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Casino Revenues and Retail Property Values: The Detroit Case

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Abstract We analyze the effects of commercial casinos on retail property values in the Detroit urban area. Accounting for property characteristics and proximity to the casinos, casinos are found to have a significantly positive influence on retail property values. The effect is stronger within a 5-mile radius of the casinos, suggesting that casinos have a complementary, rather than substitution, effect on other businesses. This provides some of the first micro-level empirical evidence to support the "drawing power" of casinos and the impact of consumer spending on surrounding businesses. The model developed and tested in this study can be applied to other casino jurisdictions to gain further evidence on the impact of commercial casinos.

Keywords Retail · Drawing power · Cumulative attraction · Casino

Introduction

Commercial casino gambling is now legal in 12 states, and tribal casinos are located in 29 states. Although the spread of casinos in the U.S. was fastest during the early 1990s, one sees renewed interest by states to find alternative sources of revenues and mechanisms to stimulate economic growth. In 2007, Pennsylvania was the most recent state to adopt casinos. Kansas is currently working on a regulatory framework for casinos, and although Massachusetts and Kentucky legislators rejected casino proposals in the spring of 2008, the issue will likely be revisited in the near future.

Commercial casinos are usually a policy response to state fiscal stress. Indeed, as state budgets continue to tighten during the current recession, legislators inevitably consider legalizing casinos as a means to raise additional tax revenues. A recent

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Washington Post article reports that "at least 13 states are facing huge shortfalls for the next fiscal year, and about a half a dozen others are in serious financial difficulty."[1] But is casino legalization a good solution to economic malaise? Of course, the casino industry has always argued that it acts as a strong economic stimulus, providing jobs to citizens and tax revenues to state and local governments. However, others contend that casino development will simply result in a "substitution effect", replacing other businesses, and resulting in a neutral economic impact.[2] Although several state-level empirical studies have considered casino effects, only limited evidence exists on whether casinos cause a "substitution effect" with other businesses at the local level.

This issue is addressed by examining the case of Detroit, Michigan. Detroit is an ideal case study due to land-based commercial casinos that are located in the central business district of a major urban area. Detroit employment and population decline over the sample period while the revenues of the casino industry steadily increase. Using casino revenues as a measure of casino activity and retail property transaction data, we test the effect casinos have had on Detroit commercial property values. Our results indicate that casinos have a positive impact on commercial property prices, suggesting that casinos act as complements, rather than substitutes, to existing businesses. Although the results apply only to Detroit, the empirical approach used in this study can serve as an example for future market studies.

This paper is organized as follows. The next section provides background on commercial casinos in Detroit, the economic effects of casino gambling, as well as the influence of casino activity on real estate property values documented by previous research. The data and empirical approach are described in section three. In the fourth section, the model is estimated and the empirical findings analyzed. The paper concludes with a summary of the findings of this study.

Background

Commercial casinos began to spread in the U.S. in the early 1990s. Michigan was the 11th state to legalize casinos in 1996.[3] The first casino opened in Detroit in 1999. The three Detroit casinos are very close to each other—within a 1.4 mile drive of each other. The only other casino in proximity is the Caesars Windsor, just across the Detroit River in Windsor, Ontario, Canada.

Annual casino revenues in Detroit first topped $1.0 billion in 2001, and there has been a modest, steady increase in revenues since that year.[4] In 2007, gross gaming revenues were $1.34 billion, and the casinos paid $365 million in state and local

[1] Keith Richburg, "Governors seek remedies for shortfalls" *Washington Post* (13 Jan. 2008).

[2] An additional facet of the casino debate is that gambling is seen by some as a "moral" issue. Thus, those with a moral opposition to gambling may be opposed to casinos regardless of any economic benefits.

[3] In this paper our concern is commercial casinos. Michigan also has 19 tribal casinos, as of 2008. The first of these opened in 1993. The nearest tribal casinos to Detroit are the Soaring Eagle Casino in Mt. Pleasant and the Saganing Eagles Landing Casino in Standish. Both are more than 140 miles from Detroit. Hereafter, when we refer to "casinos" we are referring only to the three commercial casinos in Detroit.

[4] For a more detailed discussion of Detroit's casino revenues, taxes, etc., see American Gaming Association (2008).

taxes. The academic literature contains a number of general studies on the economic effects of casinos, as well as a few studies that focus on the Detroit case. Generally, the benefits typically expected from legalized casino gambling include tax revenues, employment, increased economic activity, and the potential for positive spillovers to complementary local businesses. Among the potential costs of legalized casinos, one of the most commonly cited is the "substitution effect"—casinos shifting consumer spending away from other local businesses. Other major costs associated with casinos are the social costs associated with pathological gambling behaviors. A few studies have examined these issues providing empirical estimates of the costs and benefits.[5] We briefly review some general studies of the economic effects of casinos, as well as some more specific studies related to Detroit casinos.

Economic Effects of Casino Gambling

Although there are no reliable national-level comprehensive studies on the economic effects of casinos in the U.S., several state-level analyses have been published. Walker and Jackson (1998) analyzed the relationship between casino revenues and per capita income at the state level. Their study utilized quarterly data from 1991–96. During this period, they found evidence that casino gambling has a statistically significant positive impact on state-level per capita income.[6] However, Walker and Jackson repeated their analysis in 2007 using annual data from 1991 to 2005. For this longer, more recent time period, they found no relationship between casinos and state-level growth. Walker and Jackson (2007) suggest that these newer results may indicate that casinos have a positive short-term growth effect, but this effect diminishes over time.

Several studies have examined the Detroit case specifically. Wacker (2006) provides a thorough discussion of the political economy leading up to casino approval. The loss of manufacturing jobs in postindustrial Detroit and the economic decline of the CBD are offered as key explanations. Wacker points out that there is a regional draw to the urban Detroit casinos where visitors emanate from adjacent states. In another descriptive paper, McCarthy (2002) discusses the "entertainment-led" strategy to revitalize Detroit′s weakening economic base. Noted benefits include enhanced city marketing and tourism volume. Problems associated with the strategy are political in nature related to governance, location and isolation from potentially compatible land uses. The study by the Michigan Senate Fiscal Agency (2000) provides comprehensive information on the Detroit casino agreements, as well as expectations regarding revenues, employment and tax payments. However, all three of these Detroit studies fail to provide any empirical analysis of the effects of the Detroit casinos on property values or on the performance of the local economy.[7]

[5] For a review of the literature, see Walker (2007).

[6] Specifically, they found that casino revenues Granger cause per capita income. See Walker and Jackson (1998) for a detailed explanation.

[7] There have been, of course, several other descriptive pieces such as policy reports and newspaper reports. These sources typically list a variety of statistics such as employment figures, tax receipts, and casino revenues, but generally fail to provide a valid econometric analysis of the casinos' effects. An example of this type of study is the American Gaming Association's annual report (2008).

Perhaps the most comprehensive study of the Detroit casino case is Moufakkir′s (2002) study. This study is somewhat dated, but it addresses five specific issues influenced by casinos: tourism activity, gambling spending capture rates (relative to the nearby casino in Windsor, Canada); projections compared to actual results; crime in Detroit; and bankruptcy filings. Moufakkir provides evidence that crime and bankruptcy filings did not increase following casino openings in Detroit, and the net economic contribution is beneficial. Although the study examines a number of important social and economic issues, it does not address whether casinos create a local "substitution effect" that harms other businesses.

Casino Activity and Real Estate Property Values

Wenz (2007) develops a hedonic pricing model to estimate the net impact of casinos on residential property values, using national data from the Public Use Microdata Sample (PUMS) of the 2000 U.S. Census. Wenz argues that the hedonic approach has advantages over other potential measures because it connects the value of public goods that are revealed in home values as a result of casino gambling. The study is general in nature, finding that casinos have a net positive impact on housing prices (about 2%) in the same geographic area as a casino, while property values in bordering areas experience even greater positive spillover effects (about a 6% difference in value).[8] Due to the national scope of the Wenz study, there is considerable heterogeneity across casinos, markets and corresponding local economies; hence, some of these differences may be attributed to fundamental market differences or the timing of casino development. Most casinos in Wenz′s sample are Native American casinos, while only two cities are identified with non-Native American legalized gambling; Atlantic City, NJ and Deadwood, SD. Accordingly, Wenz finds that positive impacts of casino gambling decline as population density increases and that the number of gaming positions (i.e., casino industry size) has no effect on the local economy.

In another study specific to Atlantic City, Buck et al. (1991) examine 64 connecting localities to simultaneously estimate determinants for property crime and average housing values using economic variables including population, unemployment, government revenues, police expenditures and distance from Atlantic City. They find that, although the development effect of casinos has a positive effect on property values, the crime attracted by the casinos has a negative effect on property values. Both effects diminish with the distance from a new casino.

The study by Phipps (2004) examined the effects of casino openings and closings on neighborhood crime and housing prices, using a time-series hedonic approach with MLS data in Windsor, Ontario. (Windsor is just across the river from Detroit.) Phipps finds that, although crime reports are higher and property values are lower in close proximity to casinos, crime and housing prices vary randomly around mean values after either the opening of a new casino or the closing of an existing one. According to this evidence, Phipps concludes that casinos have a benign effect on crime and housing prices in Windsor.

[8] Geographic area is defined as the U.S. Census Public Use Microdata Area (PUMA), which contains at least 100,000 individuals.

There is no published evidence of the impact of casinos on commercial property values. In contrast to previous work, our study provides an original examination of the influence of casinos on retail property values. We focus on a single market, thus eliminating the bias introduced by casino and economic heterogeneity across the U.S. The use of transaction level data enables empirical methods that control for unique physical and locational differences across properties. Rather than using only an indicator variable to consider the fixed effect of casinos, the analysis is dynamic and features total casino revenues to account for time variation in industry performance. Finally, we consider the value impact on properties in close proximity to casinos. These methods elicit a more direct connection between consumer spending at casinos and changes in individual retail property values. The empirical tests are designed to answer the open question of whether casino performance causes a substitution effect away from other commercial land uses, or if certain property types exist as complements to casino gambling.[9]

Data & Methodology

Market selection is a key consideration for this analysis. A number of possible markets could be examined. The focus is on urban location because of the interest in examining the impact on surrounding businesses. From the AGA (2008) list of the top 20 US casino markets, only four markets have population greater than 50,000 and greater than 50 retail sales observations in CoStar. These are Las Vegas, Detroit, St. Louis and Kansas City. Las Vegas is problematic because the gaming industry contributes such a large share of the economic base. Multiple new casinos are built every year in Las Vegas, adding difficulty to isolating differences between the novelty effect of new casino development and the impact of existing industry trends. Missouri allows riverboat casinos, but not land-based casinos. The consequence is that gambling venues in Kansas City and St. Louis are relatively isolated from the core urban market and the opportunity to examine the impact on surrounding businesses is limited. Additionally, prior to 2008 the Missouri Gaming Commission enforced an unpopular $500 loss limit which largely restricted the drawing power for visitors in surrounding states.

Detroit is selected for this study due to the public disclosure of casino revenues combined with a steady gaming industry in a large metropolitan market. In addition, Detroit represents a convenient case study because its urban commercial casinos are distant from the tribal casinos in the state. Detroit has only three commercial casinos, all in close proximity to each other. This offers a relatively direct connection between casino performance and commercial property values. Finally, population and employment decline during the 2001–2008 period while casino revenues steadily rise. This divergence suggests that a connection to retail property values can more directly be attributed to casino performance than general urban growth. No

[9] Note that by "substitute" and "complement" we are not referring to the standard economic relationship between price of one good and demand for another. Rather, we are simply referring to a relationship among the revenues in different industries.

other urban casino market in the U.S. offers this combination of characteristics along with adequate retail property transaction data to make this type of analysis possible.

We posit three separate models of commercial property prices in Detroit. The goal is to isolate the effect casinos in Detroit have had on commercial property prices. Data is collected on a number of variables that are expected to explain commercial property values. We utilize retail property sales data, along with property and locational characteristic data for Detroit provided by the CoStar Group. Data include a total of 1,135 observations (property transactions) over more than a 7-year period spanning from May 2001 to June 2008. The sample is limited to include the 488 observations where data are jointly available for the variables listed and described in Table 1. The sample is diverse in nature with property uses that range from service stations to day care centers. Table 2 provides descriptive statistics for the sample. The average property is almost 35 years old, and average selling price is just over $1.0 million.

In addition to property specific information, data are collected on macroeconomic market factors that may influence the supply and demand of retail space. Retail supply data are extracted from a recent CoStar Retail Market Report for the Detroit market. Supply of rentable building area (RBA) is reported quarterly and ranges from a minimum of 194 million square feet in the second quarter of 2001 to a maximum of 212 million square feet in the first quarter of 2008. Aggregate retail supply estimates are merged with property transaction data based on the quarter in which the transaction occurs to create the Supply_RBA variable.

Following the widely held belief that *retail follows residential growth*, population estimates are frequently the first line of even the most detailed demand models for retail market analysis. Annual population estimates from the Detroit–Livonia–Dearborn, MI Metropolitan Statistical Area (MSA) for years 2000 through 2007 were collected from the U.S. Census Bureau. Population is lagged so that transaction

Table 1 List of variables

Variable	Description
5mile	Equals 1 if property is within 5-mile radius of any Detroit casino
Age	Property age (in years)
Bldg_SF	Property size (in square feet)
Casino_rev	Total adjusted gross receipts from Detroit casino operations
Coverage	Lot coverage ratio
D_Type_i	Indicator variable for property type *i*
Distance	Average of measured distances from each casino (in miles)
Land_area	Land area for subject site (in square feet)
N_floors	Number of floors
Pop_Det	Estimated population for the Detroit–Livonia–Dearborn, MI area
Rel_days	Number of days since sale date (measured relative to August 14, 2008)
Sale_price	Recorded purchase price
$SubMkt_j$	Indicator variable for submarket j
Supply_RBA	Total existing inventory of retail space in the Detroit market (in square feet of rentable building area)

Table 2 Descriptive statistics

Variable	Mean	Standard deviation	Mean (if 5mile=1)	*t*-test of difference	Minimum	Maximum
Property information (n=488)						
Age	34.7	25.4	30.4	(−0.68)		
Bldg_SF	6,488	7,866	5,391	(−0.95)		
Coverage	0.156	0.400	0.280	(1.18)		
Distance	19.649	13.171	–	–		
Land_area	69,161	280,565	16,116***	(−8.63)		
N_floors	1.09	0.344	1.19	(0.96)		
Rel_days	564	349	499	(−0.74)		
Sale_price	$1,022,774	$1,196,730	$720,522**	(−2.67)		
Market information (Q2 2001 to Q2 2008)						
Casino_rev	$110,513,274	$6,219,181			$79,973,338	$123,755,238
Pop_Det	2,015,413	16,647			1,985,101	2,058,895
Supply_RBA	208,689,927	2,617,117			194,080,564	212,267,916

*p=0.10; **p=0.05; ***p=0.01 (significant difference from the mean of the control set)

sale dates are matched with population estimates from the previous year to create the Pop_Det variable. Consistent with publicized struggles of manufacturing industries in Detroit and resulting employment trends, population for Detroit MSA is declining every year since the beginning of the decade—most recently falling by as much as 1.36%. As shown in Table 2, population dropped from 2.06 million in 2000 to 1.99 million in 2007.

Detroit has only three casinos, MGM Grand Detroit, MotorCity Casino and Greektown Casino, with openings in July 1999, December 1999 and November 2000, respectively. All casinos are within a maximum driving distance of 1.4 miles of each other and no new casino openings occur during the sample period.[10] Revenue from operations are made publicly available online from the Michigan Gaming Control Board. In March 2008, the three Detroit casinos reported their highest collective monthly revenue, approaching $124 million. Monthly casino revenues are merged with property transaction data based on month of sale to create the Casino_rev variable. This variable serves as a good proxy for the overall amount of consumer spending in Detroit that can be attributed to casino visitors.

If visitors only spend their money on an all-inclusive casino experience, then casino revenues should have little to no influence on retail property values. It is also possible that casinos oversupply the market with retail space and cannibalize competition so that casino revenues act as a substitute to other consumer spending, leading to a decrease in retail property values. On the other hand, if casino guests also spend disposable income outside the casino, then retail property values should be positively affected by the casino volume. Brueckner (1993) provides a formal model to argue that the successful performance of anchor tenants benefits in-line

[10] As noted earlier, tribal casinos are a significant distance away from the commercial casinos in Detroit; we therefore ignore their effect on the Detroit real estate market.

retail tenants by drawing customers for multi-purpose shopping trips.[11] Although this earlier work is focused on enclosed shopping centers, it opens the question about possible customer spillovers in walkable urban locations when customers are drawn to the area by major retail or entertainment venues. Based on the economies of agglomeration principle, the influence of casinos is not expected to be constant and should vary by retail use and proximity to casinos.[12] According to this hypothesis, during periods where gaming spending is high, nearby complementary retail tenants should see improved sales revenue escalating the competition for their space. Retail is an income-producing property; therefore, higher rents for properties nearby casinos lead to higher valuations and selling prices.[13]

Latitude and longitude coordinates are used to measure the distance (in nautical miles, or "as the crow flies") from sold properties to the three casinos. With coordinates given as radians measured relative to 90°, the calculation of the variable Distance is made according to the spherical law of cosines.[14] Distance measures the distance between each retail observation and the midpoint of the casino triangle. The Distance variable is included in the hedonic model to control for the gradient of commercial values relative to the city center. In order to test whether the effects of casinos diminish further away from the casinos, we introduce a variable, 5mile, which identifies retail properties that are within 5 miles of any of the three Detroit casinos.

Panel A of Table 2 reports the means for selected variables describing properties within a 5-mile radius of any Detroit casino (if 5mile=1). It is shown that properties within a 5-mile radius are similar in age, size and sale date, yet lot sizes are smaller and the average selling price is significantly less than the overall market average. This preliminary observation would seem to suggest that the presence of Detroit casinos is a detriment to retail property values. However, the comparison of sample means is misleading since it fails to consider fundamental differences like property type, physical attributes and location within an urban market. Regression analysis has the superior ability to directly link the influence of casino revenues to retail property values.

The starting point is a traditional hedonic model using property characteristics to explain variation is selling prices. The model is log-linear where the dependent variable is ln(Sale_price).[15] The natural log of building size, ln(Bldg_SF), is included as an influential determinant of selling price because the dependent variable is not measured as price per unit of size. Property age, measured as ln(Age), is a key

[11] This important retail concept is later supported by the findings of Gatzlaff et al. (1994), Eppli and Shilling (1995), and Miceli and Sirmans (1995). Mejia and Eppli (2003) extend this analysis to find evidence of demand externalities between regional shopping centers.

[12] For theoretical discussion of economies of agglomeration, see Pascal and McCall (1980) and Goldstein and Gronberg (1984). Eppli and Benjamin (1994) provide a review of retail research that summarizes the literature linked to economies of agglomeration, along with other important retail concepts.

[13] Chiang, Lai and Ling (1986) demonstrate that base retail rents are positively related to expected tenant sales. Improved tenant performance increases the tenant's ability to pay more and intensifies competition for space. These economic influences are in turn capitalized into higher retail property values.

[14] Distance=3443.92×arccos[cos(lat1)×cos(lat2)+sin(lat1)×sin(lat1)×cos(long1 − long2)], where 3443.92 miles is the radius of the earth.

[15] Colwell and Munneke (1997) verify concavity in property values with respect to lot size and point out the bias in using price per acre as a dependent variable in urban locations. The natural log of Sale_Price is used to alleviate this concern.

consideration due to functional obsolescence and continuous technological change in retail industry standards.[16] The Rel_days variable measures the number of days since the property sale relative to August 14, 2008, and is included to control for the time trend in retail prices relative to other market variables.[17] Since market locations range from urban to suburban and MSA periphery, lot size and building size are not highly correlated; hence, lot size is included as ln(Land_area) to measure the value of undeveloped land.[18] Coverage and ln(N_floors) measure density effects within the urban location according to the efficiency of land use and building height, respectively. The D_Type_i indicator variables are included to identify properties according to 16 different types.[19]

Colwell and Munneke (2008) point out that the use of a constant gradient assumption to control for urban location and distance from the CBD may be inappropriate due to directional differences in many markets. To avoid this concern, the $SubMkt_j$ variables are used to control for differences across respective Detroit submarkets as distinguished by CoStar.[20] Additional market variables ln(Supply_RBA) and ln(Pop_Det) are included to control for macroeconomic influences on the supply and demand of retail space. Finally, the variable ln(Casino_rev) and the interaction term 5mile×ln (Casino_rev) are included to measure the scale and proximity effects of casino revenues on retail property values. Hence, the operational model to be estimated is:

$$\begin{aligned}\ln(\text{Sale\_Price}) = {} & \beta_0 + \sum_{i=1}^{15} \beta_i \times \text{D\_Type}_i + \sum_{i=16}^{36} \beta_i \times \text{SubMkt}_j + \beta_{37} \times \ln(\text{Age}) \\ & + \beta_{38} \times \ln(\text{Bldg\_SF}) + \beta_{39} \times \text{Coverage} + \beta_{40} \times \text{Distance} \\ & + \beta_{41} \times \ln(\text{Land\_area}) + \beta_{42} \times \ln(\text{N\_floors}) + \beta_{43} \times \ln(\text{Rel\_days}) \\ & + \beta_{44} \times \ln(\text{Pop\_Det}) + \beta_{45} \times \ln(\text{Supply\_RBA}) + \beta_{46} \times \ln(\text{Casino\_rev}) \\ & + \beta_{47} \times 5\text{mile} \times \ln(\text{Casino\_rev}) + \varepsilon \end{aligned} \tag{1}$$

where ε is a normally distributed error term.

[16] An in-depth discussion of the interaction between age and retail depreciation is provided by Colwell and Ramsland (2003).

[17] The linear time trend assumption includes *Rel_days* as a dependent variable but is insignificant in all estimations. Instead, the nonlinear time trend is included as ln(*Rel_days*) and shows up as positive and statistically significant, improving the model fit for all estimations.

[18] The importance of including lot size when land values peak in urban locations is emphasized by Guntermann and Thomas (2005).

[19] Each of the following property types is included: Auto Dealership, Auto Repair, Bank, Bar, Car Wash, Convenience Store, Day Care Center, Drug Store, Fast Food, General Freestanding, Restaurant, Service Station, Storefront, Storefront Retail/Office, Storefront Retail/Residential and Supermarket. The variable for General Freestanding is suppressed with 170 observations.

[20] There are 31 submarkets in the sample, including Airport District, Auburn Hills, Birmingham Area, Bloomfield, Bloomfield West, CBD, Central I-96 Corridor, Dearborn, Detroit East of Woodward, Detroit West of Woodward, Detroit-New Center, Downriver North, Downriver South, Farmington/Farm Hills, Howell/Brighton Area, Lakes Area, Macomb East, Macomb West, Monroe County, Northern Outlying, Pontiac, Rochester, Royal Oak Vicinity, Southern I-275 Corridor, Southfield North of 10 Mile, Southfield South of 10 Mile, The Pointes/Harper Woods, Troy North, Troy South, Washtenaw East of 23 and Washtenaw West of 23. The variable for Northern Outlying is suppressed with 66 observations.

The second step of the empirical analysis is to examine whether there are specific property types driving the empirical results. In order to do this, Eq. 1 is modified so that the variables ln(Casino_rev) and 5mile×ln(Casino_rev) are omitted. Instead the ln(Casino_rev) variable is partitioned into interaction terms $D\_Type_i \times \ln(Casino\_rev)$, measuring whether specific property types are influenced by casino revenues. The operational model to be estimated can be written as:

$$\begin{aligned}\ln(Sale\_Price) = {} & \beta_0 + \sum_{i=1}^{15} \beta_i \times D\_Type_i + \sum_{i=16}^{36} \beta_i \times SubMkt_j + \beta_{37} \times \ln(Age) \\ & + \beta_{38} \times \ln(Bldg\_SF) + \beta_{39} \times Coverage + \beta_{40} \times Distance \\ & + \beta_{41} \times \ln(Land\_area) + \beta_{42} \times \ln(N\_floors) + \beta_{43} \times \ln(Rel\_days) \\ & + \beta_{44} \times \ln(Pop\_Det) + \beta_{45} \times \ln(Supply\_RBA) + \beta_{46} \times \ln(Casino\_rev) \\ & + \beta_{47} \times 5mile \times \ln(Casino\_rev) + \sum_{i=48}^{64} \beta_i \times D\_Type_i \times \ln(Casino\_rev) + \varepsilon\end{aligned} \tag{2}$$

The final step of the empirical analysis is to examine the partitioning of ln (Casino_rev) influences by property type for only those properties located within the 5-mile radius of the Detroit casinos. This is done because one might expect the effects of casinos to be more pronounced in closer proximity to the casinos, and to diminish as one moves further away. Hence, $D\_Type_i \times \ln(Casino\_rev)$ is multiplied by 5mile to create the following model:

$$\begin{aligned}\ln(Sale\_Price) = {} & \beta_0 + \sum_{i=1}^{15} \beta_i \times D\_Type_i + \sum_{i=16}^{36} \beta_i \times SubMkt_j + \beta_{37} \times \ln(Age) \\ & + \beta_{38} \times \ln(Bldg\_SF) + \beta_{39} \times Coverage + \beta_{40} \times Distance \\ & + \beta_{41} \times \ln(Land\_area) + \beta_{42} \times \ln(N\_floors) + \beta_{43} \times \ln(Rel\_days) \\ & + \beta_{44} \times \ln(Pop\_Det) + \beta_{45} \times \ln(Supply\_RBA) + \beta_{46} \times \ln(Casino\_rev) \\ & + \beta_{47} \times 5mile \times \ln(Casino\_rev) + \sum_{i=48}^{58} \beta_i \times 5mile \times D\_Type_i \times \ln(Casino\_rev) + \varepsilon\end{aligned} \tag{3}$$

Equation 3 includes only eight interaction terms due to unavailable data for certain property types within the radius. The results from the empirical estimation of Eqs. 1, 2 and 3 are discussed in the next section.

Results

Table 3 provides the results from three estimations of Eq. 1.[21] The first model assumes β_{46} and β_{47} equal zero to ignore the influence of casino revenues. The model results suggest that property values are lower for older properties, which are more likely to be functionally obsolete or may have deferred maintenance. Property

[21] In the interest of brevity, the 15 D_Type_i variables and the 30 $SubMkt_j$ variables included in the estimations are not reported. The full results are available from the authors by request.

Table 3 Empirical results [dependent variable: ln(Sale_price)]

Variables	Equation 1 (β_{46}, β_{47}=0) Coefficient (*t*-statistic)	Equation 1 (β_{47}=0) Coefficient (*t*-statistic)	Equation 1 (full model) Coefficient (*t*-statistic)
Constant	36.8 (0.18)	60.2 (0.30)	85.5 (0.43)
ln(Age)	−0.4098*** (−10.05)	−0.4148*** (−10.18)	−0.3997*** (−9.77)
ln(Bldg_SF)	0.5332*** (13.33)	0.5341*** (13.39)	0.5329*** (13.45)
Coverage	0.1823** (2.09)	0.2010** (2.29)	0.2020** (2.32)
Distance	−0.0074 (−1.40)	−0.0070 (−1.33)	−0.0055 (−1.04)
ln(Land_area)	−1.444** (−2.27)	−1.491** (−2.35)	−1.423** (−2.25)
ln(N_floors)	−0.1149 (−0.66)	−0.1322 (−0.76)	−0.1585 (−0.91)
ln(Rel_days)	0.2919** (2.50)	0.2786** (2.39)	0.3170*** (2.71)
ln(Pop_Det)	−13.59 (−1.43)	−12.38 (−1.30)	−14.49 (−1.53)
ln(Supply_RBA)	9.88 (1.43)	6.58 (0.93)	6.82 (0.97)
ln(Casino_rev)	–	1.236* (1.83)	1.213* (1.81)
ln(Casino_rev)×5mile	–	–	0.0281*** (2.58)
D_Type$_i$ variables	Included	Included	Included
SubMkt$_j$ variables	Included	Included	Included
R-square	64.2%	64.5%	65.0%
Number of observations	488	488	488

*p=0.10; **p=0.05; ***p=0.01

size and lot coverage both positively influence property values. Properties in urban locations are often associated with higher coverage ratios; hence, urban location is valuable for Detroit retail space. Properties with large land area *ceteris paribus*, are linked to lower property values and often include substantial portions of undeveloped land. Speculative land holdings are risky and heavily discounted due to future cash flow uncertainty. In addition, unimproved land on a property can signal a lack of connection to surrounding land uses which is a very important attribute to retail tenants. Number of floors is not associated with any significant value differences. Retail tenants rarely succeed without street-level access and unlike office space, there is considerable homogeneity in the sample as most properties are characterized by a single floor. The time trend variable (Rel_days) reveals that retail property values are generally increasing throughout the sample period. This outcome is a result of urban trends in Detroit. New neighborhoods become popular and attract affluent homeowners. This is followed by new retail development. At the same time, continual efforts over the last decade lead to gentrification of aging neighborhoods and the eventual replacement of outdated, underperforming retail centers. Population in Detroit is decreasing while supply of existing space is generally increasing throughout the sample, but neither appears to explain significant differences in property values.[22]

[22] Eppli et al. (1998) analyze macroeconomic factors influencing retail returns at the metropolitan level for eight markets, including Detroit. They estimate six equations including retail construction starts, retail sales, mortgage rates, inflation, stock market returns and stock market volatility. Using residuals from these estimations, they find that unexplained changes in retail supply and retail sales have no significant influence on retail returns.

The second model in Table 3 adds the variable ln(Casino_rev) to consider the influence of casino revenues on retail property values. However, in this model we still ignore the 5-mile distance designation ($\beta_{47}=0$). The model is relatively stable, showing only minimal differences in parameter estimates from the first model. The estimated coefficient for ln(Casino_rev) is positive and significant at the 5% level, suggesting that casino revenues have a positive influence on retail property values. The coefficient can be interpreted to say that a 1% increase in casino revenues is predicted to lead to an average 1.236% increase in retail property values.

The final model in Table 3 includes the casino revenue interaction variable 5mile×ln (Casino_rev), so that the influence of properties in close proximity to Detroit casinos can be directly examined. The coefficients for both 5mile×ln(Casino_rev) and ln (Casino_rev) variables are statistically significant in this estimation. Thus, retail properties within the 5-mile radius are influenced by casino revenues and more strongly so than those outside the 5-mile casino radius. This result is very interesting although not surprising; visitors considering Detroit as a casino destination are more likely to lodge, shop, dine and find other entertainment venues in close proximity to casinos.

Retail properties and associated values vary widely by property type, making it inappropriate to assume that the influence of casino revenues will be identical across property type. The next step of the empirical analysis is to partition the effect of casino revenues to determine whether the results are driven by specific property types. Table 4 presents the results from the empirical estimation of Eq. 2. For the interactions of ln(Casino_rev) with the D_Type_i variables, only values for convenience stores and service stations are found to significantly increase with casino revenues. This result is fairly intuitive and suggests that the impact on the retail market as a whole may be attributed to out-of-town casino visitors who arrive via auto. It is interesting to note that none of the specific property types is significantly negatively affected by casino revenues.

Equation 3 provides a more direct test for the influence of casino revenues on specific property types within the immediate surrounding community (within the 5 mile radius). The interactions for general freestanding, restaurants and service stations all have positive and significant coefficients, as shown in Table 5. General freestanding is by far the largest property type, represented with 170 observations, making up nearly 35% of the sample. This includes many freestanding retail establishment not picked up by other indicators, such as apparel stores, restaurants and theatres. Within the sample, general freestanding typically includes only a single tenant in a structure built around 1969 averaging roughly 10,000 ft^2. The indicator for restaurants more commonly describes attached units that are smaller in size (averaging 5,500 ft^2) but newer (typically built around 1977). The significance of all three variables supports the hypothesis that the presence of casinos contributes to retail property values through the principle of cumulative attraction. Each category describes a retail use that is intuitively complementary to gaming, tourism and entertainment. Interestingly, there are no significantly negative coefficients for property type interaction variables in Tables 4 and 5; hence, there is not a single property type identified where visitor spending in casinos significantly reduces retail property values.

The results of this analysis provide empirical evidence that the commercial casinos in Detroit have had a positive impact on retail property values in the city. The effect is particularly strong within a 5 mile radius of the casinos, which suggests

Table 4 Results by property type [dependent variable: ln(Sale_price)]

Variables	Equation 2		
	Coefficient	Std. error	(*t*-stat)
Constant	134.6	205.6	(0.65)
ln(Age)	−0.4185***	0.0414	(−10.10)
ln(Bldg_SF)	0.5302***	0.0406	(13.06)
Coverage	0.2181**	0.0960	(2.27)
Distance	−0.0066	0.0054	(−1.21)
ln(Land_area)	−1.684**	0.6576	(−2.56)
Ln(N_floors)	−0.1040	0.1802	(−0.58)
ln(Rel_days)	0.2477**	0.1205	(2.05)
Ln(Pop_Det)	−13.92	9.762	(−1.43)
ln(Supply_RBA)	5.110	7.352	(0.70)
ln(Casino_rev)×D_Auto dealership	−6.070	10.14	(−0.60)
ln(Casino_rev)×D_Auto repair	−1.434	2.655	(−0.54)
ln(Casino_rev)×D_Bank	4.776	4.982	(0.96)
ln(Casino_rev)×D_Bar	−2.744	4.833	(−0.57)
ln(Casino_rev)×D_Car wash	2.393	2.445	(0.98)
ln(Casino_rev)×D_Convenience store	5.508*	3.187	(1.73)
ln(Casino_rev)×D_Day care center	3.644	3.177	(1.15)
ln(Casino_rev)×D_Drug store	1.196	3.220	(0.37)
ln(Casino_rev)×D_Fast food	0.8200	1.992	(0.41)
ln(Casino_rev)×D_General freestanding	0.1007	0.9908	(0.10)
ln(Casino_rev)×D_Restaurant	2.010	1.862	(1.08)
ln(Casino_rev)×D_Service station	2.323**	1.111	(2.09)
ln(Casino_rev)×D_Storefront	3.336	5.657	(0.59)
ln(Casino_rev)×D_Storefront retail/Office	3.914	5.336	(0.73)
ln(Casino_rev)×D_Storefront retail/Resident	2.351	3.397	(0.69)
ln(Casino_rev)×D_Supermarket	3.740	15.59	(0.24)
D_Type_i variables	Included	Included	Included
$SubMkt_j$ variables	Included	Included	Included
R-square	65.3%		
Number of observations	488		

*p=0.10; **p=0.05; ***p=0.01

that the complementary effects of casinos on other businesses in our analysis diminish as the distance from casino increases.

Conclusion

As the US recession worsens, state governments continue to search for political and economic tools to spur their economies. During the past two decades, commercial

Table 5 Results by property type: 5-mile radius [dependent variable: ln(*Sale_price)*]

	Equation 3		
Variables	Coefficient	Std. error	(*t*-stat)
Constant	70.2	195.8	(0.36)
ln(Age)	−0.3876***	0.0413	(−9.39)
ln(Bldg_SF)	0.5352***	0.0398	(13.45)
Coverage	0.1251	0.0868	(1.44)
Distance	−0.0054	0.0053	(−1.02)
ln(Land_area)	−1.501**	0.6251	(−2.40)
ln(N_Floors)	−0.1818	0.1737	(−1.05)
ln(Rel_days)	0.3656***	0.1173	(3.12)
ln(Pop_Det)	−18.10**	9.412	(−1.92)
ln(Supply_RBA)	11.56*	6.770	(1.71)
5mile×ln(Casino_rev)×D_Auto dealership	0.0164	0.0366	(0.45)
5mile×ln(Casino_rev)×D_Convenience store	−0.0041	0.0339	(−0.12)
5mile×ln(Casino_rev)×D_Fast food	−0.0041	0.0247	(−0.16)
5mile×ln(Casino_rev)×D_General freestanding	0.0993***	0.0256	(3.88)
5mile×ln(Casino_rev)×D_Restaurant	0.0827**	0.0344	(2.41)
5mile×ln(Casino_rev)×D_Service station	0.0621***	0.0195	(3.18)
5mile×ln(Casino_rev)×D_Storefront retail/Office	−0.0358	0.0264	(−1.36)
5mile×ln(Casino_rev)×D_Supermarket	−0.0042	0.0467	(−0.09)
D_Type_i variables	Included	Included	Included
$SubMkt_j$ variables	Included	Included	Included
R-square	66.5%		
Number of observations	488		

*p=0.10; **p=0.05; ***p=0.01

casinos have been popular. Yet, few empirical analyses have examined the actual economic effects of casinos. Detroit represents one of the first examples of "urban casinos" in the U.S, making it an ideal case for this analysis. This study examined the effect of Detroit′s commercial casinos on commercial property values. Using retail property sales data, as well as property characteristics and casino volume, we empirically test the impact the Detroit casinos have had on commercial property values in the city.

The results indicate that casinos have a complementary effect on Detroit retail. An increase in casino revenues is associated with a statistically significant increase in retail property values. This effect is stronger in magnitude for properties within a 5-mile radius surrounding the commercial casinos. Restaurants, service stations and general freestanding retail are each identified as property types that appreciate in value when nearby casinos generate higher revenue flows. Businesses who are either tenants or owners in these properties appear to significantly benefit from casino spillover effects. This is consistent with demand externalities on retail property that result from the drawing power of commercial casinos in an urban location.

This evidence is the first rigorous empirical evidence on how casinos affect other commercial businesses. The findings suggest that casinos have a complementary effect on nearby businesses, as measured by commercial property prices. There is no evidence to support the hypothesis that a substitution effect exists whereby casinos merely absorb spending that might have taken place at other businesses. These results apply only to Detroit, however the model in this paper can provide a blueprint for subsequent empirical analyses. Understanding the influence of casinos on urban economies and real estate markets is of interest not only to policymakers and voters who may currently be considering casino legalization, but also to academics and business owners who seek to better understand the full effects of casino development.

Several important caveats to this analysis should be emphasized. First, the casino-retail relationship in other markets may be markedly different than what we find for Detroit. Detroit is notably unique and strong conclusions about the general effects of casinos on surrounding businesses should not be drawn from this analysis. Current data availability makes it difficult to analyze all urban casino markets. Market heterogeneity alters expected outcomes from such efforts. Future research considering alternative markets and time periods is necessary to further the understanding of this relationship between casinos and retail property values.

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