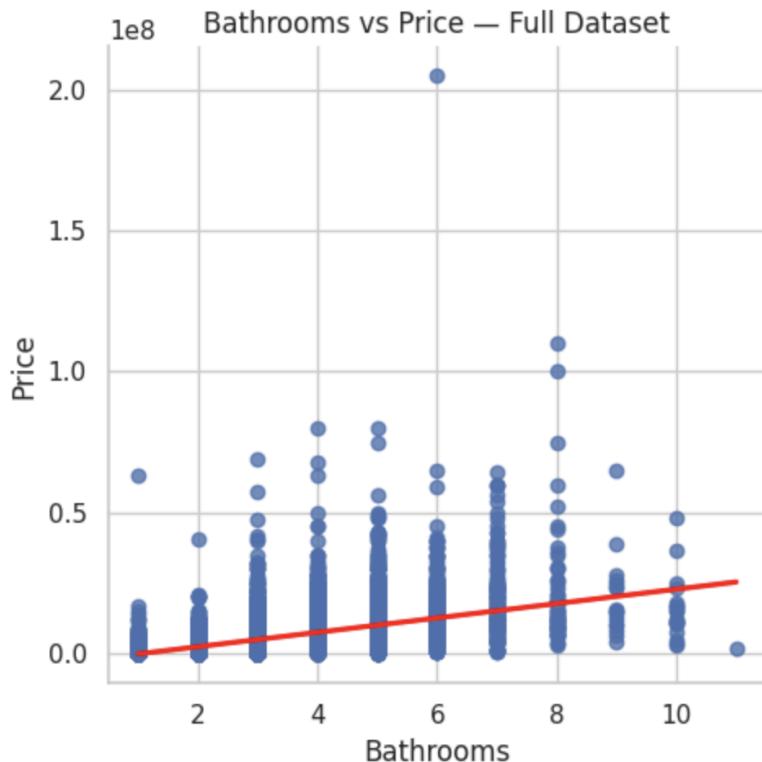


Figure 13: points graph; Bathrooms vs Price (full dataset)



## Appendix B: Hypothesis 1, intera city analysis results

Test 1: Analyze Price Variation Across Developers Within Top Sub-Cities (Fixed Beds, Baths, and Area)

### Results of test 1:

#### 1. --- Analyzing North Coast — (values)

Found 499 listings matching criteria in North Coast.

Analyzing 499 listings across 55 unique developers in North Coast.

Using 55 developer groups with 3+ listings for statistical tests.

ANOVA test (F-statistic=11.8373, p-value=0.0000)

Conclusion: Significant difference in mean price between developers (ANOVA).

Kruskal-Wallis test (Statistic=241.9820, p-value=0.0000)

Conclusion: Significant difference in median price between developers (Kruskal-Wallis).

Figure 1: North Coast - Developer price spread w/mean Overlay (beds =3, baths = 2, Area =140-240 sqm)

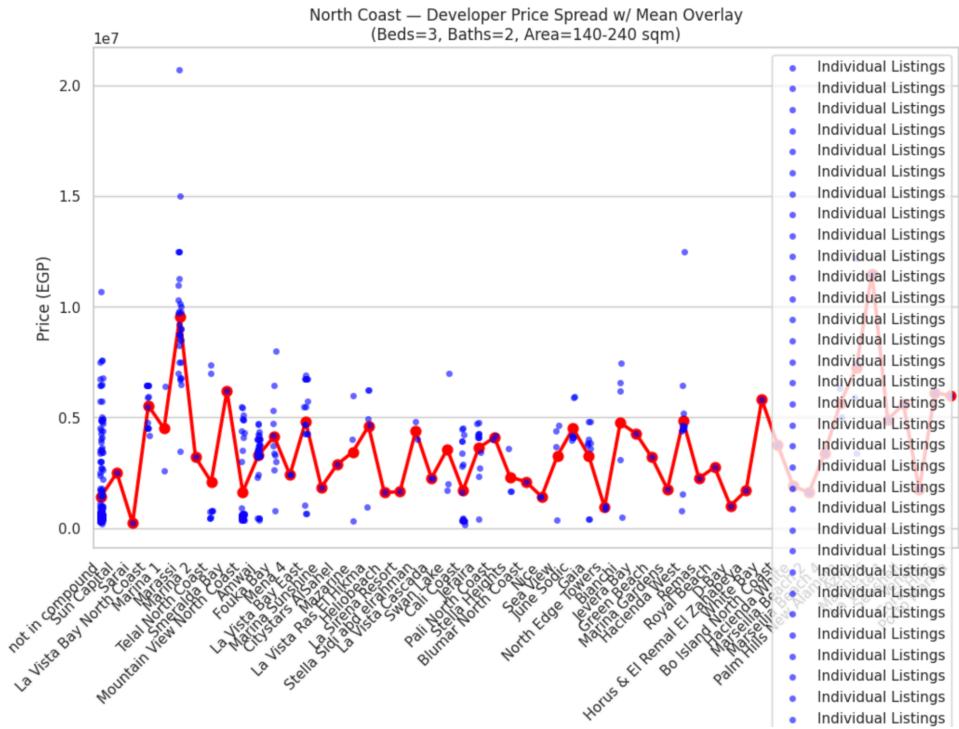
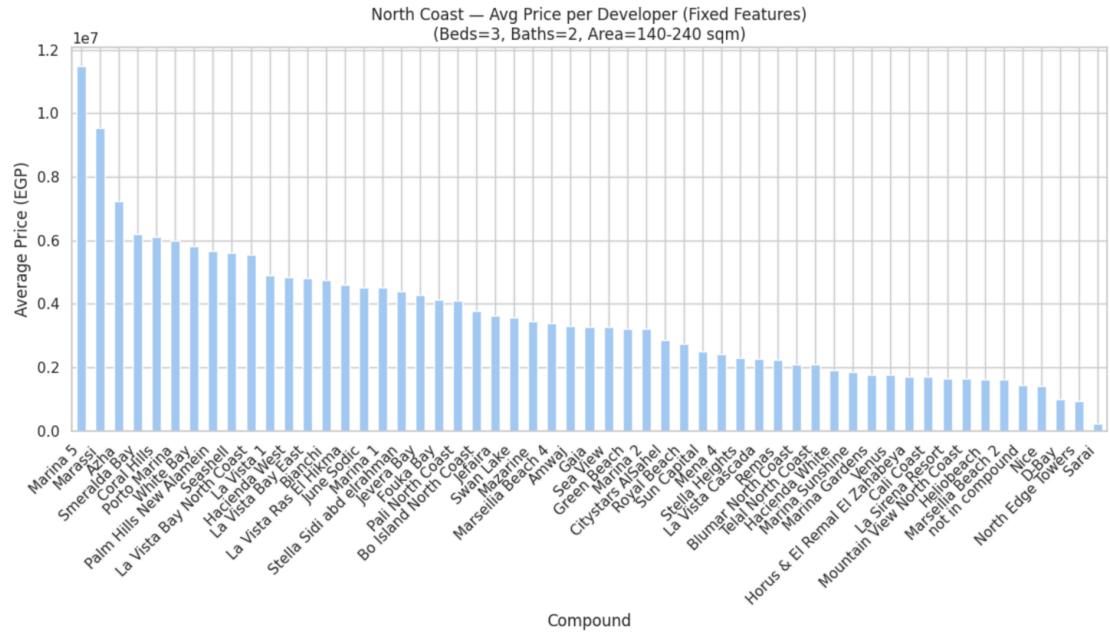


Figure 2: Bar chart; North coast - Avg Price per Developer (Fixed features) (beds =3, baths = 2, Area =140-240 sqm)



## 2. --- Analyzing Madinaty — (Values)

Found 90 listings matching criteria in Madinaty.

Analyzing 90 listings across 4 unique developers in Madinaty.

Using 4 developer groups with 3+ listings for statistical tests.

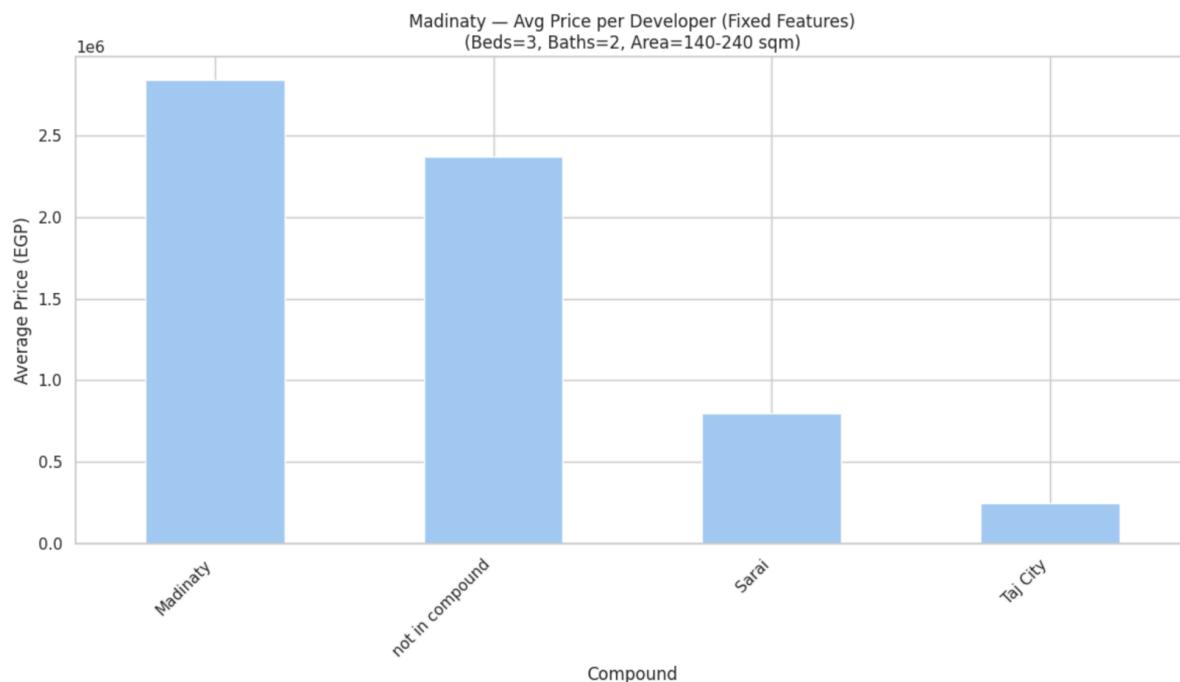
ANOVA test (F-statistic=5.9291, p-value=0.0010)

Conclusion: Significant difference in mean price between developers (ANOVA).

Kruskal-Wallis test (Statistic=12.5897, p-value=0.0056)

Conclusion: Significant difference in median price between developers (Kruskal-Wallis).

**Figure 1: Bar chart; Average price per 3 compounds (Madinaty, Sarai, Taj City) and not in compound houses**



## 3. --- Analyzing New Cairo - El Tagamoia — (values)

Found 793 listings matching criteria in New Cairo - El Tagamoia.

Analyzing 793 listings across 68 unique developers in New Cairo - El Tagamoia.

Using 68 developer groups with 3+ listings for statistical tests.

ANOVA test (F-statistic=6.6766, p-value=0.0000)

Conclusion: Significant difference in mean price between developers (ANOVA).

Kruskal-Wallis test (Statistic=208.3086, p-value=0.0000)

Conclusion: Significant difference in median price between developers (Kruskal-Wallis).

Figure 1: New Cairo - El Tagamo - Developer price spread w/mean Overlay (beds =3, baths = 2, Area =140-240 sqm)

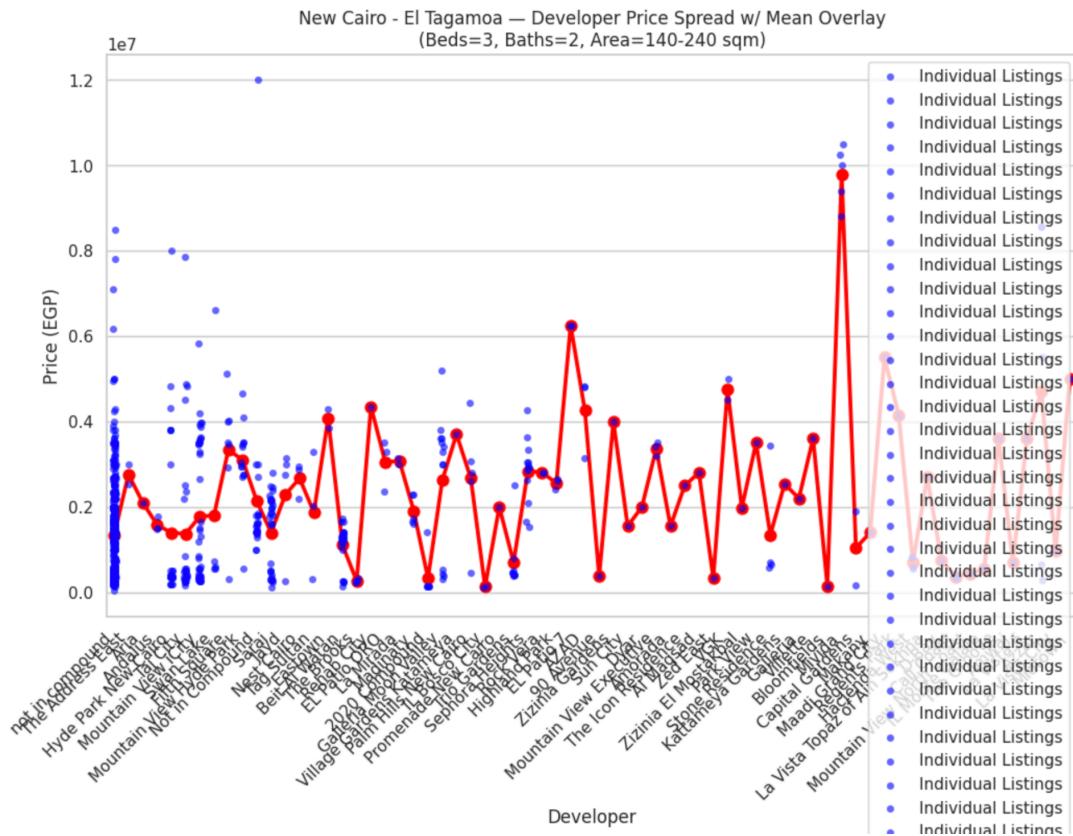
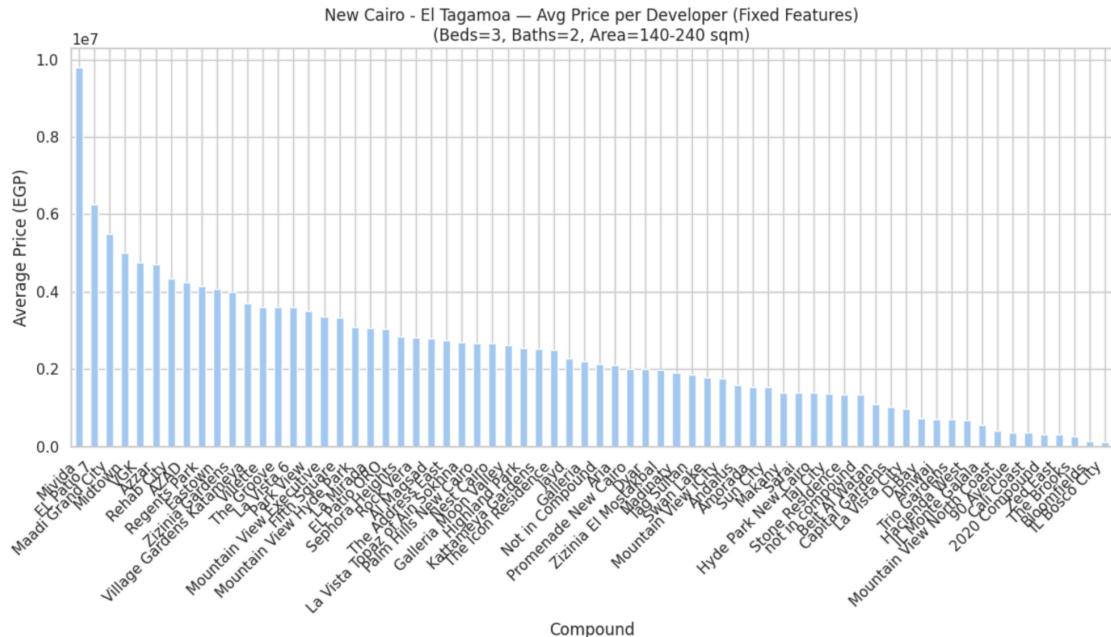


Figure 2: Bar chart; North coast - Avg Price per Developer (Fixed features) (beds =3, baths = 2, Area =140-240 sqm)



### 3--- Analyzing Sheikh Zayed — (values)

Found 198 listings matching criteria in Sheikh Zayed.

Analyzing 198 listings across 30 unique developers in Sheikh Zayed.

Using 30 developer groups with 3+ listings for statistical tests.

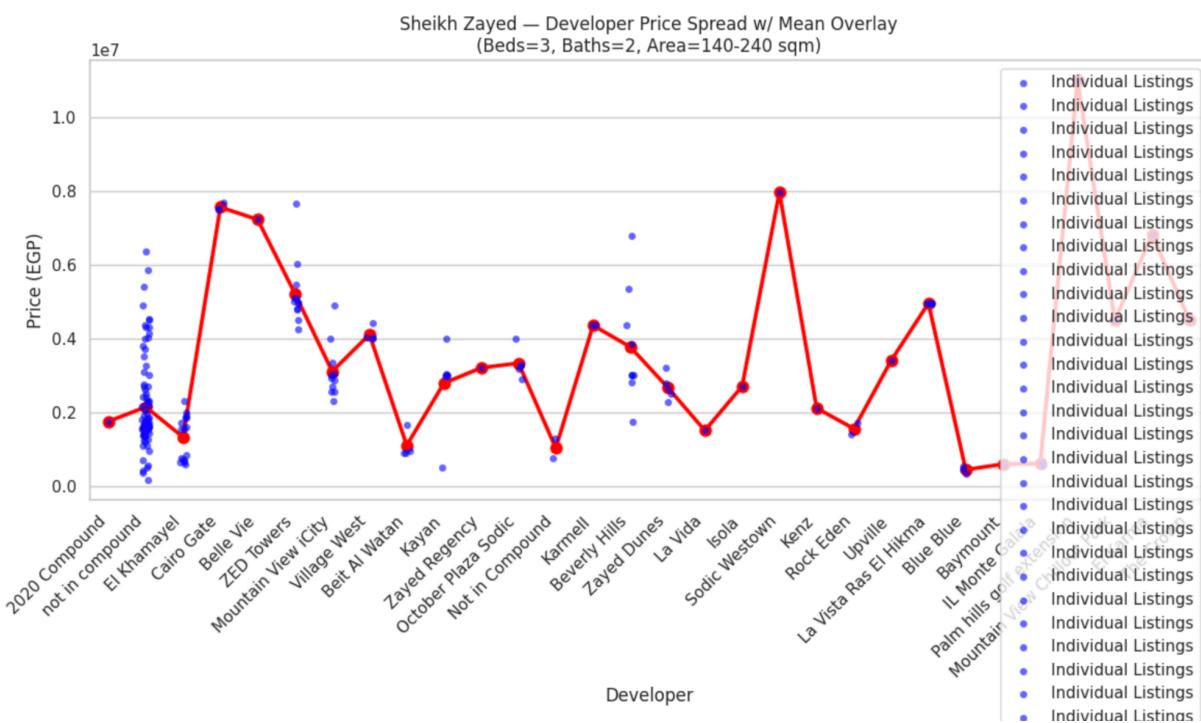
ANOVA test (F-statistic=14.4429, p-value=0.0000)

Conclusion: Significant difference in mean price between developers (ANOVA).

Kruskal-Wallis test (Statistic=120.4305, p-value=0.0000)

Conclusion: Significant difference in median price between developers (Kruskal-Wallis).

**Figure 1: Sheikh zayed - Developer price spread w/mean Overlay (beds =3, baths = 2, Area =140-240 sqm)**



**Figure 2: Bar chart; Sheikh Zayed- Avg Price per Developer (Fixed features) (beds =3, baths = 2, Area =140-240 sqm)**

Figure 2: Bar chart; Sheikh Zayed- Avg Price per Developer (Fixed features) (beds =3, baths = 2, Area =140-240 sqm)

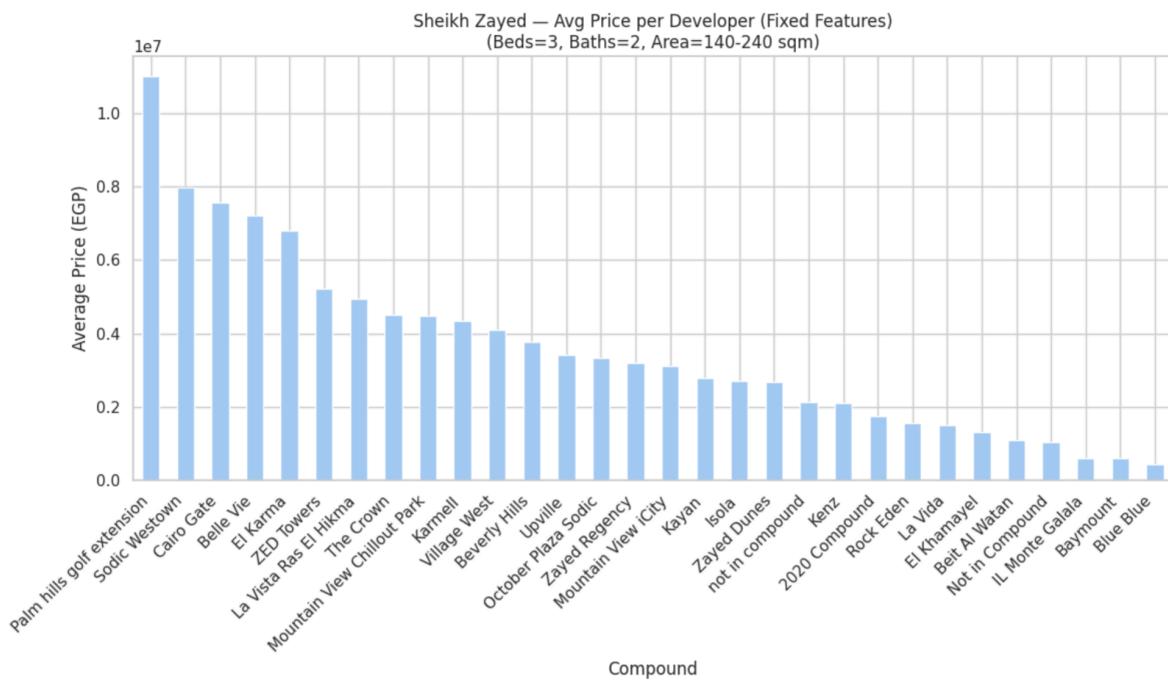


Figure 3: Price distribution of not in compound houses in the top 10 cities

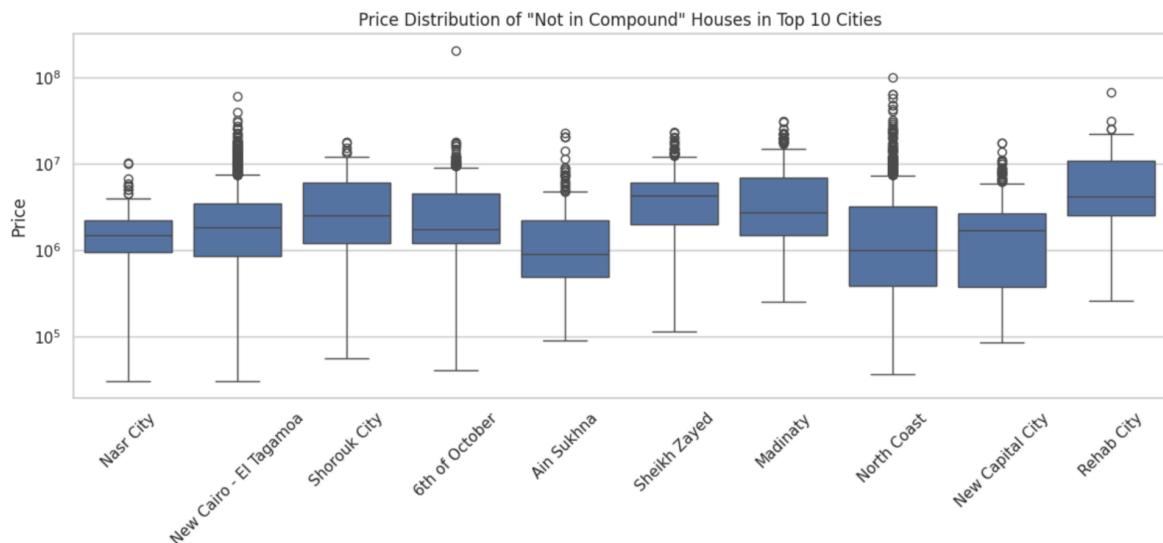


Figure 4: Regression of Mean Prices for the top 10 cities (not in compound houses)



### **Section 3: (chatgpt please create hypothesis based on the tests done below in this section you can more than one if it fits to do so)**

1. Compute Pearson Correlation Between Property Features and Price per Sub-City ; Results:

Pearson Correlations for North Coast:

Bedrooms: 0.4541

Bathrooms: 0.5466

Area: 0.5973

Pearson Correlations for Madinaty:

Bedrooms: 0.6397

Bathrooms: 0.7228

Area: 0.8248

Pearson Correlations for New Cairo - El Tagamoa:

Bedrooms: 0.5259

Bathrooms: 0.6150

Area: 0.7317

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Pearson Correlations for Sheikh Zayed:

Bedrooms: 0.4424

Bathrooms: 0.5122

Area: 0.5871

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## 2. Confidence Intervals for Mean Prices per City and Pairwise Price Comparison (t-test); results:

Pairwise t-test results:

Comparison: North Coast vs Madinaty

t-statistic: -11.7118, p-value: 0.0000

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Comparison: North Coast vs New Cairo - El Tagamoa

t-statistic: -21.6760, p-value: 0.0000

-----

Comparison: North Coast vs Sheikh Zayed

t-statistic: -17.2319, p-value: 0.0000

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Comparison: Madinaty vs New Cairo - El Tagamoa

t-statistic: -2.0019, p-value: 0.0454

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Comparison: Madinaty vs Sheikh Zayed

t-statistic: -0.8263, p-value: 0.4087

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Comparison: New Cairo - El Tagamoa vs Sheikh Zayed

t-statistic: 1.4909, p-value: 0.1360

Figure 1: dot plot chart: Confidence intervals of mean prices by city



### 3. Pairwise Z-Tests for Comparing Mean Prices Between Sub-Cities ; results:

Pairwise z-test results:

Comparison: North Coast vs Madinaty

z-statistic: -11.7118, p-value: 0.0000

-----

Comparison: North Coast vs New Cairo - El Tagamoa

z-statistic: -21.6760, p-value: 0.0000

-----

Comparison: North Coast vs Sheikh Zayed

z-statistic: -17.2319, p-value: 0.0000

-----

Comparison: Madinaty vs New Cairo - El Tagamoa

z-statistic: -2.0019, p-value: 0.0453

-----  
Comparison: Madinaty vs Sheikh Zayed

z-statistic: -0.8263, p-value: 0.4086  
-----

Comparison: New Cairo - El Tagamoa vs Sheikh Zayed

z-statistic: 1.4909, p-value: 0.1360  
-----

#### 4. Pairwise Cohen's d Effect Sizes Between Top Sub-Cities; results:

	City 1	City 2	Cohen's d	Effect Size
0	North Coast	Madinaty	-0.3562	small
1	North Coast	New Cairo - El Tagamoa	-0.3812	small
2	North Coast	Sheikh Zayed	-0.4026	small
3	Madinaty	New Cairo - El Tagamoa	-0.0532	negligible
4	Madinaty	Sheikh Zayed	-0.0282	negligible
5	New Cairo - El Tagamoa	Sheikh Zayed	0.0313	negligible

#### 5. Linear Regression and R<sup>2</sup> Scores for Top Sub-Cities; results:

✓ North Coast - R<sup>2</sup>: 0.3926

Coefficients: {'Area': np.float64(22794.72187991895), 'Bedrooms':  
np.float64(-870749.6682351445), 'Bathrooms':  
np.float64(1712576.4264681006)}

✓ Madinaty - R<sup>2</sup>: 0.6980

```
Coefficients: {'Area': np.float64(20248.26622043704), 'Bedrooms':  
np.float64(-203902.09928176797), 'Bathrooms':  
np.float64(1167101.4543737792) }
```

✓ New Cairo - El Tagamo - R<sup>2</sup>: 0.5572

```
Coefficients: {'Area': np.float64(24028.42083086015), 'Bedrooms':  
np.float64(-689928.001705818), 'Bathrooms': np.float64(1333942.02629171) }
```

✓ Sheikh Zayed - R<sup>2</sup>: 0.3779

```
Coefficients: {'Area': np.float64(12937.595053771724), 'Bedrooms':  
np.float64(-244888.48194933223), 'Bathrooms':  
np.float64(1055730.9060299823) }
```

Figure 1: point graph; North coast - Area vs price

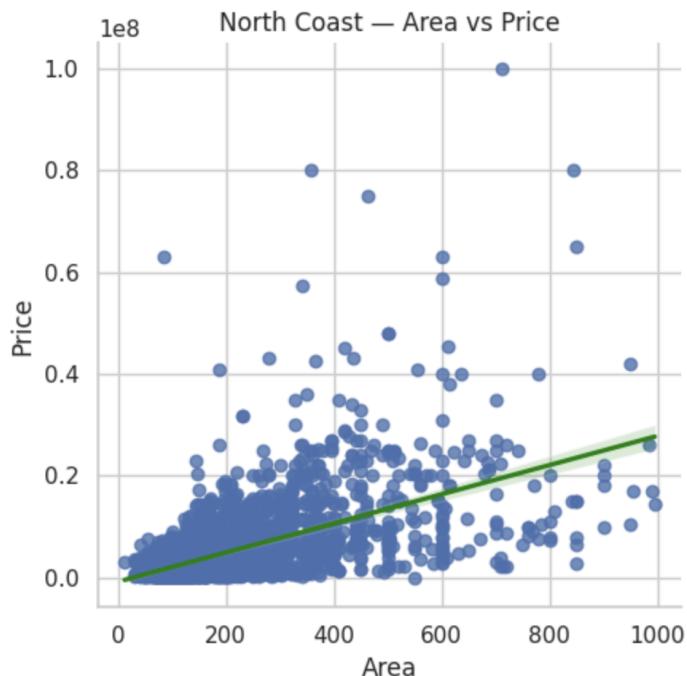


Figure 2: point graph; Madinaty - Area vs price



Figure 3: point graph; New Cairo - El Tagamoa - Area vs price

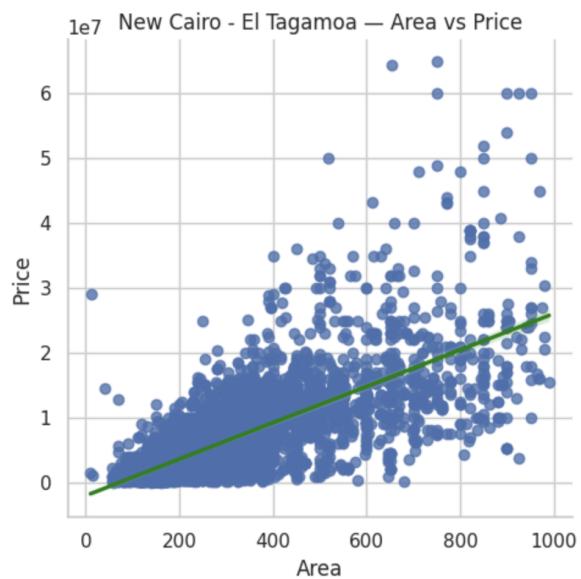


Figure 4: point graph; Sheikh Zayed - Area vs price

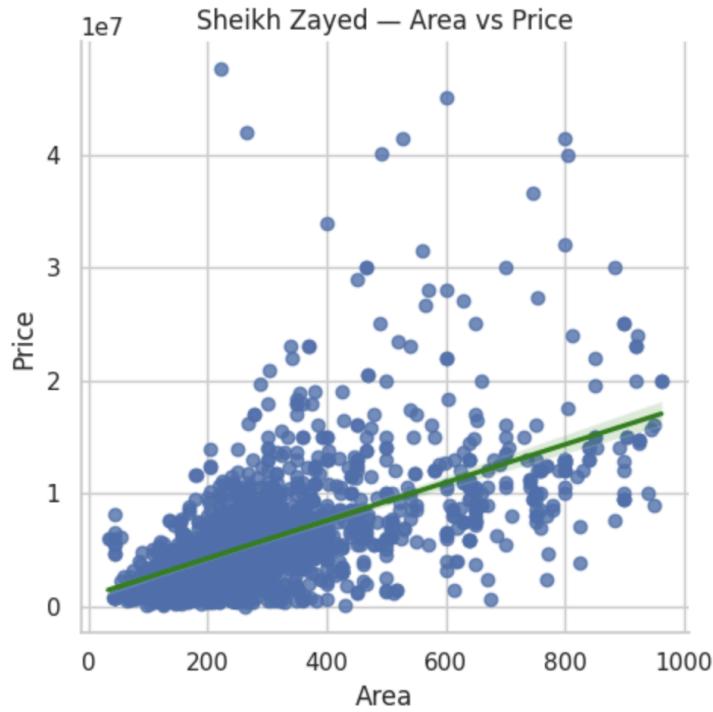
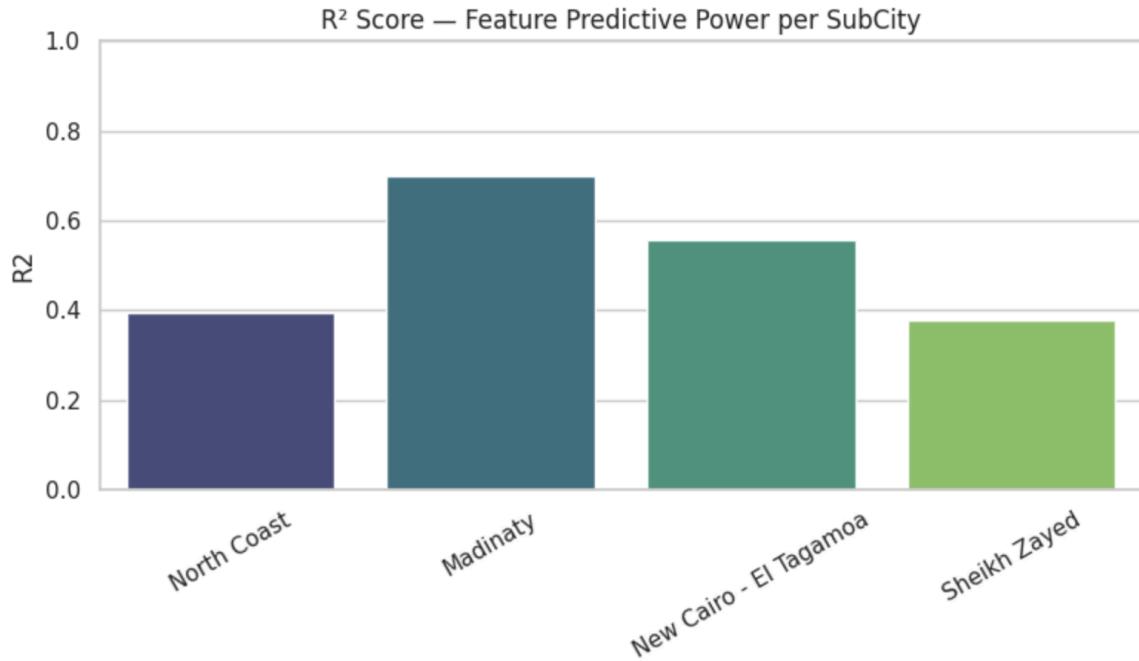


Figure 5: Bar chart; R^2 Score \_ Feature Predictive Power Per City



## Section 4: BootStrapping

### 1. Bootstrap analysis for z-tests, confidence intervals, and Pearson correlations per city; results:

Mean z-test p-values across bootstrap samples:

('North Coast', 'Madinaty'): 0.0000 ± 0.0000  
('North Coast', 'New Cairo - El Tagamoa'): 0.0000 ± 0.0000  
('North Coast', 'Sheikh Zayed'): 0.0000 ± 0.0000  
('Madinaty', 'New Cairo - El Tagamoa'): 0.1409 ± 0.2095  
('Madinaty', 'Sheikh Zayed'): 0.4176 ± 0.2996  
('New Cairo - El Tagamoa', 'Sheikh Zayed'): 0.2248 ± 0.2596

Mean Confidence Intervals for Mean Prices:

North Coast: CI = [3602543.42, 3859400.94] ± [61404.64, 70716.20]  
Madinaty: CI = [5351136.43, 5936245.39] ± [139429.19, 153054.19]  
New Cairo - El Tagamoa: CI = [5830126.27, 6145945.25] ± [74374.75, 79075.16]  
Sheikh Zayed: CI = [5590825.39, 5981521.25] ± [93842.60, 105476.54]

Mean Pearson Correlations Across Bootstrap Samples:

North Coast:

Bedrooms: 0.4543 ± 0.0154  
Bathrooms: 0.5471 ± 0.0161  
Area: 0.5980 ± 0.0170

Madinaty:

Bedrooms: 0.6392 ± 0.0215  
Bathrooms: 0.7223 ± 0.0152  
Area: 0.8249 ± 0.0124

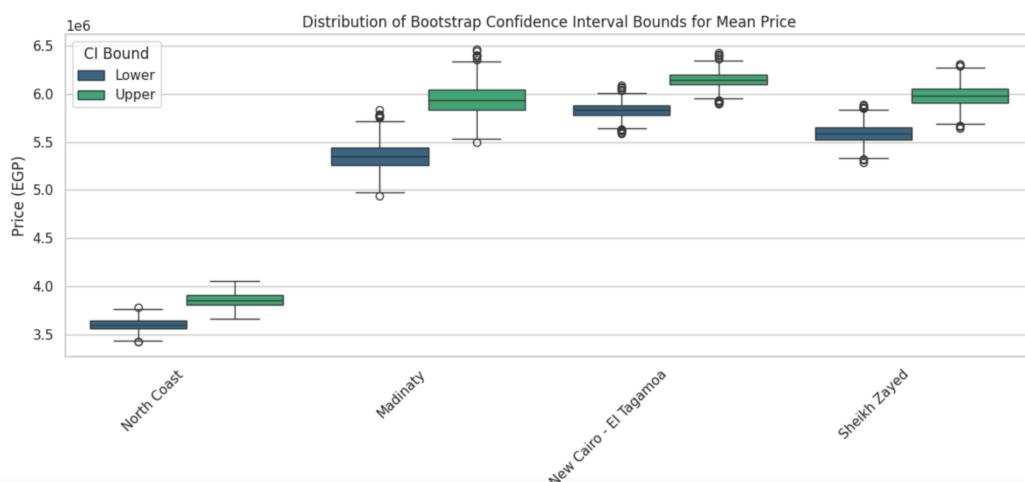
New Cairo - El Tagamoa:

Bedrooms: 0.5259 ± 0.0114  
Bathrooms: 0.6150 ± 0.0093  
Area: 0.7317 ± 0.0072

Sheikh Zayed:

Bedrooms: 0.4429 ± 0.0186  
Bathrooms: 0.5124 ± 0.0201  
Area: 0.5870 ± 0.0208

Figure 1: box plot chart; Distribution of Bootstrap Confidence Interval Bounds For Mean Price Top 5 cities



## 2. Bootstrap ANOVA Testing on Property Prices by Developer Across cities with Fixed Property Characteristics; result:

North Coast - Bootstrap ANOVA Results (n=1000 samples):

Mean F-statistic:  $30.8082 \pm 5.8545$

Mean p-value:  $0.0000 \pm 0.0000$

Conclusion: Significant difference in mean price between developers (ANOVA).

Madinaty - Bootstrap ANOVA Results (n=1000 samples):

Mean F-statistic:  $9.5746 \pm 6.6996$

Mean p-value:  $0.0347 \pm 0.1095$

Conclusion: Significant difference in mean price between developers (ANOVA).

New Cairo - El Tagamoa - Bootstrap ANOVA Results (n=1000 samples):

Mean F-statistic:  $14.5759 \pm 4.5417$

Mean p-value:  $0.0000 \pm 0.0000$

Conclusion: Significant difference in mean price between developers (ANOVA).

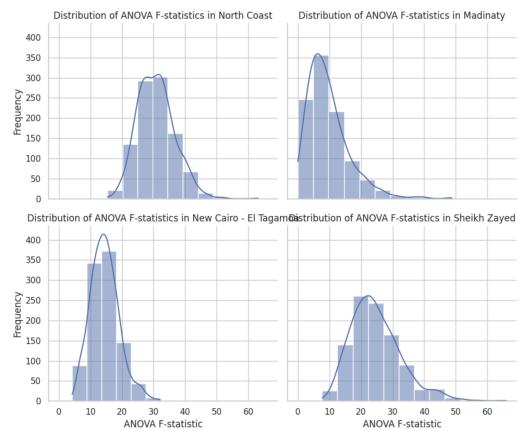
Sheikh Zayed - Bootstrap ANOVA Results (n=1000 samples):

Mean F-statistic:  $24.7730 \pm 8.1067$

Mean p-value:  $0.0000 \pm 0.0000$

Conclusion: Significant difference in mean price between developers (ANOVA).

**Figure 1: Bar charts; Distribution of F-statistics**



### 3. Bootstrap Linear Regression Analysis of Property Prices by Subcity with Aggregated R<sup>2</sup> Scores and Coefficients

--- Aggregated Results Across Bootstrap Samples ---

Mean R<sup>2</sup> Scores:

North Coast:  $0.3939 \pm 0.0189$

Madinaty:  $0.6992 \pm 0.0192$

New Cairo - El Tagamoa:  $0.5581 \pm 0.0100$

Sheikh Zayed:  $0.3799 \pm 0.0242$

Mean Coefficients:

North Coast:

Area: 22743.5548

Bedrooms: -871749.3215

Bathrooms: 1712426.4501

Madinaty:

Area: 20257.3527

Bedrooms: -198619.8238

Bathrooms: 1163905.0026

New Cairo - El Tagamoa:

Area: 24064.1667

Bedrooms: -688442.8535

Bathrooms: 1331336.9469

Sheikh Zayed:

Area: 12917.4429

Bedrooms: -243273.9881

Bathrooms: 1060988.5414

Figure 1: Distribution of Bedrooms Coefficients Across Bootstrapping samples per City (top 5)

