

# Appendix: Mining Proximity and Residential Property Values in India

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## 1 Appendix

This appendix presents the complete raw output from all regression models discussed in the main text. Results are organized by distance radius (3km, 5km, 7km, 10km).

### 1.1 Full Sample Results

#### 1.1.1 3km Radius - OLS Results

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BASELINE OLS HEDONIC REGRESSION (Radius: 3.0km)
CORRECTED VERSION - Matches other analyses
Sample: 1,602,159 observations
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                                OLS Regression Results
=====
Dep. Variable:          Log_Price    R-squared:                0.440
Model:                  OLS          Adj. R-squared:           0.440
Method:                 Least Squares    F-statistic:            2.135e+04
Date:                  Tue, 03 Feb 2026    Prob (F-statistic):      0.00
Time:                  17:37:21          Log-Likelihood:         -1.7794e+06
No. Observations:      1602159          AIC:                   3.559e+06
Df Residuals:          1602099          BIC:                   3.560e+06
Df Model:              59
Covariance Type:       nonrobust
=====

                                coef    std err          t      P>|t|     [0.025     0.975]
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const                14.0886      0.072    195.263    0.000     13.947     14.230
Mining_Coverage_Percent -0.0058      0.001    -4.456    0.000     -0.008     -0.003
Area_Sqft            1.83e-05    1.09e-07   168.257    0.000     1.81e-05    1.85e-05
Num_Bedrooms         0.4453      0.001   684.391    0.000      0.444      0.447
Landmark_School      -0.0217      0.000   -46.157    0.000     -0.023     -0.021
Landmark_Hospital     0.0045      0.000    10.116    0.000      0.004      0.005
Landmark_Restaurant  -0.0275      0.000   -63.829    0.000     -0.028     -0.027
Landmark_Mall        -0.0147      0.000   -30.702    0.000     -0.016     -0.014
```

City_Badlapur	-0.5351	0.008	-64.434	0.000	-0.551	-0.519
City_Bangalore	0.4204	0.004	108.938	0.000	0.413	0.428
City_Bhubaneswar	0.0366	0.007	5.018	0.000	0.022	0.051
City_Chennai	0.0301	0.004	7.881	0.000	0.023	0.038
City_Coimbatore	-0.1417	0.006	-25.703	0.000	-0.153	-0.131
City_Faridabad	0.5461	0.007	79.341	0.000	0.533	0.560
City_Ghaziabad	0.1867	0.005	35.091	0.000	0.176	0.197
City_Greater Noida	0.3331	0.005	67.893	0.000	0.323	0.343
City_Gurgaon	1.1121	0.004	254.588	0.000	1.104	1.121
City_Hyderabad	0.1982	0.004	52.820	0.000	0.191	0.206
City_Indore	0.1252	0.006	19.264	0.000	0.112	0.138
City_Jaipur	-0.2354	0.005	-48.700	0.000	-0.245	-0.226
City_Kalyan	0.0122	0.008	1.465	0.143	-0.004	0.029
City_Kolkata	-0.1904	0.004	-52.253	0.000	-0.198	-0.183
City_Lucknow	-0.1764	0.006	-30.817	0.000	-0.188	-0.165
City_Mohali	0.2529	0.007	33.752	0.000	0.238	0.268
City_Mumbai	0.8390	0.004	215.652	0.000	0.831	0.847
City_Nagpur	-0.3412	0.006	-57.413	0.000	-0.353	-0.330
City_Nashik	-0.4668	0.007	-71.459	0.000	-0.480	-0.454
City_Navi Mumbai	0.2609	0.005	55.224	0.000	0.252	0.270
City_New Delhi	0.4868	0.005	89.823	0.000	0.476	0.497
City_Noida	0.4380	0.006	77.415	0.000	0.427	0.449
City_Other	-0.1433	0.003	-41.833	0.000	-0.150	-0.137
City_Pune	0.1501	0.003	43.490	0.000	0.143	0.157
City_Raipur	-0.3728	0.009	-41.426	0.000	-0.390	-0.355
City_Secunderabad	0.1387	0.008	16.623	0.000	0.122	0.155
City_Surat	-0.2503	0.008	-31.794	0.000	-0.266	-0.235
City_Thane	0.1317	0.004	30.668	0.000	0.123	0.140
City_Vadodara	-0.4151	0.007	-58.967	0.000	-0.429	-0.401
City_Visakhapatnam	-0.1741	0.008	-22.181	0.000	-0.189	-0.159
PropType_Apartment	0.4029	0.072	5.591	0.000	0.262	0.544
PropType_Builder Floor	0.3272	0.073	4.509	0.000	0.185	0.469
PropType_Bungalow	0.3322	0.077	4.324	0.000	0.182	0.483
PropType_Condo	0.7617	0.524	1.452	0.146	-0.266	1.790
PropType_Duplex	0.4894	0.073	6.749	0.000	0.347	0.632
PropType_Farm House	0.3724	0.075	4.934	0.000	0.224	0.520
PropType_Independent Floor	0.1758	0.072	2.436	0.015	0.034	0.317
PropType_Independent House	0.0782	0.072	1.085	0.278	-0.063	0.220
PropType_Penthouse	0.9514	0.073	13.027	0.000	0.808	1.094
PropType_Plot	0.4297	0.072	5.962	0.000	0.288	0.571
PropType_Row House	0.2261	0.078	2.903	0.004	0.073	0.379
PropType_Serviced Apartment	0.3432	0.134	2.555	0.011	0.080	0.607
PropType_Studio	0.2872	0.076	3.782	0.000	0.138	0.436
PropType_Studio Apartment	0.1990	0.074	2.689	0.007	0.054	0.344
PropType_Triplex	0.8669	0.087	10.002	0.000	0.697	1.037
PropType_Villa	0.6307	0.072	8.746	0.000	0.489	0.772
PropType_Villament	0.8774	0.090	9.778	0.000	0.702	1.053
Furnish_Fully Furnished	0.1124	0.003	36.064	0.000	0.106	0.118
Furnish_Semi-Furnished	0.0176	0.002	8.669	0.000	0.014	0.022
Furnish_Unfurnished	0.0013	0.002	0.674	0.500	-0.002	0.005
Rera_1.0	0.2667	0.001	179.417	0.000	0.264	0.270
Rera_Missing	0.3579	0.002	175.651	0.000	0.354	0.362

```

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Omnibus:                285296.564    Durbin-Watson:                0.943
Prob(Omnibus):           0.000    Jarque-Bera (JB):            7154138.404
Skew:                    -0.088    Prob(JB):                     0.00
Kurtosis:                13.351    Cond. No.                    5.08e+06
=====

```

Notes:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 5.08e+06. This might indicate that there are strong multicollinearity or other numerical problems.

## 1.1.2 3km Radius - PSM Results

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PROPSENSITY SCORE MATCHING RESULTS (Radius: 3.0km)

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ROBUSTNESS ACROSS TREATMENT THRESHOLDS

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THRESHOLD: Mining coverage > 0.3%

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Treated units: 103,056  
Control units: 1,499,103  
Matched pairs: 103,056  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: 2.63%  
Standard Error: 0.38%  
95% CI: [1.99%, 3.54%]

Interpretation: Properties near mines (>0.3% coverage) are  
2.63% more expensive than similar properties not near mines.

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THRESHOLD: Mining coverage > 0.5%

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Treated units: 73,759  
Control units: 1,528,400  
Matched pairs: 73,759  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: 5.56%  
Standard Error: 0.49%  
95% CI: [4.71%, 6.52%]

Interpretation: Properties near mines (>0.5% coverage) are  
5.56% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 1.0%

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Treated units: 46,229  
Control units: 1,555,930  
Matched pairs: 46,229  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: 14.81%  
Standard Error: 0.61%

95% CI: [13.75%, 16.08%]

Interpretation: Properties near mines (>1.0% coverage) are  
14.81% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 2.0%

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Treated units: 18,384  
Control units: 1,583,775  
Matched pairs: 18,384  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: 2.96%  
Standard Error: 0.85%  
95% CI: [1.42%, 4.80%]

Interpretation: Properties near mines (>2.0% coverage) are  
2.96% more expensive than similar properties not near mines.

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SUMMARY TABLE

Threshold	Treated	Matched	ATT	95% CI
0.3%	103,056	103,056	2.63	% [1.99%, 3.54%]
0.5%	73,759	73,759	5.56	% [4.71%, 6.52%]
1.0%	46,229	46,229	14.81	% [13.75%, 16.08%]
2.0%	18,384	18,384	2.96	% [1.42%, 4.80%]

NOTES:

- Method: 1:1 Nearest Neighbor Matching with caliper=0.1
- Standard errors computed via bootstrap (200 iterations)
- All matches achieved within caliper threshold

### 1.1.3 3km Radius - SAC Model

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SAC (SPATIAL AUTOREGRESSIVE COMBINED) - PRIMARY MODEL

Radius: 3.0km | Sample: 1,602,159 obs

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MODEL SPECIFICATION:

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 $y = W*y + X* + u$   
 $u = W*u +$

Where:

$y = \text{Log}(\text{Price})$   
= Spatial lag coefficient (spillover effects)  
= Spatial error coefficient (correlated shocks)  
 $W = 8\text{-nearest neighbors matrix (row-standardized)}$

# REGRESSION RESULTS

## SUMMARY OF OUTPUT: SPATIALLY WEIGHTED 2SLS- GM-COMBO MODEL (HET)

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Data set      :      unknown
Weights matrix :      unknown
Dependent Variable :  Log_Price      Number of Observations:  1602159
Mean dependent var :  15.7453      Number of Variables   :    61
S.D. dependent var :  0.9819      Degrees of Freedom    :  1602098
Pseudo R-squared :  0.7667
Spatial Pseudo R-squared:  0.4127
N. of iterations :  1      Step1c computed      :      No

```

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	5.35927	0.10342	51.81975	0.00000
Mining_Coverage_Percent	0.01222	0.00206	5.92965	0.00000
Area_Sqft	0.00001	0.00000	7.50905	0.00000
Num_Bedrooms	0.28962	0.00116	249.85400	0.00000
Landmark_School	-0.01162	0.00072	-16.22994	0.00000
Landmark_Hospital	0.00064	0.00066	0.96876	0.33266
Landmark_Restaurant	-0.01132	0.00066	-17.08331	0.00000
Landmark_Mall	-0.00643	0.00071	-9.01180	0.00000
City_Badlapur	-0.04340	0.00835	-5.19470	0.00000
City_Bangalore	0.14172	0.00584	24.24734	0.00000
City_Bhubaneswar	-0.02519	0.01146	-2.19923	0.02786
City_Chennai	-0.05721	0.00608	-9.40891	0.00000
City_Coimbatore	-0.18855	0.01004	-18.78211	0.00000
City_Faridabad	0.13917	0.01206	11.53785	0.00000
City_Ghaziabad	0.07740	0.00794	9.74377	0.00000
City_Greater Noida	0.10266	0.00759	13.53207	0.00000
City_Gurgaon	0.41582	0.00712	58.39457	0.00000
City_Hyderabad	-0.01382	0.00572	-2.41631	0.01568
City_Indore	-0.06856	0.01361	-5.03682	0.00000
City_Jaipur	-0.18262	0.00854	-21.38505	0.00000
City_Kalyan	0.15575	0.00879	17.72276	0.00000
City_Kolkata	-0.05032	0.00524	-9.60363	0.00000
City_Lucknow	-0.20207	0.01142	-17.69402	0.00000
City_Mohali	0.02003	0.01043	1.92069	0.05477
City_Mumbai	0.45013	0.00538	83.67225	0.00000
City_Nagpur	-0.23501	0.00990	-23.73052	0.00000
City_Nashik	-0.10926	0.00835	-13.08541	0.00000
City_Navi Mumbai	0.23101	0.00680	33.95424	0.00000
City_New Delhi	0.21625	0.00962	22.47424	0.00000
City_Noida	0.19937	0.00984	20.26118	0.00000
City_Other	-0.08859	0.00553	-16.02616	0.00000
City_Pune	0.14107	0.00482	29.24106	0.00000
City_Raipur	-0.33551	0.01622	-20.68180	0.00000
City_Secunderabad	-0.04171	0.01413	-2.95139	0.00316
City_Surat	-0.12091	0.01237	-9.77492	0.00000
City_Thane	0.19171	0.00576	33.30247	0.00000
City_Vadodara	-0.22532	0.01068	-21.09073	0.00000
City_Visakhapatnam	-0.07955	0.01322	-6.01846	0.00000
PropType_Apartment	0.32485	0.09429	3.44514	0.00057
PropType_Builder Floor	0.35284	0.09445	3.73580	0.00019
PropType_Bungalow	0.55270	0.09743	5.67252	0.00000
PropType_Condo	0.21151	0.14563	1.45243	0.14638

PropType_Duplex	0.57541	0.09444	6.09289	0.00000
PropType_Farm House	0.68153	0.10000	6.81563	0.00000
PropType_Independent Floor	0.18207	0.09433	1.93007	0.05360
PropType_Independent House	0.44562	0.09431	4.72494	0.00000
PropType_Penthouse	0.68547	0.09437	7.26384	0.00000
PropType_Plot	0.70659	0.09404	7.51385	0.00000
PropType_Row House	0.44099	0.09647	4.57121	0.00000
PropType_Serviced Apartment	-0.10061	0.11819	-0.85125	0.39463
PropType_Studio	0.07765	0.09651	0.80460	0.42105
PropType_Studio Apartment	0.01176	0.09470	0.12416	0.90119
PropType_Triplex	0.59606	0.12152	4.90518	0.00000
PropType_Villa	0.71087	0.09424	7.54341	0.00000
PropType_Villament	0.52921	0.09627	5.49709	0.00000
Furnish_Fully Furnished	0.08254	0.00231	35.71817	0.00000
Furnish_Semi-Furnished	-0.00705	0.00131	-5.36976	0.00000
Furnish_Unfurnished	-0.01245	0.00124	-10.00810	0.00000
Rera_1.0	0.15860	0.00179	88.43983	0.00000
Rera_Missing	0.18876	0.00250	75.55870	0.00000
W_Log_Price	0.58354	0.00262	222.32500	0.00000
lambda	0.62589	0.00333	187.80369	0.00000

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Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar, W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur, W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,  
W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,  
W\_PropType\_Bungalow, W\_PropType\_Condo, W\_PropType\_Duplex,  
W\_PropType\_Farm House, W\_PropType\_Independent Floor,  
W\_PropType\_Independent House, W\_PropType\_Penthouse,  
W\_PropType\_Plot, W\_PropType\_Row House, W\_PropType\_Serviced  
Apartment, W\_PropType\_Studio, W\_PropType\_Studio Apartment,  
W\_PropType\_Triplex, W\_PropType\_Villa, W\_PropType\_Villament,  
W\_Rera\_1.0, W\_Rera\_Missing

===== END OF REPORT =====

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#### MINING COVERAGE EFFECTS

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Coefficient: 0.012221  
Std. Error: 0.002061  
P-value: 0.000000  
Impact: 1.23% per 1pp mining coverage

Spatial lag (): 0.583537  
Spatial error (): 0.625890  
Pseudo R<sup>2</sup>: 0.7667

### 1.1.4 3km Radius - SAR Model (Robustness)

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SAR (SPATIAL LAG) - ROBUSTNESS CHECK
Radius: 3.0km | Sample: 1,602,159 obs
=====
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MODEL SPECIFICATION:

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 $y = W*y + X* +$

Where:

$y$  = Log(Price)  
= Spatial lag coefficient (spillover effects only)  
 $W$  = 8-nearest neighbors matrix (row-standardized)  
Estimation: GM (Generalized Method of Moments)

REGRESSION RESULTS

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SUMMARY OF OUTPUT: SPATIAL TWO STAGE LEAST SQUARES

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Data set : unknown  
Weights matrix : unknown  
Dependent Variable : Log\_Price Number of Observations: 1602159  
Mean dependent var : 15.7453 Number of Variables : 61  
S.D. dependent var : 0.9819 Degrees of Freedom : 1602098  
Pseudo R-squared : 0.7721  
Spatial Pseudo R-squared: 0.4815

-----  
Variable Coefficient Std. Error z-Statistic Probability  
-----  
CONSTANT 5.68947 0.04919 115.67306 0.00000  
Mining\_Coverage\_Percent 0.00609 0.00085 7.20376 0.00000  
Area\_Sqft 0.00001 0.00000 186.89893 0.00000  
Num\_Bedrooms 0.28861 0.00050 574.25134 0.00000  
Landmark\_School -0.00780 0.00031 -25.40773 0.00000  
Landmark\_Hospital 0.00127 0.00029 4.42164 0.00001  
Landmark\_Restaurant -0.01023 0.00028 -36.27411 0.00000  
Landmark\_Mall -0.00518 0.00031 -16.56036 0.00000  
City\_Badlapur -0.08260 0.00547 -15.11111 0.00000  
City\_Bangalore 0.18565 0.00255 72.89085 0.00000  
City\_Bhubaneswar 0.00848 0.00475 1.78558 0.07417  
City\_Chennai 0.02993 0.00249 12.03019 0.00000  
City\_Coimbatore -0.06288 0.00360 -17.49018 0.00000  
City\_Faridabad 0.22687 0.00452 50.21267 0.00000  
City\_Ghaziabad 0.09289 0.00347 26.76608 0.00000  
City\_Greater Noida 0.15038 0.00321 46.82165 0.00000  
City\_Gurgaon 0.45693 0.00306 149.24453 0.00000  
City\_Hyderabad 0.06843 0.00245 27.87849 0.00000  
City\_Indore 0.07552 0.00424 17.83110 0.00000  
City\_Jaipur -0.12377 0.00316 -39.22627 0.00000  
City\_Kalyan 0.13415 0.00545 24.60762 0.00000  
City\_Kolkata -0.06329 0.00238 -26.54646 0.00000  
City\_Lucknow -0.08845 0.00373 -23.69307 0.00000  
City\_Mohali 0.09571 0.00489 19.57413 0.00000  
City\_Mumbai 0.44705 0.00262 170.42988 0.00000  
City\_Nagpur -0.14239 0.00389 -36.63267 0.00000

City_Nashik	-0.12899	0.00430	-30.02626	0.00000
City_Navi Mumbai	0.21121	0.00308	68.59030	0.00000
City_New Delhi	0.22566	0.00356	63.39319	0.00000
City_Noida	0.19644	0.00371	52.95897	0.00000
City_Other	-0.03934	0.00224	-17.57290	0.00000
City_Pune	0.12917	0.00225	57.42039	0.00000
City_Raipur	-0.16420	0.00587	-27.94954	0.00000
City_Secunderabad	0.03116	0.00544	5.73129	0.00000
City_Surat	-0.10840	0.00513	-21.11291	0.00000
City_Thane	0.17089	0.00280	61.06645	0.00000
City_Vadodara	-0.21271	0.00460	-46.24293	0.00000
City_Visakhapatnam	-0.04395	0.00512	-8.58873	0.00000
PropType_Apartment	0.24180	0.04695	5.14970	0.00000
PropType_Builder Floor	0.20007	0.04728	4.23196	0.00002
PropType_Bungalow	0.24578	0.05006	4.90930	0.00000
PropType_Condo	0.17674	0.34172	0.51719	0.60502
PropType_Duplex	0.38947	0.04724	8.24369	0.00000
PropType_Farm House	0.45962	0.04917	9.34741	0.00000
PropType_Independent Floor	0.06928	0.04702	1.47330	0.14067
PropType_Independent House	0.18127	0.04700	3.85700	0.00011
PropType_Penthouse	0.61788	0.04758	12.98519	0.00000
PropType_Plot	0.36822	0.04696	7.84135	0.00000
PropType_Row House	0.18866	0.05074	3.71837	0.00020
PropType_Serviced Apartment	0.14833	0.08754	1.69443	0.09018
PropType_Studio	0.07384	0.04947	1.49256	0.13555
PropType_Studio Apartment	0.04544	0.04821	0.94254	0.34592
PropType_Triplex	0.45755	0.05647	8.10255	0.00000
PropType_Villa	0.42771	0.04699	9.10227	0.00000
PropType_Villament	0.44244	0.05847	7.56704	0.00000
Furnish_Fully Furnished	0.07488	0.00203	36.85768	0.00000
Furnish_Semi-Furnished	-0.01093	0.00132	-8.25051	0.00000
Furnish_Unfurnished	-0.01916	0.00125	-15.28279	0.00000
Rera_1.0	0.13410	0.00100	134.74253	0.00000
Rera_Missing	0.19793	0.00136	145.99204	0.00000
W_Log_Price	0.56987	0.00098	580.46441	0.00000

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Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar , W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur , W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,  
W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,  
W\_PropType\_Bungalow, W\_PropType\_Condo, W\_PropType\_Duplex,  
W\_PropType\_Farm House, W\_PropType\_Independent Floor,  
W\_PropType\_Independent House, W\_PropType\_Penthouse,  
W\_PropType\_Plot, W\_PropType\_Row House, W\_PropType\_Serviced  
Apartment, W\_PropType\_Studio, W\_PropType\_Studio Apartment,  
W\_PropType\_Triplex, W\_PropType\_Villa, W\_PropType\_Villament,  
W\_Rera\_1.0, W\_Rera\_Missing



# DIAGNOSTICS FOR SPATIAL DEPENDENCE

TEST	DF	VALUE	PROB
Anselin-Kelejian Test	1	43283.509	0.0000

## SPATIAL LAG MODEL IMPACTS

Impacts computed using the 'simple' method.

Variable	Direct	Indirect	Total
Mining_Coverage_Percent	0.0061	0.0081	0.0142
Area_Sqft	0.0000	0.0000	0.0000
Num_Bedrooms	0.2886	0.3824	0.6710
Landmark_School	-0.0078	-0.0103	-0.0181
Landmark_Hospital	0.0013	0.0017	0.0030
Landmark_Restaurant	-0.0102	-0.0136	-0.0238
Landmark_Mall	-0.0052	-0.0069	-0.0121
City_Badlapur	-0.0826	-0.1094	-0.1920
City_Bangalore	0.1856	0.2460	0.4316
City_Bhubaneswar	0.0085	0.0112	0.0197
City_Chennai	0.0299	0.0397	0.0696
City_Coimbatore	-0.0629	-0.0833	-0.1462
City_Faridabad	0.2269	0.3006	0.5274
City_Ghaziabad	0.0929	0.1231	0.2160
City_Greater Noida	0.1504	0.1992	0.3496
City_Gurgaon	0.4569	0.6054	1.0623
City_Hyderabad	0.0684	0.0907	0.1591
City_Indore	0.0755	0.1001	0.1756
City_Jaipur	-0.1238	-0.1640	-0.2878
City_Kalyan	0.1341	0.1777	0.3119
City_Kolkata	-0.0633	-0.0838	-0.1471
City_Lucknow	-0.0885	-0.1172	-0.2056
City_Mohali	0.0957	0.1268	0.2225
City_Mumbai	0.4471	0.5923	1.0393
City_Nagpur	-0.1424	-0.1886	-0.3310
City_Nashik	-0.1290	-0.1709	-0.2999
City_Navi Mumbai	0.2112	0.2798	0.4910
City_New Delhi	0.2257	0.2990	0.5246
City_Noida	0.1964	0.2603	0.4567
City_Other	-0.0393	-0.0521	-0.0915
City_Pune	0.1292	0.1711	0.3003
City_Raipur	-0.1642	-0.2175	-0.3817
City_Secunderabad	0.0312	0.0413	0.0725
City_Surat	-0.1084	-0.1436	-0.2520
City_Thane	0.1709	0.2264	0.3973
City_Vadodara	-0.2127	-0.2818	-0.4945
City_Visakhapatnam	-0.0440	-0.0582	-0.1022
PropType_Apartment	0.2418	0.3204	0.5622
PropType_Builder Floor	0.2001	0.2651	0.4651
PropType_Bungalow	0.2458	0.3256	0.5714
PropType_Condo	0.1767	0.2342	0.4109
PropType_Duplex	0.3895	0.5160	0.9055
PropType_Farm House	0.4596	0.6089	1.0686
PropType_Independent Floor	0.0693	0.0918	0.1611
PropType_Independent House	0.1813	0.2402	0.4214
PropType_Penthouse	0.6179	0.8186	1.4365
PropType_Plot	0.3682	0.4878	0.8561
PropType_Row House	0.1887	0.2499	0.4386
PropType_Serviced Apartment	0.1483	0.1965	0.3449
PropType_Studio	0.0738	0.0978	0.1717
PropType_Studio Apartment	0.0454	0.0602	0.1056
PropType_Triplex	0.4576	0.6062	1.0637

PropType_Villa	0.4277	0.5667	0.9944
PropType_Villament	0.4424	0.5862	1.0286
Furnish_Fully Furnished	0.0749	0.0992	0.1741
Furnish_Semi-Furnished	-0.0109	-0.0145	-0.0254
Furnish_Unfurnished	-0.0192	-0.0254	-0.0446
Rera_1.0	0.1341	0.1777	0.3118
Rera_Missing	0.1979	0.2622	0.4602

===== END OF REPORT =====

#### MINING COVERAGE EFFECTS

Coefficient: 0.006087  
 Std. Error: 0.000845  
 P-value: 0.000000  
 Impact: 0.61% per 1pp mining coverage

Spatial lag (:): 0.569867  
 Pseudo R<sup>2</sup>: 0.7721

### 1.1.5 3km Radius - SEM Model (Robustness)

#### SEM (SPATIAL ERROR) - ROBUSTNESS CHECK

Radius: 3.0km | Sample: 1,602,159 obs

#### MODEL SPECIFICATION:

$y = X* + u$   
 $u = W*u +$

Where:

$y = \text{Log}(\text{Price})$   
 $= \text{Spatial error coefficient (correlated shocks only)}$   
 $W = 8\text{-nearest neighbors matrix (row-standardized)}$   
 Estimation: GM (Generalized Method of Moments) with heteroskedasticity

#### REGRESSION RESULTS

#### SUMMARY OF OUTPUT: GM SPATIALLY WEIGHTED LEAST SQUARES (HET)

Data set	:	unknown		
Weights matrix	:	unknown		
Dependent Variable	:	Log_Price	Number of Observations:	1602159
Mean dependent var	:	15.7453	Number of Variables	60
S.D. dependent var	:	0.9819	Degrees of Freedom	1602099
Pseudo R-squared	:	0.3637		
N. of iterations	:	1	Stepic computed	No

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	14.81712	0.09182	161.36993	0.00000
Mining_Coverage_Percent	-0.00357	0.00649	-0.55009	0.58225
Area_Sqft	0.00001	0.00000	7.92559	0.00000
Num_Bedrooms	0.29316	0.00110	267.64456	0.00000

Landmark_School	-0.02076	0.00154	-13.47457	0.00000
Landmark_Hospital	0.00112	0.00146	0.76325	0.44531
Landmark_Restaurant	-0.02344	0.00146	-16.08723	0.00000
Landmark_Mall	-0.01484	0.00158	-9.36543	0.00000
City_Badlapur	-0.65737	0.02707	-24.28394	0.00000
City_Bangalore	0.21147	0.01753	12.06583	0.00000
City_Bhubaneswar	-0.11087	0.03575	-3.10117	0.00193
City_Chennai	-0.29880	0.01722	-17.34851	0.00000
City_Coimbatore	-0.55622	0.02923	-19.02808	0.00000
City_Faridabad	0.28908	0.03935	7.34641	0.00000
City_Ghaziabad	0.11589	0.02451	4.72898	0.00000
City_Greater Noida	0.13445	0.02240	6.00222	0.00000
City_Gurgaon	1.02280	0.02043	50.06935	0.00000
City_Hyderabad	-0.04959	0.01679	-2.95370	0.00314
City_Indore	-0.39726	0.03882	-10.23428	0.00000
City_Jaipur	-0.41462	0.02539	-16.32721	0.00000
City_Kalyan	-0.13304	0.02405	-5.53305	0.00000
City_Kolkata	-0.22999	0.01526	-15.07601	0.00000
City_Lucknow	-0.56474	0.03437	-16.43071	0.00000
City_Mohali	-0.17933	0.02078	-8.63207	0.00000
City_Mumbai	0.68038	0.01629	41.77921	0.00000
City_Nagpur	-0.67103	0.02892	-23.20548	0.00000
City_Nashik	-0.56038	0.02372	-23.62709	0.00000
City_Navi Mumbai	0.12923	0.01999	6.46604	0.00000
City_New Delhi	0.41522	0.02951	14.06859	0.00000
City_Noida	0.40678	0.03036	13.40054	0.00000
City_Other	-0.34174	0.01583	-21.58599	0.00000
City_Pune	0.06210	0.01417	4.38245	0.00001
City_Raipur	-0.93499	0.04853	-19.26672	0.00000
City_Secunderabad	-0.06189	0.03760	-1.64579	0.09981
City_Surat	-0.31199	0.03598	-8.67235	0.00000
City_Thane	-0.02091	0.01682	-1.24284	0.21393
City_Vadodara	-0.43025	0.03092	-13.91418	0.00000
City_Visakhapatnam	-0.36160	0.03930	-9.20020	0.00000
PropType_Apartment	0.11774	0.09064	1.29890	0.19398
PropType_Builder Floor	0.18906	0.09085	2.08102	0.03743
PropType_Bungalow	0.48802	0.09471	5.15279	0.00000
PropType_Condo	0.15781	0.18771	0.84073	0.40050
PropType_Duplex	0.42158	0.09079	4.64354	0.00000
PropType_Farm House	0.56756	0.09651	5.88061	0.00000
PropType_Independent Floor	0.01602	0.09067	0.17668	0.85976
PropType_Independent House	0.31523	0.09062	3.47857	0.00050
PropType_Penthouse	0.46434	0.09076	5.11632	0.00000
PropType_Plot	0.66833	0.09038	7.39454	0.00000
PropType_Row House	0.33529	0.09315	3.59923	0.00032
PropType_Serviced Apartment	-0.31447	0.10759	-2.92285	0.00347
PropType_Studio	-0.11234	0.09286	-1.20975	0.22638
PropType_Studio Apartment	-0.21673	0.09106	-2.38016	0.01730
PropType_Triplex	0.48687	0.12162	4.00338	0.00006
PropType_Villa	0.63783	0.09059	7.04077	0.00000
PropType_Villament	0.35914	0.09283	3.86884	0.00011
Furnish_Fully Furnished	0.10369	0.00227	45.67587	0.00000
Furnish_Semi-Furnished	0.01434	0.00132	10.83840	0.00000
Furnish_Unfurnished	0.00830	0.00125	6.61518	0.00000
Rera_1.0	0.20997	0.00260	80.82158	0.00000
Rera_Missing	0.21080	0.00298	70.79393	0.00000
lambda	0.87774	0.00143	612.29609	0.00000

===== END OF REPORT =====

```

=====
MINING COVERAGE EFFECTS
=====
Coefficient:      -0.003569
Std. Error:      0.006489
P-value:         0.582254
Impact:          -0.36% per 1pp mining coverage

Spatial error (): 0.877740
Pseudo R²:       0.3637

```

### 1.1.6 3km Radius - Machine Learning Results

```

=====
ML ANALYSIS - HARMONIZED VERSION (FIXED) (Radius: 3.0km)
Date: 2026-02-04 11:37:24
=====

```

#### FIXES IMPLEMENTED:

```

-----
NO data leakage: City selection from TRAINING set only
STANDARDIZED: Outlier removal BEFORE GeoDataFrame
ERROR HANDLING: Geometry operations protected
Imputation using TRAINING statistics only
All feature engineering respects train/test boundary
AUTO-DROP: Variables with >25% missing data excluded
HYPERPARAMETER TUNING: GridSearchCV on XGBoost, RF, GB

```

#### HARMONIZATION:

```

-----
Feature set IDENTICAL to lm_test.py, spatial_sdm_CORRECTED.py, final_CORRECTED.py
Same 9 continuous variables across ALL analyses
Top 30 cities (selected from training data only)

```

#### 1. PREDICTIVE MODELS

Model	MAE	RMSE	R²
XGBoost	0.272070	0.393293	0.8389
Random Forest	0.332190	0.468142	0.7718
Extra Trees	0.429521	0.582575	0.6466
Gradient Boosting	0.307000	0.433123	0.8047
LightGBM	0.343917	0.478622	0.7615
CatBoost	0.349735	0.485073	0.7550
Neural Network	0.334420	0.650266	0.5597
Ridge	0.537417	0.731659	0.4426
Lasso	0.541736	0.735699	0.4364
ElasticNet	0.539452	0.733203	0.4402

#### 2. TOP 20 FEATURES

```

-----
Area_Sqft           : 140.281702
Landmark_Mall       : 84.678278
Landmark_Restaurant : 81.437615
Landmark_Hospital   : 79.152488
Landmark_School     : 71.546150
Num_Bedrooms        : 66.294350

```

Mining_Coverage_Percent	: 54.119792
PropType_Plot	: 42.911467
Rera_1.0	: 28.301536
City_Mumbai	: 26.529159
PropType_Apartment	: 19.822529
City_Navi Mumbai	: 17.250408
City_Gurgaon	: 16.886920
City_Other	: 15.867396
City_Thane	: 15.737125
City_Pune	: 15.450616
City_Kolkata	: 14.254817
City_New Delhi	: 12.564394
Rera_Missing	: 12.299933
City_Greater Noida	: 12.225021

### 3. HETEROGENEOUS EFFECTS (PARTIAL DEPENDENCE - FIXED)

Effect across mining coverage range, controlling for:

- Property size, bedrooms, bathrooms, balconies
- Nearby amenities (schools, hospitals, restaurants, malls)
- City location (top 30 cities from training set)
- Property type, furnishing, RERA status
- All other property characteristics

Bungalow	: 6.87% (n= 615)
Studio	: 2.29% (n= 743)
Plot	: 0.36% (n=215,333)
Villa	: -0.06% (n=54,536)
Row House	: -1.31% (n= 497)
Triplex	: -3.05% (n= 177)
Duplex	: -3.17% (n= 6,865)
Agricultural Land	: -4.31% (n= 83)
Studio Apartment	: -5.01% (n= 1,506)
Independent House	: -5.20% (n=64,700)
Villament	: -6.14% (n= 150)
Builder Floor	: -10.87% (n= 6,410)
Apartment	: -12.66% (n=884,745)
Farm House	: -16.00% (n= 852)

NOTES:

This analysis uses IDENTICAL feature engineering to:

- lm\_test.py (OLS with LM diagnostics)
- spatial\_sdm\_CORRECTED.py (spatial econometric models)
- final\_CORRECTED.py (OLS + PSM pipeline)

CRITICAL: All feature engineering respects train/test boundary.

City selection uses TRAINING set only to prevent data leakage.

Results are directly comparable across all methodologies.

## 1.1.7 5km Radius - OLS Results

BASELINE OLS HEDONIC REGRESSION (Radius: 5.0km)

CORRECTED VERSION - Matches other analyses

Sample: 1,602,159 observations

# OLS Regression Results

```

=====
Dep. Variable:          Log_Price      R-squared:                0.440
Model:                  OLS            Adj. R-squared:           0.440
Method:                 Least Squares  F-statistic:              2.135e+04
Date:                   Tue, 03 Feb 2026 Prob (F-statistic):       0.00
Time:                   17:39:51       Log-Likelihood:           -1.7794e+06
No. Observations:      1602159        AIC:                     3.559e+06
Df Residuals:          1602099        BIC:                     3.560e+06
Df Model:               59
Covariance Type:       nonrobust
=====

```

	coef	std err	t	P> t	[0.025	0.975]
const	14.0893	0.072	195.273	0.000	13.948	14.231
Mining_Coverage_Percent	0.0053	0.002	3.081	0.002	0.002	0.009
Area_Sqft	1.83e-05	1.09e-07	168.248	0.000	1.81e-05	1.85e-05
Num_Bedrooms	0.4455	0.001	684.760	0.000	0.444	0.447
Landmark_School	-0.0216	0.000	-45.947	0.000	-0.023	-0.021
Landmark_Hospital	0.0045	0.000	10.259	0.000	0.004	0.005
Landmark_Restaurant	-0.0275	0.000	-63.892	0.000	-0.028	-0.027
Landmark_Mall	-0.0149	0.000	-31.176	0.000	-0.016	-0.014
City_Badlapur	-0.5380	0.008	-64.810	0.000	-0.554	-0.522
City_Bangalore	0.4187	0.004	108.244	0.000	0.411	0.426
City_Bhubaneswar	0.0362	0.007	4.969	0.000	0.022	0.050
City_Chennai	0.0292	0.004	7.651	0.000	0.022	0.037
City_Coimbatore	-0.1427	0.006	-25.883	0.000	-0.154	-0.132
City_Faridabad	0.5456	0.007	79.265	0.000	0.532	0.559
City_Ghaziabad	0.1865	0.005	35.053	0.000	0.176	0.197
City_Greater Noida	0.3331	0.005	67.897	0.000	0.323	0.343
City_Gurgaon	1.1116	0.004	254.421	0.000	1.103	1.120
City_Hyderabad	0.1972	0.004	52.530	0.000	0.190	0.205
City_Indore	0.1180	0.007	17.922	0.000	0.105	0.131
City_Jaipur	-0.2356	0.005	-48.738	0.000	-0.245	-0.226
City_Kalyan	0.0118	0.008	1.409	0.159	-0.005	0.028
City_Kolkata	-0.1904	0.004	-52.264	0.000	-0.198	-0.183
City_Lucknow	-0.1766	0.006	-30.843	0.000	-0.188	-0.165
City_Mohali	0.2528	0.007	33.738	0.000	0.238	0.267
City_Mumbai	0.8376	0.004	215.210	0.000	0.830	0.845
City_Nagpur	-0.3414	0.006	-57.438	0.000	-0.353	-0.330
City_Nashik	-0.4672	0.007	-71.504	0.000	-0.480	-0.454
City_Navi Mumbai	0.2482	0.005	49.026	0.000	0.238	0.258
City_New Delhi	0.4868	0.005	89.812	0.000	0.476	0.497
City_Noida	0.4380	0.006	77.421	0.000	0.427	0.449
City_Other	-0.1442	0.003	-42.086	0.000	-0.151	-0.137
City_Pune	0.1497	0.003	43.348	0.000	0.143	0.156
City_Raipur	-0.3736	0.009	-41.504	0.000	-0.391	-0.356
City_Secunderabad	0.1384	0.008	16.594	0.000	0.122	0.155
City_Surat	-0.2503	0.008	-31.796	0.000	-0.266	-0.235
City_Thane	0.1305	0.004	30.371	0.000	0.122	0.139
City_Vadodara	-0.4151	0.007	-58.964	0.000	-0.429	-0.401
City_Visakhapatnam	-0.1747	0.008	-22.259	0.000	-0.190	-0.159
PropType_Apartment	0.4021	0.072	5.579	0.000	0.261	0.543
PropType_Builder Floor	0.3263	0.073	4.497	0.000	0.184	0.469
PropType_Bungalow	0.3319	0.077	4.319	0.000	0.181	0.482
PropType_Condo	0.7619	0.524	1.453	0.146	-0.266	1.790
PropType_Duplex	0.4887	0.073	6.740	0.000	0.347	0.631
PropType_Farm House	0.3714	0.075	4.921	0.000	0.223	0.519

PropType_Independent Floor	0.1750	0.072	2.425	0.015	0.034	0.316
PropType_Independent House	0.0775	0.072	1.075	0.282	-0.064	0.219
PropType_Penthouse	0.9507	0.073	13.018	0.000	0.808	1.094
PropType_Plot	0.4295	0.072	5.959	0.000	0.288	0.571
PropType_Row House	0.2252	0.078	2.892	0.004	0.073	0.378
PropType_Serviced Apartment	0.3428	0.134	2.551	0.011	0.079	0.606
PropType_Studio	0.2865	0.076	3.773	0.000	0.138	0.435
PropType_Studio Apartment	0.1986	0.074	2.683	0.007	0.054	0.344
PropType_Triplex	0.8633	0.087	9.962	0.000	0.693	1.033
PropType_Villa	0.6299	0.072	8.735	0.000	0.489	0.771
PropType_Villament	0.8774	0.090	9.778	0.000	0.702	1.053
Furnish_Fully Furnished	0.1124	0.003	36.072	0.000	0.106	0.119
Furnish_Semi-Furnished	0.0176	0.002	8.644	0.000	0.014	0.022
Furnish_Unfurnished	0.0011	0.002	0.573	0.566	-0.003	0.005
Rera_1.0	0.2666	0.001	179.346	0.000	0.264	0.270
Rera_Missing	0.3580	0.002	175.709	0.000	0.354	0.362

```

=====
Omnibus:                285249.325   Durbin-Watson:                0.943
Prob(Omnibus):           0.000   Jarque-Bera (JB):            7150947.730
Skew:                    -0.087   Prob(JB):                     0.00
Kurtosis:                13.348   Cond. No.                     5.08e+06
=====

```

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
[2] The condition number is large, 5.08e+06. This might indicate that there are strong multicollinearity or other numerical problems.

## 1.1.8 5km Radius - PSM Results

```

=====
PROPSENSITY SCORE MATCHING RESULTS (Radius: 5.0km)
=====

```

ROBUSTNESS ACROSS TREATMENT THRESHOLDS

THRESHOLD: Mining coverage > 0.3%

```

-----
Treated units: 155,191
Control units: 1,446,968
Matched pairs: 155,191
Match rate: 100.0%

```

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

```

ATT: 11.25%
Standard Error: 0.34%
95% CI: [10.53%, 11.93%]

```

Interpretation: Properties near mines (>0.3% coverage) are  
11.25% more expensive than similar properties not near mines.

```

=====
THRESHOLD: Mining coverage > 0.5%
-----

```

```

Treated units: 102,407
Control units: 1,499,752

```

Matched pairs: 102,407  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: 19.52%  
Standard Error: 0.43%  
95% CI: [18.71%, 20.30%]

Interpretation: Properties near mines (>0.5% coverage) are  
19.52% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 1.0%

-----

Treated units: 42,355  
Control units: 1,559,804  
Matched pairs: 42,355  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: 14.35%  
Standard Error: 0.76%  
95% CI: [12.90%, 15.84%]

Interpretation: Properties near mines (>1.0% coverage) are  
14.35% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 2.0%

-----

Treated units: 24,678  
Control units: 1,577,481  
Matched pairs: 24,678  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: 13.24%  
Standard Error: 0.91%  
95% CI: [11.28%, 14.79%]

Interpretation: Properties near mines (>2.0% coverage) are  
13.24% more expensive than similar properties not near mines.

=====

SUMMARY TABLE

-----

Threshold	Treated	Matched	ATT	95% CI
0.3%	155,191	155,191	11.25	% [10.53%, 11.93%]
0.5%	102,407	102,407	19.52	% [18.71%, 20.30%]
1.0%	42,355	42,355	14.35	% [12.90%, 15.84%]
2.0%	24,678	24,678	13.24	% [11.28%, 14.79%]

-----

NOTES:



- Method: 1:1 Nearest Neighbor Matching with caliper=0.1
- Standard errors computed via bootstrap (200 iterations)
- All matches achieved within caliper threshold

### 1.1.9 5km Radius - SAC Model

```
=====
SAC (SPATIAL AUTOREGRESSIVE COMBINED) - PRIMARY MODEL
Radius: 5.0km | Sample: 1,602,159 obs
=====
```

#### MODEL SPECIFICATION:

```
-----
y = W*y + X* + u
u = W*u +
```

Where:

```
y = Log(Price)
= Spatial lag coefficient (spillover effects)
= Spatial error coefficient (correlated shocks)
W = 8-nearest neighbors matrix (row-standardized)
```

#### REGRESSION RESULTS

##### SUMMARY OF OUTPUT: SPATIALLY WEIGHTED 2SLS- GM-COMBO MODEL (HET)

```
-----
Data set      :      unknown
Weights matrix :      unknown
Dependent Variable :  Log_Price      Number of Observations:  1602159
Mean dependent var :   15.7453      Number of Variables   :       61
S.D. dependent var :    0.9819      Degrees of Freedom    :  1602098
Pseudo R-squared  :    0.7667
Spatial Pseudo R-squared:  0.4128
N. of iterations   :          1      Step1c computed      :      No
```

```
-----
Variable      Coefficient      Std. Error      z-Statistic      Probability
-----
CONSTANT      5.35985      0.10343      51.81954      0.00000
Mining_Coverage_Percent      0.02291      0.00288      7.94314      0.00000
Area_Sqft      0.00001      0.00000      7.50902      0.00000
Num_Bedrooms      0.28963      0.00116      249.84196      0.00000
Landmark_School      -0.01145      0.00072      -15.97704      0.00000
Landmark_Hospital      0.00067      0.00066      1.01712      0.30909
Landmark_Restaurant      -0.01120      0.00066      -16.91215      0.00000
Landmark_Mall      -0.00643      0.00071      -9.02127      0.00000
City_Badlapur      -0.04440      0.00835      -5.31539      0.00000
City_Bangalore      0.13923      0.00587      23.73455      0.00000
City_Bhubaneswar      -0.02576      0.01146      -2.24835      0.02455
City_Chennai      -0.05838      0.00609      -9.59156      0.00000
City_Coimbatore      -0.18909      0.01004      -18.83201      0.00000
City_Faridabad      0.13844      0.01206      11.47427      0.00000
City_Ghaziabad      0.07731      0.00794      9.73155      0.00000
City_Greater Noida      0.10243      0.00759      13.50049      0.00000
City_Gurgaon      0.41496      0.00712      58.25427      0.00000
City_Hyderabad      -0.01494      0.00572      -2.61064      0.00904
City_Indore      -0.07878      0.01380      -5.70893      0.00000
```

City_Jaipur	-0.18295	0.00854	-21.42083	0.00000
City_Kalyan	0.15370	0.00879	17.47985	0.00000
City_Kolkata	-0.05034	0.00524	-9.60673	0.00000
City_Lucknow	-0.20224	0.01142	-17.70708	0.00000
City_Mohali	0.01967	0.01043	1.88526	0.05939
City_Mumbai	0.44902	0.00539	83.35073	0.00000
City_Nagpur	-0.23582	0.00991	-23.80709	0.00000
City_Nashik	-0.11042	0.00835	-13.22020	0.00000
City_Navi Mumbai	0.21340	0.00756	28.23396	0.00000
City_New Delhi	0.21631	0.00962	22.47898	0.00000
City_Noida	0.19938	0.00984	20.25995	0.00000
City_Other	-0.08952	0.00553	-16.18224	0.00000
City_Pune	0.14005	0.00483	29.00729	0.00000
City_Raipur	-0.33670	0.01623	-20.75126	0.00000
City_Secunderabad	-0.04224	0.01413	-2.98843	0.00280
City_Surat	-0.12095	0.01237	-9.77747	0.00000
City_Thane	0.19000	0.00577	32.94193	0.00000
City_Vadodara	-0.22538	0.01068	-21.09475	0.00000
City_Visakhapatnam	-0.08037	0.01322	-6.07989	0.00000
PropType_Apartment	0.32485	0.09430	3.44470	0.00057
PropType_Builder Floor	0.35289	0.09446	3.73595	0.00019
PropType_Bungalow	0.55307	0.09744	5.67573	0.00000
PropType_Condo	0.21149	0.14559	1.45262	0.14633
PropType_Duplex	0.57555	0.09445	6.09366	0.00000
PropType_Farm House	0.68154	0.10000	6.81515	0.00000
PropType_Independent Floor	0.18214	0.09434	1.93065	0.05353
PropType_Independent House	0.44566	0.09432	4.72489	0.00000
PropType_Penthouse	0.68556	0.09438	7.26409	0.00000
PropType_Plot	0.70672	0.09405	7.51446	0.00000
PropType_Row House	0.44128	0.09648	4.57366	0.00000
PropType_Serviced Apartment	-0.10054	0.11820	-0.85059	0.39500
PropType_Studio	0.07766	0.09652	0.80458	0.42106
PropType_Studio Apartment	0.01189	0.09471	0.12559	0.90006
PropType_Triplex	0.59655	0.12153	4.90844	0.00000
PropType_Villa	0.71085	0.09425	7.54241	0.00000
PropType_Villament	0.52942	0.09628	5.49890	0.00000
Furnish_Fully Furnished	0.08253	0.00231	35.71302	0.00000
Furnish_Semi-Furnished	-0.00705	0.00131	-5.37141	0.00000
Furnish_Unfurnished	-0.01251	0.00124	-10.05532	0.00000
Rera_1.0	0.15866	0.00179	88.48625	0.00000
Rera_Missing	0.18884	0.00250	75.58785	0.00000
W_Log_Price	0.58346	0.00262	222.31384	0.00000
lambda	0.62592	0.00333	187.83451	0.00000

-----  
Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar, W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur, W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,  
W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,

```

W_PropType_Bungalow, W_PropType_Condo, W_PropType_Duplex,
W_PropType_Farm House, W_PropType_Independent Floor,
W_PropType_Independent House, W_PropType_Penthouse,
W_PropType_Plot, W_PropType_Row House, W_PropType_Serviced
Apartment, W_PropType_Studio, W_PropType_Studio Apartment,
W_PropType_Triplex, W_PropType_Villa, W_PropType_Villament,
W_Rera_1.0, W_Rera_Missing
===== END OF REPORT =====

```

#### MINING COVERAGE EFFECTS

```

Coefficient:      0.022914
Std. Error:      0.002885
P-value:         0.000000
Impact:          2.32% per 1pp mining coverage

```

```

Spatial lag (): 0.583459
Spatial error (): 0.625924
Pseudo R²:      0.7667

```

### 1.1.10 5km Radius - SAR Model (Robustness)

#### SAR (SPATIAL LAG) - ROBUSTNESS CHECK

```
Radius: 5.0km | Sample: 1,602,159 obs
```

#### MODEL SPECIFICATION:

```
y = W*y + X* +
```

Where:

```

y = Log(Price)
  = Spatial lag coefficient (spillover effects only)
W = 8-nearest neighbors matrix (row-standardized)
Estimation: GM (Generalized Method of Moments)

```

#### REGRESSION RESULTS

#### SUMMARY OF OUTPUT: SPATIAL TWO STAGE LEAST SQUARES

```

Data set      :      unknown
Weights matrix :      unknown
Dependent Variable :  Log_Price      Number of Observations:  1602159
Mean dependent var :   15.7453      Number of Variables   :       61
S.D. dependent var :    0.9819      Degrees of Freedom    :  1602098
Pseudo R-squared   :    0.7721
Spatial Pseudo R-squared:  0.4815

```

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	5.68961	0.04918	115.68028	0.00000
Mining_Coverage_Percent	0.01248	0.00111	11.19266	0.00000
Area_Sqft	0.00001	0.00000	186.88600	0.00000
Num_Bedrooms	0.28864	0.00050	574.31328	0.00000

Landmark_School	-0.00769	0.00031	-25.04539	0.00000
Landmark_Hospital	0.00129	0.00029	4.50537	0.00001
Landmark_Restaurant	-0.01017	0.00028	-36.03869	0.00000
Landmark_Mall	-0.00520	0.00031	-16.61263	0.00000
City_Badlapur	-0.08327	0.00546	-15.23628	0.00000
City_Bangalore	0.18418	0.00255	72.15740	0.00000
City_Bhubaneswar	0.00813	0.00475	1.71247	0.08681
City_Chennai	0.02923	0.00249	11.74081	0.00000
City_Coimbatore	-0.06324	0.00360	-17.59151	0.00000
City_Faridabad	0.22636	0.00452	50.09788	0.00000
City_Ghaziabad	0.09279	0.00347	26.73857	0.00000
City_Greater Noida	0.15023	0.00321	46.77592	0.00000
City_Gurgaon	0.45636	0.00306	149.03586	0.00000
City_Hyderabad	0.06774	0.00246	27.58172	0.00000
City_Indore	0.06957	0.00429	16.21184	0.00000
City_Jaipur	-0.12399	0.00316	-39.29558	0.00000
City_Kalyan	0.13308	0.00545	24.40823	0.00000
City_Kolkata	-0.06328	0.00238	-26.54670	0.00000
City_Lucknow	-0.08858	0.00373	-23.72787	0.00000
City_Mohali	0.09555	0.00489	19.54282	0.00000
City_Mumbai	0.44637	0.00262	170.13135	0.00000
City_Nagpur	-0.14286	0.00389	-36.75259	0.00000
City_Nashik	-0.12961	0.00430	-30.16843	0.00000
City_Navi Mumbai	0.20103	0.00330	60.94237	0.00000
City_New Delhi	0.22564	0.00356	63.38928	0.00000
City_Noida	0.19642	0.00371	52.95364	0.00000
City_Other	-0.03991	0.00224	-17.81804	0.00000
City_Pune	0.12861	0.00225	57.15040	0.00000
City_Raipur	-0.16489	0.00588	-28.06496	0.00000
City_Secunderabad	0.03084	0.00544	5.67155	0.00000
City_Surat	-0.10840	0.00513	-21.11302	0.00000
City_Thane	0.16993	0.00280	60.67809	0.00000
City_Vadodara	-0.21273	0.00460	-46.24939	0.00000
City_Visakhapatnam	-0.04443	0.00512	-8.68107	0.00000
PropType_Apartment	0.24128	0.04695	5.13871	0.00000
PropType_Builder Floor	0.19963	0.04728	4.22265	0.00002
PropType_Bungalow	0.24571	0.05006	4.90788	0.00000
PropType_Condo	0.17650	0.34171	0.51650	0.60550
PropType_Duplex	0.38915	0.04724	8.23722	0.00000
PropType_Farm House	0.45905	0.04917	9.33591	0.00000
PropType_Independent Floor	0.06886	0.04702	1.46432	0.14311
PropType_Independent House	0.18081	0.04700	3.84721	0.00012
PropType_Penthouse	0.61757	0.04758	12.97899	0.00000
PropType_Plot	0.36789	0.04696	7.83451	0.00000
PropType_Row House	0.18830	0.05074	3.71146	0.00021
PropType_Serviced Apartment	0.14794	0.08754	1.68994	0.09104
PropType_Studio	0.07342	0.04947	1.48412	0.13778
PropType_Studio Apartment	0.04520	0.04821	0.93763	0.34843
PropType_Triplex	0.45690	0.05647	8.09128	0.00000
PropType_Villa	0.42711	0.04699	9.08979	0.00000
PropType_Villament	0.44228	0.05847	7.56456	0.00000
Furnish_Fully Furnished	0.07485	0.00203	36.84368	0.00000
Furnish_Semi-Furnished	-0.01096	0.00132	-8.27457	0.00000
Furnish_Unfurnished	-0.01932	0.00125	-15.41016	0.00000
Rera_1.0	0.13415	0.00100	134.81239	0.00000
Rera_Missing	0.19804	0.00136	146.07159	0.00000
W_Log_Price	0.56986	0.00098	580.63494	0.00000

-----  
Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar , W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur , W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,  
W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,  
W\_PropType\_Bungalow, W\_PropType\_Condo, W\_PropType\_Duplex,  
W\_PropType\_Farm House, W\_PropType\_Independent Floor,  
W\_PropType\_Independent House, W\_PropType\_Penthouse,  
W\_PropType\_Plot, W\_PropType\_Row House, W\_PropType\_Serviced  
Apartment, W\_PropType\_Studio, W\_PropType\_Studio Apartment,  
W\_PropType\_Triplex, W\_PropType\_Villa, W\_PropType\_Villament,  
W\_Rera\_1.0, W\_Rera\_Missing

#### DIAGNOSTICS FOR SPATIAL DEPENDENCE

TEST	DF	VALUE	PROB
Anselin-Kelejian Test	1	43302.009	0.0000

#### SPATIAL LAG MODEL IMPACTS

Impacts computed using the 'simple' method.

Variable	Direct	Indirect	Total
Mining_Coverage_Percent	0.0125	0.0165	0.0290
Area_Sqft	0.0000	0.0000	0.0000
Num_Bedrooms	0.2886	0.3824	0.6711
Landmark_School	-0.0077	-0.0102	-0.0179
Landmark_Hospital	0.0013	0.0017	0.0030
Landmark_Restaurant	-0.0102	-0.0135	-0.0236
Landmark_Mall	-0.0052	-0.0069	-0.0121
City_Badlapur	-0.0833	-0.1103	-0.1936
City_Bangalore	0.1842	0.2440	0.4282
City_Bhubaneswar	0.0081	0.0108	0.0189
City_Chennai	0.0292	0.0387	0.0679
City_Coimbatore	-0.0632	-0.0838	-0.1470
City_Faridabad	0.2264	0.2999	0.5262
City_Ghaziabad	0.0928	0.1229	0.2157
City_Greater Noida	0.1502	0.1990	0.3493
City_Gurgaon	0.4564	0.6046	1.0610
City_Hyderabad	0.0677	0.0897	0.1575
City_Indore	0.0696	0.0922	0.1617
City_Jaipur	-0.1240	-0.1643	-0.2883
City_Kalyan	0.1331	0.1763	0.3094
City_Kolkata	-0.0633	-0.0838	-0.1471
City_Lucknow	-0.0886	-0.1174	-0.2059
City_Mohali	0.0956	0.1266	0.2222
City_Mumbai	0.4464	0.5914	1.0377
City_Nagpur	-0.1429	-0.1893	-0.3321
City_Nashik	-0.1296	-0.1717	-0.3013
City_Navi Mumbai	0.2010	0.2663	0.4674
City_New Delhi	0.2256	0.2989	0.5246
City_Noida	0.1964	0.2602	0.4566
City_Other	-0.0399	-0.0529	-0.0928

City_Pune	0.1286	0.1704	0.2990
City_Raipur	-0.1649	-0.2184	-0.3833
City_Secunderabad	0.0308	0.0409	0.0717
City_Surat	-0.1084	-0.1436	-0.2520
City_Thane	0.1699	0.2251	0.3951
City_Vadodara	-0.2127	-0.2818	-0.4946
City_Visakhapatnam	-0.0444	-0.0589	-0.1033
PropType_Apartment	0.2413	0.3197	0.5609
PropType_Builder Floor	0.1996	0.2645	0.4641
PropType_Bungalow	0.2457	0.3255	0.5712
PropType_Condo	0.1765	0.2338	0.4103
PropType_Duplex	0.3892	0.5156	0.9047
PropType_Farm House	0.4590	0.6082	1.0672
PropType_Independent Floor	0.0689	0.0912	0.1601
PropType_Independent House	0.1808	0.2395	0.4204
PropType_Penthouse	0.6176	0.8182	1.4358
PropType_Plot	0.3679	0.4874	0.8553
PropType_Row House	0.1883	0.2495	0.4378
PropType_Serviced Apartment	0.1479	0.1960	0.3439
PropType_Studio	0.0734	0.0973	0.1707
PropType_Studio Apartment	0.0452	0.0599	0.1051
PropType_Triplex	0.4569	0.6053	1.0622
PropType_Villa	0.4271	0.5659	0.9930
PropType_Villament	0.4423	0.5860	1.0282
Furnish_Fully Furnished	0.0748	0.0992	0.1740
Furnish_Semi-Furnished	-0.0110	-0.0145	-0.0255
Furnish_Unfurnished	-0.0193	-0.0256	-0.0449
Rera_1.0	0.1341	0.1777	0.3119
Rera_Missing	0.1980	0.2624	0.4604

===== END OF REPORT =====

#### MINING COVERAGE EFFECTS

Coefficient: 0.012479  
 Std. Error: 0.001115  
 P-value: 0.000000  
 Impact: 1.26% per 1pp mining coverage

Spatial lag (): 0.569864  
 Pseudo R<sup>2</sup>: 0.7721

### 1.1.11 5km Radius - SEM Model (Robustness)

#### SEM (SPATIAL ERROR) - ROBUSTNESS CHECK

Radius: 5.0km | Sample: 1,602,159 obs

#### MODEL SPECIFICATION:

$y = X* + u$   
 $u = W*u +$

Where:

$y = \text{Log}(\text{Price})$   
 $= \text{Spatial error coefficient (correlated shocks only)}$   
 $W = 8\text{-nearest neighbors matrix (row-standardized)}$

Estimation: GM (Generalized Method of Moments) with heteroskedasticity

# REGRESSION RESULTS

## SUMMARY OF OUTPUT: GM SPATIALLY WEIGHTED LEAST SQUARES (HET)

```

Data set      :      unknown
Weights matrix :      unknown
Dependent Variable :  Log_Price      Number of Observations:  1602159
Mean dependent var :   15.7453      Number of Variables   :       60
S.D. dependent var :    0.9819      Degrees of Freedom    :  1602099
Pseudo R-squared :    0.3637
N. of iterations :          1      Step1c computed      :      No
  
```

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	14.81705	0.09183	161.35963	0.00000
Mining_Coverage_Percent	0.02550	0.00932	2.73587	0.00622
Area_Sqft	0.00001	0.00000	7.92564	0.00000
Num_Bedrooms	0.29318	0.00110	267.66607	0.00000
Landmark_School	-0.02060	0.00154	-13.36820	0.00000
Landmark_Hospital	0.00118	0.00146	0.80761	0.41932
Landmark_Restaurant	-0.02344	0.00146	-16.09079	0.00000
Landmark_Mall	-0.01509	0.00158	-9.52487	0.00000
City_Badlapur	-0.66409	0.02709	-24.51429	0.00000
City_Bangalore	0.20660	0.01759	11.74425	0.00000
City_Bhubaneswar	-0.11175	0.03575	-3.12565	0.00177
City_Chennai	-0.30099	0.01724	-17.46163	0.00000
City_Coimbatore	-0.55812	0.02923	-19.09274	0.00000
City_Faridabad	0.28800	0.03936	7.31787	0.00000
City_Ghaziabad	0.11571	0.02450	4.72201	0.00000
City_Greater Noida	0.13442	0.02240	6.00123	0.00000
City_Gurgaon	1.02143	0.02042	50.01735	0.00000
City_Hyderabad	-0.05204	0.01680	-3.09686	0.00196
City_Indore	-0.41733	0.03929	-10.62264	0.00000
City_Jaipur	-0.41495	0.02539	-16.34061	0.00000
City_Kalyan	-0.13596	0.02407	-5.64938	0.00000
City_Kolkata	-0.23006	0.01526	-15.08024	0.00000
City_Lucknow	-0.56475	0.03437	-16.43122	0.00000
City_Mohali	-0.18106	0.02079	-8.70970	0.00000
City_Mumbai	0.67653	0.01632	41.46317	0.00000
City_Nagpur	-0.67164	0.02892	-23.22615	0.00000
City_Nashik	-0.56202	0.02373	-23.68814	0.00000
City_Navi Mumbai	0.09262	0.02248	4.11953	0.00004
City_New Delhi	0.41526	0.02952	14.06932	0.00000
City_Noida	0.40682	0.03036	13.40116	0.00000
City_Other	-0.34418	0.01585	-21.71232	0.00000
City_Pune	0.06028	0.01418	4.25060	0.00002
City_Raipur	-0.93689	0.04853	-19.30452	0.00000
City_Secunderabad	-0.06272	0.03760	-1.66785	0.09535
City_Surat	-0.31208	0.03598	-8.67432	0.00000
City_Thane	-0.02484	0.01686	-1.47326	0.14068
City_Vadodara	-0.43021	0.03092	-13.91587	0.00000
City_Visakhapatnam	-0.36327	0.03931	-9.24177	0.00000
PropType_Apartment	0.11795	0.09065	1.30115	0.19321
PropType_Builder Floor	0.18930	0.09086	2.08349	0.03721
PropType_Bungalow	0.48840	0.09472	5.15655	0.00000

PropType_Condo	0.15828	0.18767	0.84342	0.39900
PropType_Duplex	0.42185	0.09079	4.64614	0.00000
PropType_Farm House	0.56765	0.09652	5.88112	0.00000
PropType_Independent Floor	0.01627	0.09068	0.17947	0.85757
PropType_Independent House	0.31548	0.09063	3.48104	0.00050
PropType_Penthouse	0.46457	0.09076	5.11844	0.00000
PropType_Plot	0.66873	0.09039	7.39845	0.00000
PropType_Row House	0.33564	0.09316	3.60277	0.00031
PropType_Serviced Apartment	-0.31413	0.10760	-2.91948	0.00351
PropType_Studio	-0.11215	0.09287	-1.20762	0.22719
PropType_Studio Apartment	-0.21646	0.09106	-2.37710	0.01745
PropType_Triplex	0.48610	0.12161	3.99705	0.00006
PropType_Villa	0.63807	0.09060	7.04286	0.00000
PropType_Villament	0.35954	0.09283	3.87304	0.00011
Furnish_Fully Furnished	0.10371	0.00227	45.68687	0.00000
Furnish_Semi-Furnished	0.01438	0.00132	10.86703	0.00000
Furnish_Unfurnished	0.00831	0.00125	6.62192	0.00000
Rera_1.0	0.20989	0.00260	80.79140	0.00000
Rera_Missing	0.21079	0.00298	70.79137	0.00000
lambda	0.87774	0.00143	612.28933	0.00000

===== END OF REPORT =====

#### MINING COVERAGE EFFECTS

Coefficient: 0.025501  
 Std. Error: 0.009321  
 P-value: 0.006222  
 Impact: 2.58% per 1pp mining coverage

Spatial error (): 0.877737  
 Pseudo R<sup>2</sup>: 0.3637

## 1.1.12 5km Radius - Machine Learning Results

ML ANALYSIS - HARMONIZED VERSION (FIXED) (Radius: 5.0km)  
 Date: 2026-02-04 02:18:41

#### FIXES IMPLEMENTED:

NO data leakage: City selection from TRAINING set only  
 STANDARDIZED: Outlier removal BEFORE GeoDataFrame  
 ERROR HANDLING: Geometry operations protected  
 Imputation using TRAINING statistics only  
 All feature engineering respects train/test boundary  
 AUTO-DROP: Variables with >25% missing data excluded  
 HYPERPARAMETER TUNING: GridSearchCV on XGBoost, RF, GB

#### HARMONIZATION:

Feature set IDENTICAL to lm\_test.py, spatial\_sdm\_CORRECTED.py, final\_CORRECTED.py  
 Same 9 continuous variables across ALL analyses  
 Top 30 cities (selected from training data only)

#### 1. PREDICTIVE MODELS



Model	MAE	RMSE	R <sup>2</sup>
XGBoost	0.266051	0.387356	0.8438
Random Forest	0.327856	0.464554	0.7753
Extra Trees	0.428963	0.581592	0.6478
Gradient Boosting	0.325436	0.456467	0.7830
LightGBM	0.339452	0.474506	0.7655
CatBoost	0.346745	0.482549	0.7575
Neural Network	0.329739	0.467540	0.7724
Ridge	0.537450	0.731651	0.4426
Lasso	0.541736	0.735699	0.4364
ElasticNet	0.539452	0.733202	0.4402

## 2. TOP 20 FEATURES

Area_Sqft	: 133.224791
Landmark_Mall	: 78.890151
Mining_Coverage_Percent	: 75.678026
Landmark_Restaurant	: 69.763734
Landmark_Hospital	: 68.860601
Num_Bedrooms	: 67.584935
Landmark_School	: 67.231602
PropType_Plot	: 44.263379
Rera_1.0	: 31.108729
City_Mumbai	: 28.194046
PropType_Apartment	: 19.309746
City_Other	: 18.025013
City_Pune	: 17.639245
City_Gurgaon	: 16.720928
City_Thane	: 16.258575
City_Navi Mumbai	: 16.218813
City_Kolkata	: 15.744851
City_New Delhi	: 12.728579
City_Bangalore	: 12.339864
Rera_Missing	: 11.972935

## 3. HETEROGENEOUS EFFECTS (PARTIAL DEPENDENCE - FIXED)

Effect across mining coverage range, controlling for:

- Property size, bedrooms, bathrooms, balconies
- Nearby amenities (schools, hospitals, restaurants, malls)
- City location (top 30 cities from training set)
- Property type, furnishing, RERA status
- All other property characteristics

Bungalow	: 18.45% (n= 615)
Independent Floor	: 2.14% (n=41,350)
Row House	: 1.70% (n= 497)
Farm House	: -2.36% (n= 852)
Agricultural Land	: -3.32% (n= 83)
Apartment	: -4.34% (n=884,745)
Plot	: -6.10% (n=215,333)
Villament	: -6.54% (n= 150)
Penthouse	: -6.91% (n= 3,130)
Studio	: -7.08% (n= 743)
Villa	: -7.68% (n=54,536)
Studio Apartment	: -8.37% (n= 1,506)
Triplex	: -8.66% (n= 177)

Duplex : -9.16% (n= 6,865)  
Independent House : -9.72% (n=64,700)

#### NOTES:

This analysis uses IDENTICAL feature engineering to:

- lm\_test.py (OLS with LM diagnostics)
- spatial\_sdm\_CORRECTED.py (spatial econometric models)
- final\_CORRECTED.py (OLS + PSM pipeline)

CRITICAL: All feature engineering respects train/test boundary.  
City selection uses TRAINING set only to prevent data leakage.  
Results are directly comparable across all methodologies.

### 1.1.13 7km Radius - OLS Results

BASELINE OLS HEDONIC REGRESSION (Radius: 7.0km)

CORRECTED VERSION - Matches other analyses

Sample: 1,602,159 observations

#### OLS Regression Results

```

Dep. Variable:      Log_Price      R-squared:      0.440
Model:              OLS            Adj. R-squared:  0.440
Method:             Least Squares  F-statistic:   2.135e+04
Date:               Tue, 03 Feb 2026 Prob (F-statistic): 0.00
Time:               17:42:23       Log-Likelihood: -1.7794e+06
No. Observations:   1602159       AIC:           3.559e+06
Df Residuals:       1602099       BIC:           3.560e+06
Df Model:           59
Covariance Type:    nonrobust

```

	coef	std err	t	P> t	[0.025	0.975]
const	14.0892	0.072	195.274	0.000	13.948	14.231
Mining_Coverage_Percent	0.0171	0.002	6.857	0.000	0.012	0.022
Area_Sqft	1.83e-05	1.09e-07	168.242	0.000	1.81e-05	1.85e-05
Num_Bedrooms	0.4456	0.001	684.788	0.000	0.444	0.447
Landmark_School	-0.0216	0.000	-45.909	0.000	-0.022	-0.021
Landmark_Hospital	0.0045	0.000	10.232	0.000	0.004	0.005
Landmark_Restaurant	-0.0276	0.000	-64.014	0.000	-0.028	-0.027
Landmark_Mall	-0.0149	0.000	-31.174	0.000	-0.016	-0.014
City_Badlapur	-0.5393	0.008	-64.968	0.000	-0.556	-0.523
City_Bangalore	0.4165	0.004	107.215	0.000	0.409	0.424
City_Bhubaneswar	0.0358	0.007	4.911	0.000	0.022	0.050
City_Chennai	0.0284	0.004	7.426	0.000	0.021	0.036
City_Coimbatore	-0.1433	0.006	-25.988	0.000	-0.154	-0.132
City_Faridabad	0.5451	0.007	79.193	0.000	0.532	0.559
City_Ghaziabad	0.1864	0.005	35.037	0.000	0.176	0.197
City_Greater Noida	0.3332	0.005	67.913	0.000	0.324	0.343
City_Gurgaon	1.1104	0.004	253.894	0.000	1.102	1.119
City_Hyderabad	0.1963	0.004	52.279	0.000	0.189	0.204
City_Indore	0.1081	0.007	15.984	0.000	0.095	0.121
City_Jaipur	-0.2357	0.005	-48.766	0.000	-0.245	-0.226
City_Kalyan	0.0082	0.008	0.978	0.328	-0.008	0.025

City_Kolkata	-0.1904	0.004	-52.258	0.000	-0.198	-0.183
City_Lucknow	-0.1766	0.006	-30.852	0.000	-0.188	-0.165
City_Mohali	0.2528	0.007	33.731	0.000	0.238	0.267
City_Mumbai	0.8368	0.004	214.982	0.000	0.829	0.844
City_Nagpur	-0.3418	0.006	-57.517	0.000	-0.353	-0.330
City_Nashik	-0.4684	0.007	-71.661	0.000	-0.481	-0.456
City_Navi Mumbai	0.2355	0.005	43.928	0.000	0.225	0.246
City_New Delhi	0.4867	0.005	89.798	0.000	0.476	0.497
City_Noida	0.4379	0.006	77.413	0.000	0.427	0.449
City_Other	-0.1452	0.003	-42.325	0.000	-0.152	-0.138
City_Pune	0.1489	0.003	43.086	0.000	0.142	0.156
City_Raipur	-0.3751	0.009	-41.662	0.000	-0.393	-0.357
City_Secunderabad	0.1381	0.008	16.554	0.000	0.122	0.154
City_Surat	-0.2503	0.008	-31.798	0.000	-0.266	-0.235
City_Thane	0.1289	0.004	29.944	0.000	0.120	0.137
City_Vadodara	-0.4151	0.007	-58.970	0.000	-0.429	-0.401
City_Visakhapatnam	-0.1755	0.008	-22.358	0.000	-0.191	-0.160
PropType_Apartment	0.4020	0.072	5.578	0.000	0.261	0.543
PropType_Builder Floor	0.3262	0.073	4.495	0.000	0.184	0.468
PropType_Bungalow	0.3324	0.077	4.326	0.000	0.182	0.483
PropType_Condo	0.7628	0.524	1.454	0.146	-0.265	1.791
PropType_Duplex	0.4888	0.073	6.741	0.000	0.347	0.631
PropType_Farm House	0.3712	0.075	4.918	0.000	0.223	0.519
PropType_Independent Floor	0.1749	0.072	2.424	0.015	0.033	0.316
PropType_Independent House	0.0774	0.072	1.073	0.283	-0.064	0.219
PropType_Penthouse	0.9508	0.073	13.021	0.000	0.808	1.094
PropType_Plot	0.4296	0.072	5.961	0.000	0.288	0.571
PropType_Row House	0.2255	0.078	2.896	0.004	0.073	0.378
PropType_Serviced Apartment	0.3433	0.134	2.555	0.011	0.080	0.607
PropType_Studio	0.2865	0.076	3.774	0.000	0.138	0.435
PropType_Studio Apartment	0.1984	0.074	2.681	0.007	0.053	0.343
PropType_Triplex	0.8630	0.087	9.958	0.000	0.693	1.033
PropType_Villa	0.6298	0.072	8.733	0.000	0.488	0.771
PropType_Villament	0.8780	0.090	9.785	0.000	0.702	1.054
Furnish_Fully Furnished	0.1123	0.003	36.048	0.000	0.106	0.118
Furnish_Semi-Furnished	0.0175	0.002	8.628	0.000	0.014	0.022
Furnish_Unfurnished	0.0010	0.002	0.517	0.605	-0.003	0.005
Rera_1.0	0.2666	0.001	179.365	0.000	0.264	0.270
Rera_Missing	0.3582	0.002	175.774	0.000	0.354	0.362

```

=====
Omnibus:                285229.217   Durbin-Watson:                0.943
Prob(Omnibus):           0.000   Jarque-Bera (JB):             7149124.702
Skew:                    -0.087   Prob(JB):                     0.00
Kurtosis:                13.347   Cond. No.                     5.08e+06
=====

```

Notes:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
[2] The condition number is large, 5.08e+06. This might indicate that there are strong multicollinearity or other numerical problems.

## 1.1.14 7km Radius - PSM Results

```

=====
PROPENSITY SCORE MATCHING RESULTS (Radius: 7.0km)
=====

```

ROBUSTNESS ACROSS TREATMENT THRESHOLDS

-----  
THRESHOLD: Mining coverage > 0.3%  
-----

Treated units: 146,842  
Control units: 1,455,317  
Matched pairs: 146,842  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):  
ATT: 1.39%  
Standard Error: 0.29%  
95% CI: [0.83%, 1.85%]

Interpretation: Properties near mines (>0.3% coverage) are  
1.39% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 0.5%  
-----

Treated units: 90,728  
Control units: 1,511,431  
Matched pairs: 90,728  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):  
ATT: 10.94%  
Standard Error: 0.43%  
95% CI: [10.03%, 11.76%]

Interpretation: Properties near mines (>0.5% coverage) are  
10.94% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 1.0%  
-----

Treated units: 49,786  
Control units: 1,552,373  
Matched pairs: 49,786  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):  
ATT: 18.14%  
Standard Error: 0.73%  
95% CI: [16.74%, 19.49%]

Interpretation: Properties near mines (>1.0% coverage) are  
18.14% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 2.0%  
-----

Treated units: 5,280  
Control units: 1,596,879  
Matched pairs: 5,280  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

ATT: -0.27%

Standard Error: 1.79%

95% CI: [-3.61%, 3.24%]

Interpretation: Properties near mines (>2.0% coverage) are  
0.27% less expensive than similar properties not near mines.

=====

#### SUMMARY TABLE

Threshold	Treated	Matched	ATT	95% CI
0.3%	146,842	146,842	1.39	% [0.83%, 1.85%]
0.5%	90,728	90,728	10.94	% [10.03%, 11.76%]
1.0%	49,786	49,786	18.14	% [16.74%, 19.49%]
2.0%	5,280	5,280	-0.27	% [-3.61%, 3.24%]

#### NOTES:

- Method: 1:1 Nearest Neighbor Matching with caliper=0.1
- Standard errors computed via bootstrap (200 iterations)
- All matches achieved within caliper threshold

## 1.1.15 7km Radius - SAC Model

=====

SAC (SPATIAL AUTOREGRESSIVE COMBINED) - PRIMARY MODEL

Radius: 7.0km | Sample: 1,602,159 obs

=====

#### MODEL SPECIFICATION:

-----

$y = W*y + X* + u$

$u = W*u +$

Where:

$y = \text{Log}(\text{Price})$

= Spatial lag coefficient (spillover effects)

= Spatial error coefficient (correlated shocks)

$W$  = 8-nearest neighbors matrix (row-standardized)

#### REGRESSION RESULTS

-----

SUMMARY OF OUTPUT: SPATIALLY WEIGHTED 2SLS- GM-COMBO MODEL (HET)

-----

Data set	:	unknown		
Weights matrix	:	unknown		
Dependent Variable	:	Log_Price	Number of Observations:	1602159
Mean dependent var	:	15.7453	Number of Variables	61
S.D. dependent var	:	0.9819	Degrees of Freedom	1602098
Pseudo R-squared	:	0.7668		
Spatial Pseudo R-squared:		0.4128		
N. of iterations	:	1	Step1c computed	No

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	5.35726	0.10341	51.80446	0.00000
Mining_Coverage_Percent	0.03818	0.00460	8.30642	0.00000
Area_Sqft	0.00001	0.00000	7.50898	0.00000
Num_Bedrooms	0.28965	0.00116	249.85432	0.00000
Landmark_School	-0.01150	0.00072	-16.05579	0.00000
Landmark_Hospital	0.00059	0.00066	0.89918	0.36856
Landmark_Restaurant	-0.01133	0.00066	-17.11541	0.00000
Landmark_Mall	-0.00627	0.00071	-8.80987	0.00000
City_Badlapur	-0.04488	0.00835	-5.37604	0.00000
City_Bangalore	0.13621	0.00591	23.04942	0.00000
City_Bhubaneswar	-0.02624	0.01145	-2.29129	0.02195
City_Chennai	-0.05921	0.00609	-9.72474	0.00000
City_Coimbatore	-0.18942	0.01004	-18.87178	0.00000
City_Faridabad	0.13796	0.01206	11.43912	0.00000
City_Ghaziabad	0.07730	0.00794	9.73353	0.00000
City_Greater Noida	0.10264	0.00758	13.53416	0.00000
City_Gurgaon	0.41281	0.00713	57.87460	0.00000
City_Hyderabad	-0.01576	0.00573	-2.75221	0.00592
City_Indore	-0.09231	0.01405	-6.56899	0.00000
City_Jaipur	-0.18291	0.00854	-21.42550	0.00000
City_Kalyan	0.14678	0.00885	16.58364	0.00000
City_Kolkata	-0.05023	0.00524	-9.59064	0.00000
City_Lucknow	-0.20210	0.01142	-17.70298	0.00000
City_Mohali	0.01942	0.01043	1.86201	0.06260
City_Mumbai	0.44842	0.00539	83.19828	0.00000
City_Nagpur	-0.23641	0.00990	-23.87490	0.00000
City_Nashik	-0.11253	0.00836	-13.46447	0.00000
City_Navi Mumbai	0.19983	0.00836	23.90888	0.00000
City_New Delhi	0.21615	0.00962	22.47182	0.00000
City_Noida	0.19922	0.00984	20.25315	0.00000
City_Other	-0.09061	0.00554	-16.36547	0.00000
City_Pune	0.13888	0.00483	28.74134	0.00000
City_Raipur	-0.33918	0.01622	-20.90963	0.00000
City_Secunderabad	-0.04263	0.01413	-3.01751	0.00255
City_Surat	-0.12092	0.01236	-9.77955	0.00000
City_Thane	0.18772	0.00579	32.42249	0.00000
City_Vadodara	-0.22539	0.01068	-21.10481	0.00000
City_Visakhapatnam	-0.08137	0.01322	-6.15679	0.00000
PropType_Apartment	0.32526	0.09429	3.44948	0.00056
PropType_Builder Floor	0.35330	0.09445	3.74076	0.00018
PropType_Bungalow	0.55378	0.09743	5.68364	0.00000
PropType_Condo	0.21262	0.14565	1.45985	0.14433
PropType_Duplex	0.57597	0.09444	6.09885	0.00000
PropType_Farm House	0.68188	0.09999	6.81936	0.00000
PropType_Independent Floor	0.18259	0.09433	1.93564	0.05291
PropType_Independent House	0.44602	0.09431	4.72915	0.00000
PropType_Penthouse	0.68601	0.09437	7.26967	0.00000
PropType_Plot	0.70707	0.09404	7.51905	0.00000
PropType_Row House	0.44198	0.09647	4.58149	0.00000
PropType_Serviced Apartment	-0.09995	0.11821	-0.84551	0.39783
PropType_Studio	0.07836	0.09651	0.81194	0.41683
PropType_Studio Apartment	0.01208	0.09470	0.12761	0.89846
PropType_Triplex	0.59754	0.12153	4.91700	0.00000
PropType_Villa	0.71120	0.09424	7.54702	0.00000
PropType_Villament	0.53010	0.09627	5.50655	0.00000

Furnish_Fully Furnished	0.08247	0.00231	35.68888	0.00000
Furnish_Semi-Furnished	-0.00708	0.00131	-5.38846	0.00000
Furnish_Unfurnished	-0.01253	0.00124	-10.07380	0.00000
Rera_1.0	0.15870	0.00179	88.54375	0.00000
Rera_Missing	0.18892	0.00250	75.62744	0.00000
W_Log_Price	0.58360	0.00262	222.47422	0.00000
lambda	0.62575	0.00333	187.71167	0.00000

-----  
Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar , W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur , W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,  
W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,  
W\_PropType\_Bungalow, W\_PropType\_Condo, W\_PropType\_Duplex,  
W\_PropType\_Farm House, W\_PropType\_Independent Floor,  
W\_PropType\_Independent House, W\_PropType\_Penthouse,  
W\_PropType\_Plot, W\_PropType\_Row House, W\_PropType\_Serviced  
Apartment, W\_PropType\_Studio, W\_PropType\_Studio Apartment,  
W\_PropType\_Triplex, W\_PropType\_Villa, W\_PropType\_Villament,  
W\_Rera\_1.0, W\_Rera\_Missing

===== END OF REPORT =====

#### MINING COVERAGE EFFECTS

=====  
Coefficient: 0.038184  
Std. Error: 0.004597  
P-value: 0.000000  
Impact: 3.89% per 1pp mining coverage

Spatial lag (): 0.583595  
Spatial error (): 0.625754  
Pseudo R<sup>2</sup>: 0.7668

### 1.1.16 7km Radius - SAR Model (Robustness)

=====  
SAR (SPATIAL LAG) - ROBUSTNESS CHECK  
Radius: 7.0km | Sample: 1,602,159 obs  
=====

MODEL SPECIFICATION:

-----  
 $y = W*y + X* +$

Where:

$y = \text{Log}(\text{Price})$   
= Spatial lag coefficient (spillover effects only)

W = 8-nearest neighbors matrix (row-standardized)  
 Estimation: GM (Generalized Method of Moments)

# REGRESSION RESULTS

## SUMMARY OF OUTPUT: SPATIAL TWO STAGE LEAST SQUARES

Data set : unknown  
 Weights matrix : unknown  
 Dependent Variable : Log\_Price Number of Observations: 1602159  
 Mean dependent var : 15.7453 Number of Variables : 61  
 S.D. dependent var : 0.9819 Degrees of Freedom : 1602098  
 Pseudo R-squared : 0.7722  
 Spatial Pseudo R-squared: 0.4816

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	5.68730	0.04918	115.64672	0.00000
Mining_Coverage_Percent	0.02402	0.00163	14.75455	0.00000
Area_Sqft	0.00001	0.00000	186.88287	0.00000
Num_Bedrooms	0.28869	0.00050	574.39851	0.00000
Landmark_School	-0.00771	0.00031	-25.10230	0.00000
Landmark_Hospital	0.00125	0.00029	4.35159	0.00001
Landmark_Restaurant	-0.01025	0.00028	-36.33661	0.00000
Landmark_Mall	-0.00511	0.00031	-16.34516	0.00000
City_Badlapur	-0.08389	0.00546	-15.35317	0.00000
City_Bangalore	0.18187	0.00256	70.97622	0.00000
City_Bhubaneswar	0.00774	0.00475	1.62971	0.10316
City_Chennai	0.02850	0.00249	11.44417	0.00000
City_Coimbatore	-0.06364	0.00359	-17.70315	0.00000
City_Faridabad	0.22590	0.00452	49.99965	0.00000
City_Ghaziabad	0.09274	0.00347	26.72617	0.00000
City_Greater Noida	0.15033	0.00321	46.81341	0.00000
City_Gurgaon	0.45483	0.00306	148.42010	0.00000
City_Hyderabad	0.06699	0.00246	27.26855	0.00000
City_Indore	0.05954	0.00441	13.50423	0.00000
City_Jaipur	-0.12403	0.00316	-39.31175	0.00000
City_Kalyan	0.12852	0.00546	23.51952	0.00000
City_Kolkata	-0.06321	0.00238	-26.51821	0.00000
City_Lucknow	-0.08855	0.00373	-23.72155	0.00000
City_Mohali	0.09552	0.00489	19.53714	0.00000
City_Mumbai	0.44575	0.00262	169.90416	0.00000
City_Nagpur	-0.14332	0.00389	-36.87309	0.00000
City_Nashik	-0.13101	0.00430	-30.48304	0.00000
City_Navi Mumbai	0.18994	0.00349	54.37313	0.00000
City_New Delhi	0.22549	0.00356	63.35311	0.00000
City_Noida	0.19629	0.00371	52.92555	0.00000
City_Other	-0.04077	0.00224	-18.18987	0.00000
City_Pune	0.12776	0.00225	56.74208	0.00000
City_Raipur	-0.16663	0.00588	-28.35374	0.00000
City_Secunderabad	0.03052	0.00544	5.61305	0.00000
City_Surat	-0.10838	0.00513	-21.11129	0.00000
City_Thane	0.16830	0.00281	59.99498	0.00000
City_Vadodara	-0.21274	0.00460	-46.25651	0.00000
City_Visakhapatnam	-0.04519	0.00512	-8.83058	0.00000
PropType_Apartment	0.24146	0.04695	5.14296	0.00000
PropType_Builder Floor	0.19979	0.04727	4.22655	0.00002



PropType_Bungalow	0.24655	0.05006	4.92519	0.00000
PropType_Condo	0.17776	0.34168	0.52025	0.60289
PropType_Duplex	0.38955	0.04724	8.24643	0.00000
PropType_Farm House	0.45925	0.04917	9.34100	0.00000
PropType_Independent Floor	0.06908	0.04702	1.46928	0.14176
PropType_Independent House	0.18094	0.04699	3.85048	0.00012
PropType_Penthouse	0.61798	0.04758	12.98897	0.00000
PropType_Plot	0.36824	0.04695	7.84277	0.00000
PropType_Row House	0.18914	0.05073	3.72837	0.00019
PropType_Serviced Apartment	0.14890	0.08753	1.70116	0.08891
PropType_Studio	0.07377	0.04946	1.49148	0.13584
PropType_Studio Apartment	0.04509	0.04821	0.93538	0.34959
PropType_Triplex	0.45757	0.05646	8.10391	0.00000
PropType_Villa	0.42728	0.04698	9.09426	0.00000
PropType_Villament	0.44309	0.05846	7.57905	0.00000
Furnish_Fully Furnished	0.07473	0.00203	36.79259	0.00000
Furnish_Semi-Furnished	-0.01099	0.00132	-8.29662	0.00000
Furnish_Unfurnished	-0.01938	0.00125	-15.45500	0.00000
Rera_1.0	0.13417	0.00099	134.85759	0.00000
Rera_Missing	0.19814	0.00136	146.15409	0.00000
W_Log_Price	0.56999	0.00098	580.93366	0.00000

-----  
Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar, W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur, W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,  
W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,  
W\_PropType\_Bungalow, W\_PropType\_Condo, W\_PropType\_Duplex,  
W\_PropType\_Farm House, W\_PropType\_Independent Floor,  
W\_PropType\_Independent House, W\_PropType\_Penthouse,  
W\_PropType\_Plot, W\_PropType\_Row House, W\_PropType\_Serviced  
Apartment, W\_PropType\_Studio, W\_PropType\_Studio Apartment,  
W\_PropType\_Triplex, W\_PropType\_Villa, W\_PropType\_Villament,  
W\_Rera\_1.0, W\_Rera\_Missing

#### DIAGNOSTICS FOR SPATIAL DEPENDENCE

TEST	DF	VALUE	PROB
Anselin-Kelejian Test	1	43292.755	0.0000

#### SPATIAL LAG MODEL IMPACTS

Impacts computed using the 'simple' method.

Variable	Direct	Indirect	Total
Mining_Coverage_Percent	0.0240	0.0318	0.0559
Area_Sqft	0.0000	0.0000	0.0000
Num_Bedrooms	0.2887	0.3827	0.6714
Landmark_School	-0.0077	-0.0102	-0.0179
Landmark_Hospital	0.0012	0.0017	0.0029
Landmark_Restaurant	-0.0102	-0.0136	-0.0238
Landmark_Mall	-0.0051	-0.0068	-0.0119

City_Badlapur	-0.0839	-0.1112	-0.1951
City_Bangalore	0.1819	0.2411	0.4230
City_Bhubaneswar	0.0077	0.0103	0.0180
City_Chennai	0.0285	0.0378	0.0663
City_Coimbatore	-0.0636	-0.0844	-0.1480
City_Faridabad	0.2259	0.2994	0.5253
City_Ghaziabad	0.0927	0.1229	0.2157
City_Greater Noida	0.1503	0.1993	0.3496
City_Gurgaon	0.4548	0.6029	1.0577
City_Hyderabad	0.0670	0.0888	0.1558
City_Indore	0.0595	0.0789	0.1385
City_Jaipur	-0.1240	-0.1644	-0.2884
City_Kalyan	0.1285	0.1704	0.2989
City_Kolkata	-0.0632	-0.0838	-0.1470
City_Lucknow	-0.0885	-0.1174	-0.2059
City_Mohali	0.0955	0.1266	0.2221
City_Mumbai	0.4457	0.5909	1.0366
City_Nagpur	-0.1433	-0.1900	-0.3333
City_Nashik	-0.1310	-0.1737	-0.3047
City_Navi Mumbai	0.1899	0.2518	0.4417
City_New Delhi	0.2255	0.2989	0.5244
City_Noida	0.1963	0.2602	0.4565
City_Other	-0.0408	-0.0540	-0.0948
City_Pune	0.1278	0.1694	0.2971
City_Raipur	-0.1666	-0.2209	-0.3875
City_Secunderabad	0.0305	0.0405	0.0710
City_Surat	-0.1084	-0.1437	-0.2520
City_Thane	0.1683	0.2231	0.3914
City_Vadodara	-0.2127	-0.2820	-0.4947
City_Visakhapatnam	-0.0452	-0.0599	-0.1051
PropType_Apartment	0.2415	0.3201	0.5615
PropType_Builder Floor	0.1998	0.2648	0.4646
PropType_Bungalow	0.2465	0.3268	0.5734
PropType_Condo	0.1778	0.2356	0.4134
PropType_Duplex	0.3895	0.5164	0.9059
PropType_Farm House	0.4593	0.6088	1.0680
PropType_Independent Floor	0.0691	0.0916	0.1607
PropType_Independent House	0.1809	0.2398	0.4208
PropType_Penthouse	0.6180	0.8192	1.4371
PropType_Plot	0.3682	0.4881	0.8563
PropType_Row House	0.1891	0.2507	0.4399
PropType_Serviced Apartment	0.1489	0.1974	0.3463
PropType_Studio	0.0738	0.0978	0.1716
PropType_Studio Apartment	0.0451	0.0598	0.1049
PropType_Triplex	0.4576	0.6065	1.0641
PropType_Villa	0.4273	0.5664	0.9937
PropType_Villament	0.4431	0.5873	1.0304
Furnish_Fully Furnished	0.0747	0.0991	0.1738
Furnish_Semi-Furnished	-0.0110	-0.0146	-0.0255
Furnish_Unfurnished	-0.0194	-0.0257	-0.0451
Rera_1.0	0.1342	0.1778	0.3120
Rera_Missing	0.1981	0.2626	0.4608

===== END OF REPORT =====

=====

MINING COVERAGE EFFECTS

=====

Coefficient: 0.024021

Std. Error: 0.001628

P-value: 0.000000  
Impact: 2.43% per 1pp mining coverage

Spatial lag (): 0.569992  
Pseudo R<sup>2</sup>: 0.7722

### 1.1.17 7km Radius - SEM Model (Robustness)

```
=====
SEM (SPATIAL ERROR) - ROBUSTNESS CHECK
Radius: 7.0km | Sample: 1,602,159 obs
=====
```

#### MODEL SPECIFICATION:

```
-----
y = X* + u
u = W*u +
```

Where:

y = Log(Price)  
= Spatial error coefficient (correlated shocks only)  
W = 8-nearest neighbors matrix (row-standardized)  
Estimation: GM (Generalized Method of Moments) with heteroskedasticity

#### REGRESSION RESULTS

##### SUMMARY OF OUTPUT: GM SPATIALLY WEIGHTED LEAST SQUARES (HET)

```
-----
Data set      :      unknown
Weights matrix :      unknown
Dependent Variable : Log_Price      Number of Observations: 1602159
Mean dependent var : 15.7453      Number of Variables : 60
S.D. dependent var : 0.9819      Degrees of Freedom : 1602099
Pseudo R-squared : 0.3637
N. of iterations : 1      Step1c computed : No
```

```
-----
Variable      Coefficient      Std. Error      z-Statistic      Probability
-----
CONSTANT      14.81689      0.09182      161.36546      0.00000
Mining_Coverage_Percent      0.04001      0.01437      2.78322      0.00538
Area_Sqft      0.00001      0.00000      7.92568      0.00000
Num_Bedrooms      0.29319      0.00110      267.68317      0.00000
Landmark_School      -0.02064      0.00154      -13.39775      0.00000
Landmark_Hospital      0.00113      0.00146      0.77072      0.44088
Landmark_Restaurant      -0.02353      0.00146      -16.15499      0.00000
Landmark_Mall      -0.01497      0.00158      -9.45745      0.00000
City_Badlapur      -0.66457      0.02708      -24.54218      0.00000
City_Bangalore      0.20379      0.01773      11.49727      0.00000
City_Bhubaneswar      -0.11229      0.03575      -3.14064      0.00169
City_Chennai      -0.30184      0.01725      -17.49405      0.00000
City_Coimbatore      -0.55846      0.02923      -19.10304      0.00000
City_Faridabad      0.28754      0.03936      7.30619      0.00000
City_Ghaziabad      0.11568      0.02450      4.72090      0.00000
City_Greater Noida      0.13457      0.02240      6.00806      0.00000
City_Gurgaon      1.01941      0.02044      49.86783      0.00000
City_Hyderabad      -0.05278      0.01682      -3.13819      0.00170
-----
```

City_Indore	-0.43024	0.04017	-10.71043	0.00000
City_Jaipur	-0.41500	0.02539	-16.34326	0.00000
City_Kalyan	-0.14256	0.02428	-5.87217	0.00000
City_Kolkata	-0.23002	0.01526	-15.07758	0.00000
City_Lucknow	-0.56473	0.03437	-16.43109	0.00000
City_Mohali	-0.18183	0.02081	-8.73892	0.00000
City_Mumbai	0.67619	0.01632	41.43278	0.00000
City_Nagpur	-0.67235	0.02892	-23.24923	0.00000
City_Nashik	-0.56423	0.02376	-23.74387	0.00000
City_Navi Mumbai	0.08066	0.02479	3.25380	0.00114
City_New Delhi	0.41517	0.02951	14.06817	0.00000
City_Noida	0.40675	0.03036	13.39907	0.00000
City_Other	-0.34530	0.01588	-21.73886	0.00000
City_Pune	0.05917	0.01420	4.16634	0.00003
City_Raipur	-0.93967	0.04851	-19.37222	0.00000
City_Secunderabad	-0.06323	0.03760	-1.68139	0.09269
City_Surat	-0.31214	0.03598	-8.67583	0.00000
City_Thane	-0.02713	0.01696	-1.60000	0.10960
City_Vadodara	-0.43027	0.03091	-13.91916	0.00000
City_Visakhapatnam	-0.36423	0.03931	-9.26586	0.00000
PropType_Apartment	0.11812	0.09065	1.30306	0.19255
PropType_Builder Floor	0.18949	0.09085	2.08570	0.03701
PropType_Bungalow	0.48871	0.09471	5.15999	0.00000
PropType_Condo	0.15882	0.18774	0.84595	0.39758
PropType_Duplex	0.42201	0.09079	4.64820	0.00000
PropType_Farm House	0.56775	0.09651	5.88253	0.00000
PropType_Independent Floor	0.01647	0.09068	0.18163	0.85587
PropType_Independent House	0.31564	0.09062	3.48305	0.00050
PropType_Penthouse	0.46472	0.09076	5.12037	0.00000
PropType_Plot	0.66888	0.09038	7.40052	0.00000
PropType_Row House	0.33590	0.09316	3.60575	0.00031
PropType_Serviced Apartment	-0.31400	0.10760	-2.91829	0.00352
PropType_Studio	-0.11183	0.09286	-1.20423	0.22850
PropType_Studio Apartment	-0.21639	0.09106	-2.37635	0.01749
PropType_Triplex	0.48656	0.12161	4.00092	0.00006
PropType_Villa	0.63825	0.09059	7.04518	0.00000
PropType_Villament	0.35978	0.09283	3.87583	0.00011
Furnish_Fully Furnished	0.10370	0.00227	45.68164	0.00000
Furnish_Semi-Furnished	0.01437	0.00132	10.85880	0.00000
Furnish_Unfurnished	0.00830	0.00125	6.61496	0.00000
Rera_1.0	0.20991	0.00260	80.80233	0.00000
Rera_Missing	0.21083	0.00298	70.80122	0.00000
lambda	0.87773	0.00143	612.28621	0.00000

===== END OF REPORT =====

#### MINING COVERAGE EFFECTS

Coefficient: 0.040006  
 Std. Error: 0.014374  
 P-value: 0.005382  
 Impact: 4.08% per 1pp mining coverage

Spatial error (): 0.877731

Pseudo R<sup>2</sup>: 0.3637

## 1.1.18 7km Radius - Machine Learning Results

=====

ML ANALYSIS - HARMONIZED VERSION (FIXED) (Radius: 7.0km)

Date: 2026-02-04 02:06:51

=====

### FIXES IMPLEMENTED:

-----

NO data leakage: City selection from TRAINING set only  
STANDARDIZED: Outlier removal BEFORE GeoDataFrame  
ERROR HANDLING: Geometry operations protected  
Imputation using TRAINING statistics only  
All feature engineering respects train/test boundary  
AUTO-DROP: Variables with >25% missing data excluded  
HYPERPARAMETER TUNING: GridSearchCV on XGBoost, RF, GB

### HARMONIZATION:

-----

Feature set IDENTICAL to lm\_test.py, spatial\_sdm\_CORRECTED.py, final\_CORRECTED.py  
Same 9 continuous variables across ALL analyses  
Top 30 cities (selected from training data only)

### 1. PREDICTIVE MODELS

Model	MAE	RMSE	R <sup>2</sup>
XGBoost	0.262120	0.382051	0.8480
Random Forest	0.324652	0.460865	0.7788
Extra Trees	0.427091	0.580421	0.6492
Gradient Boosting	0.347196	0.482141	0.7579
LightGBM	0.337600	0.472240	0.7678
CatBoost	0.344101	0.479256	0.7608
Neural Network	0.327572	0.464608	0.7752
Ridge	0.537459	0.731638	0.4426
Lasso	0.541736	0.735695	0.4364
ElasticNet	0.539447	0.733176	0.4403

### 2. TOP 20 FEATURES

-----

Area_Sqft	: 143.483076
Mining_Coverage_Percent	: 100.323232
Landmark_Mall	: 77.176414
Landmark_Hospital	: 70.007105
Landmark_Restaurant	: 68.245211
Landmark_School	: 66.236279
Num_Bedrooms	: 64.116548
PropType_Plot	: 45.731609
Rera_1.0	: 28.948371
City_Mumbai	: 26.661900
PropType_Apartment	: 18.132059
City_Gurgaon	: 17.713406
City_Navi Mumbai	: 15.032973
City_Other	: 14.849666
City_Thane	: 14.711315
City_Pune	: 14.616885
Rera_Missing	: 13.990231
City_New Delhi	: 12.900044
City_Bangalore	: 11.996538

City\_Kolkata : 11.223190

### 3. HETEROGENEOUS EFFECTS (PARTIAL DEPENDENCE - FIXED)

-----  
Effect across mining coverage range, controlling for:

- Property size, bedrooms, bathrooms, balconies
  - Nearby amenities (schools, hospitals, restaurants, malls)
  - City location (top 30 cities from training set)
  - Property type, furnishing, RERA status
  - All other property characteristics
- 

Agricultural Land	:	5.85% (n= 83)
Triplex	:	5.84% (n= 177)
Studio	:	4.84% (n= 743)
Farm House	:	3.36% (n= 852)
Bungalow	:	2.54% (n= 615)
Row House	:	2.25% (n= 497)
Plot	:	1.06% (n=215,333)
Studio Apartment	:	-2.97% (n= 1,506)
Duplex	:	-3.60% (n= 6,865)
Villa	:	-3.67% (n=54,536)
Villament	:	-6.12% (n= 150)
Apartment	:	-7.52% (n=884,745)
Penthouse	:	-8.45% (n= 3,130)
Builder Floor	:	-9.60% (n= 6,410)
Independent Floor	:	-9.90% (n=41,350)
Independent House	:	-10.22% (n=64,700)

=====

NOTES:

=====

This analysis uses IDENTICAL feature engineering to:

- lm\_test.py (OLS with LM diagnostics)
- spatial\_sdm\_CORRECTED.py (spatial econometric models)
- final\_CORRECTED.py (OLS + PSM pipeline)

CRITICAL: All feature engineering respects train/test boundary.

City selection uses TRAINING set only to prevent data leakage.

Results are directly comparable across all methodologies.

## 1.1.19 10km Radius - OLS Results

=====

BASELINE OLS HEDONIC REGRESSION (Radius: 10.0km)

CORRECTED VERSION - Matches other analyses

Sample: 1,602,159 observations

=====

### OLS Regression Results

=====

Dep. Variable:	Log_Price	R-squared:	0.440
Model:	OLS	Adj. R-squared:	0.440
Method:	Least Squares	F-statistic:	2.136e+04
Date:	Tue, 03 Feb 2026	Prob (F-statistic):	0.00
Time:	17:45:21	Log-Likelihood:	-1.7793e+06
No. Observations:	1602159	AIC:	3.559e+06
Df Residuals:	1602099	BIC:	3.560e+06
Df Model:	59		

=====

Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]
-----						
const	14.0900	0.072	195.291	0.000	13.949	14.231
Mining_Coverage_Percent	0.0423	0.003	12.181	0.000	0.036	0.049
Area_Sqft	1.83e-05	1.09e-07	168.257	0.000	1.81e-05	1.85e-05
Num_Bedrooms	0.4457	0.001	684.958	0.000	0.444	0.447
Landmark_School	-0.0215	0.000	-45.870	0.000	-0.022	-0.021
Landmark_Hospital	0.0044	0.000	10.077	0.000	0.004	0.005
Landmark_Restaurant	-0.0276	0.000	-64.159	0.000	-0.028	-0.027
Landmark_Mall	-0.0148	0.000	-30.965	0.000	-0.016	-0.014
City_Badlapur	-0.5464	0.008	-65.593	0.000	-0.563	-0.530
City_Bangalore	0.4117	0.004	105.259	0.000	0.404	0.419
City_Bhubaneswar	0.0333	0.007	4.566	0.000	0.019	0.048
City_Chennai	0.0264	0.004	6.898	0.000	0.019	0.034
City_Coimbatore	-0.1445	0.006	-26.200	0.000	-0.155	-0.134
City_Faridabad	0.5425	0.007	78.763	0.000	0.529	0.556
City_Ghaziabad	0.1858	0.005	34.925	0.000	0.175	0.196
City_Greater Noida	0.3332	0.005	67.926	0.000	0.324	0.343
City_Gurgaon	1.1081	0.004	253.049	0.000	1.100	1.117
City_Hyderabad	0.1944	0.004	51.713	0.000	0.187	0.202
City_Indore	0.0947	0.007	13.861	0.000	0.081	0.108
City_Jaipur	-0.2360	0.005	-48.821	0.000	-0.245	-0.227
City_Kalyan	0.0006	0.008	0.072	0.943	-0.016	0.017
City_Kolkata	-0.1903	0.004	-52.236	0.000	-0.197	-0.183
City_Lucknow	-0.1767	0.006	-30.870	0.000	-0.188	-0.166
City_Mohali	0.2526	0.007	33.717	0.000	0.238	0.267
City_Mumbai	0.8354	0.004	214.540	0.000	0.828	0.843
City_Nagpur	-0.3470	0.006	-58.200	0.000	-0.359	-0.335
City_Nashik	-0.4739	0.007	-72.261	0.000	-0.487	-0.461
City_Navi Mumbai	0.2169	0.006	39.339	0.000	0.206	0.228
City_New Delhi	0.4866	0.005	89.782	0.000	0.476	0.497
City_Noida	0.4378	0.006	77.393	0.000	0.427	0.449
City_Other	-0.1471	0.003	-42.825	0.000	-0.154	-0.140
City_Pune	0.1474	0.003	42.616	0.000	0.141	0.154
City_Raipur	-0.3807	0.009	-42.201	0.000	-0.398	-0.363
City_Secunderabad	0.1366	0.008	16.373	0.000	0.120	0.153
City_Surat	-0.2503	0.008	-31.796	0.000	-0.266	-0.235
City_Thane	0.1228	0.004	28.244	0.000	0.114	0.131
City_Vadodara	-0.4152	0.007	-58.983	0.000	-0.429	-0.401
City_Visakhapatnam	-0.1768	0.008	-22.524	0.000	-0.192	-0.161
PropType_Apartment	0.4007	0.072	5.560	0.000	0.259	0.542
PropType_Builder Floor	0.3247	0.073	4.476	0.000	0.183	0.467
PropType_Bungalow	0.3316	0.077	4.315	0.000	0.181	0.482
PropType_Condo	0.7638	0.524	1.456	0.145	-0.264	1.792
PropType_Duplex	0.4877	0.073	6.726	0.000	0.346	0.630
PropType_Farm House	0.3703	0.075	4.907	0.000	0.222	0.518
PropType_Independent Floor	0.1737	0.072	2.407	0.016	0.032	0.315
PropType_Independent House	0.0761	0.072	1.055	0.291	-0.065	0.218
PropType_Penthouse	0.9501	0.073	13.011	0.000	0.807	1.093
PropType_Plot	0.4289	0.072	5.951	0.000	0.288	0.570
PropType_Row House	0.2246	0.078	2.884	0.004	0.072	0.377
PropType_Serviced Apartment	0.3418	0.134	2.544	0.011	0.078	0.605
PropType_Studio	0.2857	0.076	3.763	0.000	0.137	0.435
PropType_Studio Apartment	0.1971	0.074	2.663	0.008	0.052	0.342
PropType_Triplex	0.8627	0.087	9.955	0.000	0.693	1.033
PropType_Villa	0.6286	0.072	8.716	0.000	0.487	0.770
PropType_Villament	0.8783	0.090	9.788	0.000	0.702	1.054

Furnish_Fully Furnished	0.1123	0.003	36.050	0.000	0.106	0.118
Furnish_Semi-Furnished	0.0175	0.002	8.628	0.000	0.014	0.022
Furnish_Unfurnished	0.0008	0.002	0.426	0.670	-0.003	0.005
Rera_1.0	0.2667	0.001	179.424	0.000	0.264	0.270
Rera_Missing	0.3582	0.002	175.817	0.000	0.354	0.362

```

=====
Omnibus:                285220.285   Durbin-Watson:                0.943
Prob(Omnibus):          0.000   Jarque-Bera (JB):            7149465.336
Skew:                   -0.087   Prob(JB):                    0.00
Kurtosis:               13.347   Cond. No.                    5.08e+06
=====

```

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.  
 [2] The condition number is large, 5.08e+06. This might indicate that there are strong multicollinearity or other numerical problems.

## 1.1.20 10km Radius - PSM Results

```

=====
PROPSENSITY SCORE MATCHING RESULTS (Radius: 10.0km)
=====

```

ROBUSTNESS ACROSS TREATMENT THRESHOLDS

THRESHOLD: Mining coverage > 0.3%

```

-----
Treated units: 151,530
Control units: 1,450,629
Matched pairs: 151,530
Match rate: 100.0%

```

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

```

ATT: -0.86%
Standard Error: 0.31%
95% CI: [-1.37%, -0.20%]

```

Interpretation: Properties near mines (>0.3% coverage) are  
 0.86% less expensive than similar properties not near mines.

THRESHOLD: Mining coverage > 0.5%

```

-----
Treated units: 80,676
Control units: 1,521,483
Matched pairs: 80,676
Match rate: 100.0%

```

AVERAGE TREATMENT EFFECT ON TREATED (ATT):

```

ATT: 3.65%
Standard Error: 0.43%
95% CI: [2.83%, 4.44%]

```

Interpretation: Properties near mines (>0.5% coverage) are  
 3.65% more expensive than similar properties not near mines.



=====

THRESHOLD: Mining coverage > 1.0%

-----

Treated units: 34,772  
Control units: 1,567,387  
Matched pairs: 34,772  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):  
ATT: 19.19%  
Standard Error: 0.74%  
95% CI: [17.85%, 20.67%]

Interpretation: Properties near mines (>1.0% coverage) are  
19.19% more expensive than similar properties not near mines.

=====

THRESHOLD: Mining coverage > 2.0%

-----

Treated units: 846  
Control units: 1,601,313  
Matched pairs: 846  
Match rate: 100.0%

AVERAGE TREATMENT EFFECT ON TREATED (ATT):  
ATT: -22.20%  
Standard Error: 3.77%  
95% CI: [-29.46%, -14.69%]

Interpretation: Properties near mines (>2.0% coverage) are  
22.20% less expensive than similar properties not near mines.

=====

#### SUMMARY TABLE

-----

Threshold	Treated	Matched	ATT	95% CI
0.3%	151,530	151,530	-0.86	% [-1.37%, -0.20%]
0.5%	80,676	80,676	3.65	% [2.83%, 4.44%]
1.0%	34,772	34,772	19.19	% [17.85%, 20.67%]
2.0%	846	846	-22.20	% [-29.46%, -14.69%]

-----

#### NOTES:

- Method: 1:1 Nearest Neighbor Matching with caliper=0.1
- Standard errors computed via bootstrap (200 iterations)
- All matches achieved within caliper threshold

### 1.1.21 10km Radius - SAC Model

=====

SAC (SPATIAL AUTOREGRESSIVE COMBINED) - PRIMARY MODEL  
Radius: 10.0km | Sample: 1,602,159 obs

=====

# MODEL SPECIFICATION:

```

-----
y = W*y + X* + u
u = W*u +

```

Where:

```

y = Log(Price)
= Spatial lag coefficient (spillover effects)
= Spatial error coefficient (correlated shocks)
W = 8-nearest neighbors matrix (row-standardized)

```

## REGRESSION RESULTS

### SUMMARY OF OUTPUT: SPATIALLY WEIGHTED 2SLS- GM-COMBO MODEL (HET)

```

-----
Data set          :      unknown
Weights matrix    :      unknown
Dependent Variable :      Log_Price          Number of Observations:      1602159
Mean dependent var :      15.7453          Number of Variables   :           61
S.D. dependent var :      0.9819          Degrees of Freedom    :      1602098
Pseudo R-squared   :      0.7668
Spatial Pseudo R-squared: 0.4130
N. of iterations   :           1          Stepic computed      :           No

```

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	5.35604	0.10342	51.79044	0.00000
Mining_Coverage_Percent	0.06219	0.00673	9.24548	0.00000
Area_Sqft	0.00001	0.00000	7.50918	0.00000
Num_Bedrooms	0.28968	0.00116	249.86751	0.00000
Landmark_School	-0.01152	0.00072	-16.09838	0.00000
Landmark_Hospital	0.00049	0.00066	0.74548	0.45598
Landmark_Restaurant	-0.01138	0.00066	-17.20238	0.00000
Landmark_Mall	-0.00609	0.00071	-8.57511	0.00000
City_Badlapur	-0.05345	0.00845	-6.32494	0.00000
City_Bangalore	0.13166	0.00598	22.01745	0.00000
City_Bhubaneswar	-0.02942	0.01146	-2.56801	0.01023
City_Chennai	-0.06108	0.00610	-10.01034	0.00000
City_Coimbatore	-0.19033	0.01004	-18.96343	0.00000
City_Faridabad	0.13470	0.01207	11.15967	0.00000
City_Ghaziabad	0.07654	0.00794	9.63872	0.00000
City_Greater Noida	0.10269	0.00758	13.54451	0.00000
City_Gurgaon	0.41053	0.00715	57.41314	0.00000
City_Hyderabad	-0.01747	0.00574	-3.04479	0.00233
City_Indore	-0.10140	0.01412	-7.18063	0.00000
City_Jaipur	-0.18302	0.00853	-21.44369	0.00000
City_Kalyan	0.13867	0.00897	15.45877	0.00000
City_Kolkata	-0.05014	0.00524	-9.57512	0.00000
City_Lucknow	-0.20207	0.01141	-17.70518	0.00000
City_Mohali	0.01896	0.01043	1.81825	0.06903
City_Mumbai	0.44733	0.00540	82.90632	0.00000
City_Nagpur	-0.24326	0.00994	-24.46551	0.00000
City_Nashik	-0.11931	0.00842	-14.17051	0.00000
City_Navi Mumbai	0.18737	0.00892	21.01060	0.00000
City_New Delhi	0.21599	0.00962	22.46128	0.00000
City_Noida	0.19906	0.00983	20.24226	0.00000

City_Other	-0.09232	0.00554	-16.65558	0.00000
City_Pune	0.13749	0.00484	28.41611	0.00000
City_Raipur	-0.34563	0.01625	-21.27517	0.00000
City_Secunderabad	-0.04443	0.01413	-3.14482	0.00166
City_Surat	-0.12089	0.01236	-9.77964	0.00000
City_Thane	0.18040	0.00593	30.43645	0.00000
City_Vadodara	-0.22542	0.01068	-21.11439	0.00000
City_Visakhapatnam	-0.08242	0.01321	-6.23699	0.00000
PropType_Apartment	0.32528	0.09430	3.44928	0.00056
PropType_Builder Floor	0.35325	0.09446	3.73984	0.00018
PropType_Bungalow	0.55369	0.09744	5.68237	0.00000
PropType_Condo	0.21356	0.14572	1.46555	0.14277
PropType_Duplex	0.57605	0.09445	6.09895	0.00000
PropType_Farm House	0.68217	0.10000	6.82172	0.00000
PropType_Independent Floor	0.18264	0.09434	1.93590	0.05288
PropType_Independent House	0.44602	0.09432	4.72861	0.00000
PropType_Penthouse	0.68612	0.09438	7.26993	0.00000
PropType_Plot	0.70720	0.09405	7.51951	0.00000
PropType_Row House	0.44195	0.09648	4.58072	0.00000
PropType_Serviced Apartment	-0.10015	0.11817	-0.84750	0.39672
PropType_Studio	0.07870	0.09652	0.81532	0.41489
PropType_Studio Apartment	0.01215	0.09471	0.12832	0.89789
PropType_Triplex	0.59837	0.12154	4.92335	0.00000
PropType_Villa	0.71121	0.09425	7.54627	0.00000
PropType_Villament	0.53060	0.09627	5.51147	0.00000
Furnish_Fully Furnished	0.08248	0.00231	35.69564	0.00000
Furnish_Semi-Furnished	-0.00706	0.00131	-5.37717	0.00000
Furnish_Unfurnished	-0.01255	0.00124	-10.09279	0.00000
Rera_1.0	0.15878	0.00179	88.61352	0.00000
Rera_Missing	0.18886	0.00250	75.61541	0.00000
W_Log_Price	0.58366	0.00262	222.58627	0.00000
lambda	0.62565	0.00333	187.63197	0.00000

-----  
Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar , W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur , W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,  
W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,  
W\_PropType\_Bungalow, W\_PropType\_Condo, W\_PropType\_Duplex,  
W\_PropType\_Farm House, W\_PropType\_Independent Floor,  
W\_PropType\_Independent House, W\_PropType\_Penthouse,  
W\_PropType\_Plot, W\_PropType\_Row House, W\_PropType\_Serviced  
Apartment, W\_PropType\_Studio, W\_PropType\_Studio Apartment,  
W\_PropType\_Triplex, W\_PropType\_Villa, W\_PropType\_Villament,  
W\_Rera\_1.0, W\_Rera\_Missing

===== END OF REPORT =====

=====

MINING COVERAGE EFFECTS

```

=====
Coefficient:      0.062190
Std. Error:      0.006726
P-value:         0.000000
Impact:          6.42% per 1pp mining coverage

Spatial lag (): 0.583659
Spatial error (): 0.625650
Pseudo R²:       0.7668

```

## 1.1.22 10km Radius - SAR Model (Robustness)

```

=====
SAR (SPATIAL LAG) - ROBUSTNESS CHECK
Radius: 10.0km | Sample: 1,602,159 obs
=====

```

MODEL SPECIFICATION:

-----  
 $y = W*y + X* +$

Where:

$y$  = Log(Price)  
 = Spatial lag coefficient (spillover effects only)  
 $W$  = 8-nearest neighbors matrix (row-standardized)  
 Estimation: GM (Generalized Method of Moments)

REGRESSION RESULTS

-----  
 SUMMARY OF OUTPUT: SPATIAL TWO STAGE LEAST SQUARES  
 -----

Data set	:	unknown		
Weights matrix	:	unknown		
Dependent Variable	:	Log_Price	Number of Observations:	1602159
Mean dependent var	:	15.7453	Number of Variables	61
S.D. dependent var	:	0.9819	Degrees of Freedom	1602098
Pseudo R-squared	:	0.7722		
Spatial Pseudo R-squared:		0.4817		

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	5.68665	0.04917	115.64682	0.00000
Mining_Coverage_Percent	0.04195	0.00226	18.53630	0.00000
Area_Sqft	0.00001	0.00000	186.91122	0.00000
Num_Bedrooms	0.28874	0.00050	574.49066	0.00000
Landmark_School	-0.00771	0.00031	-25.14150	0.00000
Landmark_Hospital	0.00118	0.00029	4.09463	0.00004
Landmark_Restaurant	-0.01029	0.00028	-36.49332	0.00000
Landmark_Mall	-0.00498	0.00031	-15.95030	0.00000
City_Badlapur	-0.08984	0.00548	-16.38626	0.00000
City_Bangalore	0.17843	0.00258	69.18065	0.00000
City_Bhubaneswar	0.00552	0.00475	1.16222	0.24515
City_Chennai	0.02707	0.00249	10.85787	0.00000
City_Coimbatore	-0.06440	0.00360	-17.91309	0.00000
City_Faridabad	0.22357	0.00452	49.45744	0.00000
City_Ghaziabad	0.09221	0.00347	26.57542	0.00000

City_Greater Noida	0.15034	0.00321	46.82009	0.00000
City_Gurgaon	0.45306	0.00307	147.71676	0.00000
City_Hyderabad	0.06564	0.00246	26.69182	0.00000
City_Indore	0.05191	0.00445	11.65771	0.00000
City_Jaipur	-0.12416	0.00315	-39.35710	0.00000
City_Kalyan	0.12267	0.00549	22.36150	0.00000
City_Kolkata	-0.06311	0.00238	-26.47964	0.00000
City_Lucknow	-0.08858	0.00373	-23.73140	0.00000
City_Mohali	0.09544	0.00489	19.52274	0.00000
City_Mumbai	0.44485	0.00262	169.53917	0.00000
City_Nagpur	-0.14807	0.00390	-37.98265	0.00000
City_Nashik	-0.13571	0.00431	-31.47924	0.00000
City_Navi Mumbai	0.17955	0.00359	49.97894	0.00000
City_New Delhi	0.22539	0.00356	63.33098	0.00000
City_Noida	0.19614	0.00371	52.89020	0.00000
City_Other	-0.04207	0.00224	-18.74723	0.00000
City_Pune	0.12672	0.00225	56.23775	0.00000
City_Raipur	-0.17126	0.00589	-29.09082	0.00000
City_Secunderabad	0.02923	0.00544	5.37504	0.00000
City_Surat	-0.10833	0.00513	-21.10313	0.00000
City_Thane	0.16315	0.00283	57.60174	0.00000
City_Vadodara	-0.21277	0.00460	-46.26666	0.00000
City_Visakhapatnam	-0.04602	0.00512	-8.99130	0.00000
PropType_Apartment	0.24040	0.04694	5.12091	0.00000
PropType_Builder Floor	0.19858	0.04727	4.20125	0.00003
PropType_Bungalow	0.24558	0.05005	4.90639	0.00000
PropType_Condo	0.17817	0.34165	0.52151	0.60201
PropType_Duplex	0.38856	0.04723	8.22639	0.00000
PropType_Farm House	0.45868	0.04916	9.33026	0.00000
PropType_Independent Floor	0.06802	0.04701	1.44671	0.14798
PropType_Independent House	0.17994	0.04699	3.82940	0.00013
PropType_Penthouse	0.61728	0.04757	12.97542	0.00000
PropType_Plot	0.36749	0.04695	7.82748	0.00000
PropType_Row House	0.18817	0.05073	3.70954	0.00021
PropType_Serviced Apartment	0.14729	0.08752	1.68283	0.09241
PropType_Studio	0.07302	0.04946	1.47649	0.13981
PropType_Studio Apartment	0.04392	0.04820	0.91125	0.36216
PropType_Triplex	0.45788	0.05646	8.11017	0.00000
PropType_Villa	0.42626	0.04698	9.07346	0.00000
PropType_Villament	0.44308	0.05846	7.57969	0.00000
Furnish_Fully Furnished	0.07476	0.00203	36.80912	0.00000
Furnish_Semi-Furnished	-0.01097	0.00132	-8.28350	0.00000
Furnish_Unfurnished	-0.01947	0.00125	-15.52634	0.00000
Rera_1.0	0.13423	0.00099	134.93476	0.00000
Rera_Missing	0.19807	0.00136	146.12599	0.00000
W_Log_Price	0.57009	0.00098	581.24280	0.00000

-----  
Instrumented: W\_Log\_Price

Instruments: W\_Area\_Sqft, W\_City\_Badlapur, W\_City\_Bangalore,  
W\_City\_Bhubaneswar , W\_City\_Chennai, W\_City\_Coimbatore,  
W\_City\_Faridabad, W\_City\_Ghaziabad, W\_City\_Greater Noida,  
W\_City\_Gurgaon, W\_City\_Hyderabad, W\_City\_Indore, W\_City\_Jaipur,  
W\_City\_Kalyan, W\_City\_Kolkata, W\_City\_Lucknow, W\_City\_Mohali,  
W\_City\_Mumbai, W\_City\_Nagpur, W\_City\_Nashik, W\_City\_Navi  
Mumbai, W\_City\_New Delhi, W\_City\_Noida, W\_City\_Other,  
W\_City\_Pune, W\_City\_Raipur , W\_City\_Secunderabad, W\_City\_Surat,  
W\_City\_Thane, W\_City\_Vadodara, W\_City\_Visakhapatnam,  
W\_Furnish\_Fully Furnished, W\_Furnish\_Semi-Furnished,  
W\_Furnish\_Unfurnished, W\_Landmark\_Hospital, W\_Landmark\_Mall,

W\_Landmark\_Restaurant, W\_Landmark\_School,  
W\_Mining\_Coverage\_Percent, W\_Num\_Bedrooms,  
W\_PropType\_Apartment, W\_PropType\_Builder Floor,  
W\_PropType\_Bungalow, W\_PropType\_Condo, W\_PropType\_Duplex,  
W\_PropType\_Farm House, W\_PropType\_Independent Floor,  
W\_PropType\_Independent House, W\_PropType\_Penthouse,  
W\_PropType\_Plot, W\_PropType\_Row House, W\_PropType\_Serviced  
Apartment, W\_PropType\_Studio, W\_PropType\_Studio Apartment,  
W\_PropType\_Triplex, W\_PropType\_Villa, W\_PropType\_Villament,  
W\_Rera\_1.0, W\_Rera\_Missing

#### DIAGNOSTICS FOR SPATIAL DEPENDENCE

TEST	DF	VALUE	PROB
Anselin-Kelejian Test	1	43298.254	0.0000

#### SPATIAL LAG MODEL IMPACTS

Impacts computed using the 'simple' method.

Variable	Direct	Indirect	Total
Mining_Coverage_Percent	0.0420	0.0556	0.0976
Area_Sqft	0.0000	0.0000	0.0000
Num_Bedrooms	0.2887	0.3829	0.6716
Landmark_School	-0.0077	-0.0102	-0.0179
Landmark_Hospital	0.0012	0.0016	0.0027
Landmark_Restaurant	-0.0103	-0.0136	-0.0239
Landmark_Mall	-0.0050	-0.0066	-0.0116
City_Badlapur	-0.0898	-0.1191	-0.2090
City_Bangalore	0.1784	0.2366	0.4150
City_Bhubaneswar	0.0055	0.0073	0.0128
City_Chennai	0.0271	0.0359	0.0630
City_Coimbatore	-0.0644	-0.0854	-0.1498
City_Faridabad	0.2236	0.2965	0.5200
City_Ghaziabad	0.0922	0.1223	0.2145
City_Greater Noida	0.1503	0.1994	0.3497
City_Gurgaon	0.4531	0.6008	1.0538
City_Hyderabad	0.0656	0.0870	0.1527
City_Indore	0.0519	0.0688	0.1207
City_Jaipur	-0.1242	-0.1646	-0.2888
City_Kalyan	0.1227	0.1627	0.2853
City_Kolkata	-0.0631	-0.0837	-0.1468
City_Lucknow	-0.0886	-0.1175	-0.2060
City_Mohali	0.0954	0.1266	0.2220
City_Mumbai	0.4449	0.5899	1.0347
City_Nagpur	-0.1481	-0.1963	-0.3444
City_Nashik	-0.1357	-0.1800	-0.3157
City_Navi Mumbai	0.1795	0.2381	0.4176
City_New Delhi	0.2254	0.2989	0.5243
City_Noida	0.1961	0.2601	0.4562
City_Other	-0.0421	-0.0558	-0.0979
City_Pune	0.1267	0.1680	0.2948
City_Raipur	-0.1713	-0.2271	-0.3984
City_Secunderabad	0.0292	0.0388	0.0680
City_Surat	-0.1083	-0.1436	-0.2520
City_Thane	0.1632	0.2164	0.3795
City_Vadodara	-0.2128	-0.2821	-0.4949
City_Visakhapatnam	-0.0460	-0.0610	-0.1070
PropType_Apartment	0.2404	0.3188	0.5592
PropType_Builder Floor	0.1986	0.2633	0.4619
PropType_Bungalow	0.2456	0.3257	0.5712
PropType_Condo	0.1782	0.2363	0.4144

PropType_Duplex	0.3886	0.5153	0.9038
PropType_Farm House	0.4587	0.6082	1.0669
PropType_Independent Floor	0.0680	0.0902	0.1582
PropType_Independent House	0.1799	0.2386	0.4185
PropType_Penthouse	0.6173	0.8185	1.4358
PropType_Plot	0.3675	0.4873	0.8548
PropType_Row House	0.1882	0.2495	0.4377
PropType_Serviced Apartment	0.1473	0.1953	0.3426
PropType_Studio	0.0730	0.0968	0.1699
PropType_Studio Apartment	0.0439	0.0582	0.1022
PropType_Triplex	0.4579	0.6072	1.0650
PropType_Villa	0.4263	0.5652	0.9915
PropType_Villament	0.4431	0.5875	1.0306
Furnish_Fully Furnished	0.0748	0.0991	0.1739
Furnish_Semi-Furnished	-0.0110	-0.0145	-0.0255
Furnish_Unfurnished	-0.0195	-0.0258	-0.0453
Rera_1.0	0.1342	0.1780	0.3122
Rera_Missing	0.1981	0.2627	0.4607

===== END OF REPORT =====

#### MINING COVERAGE EFFECTS

Coefficient: 0.041951  
 Std. Error: 0.002263  
 P-value: 0.000000  
 Impact: 4.28% per 1pp mining coverage

Spatial lag (): 0.570085

Pseudo R<sup>2</sup>: 0.7722

### 1.1.23 10km Radius - SEM Model (Robustness)

#### SEM (SPATIAL ERROR) - ROBUSTNESS CHECK

Radius: 10.0km | Sample: 1,602,159 obs

#### MODEL SPECIFICATION:

$y = X* + u$   
 $u = W*u +$

Where:

$y = \text{Log}(\text{Price})$   
 $= \text{Spatial error coefficient (correlated shocks only)}$   
 $W = 8\text{-nearest neighbors matrix (row-standardized)}$   
 Estimation: GM (Generalized Method of Moments) with heteroskedasticity

#### REGRESSION RESULTS

#### SUMMARY OF OUTPUT: GM SPATIALLY WEIGHTED LEAST SQUARES (HET)

Data set	:	unknown		
Weights matrix	:	unknown		
Dependent Variable	:	Log_Price	Number of Observations:	1602159
Mean dependent var	:	15.7453	Number of Variables	: 60

S.D. dependent var : 0.9819                      Degrees of Freedom : 1602099  
Pseudo R-squared : 0.3638  
N. of iterations : 1                      Stepic computed : No

Variable	Coefficient	Std. Error	z-Statistic	Probability
CONSTANT	14.81655	0.09183	161.35087	0.00000
Mining_Coverage_Percent	0.07075	0.01969	3.59351	0.00033
Area_Sqft	0.00001	0.00000	7.92578	0.00000
Num_Bedrooms	0.29320	0.00110	267.69747	0.00000
Landmark_School	-0.02064	0.00154	-13.40158	0.00000
Landmark_Hospital	0.00105	0.00146	0.71878	0.47227
Landmark_Restaurant	-0.02357	0.00146	-16.18455	0.00000
Landmark_Mall	-0.01487	0.00158	-9.39278	0.00000
City_Badlapur	-0.67479	0.02740	-24.62324	0.00000
City_Bangalore	0.19814	0.01790	11.06818	0.00000
City_Bhubaneswar	-0.11604	0.03577	-3.24417	0.00118
City_Chennai	-0.30421	0.01729	-17.59401	0.00000
City_Coimbatore	-0.55972	0.02924	-19.14253	0.00000
City_Faridabad	0.28378	0.03941	7.20032	0.00000
City_Ghaziabad	0.11479	0.02451	4.68417	0.00000
City_Greater Noida	0.13461	0.02240	6.00923	0.00000
City_Gurgaon	1.01664	0.02048	49.63975	0.00000
City_Hyderabad	-0.05493	0.01685	-3.26025	0.00111
City_Indore	-0.44301	0.04027	-11.00098	0.00000
City_Jaipur	-0.41522	0.02540	-16.34999	0.00000
City_Kalyan	-0.15248	0.02463	-6.19105	0.00000
City_Kolkata	-0.22998	0.01526	-15.07389	0.00000
City_Lucknow	-0.56474	0.03437	-16.43104	0.00000
City_Mohali	-0.18343	0.02083	-8.80770	0.00000
City_Mumbai	0.67467	0.01633	41.31080	0.00000
City_Nagpur	-0.68014	0.02905	-23.41388	0.00000
City_Nashik	-0.57217	0.02396	-23.87886	0.00000
City_Navi Mumbai	0.06293	0.02570	2.44905	0.01432
City_New Delhi	0.41498	0.02952	14.05934	0.00000
City_Noida	0.40663	0.03036	13.39418	0.00000
City_Other	-0.34757	0.01592	-21.83726	0.00000
City_Pune	0.05741	0.01422	4.03635	0.00005
City_Raipur	-0.94722	0.04861	-19.48458	0.00000
City_Secunderabad	-0.06536	0.03761	-1.73766	0.08227
City_Surat	-0.31220	0.03598	-8.67680	0.00000
City_Thane	-0.03584	0.01735	-2.06558	0.03887
City_Vadodara	-0.43034	0.03091	-13.92329	0.00000
City_Visakhapatnam	-0.36564	0.03932	-9.30016	0.00000
PropType_Apartment	0.11833	0.09065	1.30538	0.19176
PropType_Builder Floor	0.18973	0.09086	2.08815	0.03678
PropType_Bungalow	0.48886	0.09472	5.16132	0.00000
PropType_Condo	0.15952	0.18779	0.84946	0.39563
PropType_Duplex	0.42226	0.09080	4.65063	0.00000
PropType_Farm House	0.56816	0.09652	5.88643	0.00000
PropType_Independent Floor	0.01672	0.09068	0.18440	0.85370
PropType_Independent House	0.31587	0.09063	3.48528	0.00049
PropType_Penthouse	0.46494	0.09077	5.12245	0.00000
PropType_Plot	0.66917	0.09039	7.40320	0.00000
PropType_Row House	0.33618	0.09316	3.60848	0.00031
PropType_Serviced Apartment	-0.31378	0.10758	-2.91660	0.00354
PropType_Studio	-0.11142	0.09287	-1.19974	0.23024
PropType_Studio Apartment	-0.21613	0.09106	-2.37339	0.01763



PropType_Triplex	0.48707	0.12162	4.00480	0.00006
PropType_Villa	0.63850	0.09060	7.04745	0.00000
PropType_Villament	0.36018	0.09283	3.87996	0.00010
Furnish_Fully Furnished	0.10370	0.00227	45.68646	0.00000
Furnish_Semi-Furnished	0.01438	0.00132	10.86716	0.00000
Furnish_Unfurnished	0.00830	0.00125	6.61177	0.00000
Rera_1.0	0.20996	0.00260	80.82352	0.00000
Rera_Missing	0.21084	0.00298	70.80480	0.00000
lambda	0.87773	0.00143	612.22048	0.00000

===== END OF REPORT =====

#### MINING COVERAGE EFFECTS

Coefficient: 0.070749  
 Std. Error: 0.019688  
 P-value: 0.000326  
 Impact: 7.33% per 1pp mining coverage

Spatial error (): 0.877732  
 Pseudo R<sup>2</sup>: 0.3638

## 1.1.24 10km Radius - Machine Learning Results

ML ANALYSIS - HARMONIZED VERSION (FIXED) (Radius: 10.0km)  
 Date: 2026-02-04 11:46:41

#### FIXES IMPLEMENTED:

NO data leakage: City selection from TRAINING set only  
 STANDARDIZED: Outlier removal BEFORE GeoDataFrame  
 ERROR HANDLING: Geometry operations protected  
 Imputation using TRAINING statistics only  
 All feature engineering respects train/test boundary  
 AUTO-DROP: Variables with >25% missing data excluded  
 HYPERPARAMETER TUNING: GridSearchCV on XGBoost, RF, GB

#### HARMONIZATION:

Feature set IDENTICAL to lm\_test.py, spatial\_sdm\_CORRECTED.py, final\_CORRECTED.py  
 Same 9 continuous variables across ALL analyses  
 Top 30 cities (selected from training data only)

#### 1. PREDICTIVE MODELS

Model	MAE	RMSE	R <sup>2</sup>
XGBoost	0.260505	0.379619	0.8499
Random Forest	0.324604	0.460209	0.7795
Extra Trees	0.425466	0.577864	0.6523
Gradient Boosting	0.296478	0.421149	0.8153
LightGBM	0.334759	0.468752	0.7712
CatBoost	0.343548	0.478329	0.7618
Neural Network	0.329004	0.465466	0.7744
Ridge	0.537492	0.731603	0.4427

Lasso	0.541731	0.735666	0.4364
ElasticNet	0.539454	0.733130	0.4403

## 2. TOP 20 FEATURES

```
-----
Mining_Coverage_Percent      : 129.307497
Area_Sqft                    : 125.344751
Landmark_Mall                : 73.092297
Landmark_Restaurant          : 64.404792
Num_Bedrooms                 : 64.086416
Landmark_School              : 61.890056
Landmark_Hospital            : 60.310952
PropType_Plot                : 45.236993
Rera_1.0                     : 26.928341
City_Mumbai                  : 26.754545
PropType_Apartment           : 21.329744
City_Gurgaon                 : 20.202857
City_Other                   : 15.687132
City_Navi Mumbai             : 15.361167
City_Thane                   : 15.175643
City_Pune                    : 14.931092
Rera_Missing                 : 13.971358
City_New Delhi               : 13.906977
City_Kolkata                 : 13.349134
City_Noida                   : 11.597193
-----
```

## 3. HETEROGENEOUS EFFECTS (PARTIAL DEPENDENCE - FIXED)

Effect across mining coverage range, controlling for:

- Property size, bedrooms, bathrooms, balconies
- Nearby amenities (schools, hospitals, restaurants, malls)
- City location (top 30 cities from training set)
- Property type, furnishing, RERA status
- All other property characteristics

```
-----
Farm House      : 17.85% (n= 852)
Row House       : 13.34% (n= 497)
Studio Apartment : 12.00% (n= 1,506)
Bungalow        : 7.01% (n= 615)
Triplex         : 2.78% (n= 177)
Plot            : 0.58% (n=215,333)
Agricultural Land : -1.18% (n= 83)
Villa           : -1.28% (n=54,536)
Penthouse       : -1.48% (n= 3,130)
Apartment       : -3.72% (n=884,745)
Duplex          : -5.91% (n= 6,865)
Studio          : -6.35% (n= 743)
Independent Floor : -6.42% (n=41,350)
Builder Floor   : -6.90% (n= 6,410)
Independent House : -8.31% (n=64,700)
Villament       : -8.98% (n= 150)
-----
```

=====

NOTES:

=====

This analysis uses IDENTICAL feature engineering to:

- lm\_test.py (OLS with LM diagnostics)
- spatial\_sdm\_CORRECTED.py (spatial econometric models)
- final\_CORRECTED.py (OLS + PSM pipeline)

CRITICAL: All feature engineering respects train/test boundary.  
City selection uses TRAINING set only to prevent data leakage.  
Results are directly comparable across all methodologies.