



Making Friends With Your Neighbor?: Agglomeration and Tactic Collusion in the Lodging industry.

Li Gan and Manuel A. Hernandez
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Presented by Liu Lu
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Introduction



- Agglomeration is a location pattern frequently observed in service industries such as hotels, hotels locate close to one another to enjoy of agglomeration effects.
- Agglomeration results in a heightened demand, where products are heterogeneous and need personal inspection (Fischer and Harrington ,1996). Agglomeration effects should be higher among hotels located in rural areas (Chung and Kalnins , 2001)
- Provides additional opportunities for frequent interaction and exchange of information, making it easier and faster to detect deviations from any potential tacit agreement, reduces monitoring costs and increases market transparency.
- Agglomeration may also facilitate the tacit coordination of prices and quantities among hotels located next to each other.

Introduction



- Collusive regimes differ from noncollusive ones In higher prices and lower quantities , which is predicted by general oligopoly models.
- How to detect collusive behavior or cartels?
- Screen test for collusion using changes in the coefficient of variation of prices Abrantes-Metz et al. , 2006).
- This paper follows Porter (1983), Ellison (1994), and Knittel and Stango (2003), using regime switching models to identify collusive and noncollusive regimes. A higher-price regime is associated with collusive behavior.

Introduction



- Firms can achieve higher profits by tacitly agreeing to raise prices (and restrict quantity) above (below) the static Nash equilibrium level. Since cheating or deviating from the collusive agreement increases current profits, firms can be deterred from deviating only if they are penalized in the future.

$$\sum_{t=1}^T \delta^t (\pi_i^c - \pi_i^s) \geq \pi_i^d - \pi_i^c,$$

- Lodging properties that operated in Non-MSA (towns) across the state between 2003 and 2005.
- A market is defined as all hotels in a given town. Towns in rural areas allows us to work with a comparable and geographically isolated set of oligopoly markets, as locations in our sample are generally small and separated from one another
- An unbalanced panel of 9,148 observations corresponding to 845 hotels operating in 250 markets between the first quarter of 2003 and the fourth quarter of 2005
- The main data source is the Texas Hotel Performance Factbook,

37% of the markets are monopolies, 18% are duopolies
another 26% have between three and five competitors.

TABLE 1.—DISTRIBUTION OF MARKETS BY NUMBER OF HOTELS

Number of Hotels in Market	Number of Markets	%
1	1,027	37.1
2	508	18.3
3	380	13.7
4	133	4.8
5	204	7.4
6	129	4.7
7	79	2.9
8	55	2.0
9	68	2.5
10	56	2.0
More than 10	132	4.8
Total	2,771	100.0

Location categories

- **Clustered** if it has at least one competitor in a radius of 0.2 miles.
- **Isolated property with a cluster in town** is a hotel with competitors in town that are more than 0.2 miles from the hotel but where at least two of these competitors are within 0.2 miles from each other
- **Monopolist** is a hotel without any competitors in town
- **Isolated property with no cluster in town** is a hotel with competitors in town that are all more than 0.2 mile apart from each other.

Variety indexes: the level of heterogeneity among hotels in a market

the weight w_i is equal to the fraction of hotels of a quality i in the market (cluster) or to the fraction of rooms of quality i in the market (cluster).

$$V(N) = \prod_N w_i^{-w_i}$$

TABLE 3.—VARIETY OF HOTELS IN EACH MARKET AND CLUSTER BASED ON QUALITY

Variety index	Average Markets			Average Clusters		
	All Markets	Markets with More Than One Hotel	Markets with More Than Two Hotels	Cluster 0.1 Mile	Cluster 0.2 Mile	Cluster 0.5 Mile
Based on two varieties (low and high quality)						
Simple index	1.33 (0.44)	1.53 (0.45)	1.65 (0.39)	1.40 (0.48)	1.45 (0.47)	1.50 (0.46)
Index accounting for hotel size	1.32 (0.42)	1.51 (0.43)	1.63 (0.39)	1.37 (0.45)	1.41 (0.44)	1.47 (0.44)
Based on four varieties (one to four diamonds)						
Simple index	1.48 (0.66)	1.76 (0.70)	1.96 (0.69)	1.55 (0.54)	1.60 (0.57)	1.71 (0.64)
Index accounting for hotel size	1.48 (0.66)	1.76 (0.69)	1.96 (0.68)	1.51 (0.51)	1.55 (0.54)	1.68 (0.62)
Number of observations	2,771	1,744	1,236	1,011	1,281	1,604

- Regardless of the number of competitors, the markets are generally dominated by one type of product variety.
- This low level of heterogeneity among hotels in our sample suggests that the risk of coordinated behavior is not necessarily low, given that tacit collusion is easier to achieve when all firms offer similar products than when they offer highly differentiated products.
- include this variety index to account for potential complementarity or substitutability across hotels, particularly among clustered hotels,

FIGURE 1.—AVERAGE DAILY RATE (ADR), BY RELATIVE LOCATION

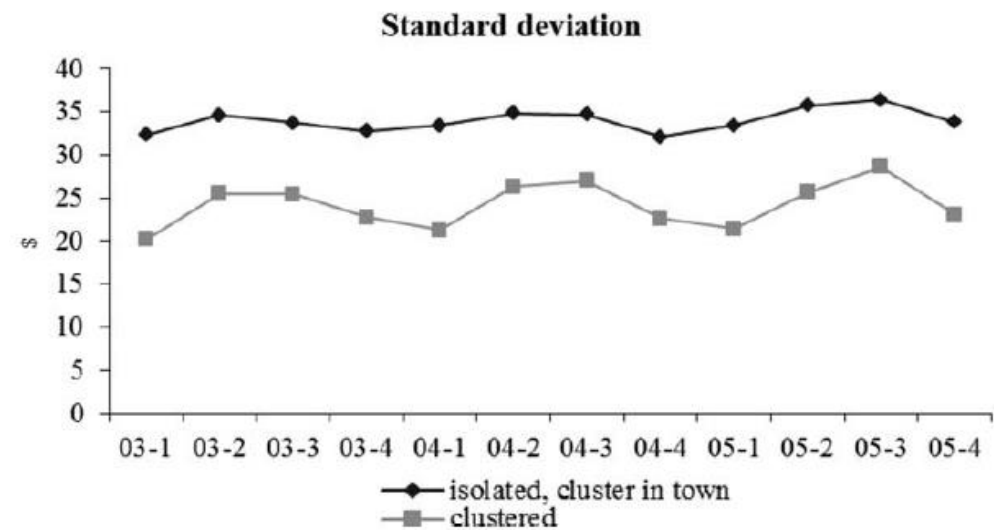
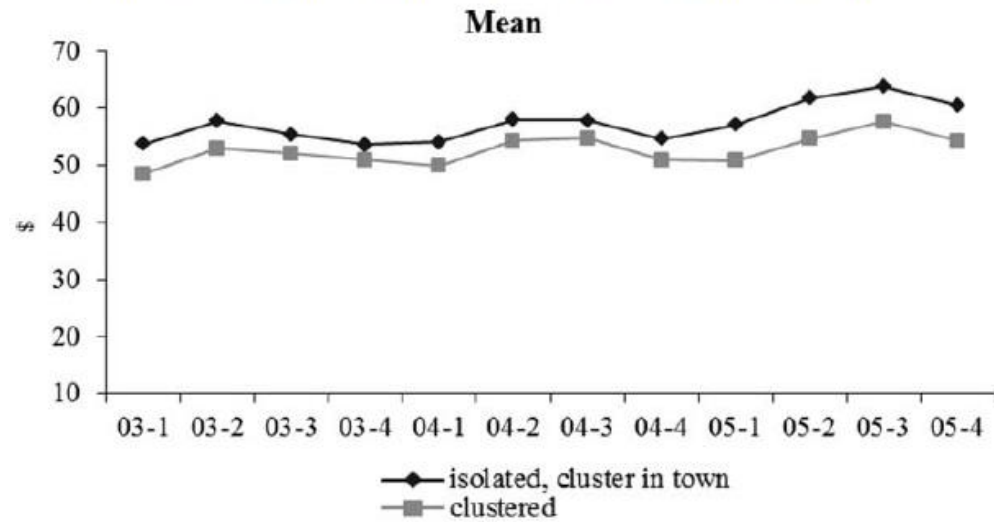
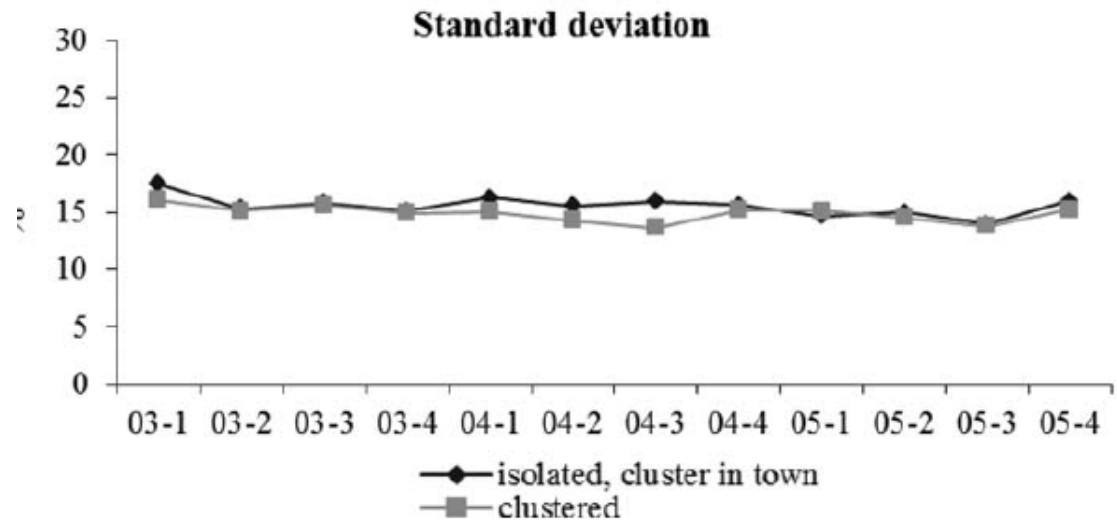
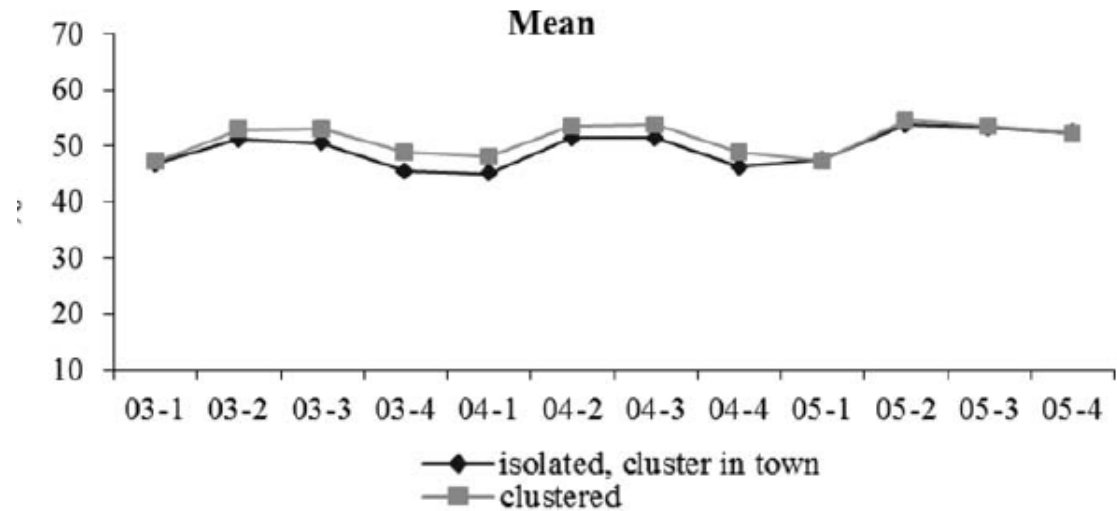


FIGURE 2.—OCCUPANCY RATE, BY RELATIVE LOCATION



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Empirical Model



$$\ln p_{imt} = \delta_1^s + \delta_2^s MktStructure_{mt} + X_{imt} \gamma^s + \varepsilon_{imt}^s,$$

$$\ln q_{imt} = \alpha_1^s + \alpha_2^s MktStructure_{mt} + X_{imt} \beta^s + u_{imt}^s,$$

- Log-linear price (p) and occupancy rate (q)
- The superscript s indicates one of two possible regimes: a collusive regime (C) and a noncollusive one (NC).
- $MktStructure_{mt}$ measures the level of concentration in the market through the Herfindahl-Hirshman Index (HHI), which is based on each firm's share of rooms sold,
- Vector X_{imt} includes several property and market-specific variables

Property-specific variables

- dummy variables for the geographic location
- Cluster size
- Number of other hotels in the cluster of similar quality,
- Cluster heterogeneity measured through a variety index
- hotel quality (one, to four diamonds),
- dummy variable if the hotel is of medium or large size (has morethan fifty rooms)
- dummy variables for high-quality and affiliations to major chains in our sample.

Market-specific variables

- Population, per capita personal income, value of rural land per acre,
- wage on leisure and hospitality, number of gas stations, wage on leisure and hospitality
- distance to a MSA, distance to the closest town, regional dummies.

Empirical Model



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$$\ln q_{imt} = \alpha_1^s + \alpha_2^s MktStructure_{mt} + X_{imt} \beta^s + u_{imt}^s,$$

- In the collusive regime, firms are expected to charge higher prices, which also result in lower occupancy rates than in the non-collusive regime. Additionally, during successful periods of tacit collusion, we expect a lower dispersion in prices and occupancy rates

$$\bar{\delta}_1^C > \delta_1^{NC}, \alpha_1^C < \alpha_1^{NC}, \sigma_\varepsilon^C < \alpha_\varepsilon^{NC}, \text{ and } \sigma_u^C < \alpha_u^{NC}.$$

Empirical Model



- Model the mixing parameter h (probability of engaging in tacit collusion) both as a constant and as a function of the geographical location of a hotel relative to its nearby competitors.

$$h = G(\kappa_1 + \kappa_2 R_1 + \kappa_3 R_2)$$

$$h_j = G(\kappa_1 + \kappa_2 \text{Clustered}_j + \kappa_3 \text{Monop}_j \\ + \kappa_4 \text{Isolated_no_cluster}_j + \kappa_5 R_1 + \kappa_6 R_2)$$

R_1 is a dummy variable equal to 1 if the hotel is located in Central Texas or the Metroplex (upper Central Texas) R_2 equals 1 if the hotel is located in the South or the Gulf Coast,

The first specification assumes the probability is constant across hotels but may vary by specific regions, while the second specification allows us to evaluate whether the probability varies with the relative location of the hotel within the town.

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- The first specification assumes the probability is constant across hotels but may vary by specific regions, while the second specification allows us to evaluate whether the probability varies with the relative location of the hotel within the town.
- The third is to avoid omitted variable or misspecification of the functional form, including other factors include cluster size, seasonality, and firm size.

The market-level HHI is presumably endogenous

- Because there might be unobserved cost or demand characteristics in a market that not only influence prices (and occupancy rates) but also the underlying market structure.
- Instrument the HHI with the HHI of the closest urban area to the town,

Endogenous variables include hotel size, quality type, and location

- number of entries and exits is very small, regarded as long-run decision variables.
- take the establishments' capacity, quality, and location as given.

TABLE 6.—SEMIPARAMETRIC 2SLS REGRESSIONS OF PRICE (ADR) AND OCCUPANCY RATE (CLUSTER RADIUS = 0.2 MILE)



	Log ADR		Log Occupancy	
	Coefficient	SE	Coefficient	SE
Constant	-0.748	0.512	-0.099	0.323
Clustered	-0.129	0.037	0.129	0.023
Monopolist	0.092	0.067	0.256	0.052
Isolated, no cluster in town	0.006	0.022	0.078	0.017
Log number of nearby hotels	0.101	0.037	-0.105	0.026
Log number of nearby competitors similar quality	-0.010	0.029	0.044	0.019
Cluster variety index	-0.029	0.015	0.000	0.013
Medium or large hotel	-0.056	0.011	-0.083	0.010
High quality	0.318	0.019	0.128	0.014
Best Western	0.045	0.018	0.209	0.014
Best Value	-0.424	0.032	-0.102	0.031
Comfort	0.177	0.019	0.213	0.018
Days	-0.114	0.019	0.064	0.017
Econolodge	-0.228	0.020	-0.138	0.024
Holiday Inn	0.263	0.019	0.318	0.015
Motel 6	-0.081	0.023	0.383	0.015
Super 8	-0.156	0.020	0.077	0.018
Ramada	-0.199	0.025	0.049	0.026
HHI	-0.206	0.091	-0.250	0.068
Log population	-0.038	0.013	-0.027	0.010
Log per capita income	0.229	0.043	-0.021	0.026
Gas stations	-0.011	0.002	0.003	0.001
Log value of land	0.138	0.015	-0.008	0.010
Log wage	0.210	0.047	-0.076	0.031
Log distance to MSA	0.128	0.017	-0.007	0.012
Log distance to closest town	0.003	0.013	0.031	0.010
Central Texas	0.172	0.034	-0.064	0.026
High Plains	0.014	0.036	-0.038	0.031
Metroplex	0.242	0.042	-0.026	0.029
Northwest Texas	-0.024	0.034	-0.020	0.028
South Texas	0.276	0.033	0.037	0.026
Southeast Texas	0.159	0.039	-0.001	0.029
Upper East Texas	0.261	0.032	-0.014	0.026
Upper Rio Grande	0.380	0.053	0.054	0.041
West Texas	0.123	0.040	-0.002	0.031
Number of observations		9,148		9,148
R ²		0.272		0.207

Results



TABLE 7.—SWITCHING REGRESSION MODEL OF PRICE (ADR) AND OCCUPANCY RATE (CLUSTER RADIUS = 0.2 MILE)

	Model 1				Model 2				Model 3			
	Log ADR		Log Occupancy		Log ADR		Log Occupancy		Log ADR		Log Occupancy	
	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE	Coefficient	SE
Regime 1												
Constant	3.182	0.268	-0.835	0.279	3.318	0.276	-0.673	0.286	3.240	0.277	-0.992	0.274
Clustered	0.073	0.030	0.100	0.029	0.074	0.028	0.091	0.029	0.063	0.025	0.083	0.028
Monopolist	0.043	0.046	0.069	0.043	0.030	0.044	0.058	0.044	0.034	0.041	0.047	0.045
Isolated, no cluster in town	0.072	0.017	0.014	0.016	0.064	0.017	0.015	0.016	0.068	0.016	0.011	0.016
Log number of nearby hotels	0.059	0.037	-0.090	0.035	0.063	0.032	-0.093	0.034	0.068	0.029	-0.087	0.031
Log nearby competitors similar quality	-0.049	0.027	0.023	0.026	-0.047	0.024	0.030	0.026	-0.069	0.022	0.022	0.024
Cluster variety index	-0.044	0.019	0.008	0.017	-0.044	0.017	0.010	0.018	-0.040	0.016	0.013	0.016
Medium or large hotel	0.028	0.013	-0.077	0.013	0.024	0.011	-0.074	0.012	0.036	0.012	-0.098	0.012
High quality	0.443	0.018	0.104	0.017	0.451	0.017	-0.104	0.019	0.464	0.017	0.125	0.017
HHI	0.125	0.058	-0.076	0.057	0.143	0.055	-0.073	0.057	0.119	0.054	-0.072	0.058
Log population	-0.069	0.010	-0.011	0.010	-0.072	0.009	-0.012	0.009	-0.071	0.009	-0.011	0.009
Log per capita income	-0.042	0.027	-0.017	0.024	-0.042	0.026	-0.022	0.026	-0.029	0.025	-0.005	0.025
Gas stations	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001
Log value of land	0.060	0.011	0.007	0.011	0.061	0.011	0.004	0.011	0.066	0.012	0.009	0.011
Log wage	0.110	0.038	0.037	0.034	0.093	0.035	0.027	0.036	0.076	0.036	0.026	0.035
Log distance to MSA	0.064	0.015	-0.004	0.014	0.058	0.013	-0.009	0.014	0.071	0.014	0.015	0.014
Log distance to closest town	-0.014	0.011	0.013	0.011	-0.016	0.011	0.012	0.011	-0.030	0.011	0.017	0.011
Regime 2												
Constant	-1.644	1.304	-2.488	1.607	-2.111	1.393	-2.429	1.685	-3.576	1.331	-0.841	1.053
Clustered	-0.669	0.093	0.149	0.085	-0.680	0.104	0.071	0.095	-0.772	0.108	0.091	0.094
Monopolist	0.065	0.152	1.015	0.132	0.087	0.158	1.004	0.133	0.188	0.165	0.931	0.132
Isolated, no cluster in town	-0.119	0.042	0.265	0.038	-0.156	0.042	0.273	0.037	-0.177	0.048	0.277	0.039
Log number of nearby hotels	0.529	0.117	-0.092	0.110	0.617	0.134	-0.023	0.121	0.646	0.137	-0.033	0.119
Log nearby competitors similar quality	-0.165	0.077	0.121	0.076	-0.225	0.090	0.099	0.083	-0.100	0.091	0.117	0.082
Cluster variety index	-0.089	0.047	-0.086	0.045	-0.128	0.054	-0.114	0.052	-0.160	0.054	-0.098	0.049
Medium or large hotel	-0.267	0.032	-0.093	0.031	-0.278	0.034	-0.100	0.030	-0.144	0.039	-0.206	0.037
High quality	0.108	0.042	0.096	0.042	0.107	0.048	0.093	0.045	0.063	0.045	0.044	0.042
HHI	-0.062	0.218	-1.367	0.186	-0.048	0.226	-1.370	0.195	-0.190	0.233	-1.217	0.185
Log population	-0.027	0.020	-0.058	0.019	-0.031	0.020	-0.059	0.021	-0.048	0.020	-0.058	0.019
Log per capita income	0.503	0.104	0.237	0.110	0.489	0.108	0.244	0.096	0.638	0.105	0.145	0.090
Gas stations	-0.011	0.003	-0.007	0.003	-0.011	0.003	-0.007	0.003	-0.014	0.003	-0.005	0.003
Log value of land	0.228	0.034	0.017	0.030	0.255	0.034	0.015	0.029	0.296	0.033	-0.018	0.029
Log wage	-0.135	0.078	-0.143	0.069	-0.075	0.085	-0.144	0.068	-0.119	0.082	-0.127	0.067
Log distance to MSA	-0.016	0.049	0.041	0.040	0.003	0.049	0.040	0.041	-0.006	0.059	-0.056	0.045
Log distance to closest town	0.097	0.043	0.142	0.038	0.110	0.043	0.127	0.036	0.144	0.045	0.085	0.039
Probability of regime 1												
Constant			1.317	0.068			1.128	0.098			0.935	0.102
Clustered							0.562	0.097			0.610	0.220
Monopolist							0.342	0.121			0.463	0.130
Isolated, no cluster in town							-0.270	0.099			-0.306	0.108
Log number of nearby hotels											-0.237	0.130
High season											-0.140	0.072
Medium or large hotel											1.434	0.114
If Central Texas or Metroplex			-0.987	0.088			-0.883	0.094			-0.846	0.100
If South Texas or Gulf Coast			-0.795	0.083			-0.803	0.091			-0.905	0.100
σ_{ϵ}^1			0.231	0.004			0.230	0.003			0.228	0.003
σ_{η}^1			0.236	0.004			0.234	0.004			0.236	0.003
ρ^1			0.362	0.005			0.368	0.005			0.374	0.005
σ_{ϵ}^2			0.426	0.010			0.434	0.011			0.454	0.010
σ_{η}^2			0.437	0.007			0.435	0.008			0.437	0.007
ρ^2			0.338	0.010			0.330	0.010			0.271	0.013
Number of observations				9,148				9,148				9,148
Log likelihood				-5,344.3				-5,290.9				-5,169.3

FIGURE 3.—PROBABILITY OF COLLUDING, CONDITIONAL ON BEING CLUSTERED
(CLUSTER RADIUS = 0.2 MILE)

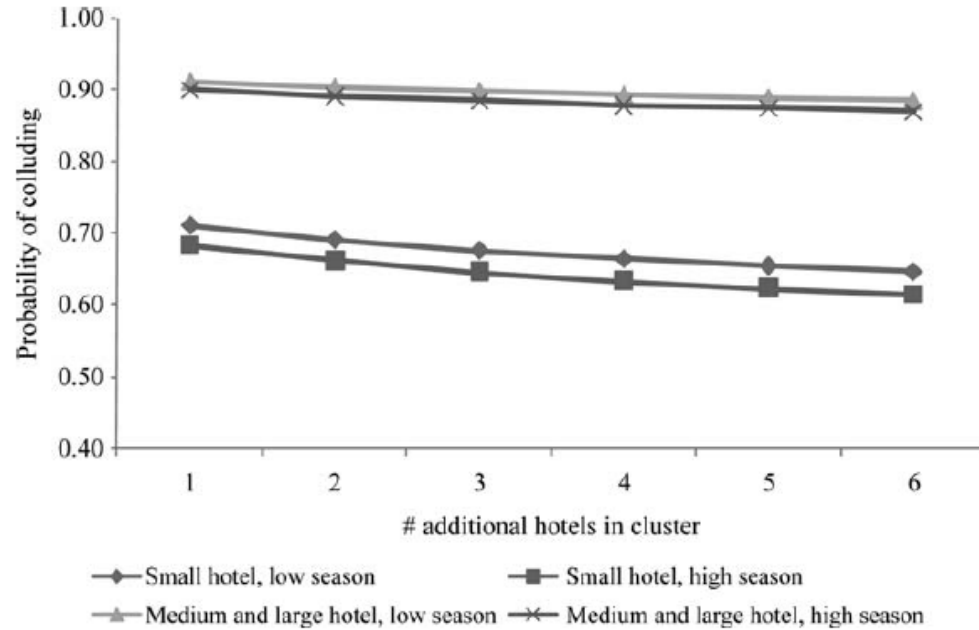


FIGURE 4.—AVERAGE PROBABILITY OF COLLUDING FOR DIFFERENT HOTEL TYPES
UNDER ALTERNATIVE SCENARIOS (CLUSTER RADIUS = 0.2 MILE)

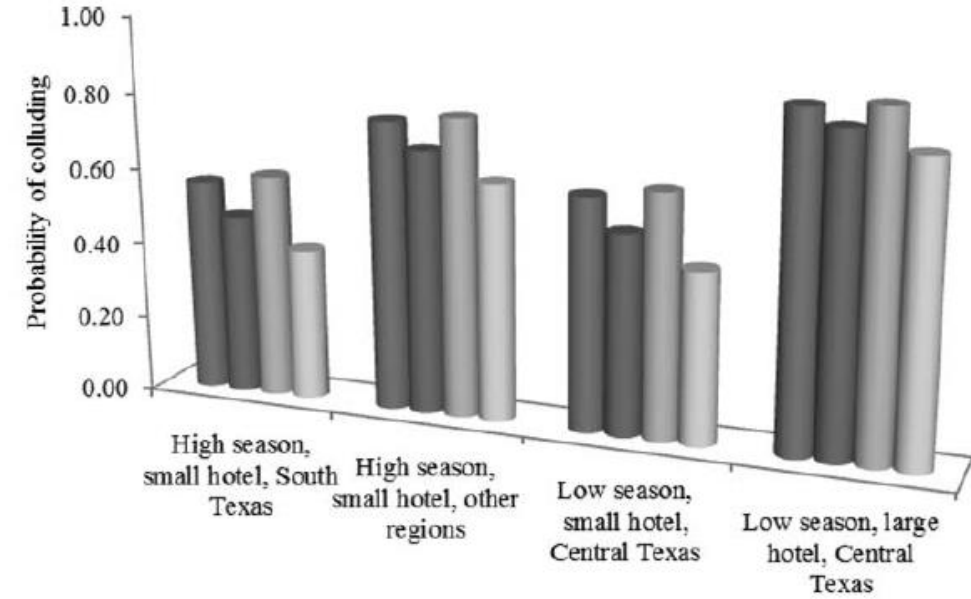
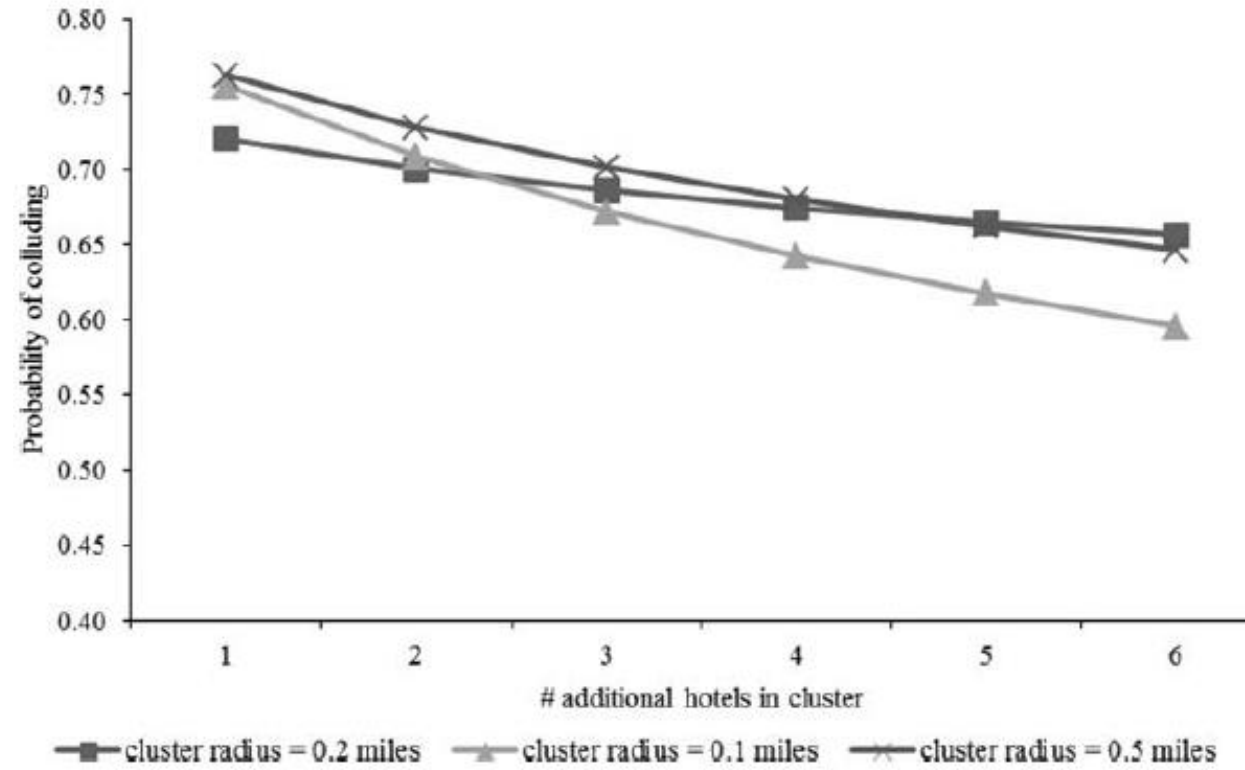


FIGURE 5.—PROBABILITY OF COLLUDING, CONDITIONAL ON BEING CLUSTERED,
BY CLUSTER DEFINITION



Probabilities based on a small hotel and low season.

Conclusion



- Clustered hotels have a higher probability of being in the potential collusive regime than isolated hotels with a cluster in town; These findings support the hypothesis that agglomeration may facilitate tacit collusion among clustered hotels
- Our identification of a collusive regime is also consistent with other factors considered to affect the sustainability of tacit collusion like cluster size, seasonality, and firm size, and the results are robust to alternative cluster definitions.