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1 Introduction

Many industries experience boom-bust cycles. In some cases, the causes and consequences of a boom or bust are easy to identify: technological change can explain why in some industries firms cannibalize their own operations by investing in new, superior plants (as in the semiconductor industry) or product lines (megaplexes replacing multiplexes in the movie theater industry). Other boom-bust cycles are caused by drastic changes in regulation (U.S. railroads in the 19th century and in the 1920s). However, many industries experience boom-bust cycles without such technological or regulatory changes. What explains those cycles? What are their consequences? In particular, does the timing of an investment over a cycle affect its performance? The aggregate nature of existing data (reporting performance at the corporate level instead of asset-specific performance) has so far made it hard to understand the performance of investments made at different points of a cycle, and thus to explore the drivers of these investment cycles.

In this paper, we use a proprietary dataset from the U.S. hotel industry to study investment cycles. This industry has the advantage of not having experienced any major technological or regulatory changes. Our data set offers several advantages. First, it includes information on the construction year of virtually all hotels in the U.S., along with performance information for the majority of them from 2000 to 2009. This allows us to identify how the performance of hotels is affected if they were built at different points of a cycle. Importantly, we can measure the performance of individual assets, instead of having to rely on the performance of a firm that owns the assets. Second, we can identify geographic "markets" (counties) for each hotel and therefore "local" investment cycles. To the extent that local investment cycles do not perfectly vary with aggregate investment cycles, we can further identify the impact of these local cycles on the performance of hotels built at different points of these cycles. Third, we have good controls for the hotels' characteristics, including brands, quality segments and the type of location; and for the markets in which these hotels operate, including economic conditions and local competition. This rich set of controls allows us to isolate the impact of investment cycles on performance from confounding market and property characteristics at the time we measure performance. Finally, the hotel industry's features make it a good laboratory for studying investment cycles. Investments are "sunk" (a conversion of hotels to alternative uses is difficult and thus rare) and long-lived, so distressed asset sales do not change the industry's capacity.

Our main focus is on the impact of both local (county-level) and aggregate (nationwide) investment booms on hotels' short-term and long-term performance. We find that hotels built during local investment booms underperform their peers significantly for a long time. A one-standard deviation increase in the number of hotels built in the same county-year reduces a hotel's performance by 3-5%. This underperformance is significant even thirty years after a hotel was built.

In contrast, aggregate investment booms have a negative, but short-lived, effect on performance (during the first five years of operation). Finding such a "cohort effect" is consistent with evidence on the underperformance of IPOs and private equity funds financed during "hot" periods (Ritter 1991; Gompers and Lerner 2000; Gompers et al. 2008; Kaplan and Schoar 2005; and Robinson and Sensoy 2011). An interpretation in line with these earlier papers is that during peak times, too much capital is available and hotels are built even if they promise subpar returns.[1]

However, aggregate capital inflows neither explain the effect of *local* investment booms on performance, nor the pervasiveness of the effect we find (significant for thirty years). We consider two possible explanations for this pattern: within-vintage competition, and "incorrect" herding. The evidence favors the herding explanation: potential entrants in a local market regard the construction of a hotel as good news about that market and are more likely to enter themselves, but are later disappointed.

Competition at the time of entry (within-vintage competition) could have a long-lasting effect on the entrants' later performance, even after controlling for the current state of competition and local market conditions, if hotels compete more strongly with others of a similar vintage (built in the same or contiguous years). If that is the case, a sudden and large increase in supply might affect all hotels built in a given market for several years. An alternative explanation is provided by the herding literature (starting with Bikhchandani, Hirshleifer and Welch, 1992; Banerjee, 1992; and Welch, 1992). This literature argues that if the value of investment opportunities is uncertain, then firms may base their investment decisions on the decisions made recently by other firms. The rationale is that those earlier decisions may reveal the information that firms investing earlier had available. However, this imitating behavior can lead to "informational

[1] This is also consistent with a "real options" view of investments; see e.g. Grenadier (1996).

cascades," sequences of decisions in which agents ignore their own information and imitate the decisions of others. Cascades are costly if several agents imitate earlier decisions to invest, while they would not invest if all information was publicly observable (i.e., "incorrect" herding). This could imply that investments made within a cascade perform less well, on average, than non-herding investments. If imitators plan their projects badly or can only choose from inferior sites, then their performance should be even worse.

We perform several empirical tests to distinguish between the within-vintage competition and herding hypotheses. First, we broaden the definition of "vintage" by including hotels built (in the same county) in the year before and the year after a given hotel was built. If within-vintage competition explained the underperformance we find, then we should find that a hotel is also negatively affected by the number of entrants in its market one year before and one year after its entry, because all these hotels are of a similar vintage. In contrast, from a herding perspective, hotels built one year after and one year before a given hotel should not have the same effect on that hotel's performance. Specifically, if many hotels were built in the year before a given hotel was built, then that hotel might be mimicking those earlier entry decisions, causing underperformance; while the number of hotels built in the year *after* a given hotel was built are unlikely to have affected that hotel's *earlier* decision (except for the anticipation of additional short-term competition).

We find that the number of entrants in the years before and after a hotel was built have a negative impact on the hotel's performance during the first 10 years of the hotel's operations. This suggests that within-vintage competition can indeed explain some of our short-term results (consistent with, e.g., Hoberg and Phillips, 2010). However, we also find evidence that competition alone cannot explain: The number of entrants in the year *before* a hotel was built has a much more long-lasting negative impact on the hotel's performance than the number of hotels built in the year *after* a hotel was built. The former effect lasts for up to 30 years, while the latter effect vanishes after 10 years of operations. The fact that the effect of entry in the year before a hotel was built is longer-lasting is consistent with herding: The decision to build a hotel was likely influenced by prior decisions to build hotels, potentially leading to an "incorrect" informational cascade.

To further differentiate competition from herding, we distinguish hotels by quality segment when counting the number of same-year entrants.[2] Intuitively, competition among hotels of the same vintage should be more relevant for hotels that operate in the same segment (i.e., targeting the same type of customers). Distinguishing within-segment from between-segment entrants may also help identify herding: An opportunity to enter a market exists if hotels from a different segment are entering, suggesting that a market has potential, although the market might only have good potential for a particular quality segment, and not for others. In this case, between-segment imitation may be a symptom of "incorrect" herding.

We find that the number of same-segment entrants has no significant effect on performance of a given hotel in its later years of operation, while the number of different-segment entrants has a significant and negative effect. This evidence favors herding over competition. However, competition is not completely irrelevant: It explains the coefficients for the number of competitors in the years in which performance is measured, as opposed to the number of hotels built in a market in the same year. The evidence on current competition is consistent with an "agglomeration" effect: A hotel's performance is better if more of its competitors operate in different quality segments, while it is worse if more of its competitors operate in the same segment (see Freedman and Kosová 2012 and Canina et. al 2005).

To confirm that our results are not driven by unobserved between-county variation, we look for evidence of herding within the counties that experience at least one spike of local hotel construction. We find that hotels built during local cycle peaks underperform their peers within the same county, confirming our herding interpretation and ruling out alternative explanations based on cross-county differences.

Finally, to better understand what role herding plays in investment cycles, we study the determinants of the number of hotels built in a county-year. We find that the likelihood of multiple hotel entry increases with the number of entrants in the preceding year, even after controlling for the county's economic conditions and the stock of hotels in the county. This effect is stronger in counties experiencing more volatile economic growth. These results are

[2] There are 6 possible quality segments: Luxury/Upper-Upscale, Upscale, Midscale with food and beverage, Midscale without food and beverage, Economy and Independent. See Table 1, Panel E for more details.

consistent with the predictions of herding models: With less reliable information on the value of entering, an agent is more tempted to rely more on other agents' information and join a herd.

Our interpretation of the results is the following: There are several reasons for entering a market, some justifying imitation, others not. A market may have great promise, for example, because the local economy is growing and more business or leisure travel is expected. Alternatively, a hotel operator may have identified an unusually promising site for a hotel in an otherwise unremarkable market. For example, a convention center may need an anchor hotel, but there is space for only one anchor hotel; or there may be a site with high traffic, but the available space is limited, so the remaining nearby sites may be less attractive. A first hotel may be built either because the market has great promise, or because an unusual site has been identified. If other hotel operators discover that a hotel will be built in that market, they may infer that the market has great promise, and a herd develops, even if the true reason was an unusual site. Herders should on average perform less well than leaders in such a setup. This interpretation is consistent with the general intuition provided by the herding literature, although it is not based on any particular model. The main reason is that herding models typically assume that all agents earn identical payoffs, so they do not make any predictions about expected payoffs (or performance) after investments are made.

We make several contributions to the literature. First, no other paper studies how market-wide investment activity affects the operating performance of a real asset (here, a hotel). Second, unlike earlier work, we can distinguish aggregate investment cycles from investment cycles at the local market level, which is where an investment faces imitation and competition. We show that hotels built during investment booms underperform others, but the impact of aggregate investment booms on performance is only short-lived, while the effect of local investment booms is much more long-lasting. This distinction may be relevant for other "booms," for example merger waves, that the literature finds difficult to explain.

Our results contribute to the empirical literature on herding and informational cascades. This literature is quite small, given the challenges in finding detailed data to test for herding behavior. Moreover, most of this literature focuses on analyst ratings or investment decisions made by fund managers (see, e.g., Welch 2000), where an important driver of imitation are career concerns. Our focus is entirely on information transmission, as in our setting career concerns are not likely to play a role (see Section 2 for details).[3]

The rest of the paper is organized as follows. In Section 2, we describe some key features of the hotel industry. In Section 3, we describe the data. In Section 4, we present our empirical strategy. In Section 5, we describe our results. Section 6 concludes.

2 Investments and Operations in the Hotel Industry

2.1 Investments in the Hotel Industry

Branded hotels dominate the hotel market in the U.S., but surprisingly few hotels are actually owned by the company that owns the brand (e.g., Marriott International, Starwood Hotels & Resorts, Hilton Worldwide, Hyatt, etc.). Instead, hotels are typically owned by individuals, partnerships or LLCs (limited liability companies), who either operate the hotels themselves or hire management companies. Specifically, around 85% of hotels are owned by individuals, partnerships or LLCs, while only around 10% are owned by large corporations (see Corgel, Mandelbaum and Woodworth 2011).[4] The typical investor who builds a hotel is a real estate developer, who selects a location, negotiates the financing and chooses the organizational form and brand (see below for details) while planning the project.

The hotel industry is thus characterized by a decentralized ownership structure, with very small units making investments and start-up decisions. As only a small fraction of the assets are owned by large corporations, there are no major concerns about bureaucracy or agency problems — including careers concerns — that complicate the analysis in other contexts. In particular, at the planning and investment stage of a hotel, the developer holds equity in the project and thus has a strong incentive to make value-maximizing decisions.

The decision to build a hotel is based on a developer's assessment of future demand in a particular market. This requires forecasts about the volume of demand for hotel services, but

[3] Empirical papers studying how information transmission affects performance are rare, because it is often difficult to measure the performance of an investment. Kennedy (2002) is an exception. He studies whether TV networks imitate each others' programming choices. The performance of a decision is measured using TV ratings and a program's time to cancellation. There is evidence of herding and of reduced performance by herders, but the evidence suggests that herding could be caused by career concerns.

[4] Investments/ownerships by hotel REITs (real estate investment funds) account only less than 2% of hotels, while other institutional investors (e.g. pension funds or financial institutions) represent usually less than 1% of investors.

also forecasts about the type of traveler that is expected (business, leisure, etc.). A developer must choose a promising market, a promising site in that market, and identify the most promising quality segment (for branded hotels, the quality segment depends on the chosen brand). Not surprisingly, these decisions are made under uncertainty, and hotels are planned (and construction starts) well before the expected increase in demand materializes.[5]

Investments in the hotel industry are long-term and irreversible. Developers invest large amounts,[6] financed partly with bank loans (mortgages). Once completed, hotels are long-lived: With occasional renovations, a hotel can be operated for several decades. It is rare for hotels to be closed permanently: According to practitioner comments, conversions (say, into offices, apartments or retirement homes) are extremely rare and only ½-1% of the existing stock is demolished per year. Sales and bankruptcies do not change the supply of hotel rooms in a given market: they merely change the ownership of a hotel, and maybe the choice of brand under which it operates. Not surprisingly, given the low exit rate, the entry rate in the industry is low, too: On average, the entry rate was 2.9% per year between 1993 and 2006, while the entry rate for other industries was about 10% for the same period (see Freedman and Kosová 2012).

The time needed to plan and construct of a hotel varies, depending on the chosen quality segment and (related to that choice) the amenities the hotel will offer (e.g., restaurant, conference facilities). Economy hotels without food or beverage service can be built in one year, but more upscale hotels (with more facilities) can require two to three years. News about a planned new hotel becomes public during the planning stage (e.g., when permits are requested) or once the site clearance and construction work begins. This implies that the decision to build a hotel can incorporate prior decisions to build by others — from the year before, for example — although the construction of these projects might not be finished.

[5] For example, the recently begun construction of an upscale hotel in the "NoMa" neighborhood of Washington, D.C., is the first investment in a large mixed-use commercial development; see "JBG launches Capitol Square with new hotel site," *Washington Business Journal*, Thursday, October 18, 2012. The investment was started based on expectations that demand will materialize once the development is complete.

[6] On a per-room basis, the total construction costs were at least $30,000 for low-tier economy hotels in 2003; for luxury hotels and resorts, the cost was as high as $600,000 per room; see http://www.hotel-online.com/News/PR2003_2nd/May03_HotelWaterParkStudy.html.

2.2 Operations in the Hotel Industry

The hotel developer can choose to operate the hotel independently or under a nationally/globally recognized brand name (e.g., Courtyard by Marriott, Hilton Garden Inns, etc.), belonging to a large corporation (e.g., Marriott International, Hilton Worldwide, etc.). The choice of brand is also related to the organizational form under which the hotel will operate: Some brands are offered to developers only through franchise agreements (e.g., Microtel, Travelodge) or only through management contracts (e.g., Fairmont, Four Seasons); other brands make no such restrictions (e.g., Courtyard by Marriott).

Under a franchise agreement, the corporation owning the brand (the franchisor, e.g., Hilton Worldwide), grants to the owner/developer of a hotel (the franchisee) the right to use its brand name (Waldorf Astoria, Hilton, DoubleTree, Hampton Inn, etc., in the case of Hilton Worldwide) and to operate the hotel under this brand name. The franchisor does not manage the hotel property, but rather leaves most day-to-day management decisions to the franchisee.

Under a management contract, on the other hand, the corporation owning the chosen brand is hired by the hotel owner/developer to manage the hotel. Thus, the corporation owning the chosen brand handles day-to-day operations and all the management decisions at the given hotel. (Usually, the hotel's owner cannot interfere with the operator's management of the property).

Both franchise agreements and management contracts tend to have long time horizons — usually 20 years, with renewal options — but can be terminated before the contract expires under certain circumstances (see Kosová and Sertsios 2012). A consumer normally cannot tell whether a branded hotel is operated under a franchise agreement or a management contract. Each brand targets a particular quality segment defined by the brand requirements, in terms of service and amenities offered.

The operating costs of a hotel are mostly fixed costs. To assess the operating performance of a hotel, the industry focuses on both the average daily rate earned per room-night sold and the average occupancy rate. These two measures are combined in the industry's key performance measure: "revenue per available room" ("RevPAR"), the revenue earned from all rooms on a given day divided by the number of room-nights available on that day.[7] A developer's decisions (choice of a location, brand, quality segment and organizational form) are likely to maximize the performance ("RevPAR") of hotels according to the market characteristics.

3 Data and Aggregate Data Patterns

3.1 Data Sources

We utilize a unique (proprietary) dataset on the hotel industry. This dataset combines hotel Census data compiled by Smith Travel Research (STR) with hotel revenue data also from STR.[8] The STR Census data covers around 98% of the hotel properties in the US — about 52,000 hotels in 2009 — and represents one of the most comprehensive sources on the hotel industry available. The data provides information about the state and county where the hotel is located; each hotel's organizational form (company-managed, franchised, or independent); a description of the hotel's location (urban, small town, suburban, etc.) and other property characteristics including the number of rooms, the quality segment and the year in which the property was built (i.e., the year in which construction ended and the hotel was first opened for operations). In addition, we were also able to obtain the brand under which each hotel operates (coded numerically to preserve anonymity).

The revenue database contains a decade of performance information from 2000 to 2009, mainly on branded hotels. We use the key performance metric used in the hotel industry: monthly RevPAR (revenue per available room). It is defined as a hotel's monthly revenues divided by the number of hotel room-nights available that month. Hotels of similar quality that operate within the same segment and in comparable markets, are supposed to earn similar RevPAR. Higher/lower RevPAR than otherwise comparable projects is perceived in the industry as indication of better/worse performance.

Since in our analysis we use the average monthly RevPAR *per year*, we restrict our final sample to those hotel-years for which we have monthly RevPAR for all 12 months in a given year. Using annual averages of RevPAR helps us to smooth out outliers and avoid biases in performance measurement due to monthly seasonality. Also, our analysis focuses on hotel

[7] See Corgel, deRoos and Fitzpatrick (2011).
[8] STR is an independent research company that collects information about hotel properties in the U.S. and internationally. We obtained access to all STR data under a strict confidentiality agreement.

properties that were built in 1940 or later, as during earlier years hotel construction patterns were sparse. Our final sample consists of 219,849 hotel-year observations across 30,283 unique hotel properties, distributed across 2,216 counties. Among these, about 89.4% of the annual RevPAR observations correspond to branded hotels that belong to 221 unique brands. The remaining 10.6% of observations correspond to independent hotels. Notice that although we restrict our sample only to those hotels for which we have performance data, we use *all* hotels in the Census data to to construct some of our control variables (the number of hotels *built* in the same year as a given hotel, and the number of competing hotels *operating* in a given county-year).

We complement the hotel data with data from the Census Bureau and the Bureau of Labor Statistics (BLS), which provide annual information on county demographics and employment. These include population (from the Census Bureau's annual population estimates), unemployment rate (from the BLS), median household income (from the Census Bureau), and the number of establishments in accommodation industry and two related industries — arts, recreation & entertainment, and food & beverage (all from the Census Bureau's County Business Patterns data). In our analysis, we rely on market characteristics at the county-level for two reasons. First, counties represent the best available approximation to the relevant geographic area in which hotels interact with each other, and which consumers typically consider when looking for alternative lodging options around their target destination (see Freedman and Kosová, 2012 for a discussion). Second, county-level data represent the lowest level of aggregation at which time-varying market characteristics are regularly reported for each year.

3.2 Aggregate Investment Cycles — The Cohort Effect.

Based on STR Census data (i.e., including all hotels in the Census, not only the ones for which we have performance data), Figure 1 shows the number of hotels built each year between 1940 and 2009. The figure clearly shows the patterns of cyclical aggregate activity (i.e., an aggregate cohort effect), with hotel construction sometimes above and sometimes below the long-term trend. We define the cohort effect in any year h as the standardized residual from the time trend of the total number of hotels built nationwide in year h. We use h to denote the year of a hotel's construction, in order to later differentiate that year from the years of operation (indexed by t) during which we measure RevPAR and other control variables.

Specifically, to construct our measure of aggregate cohort effect we regress the total number of hotels built in the United States in year *h*, $TotalHotels_h$, on a time trend as follows:

$$(1) \qquad Total\ Hotels_h = \alpha + \delta * Trend_h + e_h$$

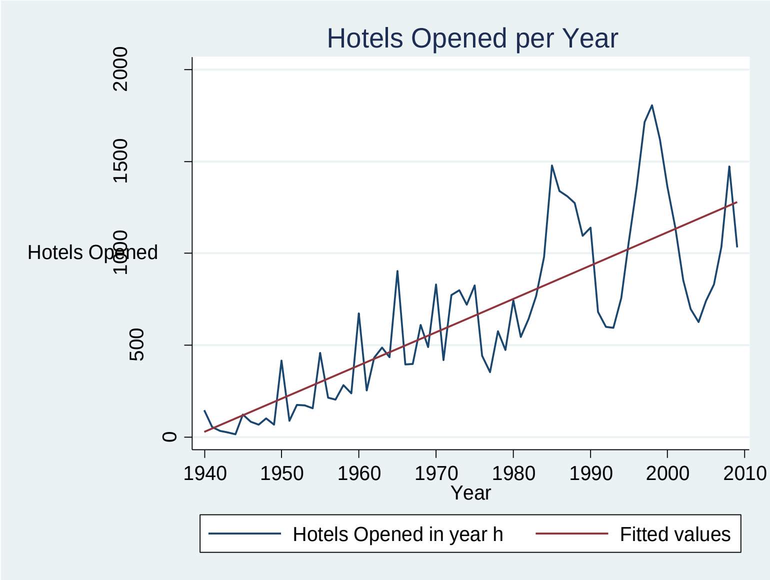
Using the estimated residuals from this regression we measure cohort effect as:

$$Cohort\ Effect_h \equiv {}^{\hat{e}_h}/_{\sigma}$$

where σ is the sample standard deviation of $\hat{e}_h$. The main advantage of this cohort effect measure is that it not only captures the annual deviations in the hotel entry from the common trend, but it standardizes such annual deviations by the overall variation in our sample.

Figure 1

The figure shows the number of hotels built each year between 1940 and 2009 using STR Census data. The fitted value line shows the predicted values from the regression: $Total\ Hotels_h = \alpha + \delta * Trend_h + e_h$.



Although our main measure of the aggregate cohort effect is detrended, we also provide an alternative measure without detrending, which we use to assess the robustness of our results:

$$Cohort\ Effect\ (levels)_h \equiv Total\ Hotels_h$$

Since our analysis uses disaggregated hotel-level data, we measure the aggregate cohort effect (both detrended and levels) for each hotel *i*, based on the year *h* in which hotel *i* was built.

As Figure 1 shows, the mid-1980s and late 1990s experienced the largest spikes in hotel construction when compared with the time trend (i.e., a positive estimated residual and a large standardized error), while the early 1990s and mid-2000s experienced slow investment (i.e., a negative estimated residual and a large standardized error). The *Cohort Effect* reached its maximum in 1998, when the total number of hotels built was 2.7 standard deviations above the long-term trend, and its minimum in 2004, when the number of hotels built was 2.1 standard deviations below the long-term trend.

3.3 Local Investment Cycles — The County Entry Effect

Since we have detailed data on hotel entry at the county-year level, we can distinguish the impact of aggregate hotel entry (i.e., the aggregate cohort effect) from local market/county entry effect. To identify the *local* investment cycles that each hotel i faces in its county c at the year of construction h, we define $Entrants_{ich}$ as the number of hotels that were built in county c during the same year h as hotel i, including hotel i itself. If hotel i is the only hotel built in county c in year h, the value of $Entrants_{ich}$ equals 1. The highest value of this variable (47 hotels) appears in our sample in Maricopa County, Arizona, in 1998. Thus all hotels that were built in Maricopa County in 1998 will have value of $Entrants_{ich}$ set to 47.

Figure 2 shows the county entry patterns for four counties. Panels A and B show the entry patterns for two counties that experienced large spikes in terms of the number of entrants in a single year: Maricopa County in Arizona and Harris County in Texas. Panels C and D show the entry patterns for two counties for which the extent of entry was much smaller: Middlesex County in New Jersey and DeKalb County in Georgia. The figures indicate that although entry patterns within counties tend to follow the aggregate investment cycles, there is substantial variation across counties in terms of the timing and the magnitude of entry. As we show below, this substantial between-county variation appears to be a key driver of long-term hotel performance.

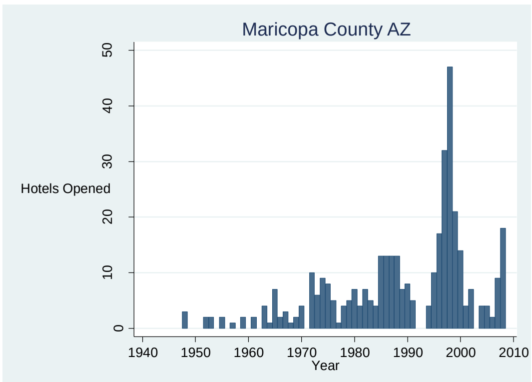
3.4 Summary Statistics

Table 1, Panel A, shows the summary statistics of our data. The panel itself is divided into 3 parts, showing descriptive statistics on: Hotel Characteristics, County (Market) Characteristics, and Year of Construction Characteristics.

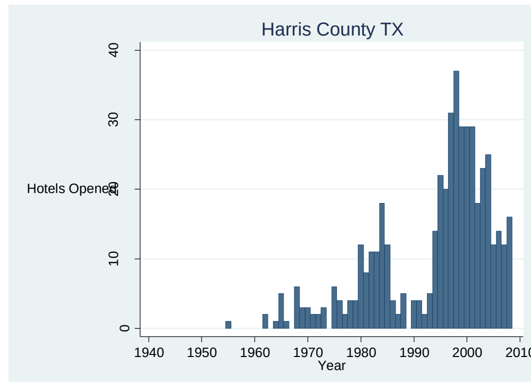
Figure 2

Panels A and B show the entry patterns in two counties that experienced large spikes in terms of the number of entrants in a single year: Maricopa County in Arizona and Harris County in Texas. Panels C and D on the other hand show the entry patterns for two counties for which the extent of entry was much smaller: Middlesex County in New Jersey and DeKalb County in Georgia.

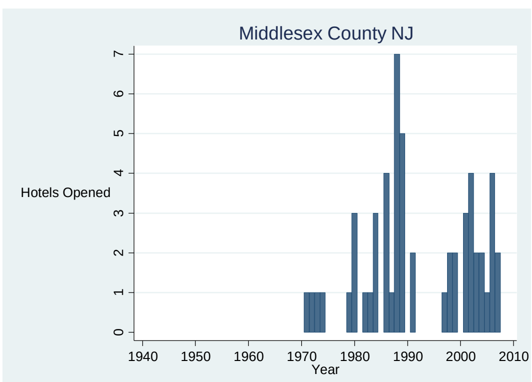
Panel A: Maricopa County



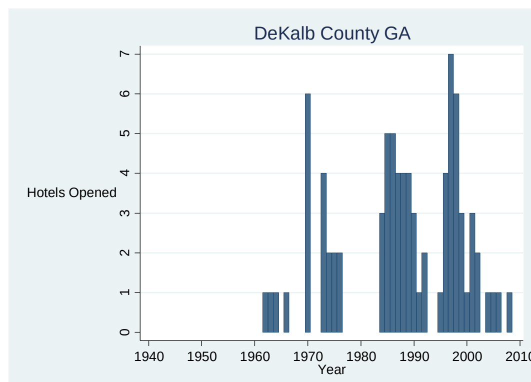
Panel B: Harris County



Panel C: Middlesex County



Panel D: DeKalb County



On average, a hotel in our sample has 123 rooms, generates $53 per room-night available (RevPAR) and total revenues of nearly $3 million per year (in 2009 US dollars). Hotel performance is measured from 2000 to 2009. Thus, hotels built before the year 2000 have 10 years of performance data, while newer hotels have fewer performance year observations. Hotel age is defined as the difference between the year of operation during our sample period (2000-2009) and the year of the hotel's construction, plus one. The average age of hotels in our sample is 18 years. Seventy-one percent of the hotel-year observations represent operations of franchisees, 18% of the hotel-year observations represent operations of company managed properties, and the remainder represents operations of independent hotels.

Regarding market characteristics, on average a hotel in our sample operates in a county with a median annual household income of $52,200, an unemployment rate of 5.5% and a population of 797,000. The average number of hotels in a county in a year of hotel operation t is 108 during our sample period, while the average number of more broadly defined accommodation establishments (including hotels, hostels, motels, etc.) in a county is 129. A hotel in our sample operates in a county with on average 394 Art, Recreation and Entertainment Establishments and 1,487 Food and Beverage Establishments. Counties with more establishments in these hotel-related industries are likely to be more attractive tourist/business destinations and have thus higher demand for hotels as well.

Table 1: Summary Statistics

Panel A shows descriptive statistics for the variables in our sample — split into Hotel Characteristics, County (Market) Characteristics, and Year of Construction Characteristics — across 219,849 hotel-year observations in our sample for 30,283 hotels during 2000-2009. Panel B shows the distribution of observations (as well as hotels) in our sample with different numbers of *Entrants*, i.e., hotels entering in the same county-year as a given hotel. The remaining panels show the distribution of hotels and RevPAR observations per year (Panel C); the distribution across different location types (Panel D); and the distribution across different quality segments (Panel E).

Panel A: Descriptive Statistics

Variable	Mean	Pctile 10	Pctile 50	Pctile 90	sd	N
Hotel Characteristics						
RevPAR	53	22.9	45.7	89.7	35	219,849
Rooms	123	50	97	216	117	219,849
Yearly Revenues (000)	2,937.1	537.9	1,468.9	5,787.2	5,826.7	219,849
Year	2005	2001	2005	2009	3	219,849
Age	18	4	15	36	12	219,849
Franchise	0.71	0	1	1	0.45	219,849
Company Managed	0.18	0	0	1	0.39	219,849
County (Market) Characteristics						
Income (000)	52.2	38.5	49.7	69.8	12.8	219,849
Unemployment Rate (%)	5.5	3.3	5.0	8.2	2.1	219,849
Population(000)	797	37.5	295	1,804	1,458	219,849
Hotels in County	108	9	54	273	152	219,849
Art, Recreation and Entertainment Establishments	394	13	116	682	1,288	219,849
Food and Beverage Establishments	1,487	63	578	3,598	2,595	219,849
Accommodation Establishments	129	11	65	341	186	219,849
Year of Construction (h) Characteristics						
Cohort Effect_h	0.66	-1.10	0.66	2.43	1.27	219,849
Cohort Effect_h (levels)	1,079	489	1,095	1,715	431	219,849
Entrants_{ch}	4	1	2	10	6	219,849

Panel B: Distribution of Observations and Hotels by Number of Entrants in the Same County-Year

$Entrants_{ch}$	Obs	Hotels	% of Obs	% of Hotels
1	77,780	11,083	35.4%	36.6%
2	43,463	6,075	19.8%	20.1%
3	23,746	3,331	10.8%	11.0%
4	16,889	2,230	7.7%	7.4%
5	11,379	1,570	5.2%	5.2%
>5	46,592	5,994	21.2%	19.8%
Total	219,849	30,283	100%	100%

Panel C: Distribution of Observations and Hotels by Year of Operation

Year	Obs/Hotels	% of total
2000	18,778	8.5%
2001	19,654	8.9%
2002	20,670	9.4%
2003	21,382	9.7%
2004	21,668	9.9%
2005	21,720	9.9%
2006	22,235	10.1%
2007	23,216	10.6%
2008	24,514	11.2%
2009	26,012	11.8%
Total	219849 / 30283	100%

Panel D: Distribution of Observations and Hotels by Location Type

Location	Obs	Hotels	% of Obs	% of Hotels
Urban	20,564	2,786	9.4%	9.2%
Suburban	93,756	12,350	44.3%	40.8%
Airport	14,071	1,817	6.4%	6.0%
Interstate	34,657	4,896	16.5%	16.2%
Resort	13,511	1,931	2.3%	6.4%
Small Town	43,290	6,503	23.6%	21.5%
Total	219,849	30,283	100%	100%

Panel E: Distribution of Observations by Segment

Location	Obs	% of Obs
Luxury/ Upper Upscale	14,563	6.6%
Upscale	22,702	10.3%
Midscale with F&B	21,831	9.9%
Midscale without F&B	66,587	30.3%
Economy	70,839	32.2%
Independent	23,327	10.6%
Total	219,849	100%

Finally, at the bottom of Panel A, we present the characteristics of hotels by year of construction, as defined in Section 3.2: *Cohort Effect*, *Cohort Effect (level),* and *Entrants*. In this panel, and in all subsequent tables, we show these variables with subscripts, to remind the reader that they have different levels of aggregation, and that both *Entrants* and *Cohort Effect* are measured in the year of a hotel's construction, *h*, not in the year when we measure a hotel's performance, *t*. For simplicity, we do not include the subscripts of the other variables in the tables, as they are all measured at year *t*, although different variables have different levels of aggregation (i.e., county/hotel level). As Panel A shows, the detrended measure *Cohort Effect* is positive on average, as more hotels were built during years of high investment activity than during years of low investment activity. The mean for the variable *Entrants* is 4, indicating that on average a hotel in our sample was built with 3 other hotels in the same county-year.

Panel B shows a more detailed description of the variable *Entrants,* which captures county investment cycles. Specifically, 37% of the hotels (35% of our sample observations) represent hotels that were the only entrants in their year of construction in their county; while 20% of the hotels (20% of our observations) were built together with one other hotel in the same county and the same year. Hotel-year observations with 3, 4 and 5 hotels built at the same time represent 11%, 8% and 5% of our data, respectively. Interestingly, more than 20% of the observations represent properties that were built in the same county-year with 5 or more other hotels.

Panel C shows the annual frequency of hotel performance observations (RevPAR) in our sample. Overall, the distribution of hotel-year observations is relatively similar across the years with gradual increases over time due to new hotel construction. Panel D shows the distribution of hotels in our sample across different location types (i.e., urban, suburban, small town, resort, near a highway, or near an airport). Finally, Panel E shows the distribution of observations by quality segment. As expected, a small fraction (6.6%) of the hotel-observations operate in the Luxury/Upper-Upscale and Upscale segments, while more than 40% operate in Midscale segments (with and without food and beverage) and Economy segment (32%). Independent hotels have no explicit quality benchmark and in our sample represent less than 11% of the observations.

4 Empirical Methodology

To analyze the impact of the aggregate investment cycles (aggregate cohort effect) and local/county-level investment cycles (county entry effect) on asset performance we estimate several variations of the following baseline empirical model:

$$(3) \qquad y_{igct} = \alpha + \beta * Cohort\ Effect_{ih} + \gamma * Entrants_{ich} + \mathbf{Q}'\boldsymbol{\Omega}_{ct} + \boldsymbol{Z}'\boldsymbol{\Gamma}_{i} + \boldsymbol{M}'\boldsymbol{\Psi}_{igct} + \mu_t + \delta_g + \varepsilon_{igct}$$

The subscript *i* indexes hotels, *t* indexes the year of a hotel's operation during our sample period 2000-2009, *c* indexes the county, *h* indexes the year of a hotel's construction, and *g* indexes a hotel's brand. The dependent variable y_{igct} represents our asset performance measure — the average monthly RevPAR in a given year *t*.

Differences in market size and economic conditions across counties and over time could affect hotel performance and at the same time be correlated with variables our of interest, thus biasing our estimates. To control for that, we include a set of market characteristics at the county-level, $\boldsymbol{\Omega}_{ct}$, namely: the median household income, the population of the county, and the county unemployment rate. In addition, we control for the total number of hotels that operate in a given county-year using the STR hotel Census database. To control for the attractiveness of a market as a business or tourist destination, we control for the number of establishments in two related industries: Arts, Entertainment and Recreation and Food and Beverage, as well as number of establishments in the broadly defined accommodation/lodging industry (not just hotels). Counties with more establishments in these industries are likely to be more attractive travel destinations and have higher demand for hotels as well.

Another set of important controls, $\boldsymbol{\Gamma}_{i}$, captures hotel-specific characteristics. These include the number of rooms or hotel capacity, and dummy variables for six hotel location types: urban, suburban, small town, resort, near a highway, or near an airport. We also include a set of time-varying hotel specific controls, $\boldsymbol{\Psi}_{\mathbf{igct}}$, that include a hotel's age (we include both a linear and a quadratic term) and dummy variables for a hotel's operation/organizational form — franchised, company-managed, or independent.[9] The organizational form of the hotels has very little variation over time in our sample; on average, the yearly rate of change in organizational form is 1.7%. We also control for year fixed effects, $\boldsymbol{\mu}_{\mathbf{t}}$, to capture unobserved macroeconomic shocks or changes in regulation that could affect hotel performance. Finally, we control for hotel brand fixed effects, γ_g, to control for unobserved differences across brands, such as different levels of popularity and quality segments (quality segments are subsumed within brands so we cannot include segment dummies together with brand dummies).[10] The default category is thus independent hotels.[11]

Key to our identification of the aggregate cohort effect and county-level entry effect is that our performance and control variables are measured at time *t* (post-entry years of hotel operation), while *Cohort Effect* and *Entrants* are measured at time *h* (year of hotel entry). In our data we have only 360 hotels/observations for which we measure their 12-month performance during their first year of operations (i.e., $t=h$), and all our results hold if we drop these observations from our sample.

Using our baseline empirical specification (equation 3) we explore the impact of the aggregate cohort effect and county-level entry effect on hotel performance for the overall sample as well as for different subsamples based on the hotels' age. We then extend our baseline empirical specification by including county-level entrants in the year before and the year after a hotel *i* was built. These extended specifications help us better understand how the dynamics of local cohort entry affect a hotel's performance. In other specifications, we further split the impact of local cohort entry into the impact from the "same" and "other" segments, to explore whether product market competition or informational concerns are more likely to explain the

[9] As Kosová et al. (2012) discuss, these organizational form dummies are likely endogeneous in our performance estimations, and thus their impact cannot be interpreted as a casual effect in our analysis (so we do not discuss them in the results section). However, including them as controls in our type of analysis is very helpful as they capture (to us) unobserved changes in ownership and hotel organizational structure that could potentially bias the coefficients of interest (i.e., aggregate cohort and county entry effects). See Stock (2010) for details.
[10] For the same reason, we do not include parent fixed effects, as parent dummies are subsumed within brands. For example, the parent company Marriott includes the brands JW Marriott, Courtyard by Marriott, etc.
[11] Our results hold for subgroups of independent and branded hotels when analyzed separately, as discussed below.

local cohort entry effect and its role in a hotel's performance. These specifications exploit both within-county and between-county variation to explain hotel performance. To verify that between-county variation and thus differences in business conditions or location attractiveness across counties are not biasing our results, we also exploit within-county variation through various specifications that include county fixed effects. We describe these additional specifications after discussing the baseline results.

5 Results

5.1 Determinants of Hotel Performance

We show the results of our baseline regressions (equation 3) in Table 2. In all regression we adjust standard errors for heteroscedasticity and county-level clusters. Since many of our explanatory variables are at the county level of aggregation, un-clustered standard errors might be underestimated (see Moulton, 1990).

In the first column, we only include *Cohort Effect* as a variable of interest; in the second column, we only include *Entrants*; and in the third column, we include both variables together. We find that when studying the impact of aggregate and local investment cycles separately, both have a negative and statistically significant impact on hotels' long-term performance. However, when we include both variables together, only *Entrants*, capturing local investment cycles, has a negative and statistically significant impact on hotel performance. Once we control investment activity at the local level, the negative aggregate cohort effect tends to disappear (as we discuss later, the cohort effect remains significant during the first years of a hotel's operation when we split the sample by hotel age).

The results from column III are not a consequence of how the cohort effect is defined. To show this, in column IV we replicate column III using our second definition of the cohort effect; namely, *Cohort Effect (levels)*, finding again similar results.

All in all, we find that local investment booms, measured as the number of entrants in a county-year, have a negative and strong impact on long-term hotel performance, even after controlling for a comprehensive set of hotel and market characteristics. The economic magnitude of local investment booms is sizable: A one-standard deviation increase in *Entrants* (6 additional hotels built in a county-year) decreases average RevPAR by about 4.8%. As our main results do not vary according to how we define the cohort effect, in the remainder of the paper we show only the results using our detrended measure (i.e., *Cohort Effect*).

Table 2: Cohort Effect and County-Level Entry

The table shows the results from our baseline empirical equation (3). The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. The variables of interest are: *Cohort Effect* to capture the impact of the aggregate investment cycles and *Entrants* to capture the impact of local/county-level investment cycles. *Entrants* is measured as the number of all hotels that entered the same county *c* in the same year *h* as a given hotel *i*. *Cohort Effect* in columns I and III is our detrended measure (i.e., the standardized residual from the time trend of the total number of hotels built in the US in year *h*, see Section 3.2). *Cohort Effect (levels)* in column IV is the total number of hotels that built in US in the same year *h* as a given hotel *i*. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

Variable	log(RevPAR)	log(RevPAR)	log(RevPAR)	log(RevPAR)
Cohort Effect$_{ih}$	-0.0055*** (0.0017)		0.0018 (0.0017)	
Entrants$_{ich}$		-0.0080*** (0.0014)	-0.0081*** (0.0014)	-0.0081*** (0.0014)
Cohort Effect$_{ih}$ (levels)				0.0067 (0.0063)
Log(Income)	0.2138*** (0.0428)	0.2132*** (0.0415)	0.2130*** (0.0416)	0.2129*** (0.0416)
Unemployment	-0.0122*** (0.0040)	-0.0133*** (0.0039)	-0.0134*** (0.0039)	-0.0134*** (0.0039)
Log(Popul.)	-0.1128*** (0.0362)	-0.1079*** (0.0356)	-0.1079*** (0.0356)	-0.1079*** (0.0356)
Hotels in County	0.0000 (0.0001)	0.0002* (0.0001)	0.0002* (0.0001)	0.0002* (0.0001)
Log(AE&R estab.)	0.0619* (0.0355)	0.0517 (0.0340)	0.0515 (0.0340)	0.0515 (0.0340)
Log(F&B estab.)	0.0920** (0.0382)	0.0957** (0.0373)	0.0959** (0.0373)	0.0959** (0.0373)
Log(Acc. estab.)	0.0161 (0.0179)	0.0226 (0.0168)	0.0228 (0.0168)	0.0228 (0.0168)
Log(Rooms)	-0.0562*** (0.0119)	-0.0568*** (0.0117)	-0.0568*** (0.0117)	-0.0568*** (0.0117)
Age	-0.0133*** (0.0011)	-0.0137*** (0.0011)	-0.0137*** (0.0011)	-0.0136*** (0.0011)
Age^2	0.0002*** (0.0000)	0.0002*** (0.0000)	0.0002*** (0.0000)	0.0002*** (0.0000)
Location Type Fixed Effects	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes
R-squared	0.644	0.647	0.6472	0.6472
N	219,849	219,849	219,849	219,849

To better understand what might be driving the negative impact of local investment cycles on performance, we run equation (3) for different subsamples according to the hotels' age. We present these results in Table 3. Column I shows the performance of hotels in the first 5 full years of operation; column II considers hotels in their 6th to 10th year of operation; column III considers hotels in their 11th to 20th year of operation; column IV considers hotels in their 21th to 30th year of operation; and column V considers hotels in operation for more than 30 years.

Table 3: Cohort Effect and County-Level Entry by Hotel Age

The table shows the results from our baseline empirical equation (3) for different subsamples based on hotels' age. The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. The variables of interest are: *Cohort Effect* to capture the impact of the aggregate investment cycles and *Entrants* to capture the impact of local/county-level investment cycles. *Entrants* is measured as the number of all hotels that entered the same county *c* in the same year *h* as a given hotel *i*. *Cohort Effect* in all columns is our detrended measure (i.e. the standardized residual from the time trend of the total number of hotels built in the US in year *h*, see Section 3.2). In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Hotel Age				
	"1-5"	"6-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort Effect$_{ih}$	-0.0118***	-0.0009	0.0006	0.0003	-0.0038
	(0.0027)	(0.0024)	(0.0028)	(0.0045)	(0.0079)
Entrants$_{ich}$	-0.0095***	-0.0094***	-0.0057***	-0.0059**	0.0055
	(0.0016)	(0.0025)	(0.0021)	(0.0023)	(0.0060)
Log(Income)	0.0818**	0.0641*	0.1993***	0.2900***	0.3815***
	(0.0349)	(0.0353)	(0.0407)	(0.0528)	(0.0640)
Unemployment	-0.0161***	-0.0221***	-0.0141***	-0.0099**	-0.0083
	(0.0044)	(0.0039)	(0.0036)	(0.0050)	(0.0055)
Log(Popul.)	-0.0218	-0.0361	-0.0932***	-0.1710***	-0.1973***
	(0.0400)	(0.0357)	(0.0316)	(0.0392)	(0.0457)
Hotels in County	-0.0000	0.0002**	0.0002*	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Log(AE&R estab.)	0.0525	0.0354	0.0406	0.0666*	0.0712
	(0.0375)	(0.0338)	(0.0294)	(0.0356)	(0.0457)
Log(F&B estab.)	0.0280	0.0305	0.0836**	0.1382***	0.1728***
	(0.0316)	(0.0320)	(0.0345)	(0.0523)	(0.0614)
Log(Acc. estab.)	0.0177	0.0231	0.0166	0.0304	0.0351
	(0.0179)	(0.0159)	(0.0159)	(0.0212)	(0.0232)
Log(Rooms)	0.0137	0.0307**	-0.0333**	-0.0903***	-0.0645***
	(0.0146)	(0.0146)	(0.0134)	(0.0160)	(0.0162)
Age	0.1678***	-0.0306***	-0.0028	-0.0211	-0.0050
	(0.0074)	(0.0079)	(0.0066)	(0.0137)	(0.0065)
Age^2	-0.0204***	0.0011**	-0.0003	0.0003	0.0001*
	(0.0010)	(0.0005)	(0.0002)	(0.0003)	(0.0001)
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes
R-squared	0.6367	0.6706	0.6717	0.6670	0.6074
N	34,253	44,118	66,100	38,411	36,967

We find that both *Cohort Effect* and *Entrants* have a negative and statistically significant impact on the hotels' performance during their first 5 years of operations. However, for older hotels the cohort effect completely vanishes, while the effect of *Entrants* only decreases moderately through time, remaining statistically significant for all hotel ages, except for those in the last category (ages 31 and above). In the Supplemental Appendix, we show that these results hold for subgroups of independent and branded hotels when analyzed separately; and that they are very similar across different quality segment hotels.

The fact that the *Cohort Effect* is only short-lived (up to 5 years) suggests that the local markets do not remain oversupplied for long. Thus, while capital inflows experienced by an industry may affect its willingness to fund low-NPV projects (Gompers and Lerner 2000; Kaplan and Schoar 2005), that does not seem to affect performance in the hotel industry, except in the short run. This result is also consistent with a real options view of investments (see Grenadier 1996). Perhaps hotels took advantage of better financing terms and were constructed "earlier" than they would have been under normal financing conditions. If this is the case, hotels might have been built when market demand was not yet high enough, and this is why they appear to perform worse than their peers in the short-run.

As mentioned above, local entry booms have a pervasive impact on hotel performance. How can we explain this long-lasting underperformance? Is it caused by competition between hotels that entered a market together? Or is this evidence of "herding," i.e., are hotels built simply because one or two "leaders" built hotels, apparently suggesting that the market has great promise, but they were later disappointed? We now try to disentangle these two alternatives.[12]

5.2 Local Investment Cycles and Performance: Competition or Herding?

Competition at the time of entry could have a long-lasting effect on the entrants' long-term performance, even after controlling for the current state of competition and local market

[12] Omitted variables are unlikely to explain the long-lasting underperformance of hotels built during local investment booms. An omitted variable bias can arise if local investment waves are caused by a common signal available to decision makers, but not to the researcher. If that was the case, investments made during high investment activity periods would be indicative of long-lasting overperformance, not underperformance as we find. Similarly, it is unlikely that differences in the cost of building a hotel over a cycle explain the underperformance (say, a developer may build a hotel that promises sub-par revenue if the up-front investment is lower). First, the brand-fixed effects ensure that hotels are compared with similar hotels, and thus hotels with similar construction costs. Second, during a boom, construction costs should increase, not decrease. Finally, while land purchase costs may be reduced if a less attractive site is chosen, that possibility is relevant only for upscale properties. But our results hold for all quality segments when analyzed in separate groups (see the Supplemental Appendix).

conditions, if hotels compete more strongly with others of a similar vintage (built in the same or contiguous years). If that is the case, a sudden and large increase in supply in a local market might affect hotels that were part of that large supply increase for several years.

Herding arguments may also explain the negative impact that additional local entrants in the same market-year have on the long-term performance of a given hotel. The herding literature argues that if the value of investment opportunities is uncertain, firms may base their investment decisions on decisions made recently by other firms. The rationale is that those earlier decisions may reveal the information that earlier entrants had available, but this imitating behavior can lead to "informational cascades," i.e., sequences of decisions in which agents ignore their own information and imitate the decisions of others. Cascades are costly if several agents imitate a first agent's decision, but they would not do so if all information was publicly observable. For example, if a hotel is built in a certain market, others may infer that entering that market is a good idea, even if (unbeknownst to them) only that first site is attractive and building a hotel anywhere else in that market is a bad idea. This imitating behavior could imply that investments made within a cascade perform less well, on average, than non-herding investments. Alternatively, if late participants in a herd plan their projects badly or can only choose from inferior sites, then their performance should be even worse. For the same reasons, larger (more numerous) herds may perform worse.

We perform several empirical tests to distinguish competition by hotels of a similar vintage from herding as potential explanations for the underperformance of hotels that entered simultaneously in a given market and year. For the first of these tests, we add two additional explanatory variables to our original empirical specification: the number of hotels built in a county in the year before and the year after a hotel *i* was built. The number of hotels that entered into the same market as hotel *i*, a year before (after) takes a value of zero if there was no entry, and it is equal to the lagged (forward) value of *Entrants* if there was entry. We denote these variables as $Entrants_{ich-1}$ and $Entrants_{ich+1}$.

Adding these two variables helps us test the role of within-vintage competition and separate it from herding. If competition among hotels of a similar vintage were to explain the negative and pervasive effect that local investment booms have on hotels' long-term performance, we should expect that a hotel's performance is negatively affected by the number of entrants in its market one year before and one year after, as all these hotels are of a similar vintage. In contrast, from a herding perspective, more entrants in the same or preceding year should be related to weaker long-term performance, as this is an indication that entrants might be mimicking others' behavior and, collectively, make inefficient use of the information available to them. More entrants in the year after the hotel has entered, however, might indicate that the hotel itself might be a "leader," and thus the entry of "followers" should have no effect in its decision process (aside from the expectation of additional short-term competition, if the action of entering a market is informative for others). Overall, the key difference between these hypotheses is whether the number of market entrants in year *h+1* has no effect on hotels' long-term performance (herding hypothesis), or it causes hotels to underperform (competition within vintage hypothesis).

We show the results of this new specification in Table 4. In column I, we show the results for the whole sample. Columns II-VI show the results for subsamples of hotels of different age ranges. Column II shows the results for hotels during their first complete year of operations. As mentioned in Section 4, there are 360 hotels whose operations started in January of their year of construction, so we have 12 month of data to compute their yearly average performance measure at age one. For all other hotels, the first complete year of operation is when their age is 2. We look at the impact of our variables of interest on the hotels' first complete year of operation, as we want to see how hotels that preceded the entry of others were doing before the other hotels entered. The other age categories are self-explanatory: 3-10; 11-20; 21-30; and >30 years.

Using this specification, we confirm that the construction of additional hotels in the same county-year reduces the entrant's long-term performance, and that this effect is long-lived (significant for about 30 years). Regarding hotels that enter before others followed, their performance during their first complete year of operation tends to be better than the performance of comparable hotels located in markets where less entry occurred later. These same hotels, however, underperform their peers once competitors enter; but this negative effect on performance is not long-lived: for hotels older than 10 years this effect vanishes. We also find that higher market entry in year *h-1* reduces the performance of hotels built in year *h*. This underperformance is as long-lived as that caused by entrants in the same county-year.

Table 4: Entrants in a County in Years Prior to and After the Year of Construction

The table shows the results from our empirical equation (3), augmented by two additional explanatory variables: $Entrants_{ich-1}$ and $Entrants_{ich+1}$. The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. $Entrants_{ich-1}$ and $Entrants_{ich+1}$, measure the number of hotels built in a county *c* in the year before *(h-1)* and the year after *(h+1)* a given hotel *i* was built. If there was no entry in a county-year, $Entrants_{ich-1}$ and $Entrants_{ich+1}$ take a value of zero. Column I shows the results for the full sample. Column II shows the results for hotels during their first complete year of operation (for some hotels it is age 1, for others age 2). Columns III-VI show the results for different hotel age cohorts. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

		Hotel Age				
	Full Sample	First Complete Year of Operation	"3-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort $Effect_{ih}$	0.0023	0.0095	0.0007	0.0009	0.0006	-0.0038
	(0.0017)	(0.0184)	(0.0020)	(0.0029)	(0.0045)	(0.0079)
$Entrants_{ich}$	-0.0043***	-0.0047*	-0.0034*	-0.0045**	-0.0042**	0.0055
	(0.0014)	(0.0027)	(0.0019)	(0.0019)	(0.0019)	(0.0057)
$Entrants_{ich+1}$	-0.0021***	0.0077***	-0.0041***	-0.0006	-0.0000	-0.0002
	(0.0008)	(0.0022)	(0.0011)	(0.0012)	(0.0015)	(0.0039)
$Entrants_{ich-1}$	-0.0037***	-0.0102***	-0.0052***	-0.0016	-0.0032*	-0.0001
	(0.0009)	(0.0027)	(0.0012)	(0.0019)	(0.0017)	(0.0038)
Log(Income)	0.2132***	0.0647*	0.0739**	0.2000***	0.2912***	0.3816***
	(0.0413)	(0.0362)	(0.0337)	(0.0405)	(0.0525)	(0.0640)
Unemployment	-0.0135***	-0.0151***	-0.0203***	-0.0141***	-0.0099**	-0.0083
	(0.0039)	(0.0054)	(0.0038)	(0.0036)	(0.0050)	(0.0055)
Log(Popul.)	-0.1074***	-0.0197	-0.0274	-0.0929***	-0.1720***	-0.1973***
	(0.0356)	(0.0428)	(0.0370)	(0.0315)	(0.0392)	(0.0457)
Hotels in County	0.0002**	-0.0001	0.0002***	0.0002**	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Log(AE&R estab.)	0.0487	0.0562	0.0330	0.0398	0.0659*	0.0712
	(0.0338)	(0.0387)	(0.0353)	(0.0290)	(0.0354)	(0.0455)
Log(F&B estab.)	0.0975***	0.0291	0.0327	0.0839**	0.1394***	0.1728***
	(0.0371)	(0.0341)	(0.0307)	(0.0344)	(0.0522)	(0.0613)
Log(Acc. estab.)	0.0236	0.0154	0.0247	0.0166	0.0307	0.0351
	(0.0167)	(0.0193)	(0.0163)	(0.0158)	(0.0212)	(0.0232)
Log(Rooms)	-0.0573***	-0.0083	0.0249*	-0.0335**	-0.0903***	-0.0645***
	(0.0117)	(0.0185)	(0.0137)	(0.0134)	(0.0160)	(0.0162)
Age	-0.0138***	5.6936***	0.0053*	-0.0025	-0.0253*	-0.0050
	(0.0011)	(0.5354)	(0.0029)	(0.0065)	(0.0138)	(0.0065)
Age^2	0.0002***	-1.8582***	-0.0011***	-0.0003	0.0004	0.0001*
	(0.0000)	(0.1789)	(0.0002)	(0.0002)	(0.0003)	(0.0001)
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.6477	0.6021	0.6645	0.6717	0.6671	0.6074
N	219,849	8,351	70,020	66,100	38,411	36,967

Our results provide support for the competition hypothesis, but only in the short run. A higher number of entrants in the year before a hotel was built does not hurt its long-term performance, contrary to what within-vintage competition would suggest. The most likely explanation is that excess supply in a market decreases over time as demand grows. Another possible explanation is that as hotels get older, competition within vintage becomes less relevant for performance.

Our results provide evidence consistent with herding, however. Hotels built in markets where many other hotels are built during the next year outperform their peers prior to that additional entry. This is consistent with those hotels being "leaders," and thus signaling that they had valuable private information about the attractiveness of a county or their chosen site in that county. Of course, a "leader's" entry may trigger more entry, and the added competition reduces the leader's performance in the short-run. This is also what we find: when many entrants follow, a hotel's performance is reduced for a few years.

Finally, herding models could predict that multiple entrants in the same year and the ones that enter the year after tend to underperform their peers for long periods, as the decision of "herders" and "laggards" could be influenced "incorrectly" by the decision of the "leaders." Again, our evidence is consistent with this prediction.

To further distinguish competition from herding, we modify our baseline specification in equation (3). Specifically, we divide our proxy for local booms (number of entrants in a county-year) into two mutually exclusive categories: number of hotels built in the same quality segment as hotel *i*, and number of hotels built in other segments. For consistency, we also split our competition variable in the same way: number of hotels operating in the same county and year (in which performance is measured) as hotel *i*, either in the same quality segment or in other segments.

The motivation for studying the impact of entrants in the same vs. other segments on long-term performance is the following. So far, we showed that within-vintage competition has only a short-lived (up to 5 years) effect on performance. However, an upscale hotel is not likely a competitor for an economy hotel, so by aggregating entry across different segments we might be under-estimating the impact of within-vintage competition.[13] Focusing on within-vintage competition within a segment may reveal that within-vintage competition has long-term effects on performance, after all.

[13] Freedman and Kosová (2012) show that competitive forces dominate among hotels of the same segments, while positive benefits from hotel co-location (agglomeration effects) dominate across hotels from different segments.

Distinguishing same-segment entrants from other entrants may also explain why hotels built during periods of high local investment activity tend to underperform their peers: different-segment imitation may be a symptom of herding. If one or more hotels from a different segment are built, this can indicate market potential. From the perspective of a potential entrant, however, correctly inferring market information from hotels entering in different segments is difficult. It is not possible to completely disentangle whether entry is profitable only for a particular hotel segment or entry itself in that market is profitable. In those cases, herding can lead to lower long-term performance.

Table 5 presents the results for the specifications that use both within-segment and between-segment *Entrants* and competition (*Hotels in County*). Column I shows the results for the overall sample, and columns II-VI shows the results for subsamples of hotels of different ages.

Regarding the differential impact of current within-segment and between-segment competition, we find evidence consistent with an "agglomeration" effect (Freedman and Kosová 2012, Canina et al. 2005): A hotel's performance is better if it has more competitors operating in different quality segments, due to an agglomeration externality. However, a hotel's performance is worse if there are more competitors operating in the same market segment. These results highlight that contemporaneous competition and agglomeration are indeed very important in explaining the performance of hotels in a given year.

The number of entrants in the same county-year (year *h*) and the same segment as hotel *i* does not seem to have an important impact on the hotel's long-term performance (measured in year *t*). The number of entrants in the same county-year but *other* segments as hotel *i*, on the other hand, clearly shows a significant impact on a given hotel's long-term performance. Hotels built during years in which more hotels from *other* segments were built in the same county tend to underperform their peers. Clearly, competition within-vintage and within-segment cannot explain this pattern. However, a herding interpretation in which a hotel herds with others which were not of the same type ("incorrect" herding) can explain this pattern.

The evidence so far is consistent with the presence of herding: There are pronounced local cycles of hotel construction, and the same-segment vs. other-segment analysis suggests that hotels entering markets in which "incorrect herding" is more likely perform less well. To verify that between-county variation and thus differences in business conditions or location attractiveness across counties are not biasing our results, we now look for evidence of herding within counties.

Table 5: Same-Segment and Other-Segment Entry and Competition

The table shows the results from our empirical equation (3), when we split the variable of interest *Entrants* (and the control variable for competition during RevPAR years, *Hotels in County* at time *t*) between same and other segments as a given hotel *i*. The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. *Entrants (same segment)* is the number of all hotels in the same segment as a given hotel *i* that entered the same county *c* in the same year *h*. *Entrants (other segments)* is the number of hotels in other segments than a given hotel *i* that entered the same county *c* in the same year *h*. Column I shows the results for the full sample. Columns II-VI show the results for different hotel age cohorts. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Hotel Age					
	Full Sample	"1-5"	"6-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort Effect$_{ih}$	0.0000	-0.0142***	-0.0034	-0.0004	0.0005	-0.0040
	(0.0017)	(0.0027)	(0.0023)	(0.0029)	(0.0045)	(0.0078)
Entrants$_{ich}$ (same segment)	-0.0000	-0.0004	0.0016	0.0002	-0.0056	0.0108*
	(0.0027)	(0.0027)	(0.0038)	(0.0038)	(0.0047)	(0.0065)
Entrants$_{ich}$ (other segments)	-0.0070***	-0.0076***	-0.0085***	-0.0053**	-0.0060***	0.0050
	(0.0013)	(0.0012)	(0.0021)	(0.0021)	(0.0021)	(0.0059)
Log(Income)	0.2098***	0.0802**	0.0646*	0.1935***	0.2908***	0.3841***
	(0.0394)	(0.0333)	(0.0332)	(0.0385)	(0.0515)	(0.0618)
Unemployment	-0.0160***	-0.0186***	-0.0242***	-0.0171***	-0.0123**	-0.0106*
	(0.0039)	(0.0044)	(0.0039)	(0.0036)	(0.0050)	(0.0056)
Log(Popul.)	-0.1028***	-0.0187	-0.0299	-0.0867***	-0.1678***	-0.1928***
	(0.0358)	(0.0387)	(0.0355)	(0.0316)	(0.0396)	(0.0458)
Hotels in County	-0.0044***	-0.0044***	-0.0044***	-0.0044***	-0.0041***	-0.0047***
(same segment)	(0.0009)	(0.0015)	(0.0012)	(0.0009)	(0.0009)	(0.0011)
Hotels in County	0.0005***	0.0003***	0.0006***	0.0005***	0.0004***	0.0004***
(other segment)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)
Log(AE&R estab.)	0.0329	0.0375	0.0174	0.0208	0.0504	0.0556
	(0.0329)	(0.0354)	(0.0325)	(0.0280)	(0.0341)	(0.0447)
Log(F&B estab.)	0.1142***	0.0458	0.0481	0.1023***	0.1560***	0.1861***
	(0.0360)	(0.0314)	(0.0309)	(0.0328)	(0.0509)	(0.0602)
Log(Acc. estab.)	0.0295*	0.0202	0.0271*	0.0258*	0.0373*	0.0405*
	(0.0162)	(0.0173)	(0.0154)	(0.0152)	(0.0204)	(0.0229)
Log(Rooms)	-0.0608***	0.0030	0.0241	-0.0362***	-0.0926***	-0.0672***
	(0.0120)	(0.0153)	(0.0150)	(0.0138)	(0.0164)	(0.0163)
Age	-0.0134***	0.1671***	-0.0286***	-0.0048	-0.0204	-0.0052
	(0.0011)	(0.0070)	(0.0077)	(0.0065)	(0.0135)	(0.0064)
Age^2	0.0002***	-0.0201***	0.0010**	-0.0003	0.0003	0.0001*
	(0.0000)	(0.0009)	(0.0005)	(0.0002)	(0.0003)	(0.0001)
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.6514	0.642	0.6761	0.6761	0.6701	
N	219,849	34,253	44,118	66,100	38,411	36,967

5.3 Within-County Herding

As herding seems to be the most plausible explanation for the long-term underperformance of hotels built during high local investment cycles, we specifically design a test which attempts to measure the relative performance of herders within a county. To this end, we restrict our sample to those counties for which there was meaningful variation in investment cyclicality. In particular, we restrict our sample to counties in which five or more hotels were built in a single year at least once. There are 160 counties that satisfy that criterion. Then, we classify hotels that were probably part of a herd according to two different criteria. For our first criterion, we create dummy variables that classify each hotel entry by deciles of same-year entry within a county, i.e., whether the year of entry is within the first decile of years of higher activity, the second decile of years of higher activity, etc. If "herd" investments were poorly planned or executed, or if they were otherwise disadvantaged, we should expect hotels built during cycle peaks to perform the worst. We show the results in Table 6, column I. We include all the control variables from our empirical model (equation (3)) in these regressions, but we do not report them in the table for space reasons.

The patterns are striking. Hotels built during highest decile years of construction activity underperform peer hotels within the same county by almost 6%. Given that these regressions control for county-fixed effects, this result confirms that the underperformance is not driven by unobserved market characteristics.

One potential disadvantage of measuring herding using deciles of construction activity within a county is that we cannot distinguish between years of high investment activity that precede the peak year from those years that came after. Thus, for our second classification of "herders," we first define peak years and then define "herders" using those years. We also define "leaders" and "laggards" relative to those years.

We define peak years as years in which at least 5 hotels were built, which were preceded by non-negative growth in hotel construction and which were followed by a decline in hotel construction. Using this criterion, we were able to classify 332 peak years in 159 counties.[14] Then, we classify hotels as "herders" (dummy variable) if they were built during a peak year in a

[14] For one county there was no year that could be classified as a peak using this criterion.

Table 6: Within-County Herders' Performance

The table shows the results for 160 counties in which 5 or more hotels built in a single year at least once. The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. Focusing on within-county variation, the regressions control for county-fixed effects and include the same controls as our empirical equation (3) together with our detrended measure of *Cohort Effect*. However, in Column I, instead of including the variable *Entrants* (as in equation (3)), we use dummies to indicate into which *County Entry Decile* a given hotel *i* belongs in its year of entry *h* (based on overall level of entry in that county). In Column II, instead of using dummies for entry deciles, we use dummies to indicate whether a given hotel *i* belongs to *Herders* (i.e., hotels built during peak years for a given county) or *Laggards/Leaders* (i.e., hotels built 3, 2 or 1 years after/before the peak year), based on its year of construction *h* and county *c*. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

Variable	log(RevPAR)	log(RevPAR)
Cohort Effect$_{ih}$	0.0027	0.0022
	(0.0025)	(0.0023)
County Entry Decile 2	0.0097	
	(0.0093)	
County Entry Decile 3	0.0111	
	(0.0113)	
County Entry Decile 4	-0.0007	
	(0.0102)	
County Entry Decile 5	-0.0076	
	(0.0108)	
County Entry Decile 6	-0.0010	
	(0.0123)	
County Entry Decile 7	-0.0076	
	(0.0107)	
County Entry Decile 8	-0.0065	
	(0.0128)	
County Entry Decile 9	-0.0063	
	(0.0124)	
County Entry Decile 10	-0.0592**	
	(0.0244)	
Leaders$_{ich-3}$ (3 years before peak)		-0.0051
		(0.0074)
Leaders$_{ich-2}$ (2 years before peak)		-0.0075
		(0.0073)
Leaders$_{ich-1}$ (1 year before peak)		-0.0079
		(0.0066)
Herders$_{ich}$ (peak year)		-0.0152**
		(0.0076)
Laggards$_{ich+1}$ (year after peak)		-0.0135*
		(0.0079)
Laggards$_{ich+2}$ (year after peak)		-0.0134
		(0.0114)
Laggards$_{ich+3}$ (year after peak)		-0.0011
		(0.0081)
Controls	Yes	Yes
Location Dummies	Yes	Yes
Org. Form Fixed Effects	Yes	Yes
Brand Fixed Effects	Yes	Yes
Year-Fixed Effects	Yes	Yes
County Fixed Effects	Yes	Yes
County Cluster	Yes	Yes
R-squared	0.7591	0.7607
N	102,133	100,714

county. We classify hotels into 3 different “leader” categories according to whether they were built 3, 2, or 1 years before the peak year, and we classify hotels into 3 different “laggards” categories according to whether hotels were built 1, 2 or 3 years after the peak year. Column II of table 6 show the performance of these hotels relative to their county peers (neither leaders, laggards nor herders). Consistent with “incorrect” herding, we find that hotels built during the peak of the local investment cycle and hotels built one year after the peak underperform their peers. Neither “leaders,” nor late “laggards” show any statistically significant difference in performance relative to the control group. This is to be expected as leaders by definition do not take “incorrect” decisions based on other’s actions, while late “laggards” have had more time to observe the early performance of herders and thus make a better-informed decision about entry.

5.4 Does Herding Drive Local Investment Cycles?

Our results on hotels’ long-term performance show that hotels that enter the market as part of a herd tend to underperform their peers. The most likely explanation for this is that “herders” put significant weight on others’ entry decisions when assessing the attractiveness of a county, and that this strategy did not pay off, on average. To provide further evidence that herding behavior is the most plausible cause of the underperformance pattern that we find, we now look for evidence of herding behavior at the time of construction. In particular, we study whether the likelihood of other hotels entering the market in a given year is affected by entry patterns in the prior year, even after controlling for common market signals. In addition, we would like to test whether entry decisions are more likely to be dependent on previous market participants’ decisions when the market common signals are more volatile, as predicted by herding models.

To address these issues, we estimate an empirical specification different from equation (3), in which the unit of observation is a county-year of hotel construction (*c,h*). The dependent variable E_{ch} is a discrete measure of the “hotel entry intensity” in given county-year, which takes a value of 0 if no hotel is built in a county-year (no entry), 1 if just one hotel is built (single entry), 2 if 2-5 hotels are built (moderate entry), and 3 if 6 or more hotels are built in a county-year (massive entry). We then estimate a multinomial logit model (equation (4) below) in order to better understand whether different levels of entry intensity (massive, moderate, single and no entry) in a county-year respond differently to common economic signals and prior actions (hotel construction) of market participants.

$$E_{ch} = \alpha + \mathbf{J}'\boldsymbol{X}_{\boldsymbol{ch-1}} + \mu_h + \varepsilon_{ch} \quad (4)$$

The county-level explanatory variables, $\boldsymbol{X}_{\boldsymbol{ch-1}}$, are lagged one year, since the decision to build a hotel is likely based on information available when construction started (recall that the year *h* is the year in which a hotel was opened). In this category, we include County GDP in year *h-1* (in logs); average county GDP growth from year *h-4* to *h-1* (both from the Bureau of Economic Analysis (BEA)); the normalized standard deviation of county GDP growth from year *h-4* to *h-1* (to capture the volatility of the common economic signals); the stock of *existing* hotels in county *c* in year *h-1*; the number of hotels built in county *c* in year *h-1*; and various interaction terms (described below). [15]

To understand the role of herding behavior, the number of hotels built in a county in the preceding year is of particular importance. In the absence of herding considerations, that number should be irrelevant for the entry decision of other participants, once the common signals about economic conditions of the county are taken into account. If herding considerations play a role in the building decision, however, we should expect that the likelihood of multiple hotels being built in a county in year *h* is positively affected by the number of hotels built in that same county on year *h-1*. In addition, if herding is indeed playing a role in the decision to build in a county-year, this decision should be more heavily influenced by other hotels being built the prior year when common county signals are less precise. To test this intuition, we include an interaction term between the number of hotels built in a county in the prior year and the normalized standard deviation of county GDP growth. We expect this coefficient to be positive.

We also include an interaction term between the number of hotels built in the prior year and county GDP growth. This term helps us test whether herding is more likely when the market is bullish, as documented by Welch (2000) for the case of analyst ratings.

Finally, we control for unobserved macro factors using time fixed effects, μ_h. Relatedly, we include the interaction between the spread of Aaa Bonds to Fed rates (obtained from the Saint Louis Fed) with county GDP growth. This interaction term helps us to control for the effect that favorable financing conditions conjoint with favorable real economic conditions may have on

[15] For parsimony, we use total income rather than income per capita and population. All the results we present are robust to including these demographics separately.

hotel construction. In our estimation, we do not include Bonds spread itself (not interacted), as the spread is perfectly collinear with time-fixed effects.

The data we use to conduct our logit analysis covers around 3,100 counties each year from 1973-2009. The data starts in 1973 because the BEA compiles annual data on county demographics only since 1969, and we use four lags for county GDP growth and its standard deviation. Our final sample consists of 114,908 county-year observations. Among those, 95,261 (82.9%) county-years register no hotels built; 13,160 (11.4%) register 1 hotel built; 5,733 (5%) register 2-5 hotels built; and 754 (0.7%) register 6 or more hotels built.

We present the results from the multinomial logit estimation in Table 7. All the control variables show expected results: high county GDP increases the likelihood of a single and multiple hotel constructions (relative to no hotel entry), and higher county GDP *growth* also increases that likelihood. The effect of higher county GDP growth is weakened when the costs of financing (yield spreads) are high, especially for multiple hotel constructions in a given county-year. We also find that higher county growth volatility decreases hotel construction, consistent with standard investment evaluation arguments (lower NPV) and real options arguments (benefits from delaying entry).

The number of hotels built in a county in the previous year does not have a significant impact on a single hotel construction (relative to no hotel construction). That is, entry, by itself, is not driven by previous participants' actions. Moderate and massive intensity of entry (columns 2-3), however, are significantly affected by the number of hotels built in the previous year. This is consistent with the idea that current entrants are inferring "something" about the market by observing the behavior of previous entrants. This result is indicative of herding, but it can also be merely due to an omitted variable bias generating positive autocorrelation between entry decisions in current and previous years. What is also indicative of herding, and not subject to this criticism, is that when the volatility of county GDP growth is high, the positive effect of previous market entry increases. This increase is particularly pronounced for multiple entry.

Of additional interest is the result that previous market entry encourages current market entry when the market is more bullish (county GDP growth is higher). This is consistent with Welch's (2000) finding that herding by analysts is more likely when markets are bullish.

Table 7: When is Herding More Likely? (Sample 1973-2008)

The table shows the results from a multinomial logit (equation (4)) across 3,100 US counties during 1973-2008. The dependent variable E_{ch} takes a value of 0 if no hotels are built in a county-year, 1 if a single hotel is built, 2 if 2-5 hotels are built, and 3 if 6 or more hotels are built. As controls we include county-level economic, demographic and financing cost variables available for each year since 1973. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Multinomial Logit Entrants$_{ch}$		
Variable	**1 vs 0**	**2-5 vs 0**	**5+ vs 0**
Hotels in County$_{ch-1}$	0.0162***	0.0249***	0.0307***
	(0.0019)	(0.0027)	(0.0034)
Hotels Built in County$_{ch-1}$	-0.0012	0.1567***	0.3711***
	(0.0403)	(0.0498)	(0.0665)
Log(County GDP)$_{ch-1}$	0.5495***	0.9064***	1.4492***
	(0.0174)	(0.0303)	(0.0986)
Mean Tot. County GDP Growth$_{ch-1}$ from h-4 to h-1	4.5990***	10.7898***	18.3985***
	(0.4756)	(0.7651)	(1.8663)
(Mean Tot. County GDP Growth$_{ch-1}$ from h-4 to h-1)*	-0.1298	-0.7202***	-1.0857*
(Spread Aaa Bonds to Fed rates h-1)	(0.1593)	(0.2405)	(0.6306)
Normalized Standard Dev. County GDP Growth$_{ch-1}$ h-4 to h-1	-0.1290***	-0.5234***	-1.5003***
	(0.0219)	(0.0930)	(0.3639)
(Hotels Built in County$_{ch-1}$)*	1.6969**	2.2125**	5.5152***
(Normalized Standard Dev. County GDP Growth$_{ch-1}$ h-4 to h-1)	(0.7082)	(1.0024)	(1.5320)
(Hotels Built in County$_{ch-1}$)*	2.2051***	3.5075***	4.1421***
(Mean Tot. County GDP Growth$_{ch-1}$ from h-4 to h-1)	(0.4647)	(0.5602)	(0.7345)
Year-Fixed Effects		Yes	
County Cluster		Yes	
"R-squared"		0.26	
N		114908	

Overall, the results in Table 7 suggest that entry in a given county-year is indeed affected by the behavior of earlier market participants. This reinforces the notion that herding is the most plausible explanation for our previous findings.

6 Conclusion

In this paper, we use a proprietary dataset from the U.S. hotel industry to study investment cycles and the impact of the timing of an investment over a cycle on that investment's performance. The evidence we have presented in this paper is intriguing. Why are hotels built in cycles at the local level? And why do hotels built during booms underperform others for decades? Our interpretation of the evidence is that there is herding: The decision to build a hotel is made under great uncertainty about future demand, and relying on information inferred from other market participants' actions is therefore tempting.

There is a large body of theoretical work on herding. In comparison, the empirical literature on herding is small. The main reason are difficulties in obtaining data that allow for rigorous tests of hypotheses drawn from herding models. Specifically, measuring the performance of an investment is hard if performance data is reported at the corporate level, not at the level of a particular investment. Furthermore, there can be many different reasons for imitative behavior, and identifying such reasons is challenging. Herding can arise if decisions must be made based on very unreliable information, but it can also be caused by career concerns (so the destruction of information is the goal). Imitation can also be spurious, simply caused by information that is available to the market participants but not to researchers.

Our data allow us to overcome many of these difficulties. Unobserved positive information cannot be driving our findings, since investments made during the peak of a cycle *under*perform others. Career concerns in connection with investment decisions are not an issue either, since the vast majority of investments into hotel developments is made by individuals, partnerships or LLCs. Moreover, our performance measure is not aggregated over several investments, since we measure performance at the hotel level rather than at a more aggregate company level. Additionally, our data include important hotel and market characteristics that typically also affect performance, allowing us to control for factors that might confound with local and aggregate investment cycles.

A theory vacuum remains, however. We find significant and long-lasting underperformance by hotels built during a local investment boom, while early participants in these booms do not underperform others (except in the short run). Traditional herding models cannot explain this result, since a standard assumption is that all participants in a "herd" earn identical payoffs. The literature has made progress in relaxing assumptions and showing that herding and informational cascades are a robust feature in models of decision-making under uncertainty.[16] Our findings suggest that models can be made more realistic by abandoning the assumption that all payoffs

[16] Relaxed assumptions include heterogeneously informed agents, costs of acquiring information, and endogenous entry; see Chamley and Gale, 1994; Zhang, 1997; Grenadier, 1999; Chari and Kehoe, 2004.

are identical. We suggest one possibility: Building a hotel may be a good idea either because a local market (in our case a county) is promising overall, or because a particular site (within that county) is promising. If other participants cannot exactly identify why a hotel was just built, they may (wrongly) infer that the overall market is promising.[17]

Clearly, there is still much to be learned about herding — in particular, given our results, why herders may *under*perform others. It would also be interesting to study whether herding leads to *under*performance in different settings (i.e., whether underperformance of herders is industry-specific or an empirical regularity). An alternative way to look at this phenomenon is to empirically study how information is transmitted during herding/non-herding periods. Perhaps a better understanding of how information is transmitted during herding periods will allow for better predictions in terms of market performance.

[17] The literature on herding in the investment management industry allows for payoff externalities, but they are positive. Positive payoff externalities are also analyzed in Choi (1997). Negative externalities within an optimal stopping game are analyzed in Frisell (2003). Negative externalities are also analyzed in Ridley (2008), who studies when an uninformed firm imitates a better-informed competitor's market entry decision (creating negative payoff externalities from competition), and how the competitor anticipates that and adapts her own entry decision.

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Supplemental Appendix: Quality Segment Subsamples

In Table 3, we study the impact of *Cohort Effect* and *Entrants* on hotel performance for different subsamples according to hotel age. Now, we replicate those estimations separately for different subgroups. First, we divide our sample between branded and independent hotels. Then, we further divide our sample of branded hotels into 3 categories: Upscale, Midscale and Economy. The first category contains hotels belonging to the 3 highest quality segments, namely Luxury, Upper Upscale and Upscale; the second category contains both types of Midscale hotels (with and without food and beverage); and the third category is simply the quality segment assigned to Economy hotels, the most frequent segment in our sample (see Table 1, Panel E).

When estimating equation (3) separately for branded and independent hotels, and between quality segments, we would like to know the organizational form and brand under which hotels started their operations. However, we only have information about their organizational form, brand and quality segment at the time of performance measurement and not at the time they were built. This distinction is unlikely to be of particular relevance when making our group classifications, for two reasons. First, as mentioned in Section 2, management contracts and franchise agreements are usually long-term (about 20 years), with a high renewal rate. Second, our data shows that the actual variation among these categories is low. For example, in our 10 years of performance data, the yearly rate of independent hotels turning into branded hotels was only 0.34%, and the yearly rate of branded hotels turning into independent hotels was similarly low: 0.42%.

Replicating our baseline specification for different subgroups helps us test some alternative explanations for our findings. For example, if agency problems have anything to do with our finding that a higher number of entrants in the same county-year have a negative and pervasive effect on hotels' performance, then that effect should be much more pronounced for branded hotels than for independent hotels. Similarly, one could postulate that the owners of the brands benefit from having a presence in all markets, even if some of these markets offer subpar returns.[18] If this is the case, our results should be completely driven by branded hotels.

[18] Although we allow for this possibility, we believe it is not likely relevant, as construction decisions and brand choices are typically made by developers, not the owners of the brands.

Alternatively, underperformance of hotels built during local booms could be due to those hotels being built in cheaper and less attractive sites and thus lower operational performance was expected. If that was the case, then the underperformance should be more pronounced for the Upscale hotels than for Economy hotels, as most Economy hotels are built in very homogenous sites (e.g., near a highway).

Table A1 shows the results for branded hotels and Table A2 shows the results for independent hotels. Our results show that *Entrants* have a pervasive negative effect on hotels' performance, both in the branded and independent hotels subgroups. The finding that *Entrants* is an important determinant of hotels' performance for both subgroups helps us to eliminate agency considerations as driving our results, since independent hotels suffer at least as much as branded hotels from other hotels being built in the same year. This finding also mitigates the concern that our main results are driven by branded hotels accepting lower returns in some of their projects due to a national positioning strategy.

Table A1: Cohort Effect and County-Level Entry by Hotel Age for Branded Hotels

The table shows the results from our baseline empirical equation (3) for different subsamples based on hotels' age, using performance data of hotels affiliated to a nationwide recognized brand. The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. The variables of interest are: *Cohort Effect* to capture the impact of the aggregate investment cycles and *Entrants* to capture the impact of local/county-level investment cycles. *Entrants* is measured as the number of all hotels that entered the same county *c* in the same year *h* as a given hotel *i*. *Cohort Effect* in all columns is our detrended measure (i.e. the standardized residual from the time trend of the total number of hotels built in the US in year *h*, see Section 3.2). We use all the control variables described in equation (3), but omit their coefficients to save space. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Hotel Age				
	"1-5"	"6-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort Effect$_{ih}$	-0.0123***	0.0004	0.0012	0.0014	-0.0116
	(0.0027)	(0.0019)	(0.0026)	(0.0045)	(0.0085)
Entrants$_{ich}$	-0.0091***	-0.0052***	-0.0047***	-0.0052**	0.0088*
	(0.0016)	(0.0017)	(0.0018)	(0.0022)	(0.0050)
Controls	Yes	Yes	Yes	Yes	Yes
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes
R-squared	0.6534	0.7262	0.6990	0.6998	0.6448
N	32,086	41,720	60,783	33,309	28,450

Table A2: Cohort Effect and County-Level Entry by Hotel Age for Independent Hotels

The table shows the results from our baseline empirical equation (3) for different subsamples based on hotels' age, using performance data of independent hotels (i.e, not affiliated to a nationwide recognized brand). The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. The variables of interest are: *Cohort Effect* to capture the impact of the aggregate investment cycles and *Entrants* to capture the impact of local/county-level investment cycles. *Entrants* is measured as the number of all hotels that entered the same county *c* in the same year *h* as a given hotel *i*. *Cohort Effect* in all columns is our detrended measure (i.e. the standardized residual from the time trend of the total number of hotels built in the US in year *h*, see Section 3.2). We use all the control variables described in equation (3), but omit their coefficients to save space. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Hotel Age				
	"1-5"	"6-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort Effect$_{ih}$	-0.0172	-0.0148	-0.0066	-0.0018	0.0045
	(0.0137)	(0.0107)	(0.0122)	(0.0153)	(0.0186)
Entrants$_{ich}$	-0.0113**	-0.0139**	-0.0125*	-0.0090*	-0.0003
	(0.0047)	(0.0056)	(0.0072)	(0.0053)	(0.0083)
Controls	Yes	Yes	Yes	Yes	Yes
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	No	No	No	No	No
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes
R-squared	0.5082	0.6057	0.4203	0.4244	0.4007
N	2,167	2,398	5,317	5,102	8,517

Tables A3, A4 and A5 show the results for branded hotels in the Upscale, Midscale and Economy subgroups, respectively. Our results show that additional *Entrants* in the same county-year in which a given hotel was built lead to significant underperformance of that hotel for up to 20 years for Upscale and Midscale hotels, and up to 30 years for Economy hotels. We also find that the impact of *Entrants* on performance is at least as large for Economy hotels as for the other 2 groups. These results help to mitigate the concern that subpar performance is a mere consequence of building hotels in cheaper, less attractive sites, as *Entrants* impacts performance more negatively for Economy hotels, the quality segment where site selection is of lesser relevance.

Table A3: Cohort Effect and County-Level Entry by Hotel Age for Upscale Hotels

The table shows the results from our baseline empirical equation (3) for different subsamples based on hotels' age, using performance data of hotels affiliated to a nationwide recognized brand in any of the following segments: Upscale, Upper Upscale and Luxury. The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. The variables of interest are: *Cohort Effect* to capture the impact of the aggregate investment cycles and *Entrants* to capture the impact of local/county-level investment cycles. *Entrants* is measured as the number of all hotels that entered the same county *c* in the same year *h* as a given hotel *i*. *Cohort Effect* in all columns is our detrended measure (i.e. the standardized residual from the time trend of the total number of hotels built in the US in year *h*, see Section 3.2). We use all the control variables described in equation (3), but omit their coefficients to save space. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Hotel Age				
	"1-5"	"6-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort Effect$_{ih}$	-0.0104**	0.0000	-0.0027	0.0060	-0.0137
	(0.0049)	(0.0044)	(0.0063)	(0.0088)	(0.0192)
Entrants$_{ich}$	-0.0079***	-0.0047***	-0.0038**	-0.0012	0.0053
	(0.0016)	(0.0013)	(0.0017)	(0.0027)	(0.0059)
Controls	Yes	Yes	Yes	Yes	Yes
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes
R-squared	0.6155	0.7289	0.6232	0.5925	0.6181
N	7,455	7,069	11,738	7,285	3,900

Table A4: Cohort Effect and County-Level Entry by Hotel Age for Midscale Hotels

The table shows the results from our baseline empirical equation (3) for different subsamples based on hotels' age, using performance data of hotels affiliated to a nationwide recognized brand in the Midscale segments (with and without food and beverage). The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. The variables of interest are: *Cohort Effect* to capture the impact of the aggregate investment cycles and *Entrants* to capture the impact of local/county-level investment cycles. *Entrants* is measured as the number of all hotels that entered the same county *c* in the same year *h* as a given hotel *i*. *Cohort Effect* in all columns is our detrended measure (i.e. the standardized residual from the time trend of the total number of hotels built in the US in year *h*, see Section 3.2). We use all the control variables described in equation (3), but omit their coefficients to save space. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Hotel Age				
	"1-5"	"6-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort Effect$_{ih}$	-0.0146***	-0.0034	-0.0022	-0.0080	-0.0092
	(0.0033)	(0.0023)	(0.0033)	(0.0064)	(0.0106)
Entrants$_{ich}$	-0.0089***	-0.0042**	-0.0048**	-0.0022	0.0148**
	(0.0020)	(0.0020)	(0.0021)	(0.0025)	(0.0066)
Controls	Yes	Yes	Yes	Yes	Yes
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes
R-squared	0.3684	0.4852	0.4015	0.4205	0.4717
N	18,590	23,846	27,831	13,223	15,261

Table A5: Cohort Effect and County-Level Entry by Hotel Age for Economy Hotels

The table shows the results from our baseline empirical equation (3) for different subsamples based on hotels' age, using performance data of hotels affiliated to a nationwide recognized brand in the Economy segment. The dependent variable in all columns is hotel performance log(RevPAR) in a given year *t* during 2000-2009. The variables of interest are: *Cohort Effect* to capture the impact of the aggregate investment cycles and *Entrants* to capture the impact of local/county-level investment cycles. *Entrants* is measured as the number of all hotels that entered the same county *c* in the same year *h* as a given hotel *i*. *Cohort Effect* in all columns is our detrended measure (i.e. the standardized residual from the time trend of the total number of hotels built in the US in year *h*, see Section 3.2). We use all the control variables described in equation (3), but omit their coefficients to save space. In all regressions, robust standard errors are adjusted for heteroscedasticity and county-level clusters. Significant at: *10%, **5%, ***1%.

	Hotel Age				
	"1-5"	"6-10"	"11-20"	"21-30"	">30"
Variable	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**	**log(RevPAR)**
Cohort Effect$_{ih}$	-0.0075	0.0043	0.0101**	0.0053	-0.0146
	(0.0074)	(0.0042)	(0.0043)	(0.0069)	(0.0128)
Entrants$_{ich}$	-0.0105***	-0.0066***	-0.0047*	-0.0107***	0.0034
	(0.0019)	(0.0021)	(0.0027)	(0.0028)	(0.0056)
Controls	Yes	Yes	Yes	Yes	Yes
Location Type Fixed Effects	Yes	Yes	Yes	Yes	Yes
Org. Form Fixed Effects	Yes	Yes	Yes	Yes	Yes
Brand Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year-Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Cluster	Yes	Yes	Yes	Yes	Yes
R-squared	0.3354	0.3494	0.1891	0.2714	0.3363
N	6,990	11,913	23,700	15,360	12,876