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Professional Sports Facilities, Teams and Property Values: Evidence from Seattle's Key Arena

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Professional Sports Facilities, Teams and Property Values: Evidence from Seattle's Key Arena

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Abstract

Professional sports teams and facilities can generate negative or positive amenities to be capitalized into nearby property prices. We investigate the effect of the departure of a National Basketball Association team, the Seattle SuperSonics, from Key Arena in Seattle in 2008 on nearby residential property values. The arena continued to operate after the team left, so this departure represents a natural experiment to identify the net effects of a sports team from the effect of a facility and other events that take place in the facility. Results from a repeat sale regression model indicate that the departure of the SuperSonics was associated with excess appreciation of condo prices near Key Arena, suggesting that the team generated disamenities in this market.

JEL Codes: R13, R58, H71, L83

Key words: repeat sales regression model, property values, professional sports

Introduction

A growing body of literature examines the effect of professional sports on nearby property values. Papers in this literature exploit the opening of a new sports facility, or the announcement of

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the location of a proposed new sports facility, as a natural experiment to generate variation in factors that affect property values. Other recent research on nearby amenities and housing prices includes urban revitalization programs (Rossi-Hansberg et al., 2010), power plants (Davis, 2011), and brownfields (Linn, 2013); (Schuetz, 2014) investigates the amenity effects of art galleries, a related entertainment activity. In the sports facility literature Tu (2005) used the opening of FedEx Field in suburban Washington DC to analyze changes in residential real estate prices, and Ahlfeldt and Maennig (2009, 2010a) use the opening of two new sports venues in Berlin in a similar analysis. All three find that residential property values increase with distance from the facilities, and that properties close to the facilities experience no increase in value. In each case, the natural experiment involves both the construction of a new facility and the arrival of sport and non-sport events that take place at the facility. The results in all three papers suggest that property values very near the facilities may be affected by negative externalities like traffic, noise, trash, etc. while property values farther away reflect only the positive amenity effects. The economic effects of a new sports facility and the events that take place in that facility have different characteristics, but most research examines only the combined, gross impact of both the new facility and the events on economic outcomes like property values. Becuase the facility construction is both a positively correlated and omitted variable, any resulting economic outcome estimates are necessarily biased. To the best of our knowledge, this is the first study to identify property price effects associated with a sports franchise in the absence of the construction of an associated facility.

The impact of sports teams and facilities on property values has important economic policy implications. The United States experienced a boom in new sports stadium and arena construction in the early 1990s. Sixty-four new sports facilities were built for National Basketball Association (NBA), Major League Baseball (MLB), the National Football League (NFL) and the National Hockey League (NHL) teams from 1991 to 2006. Most of these projects involved some public subsidies and many were 100% publicly financed (Zimbalist and Long, 2006). Tax Increment Financing (TIF) represents an increasingly popular financing mechanism for new sports facility construction.[1]. Under these funding schemes, public bonds are issued to pay for land, infrastructure, and facility construction, and incremental property tax revenues generated by the presence of the facility and team over a long period of time pay for the principle and interest on these bonds. Recent

[1]In Canada, this mechanism is called a Community Revitalization Levy (CRL)

examples of TIF/CRL financing for sports facilities include the new Edmonton Arena, the KFC Yum! Center in Louisville, a proposed new arena in downtown Chicago, and a new arena in the early planning phases in Milwaukee. The increasing use of property tax revenues to finance new sports facility construction projects highlights the importance of understanding the relationship between sports facilities and property values.

In this paper, we utilize a different type of natural experiment, the departure of the Seattle SuperSonics from Key Arena in downtown Seattle in 2008, to generate evidence about the effect of the presence of a professional sports team, but not a new facility, on surrounding property values. Previous research used event studies involving the arrival of both teams and facilities to generate quasi-experimental variation in factors believed to affect residential property values. We exploit the departure of a high-profile NBA team from an arena that continued to host Women's National Basketball Association games, minor league hockey games, and concerts, after the departure of the NBA team to generate exogenous variation in the external amenities and disamenities from a sports arena.

Results from a repeat sales regression model indicate that condominiums near Key Arena experienced excess price appreciation after the SuperSonics left Seattle in mid 2008, based on data from more than 10,000 residential property transactions within one mile of Key Arena over the period 2000-2013. These results suggest that the presence of a team in a high profile sports league is not the most important factor driving observed property value increases documented in the existing literature. In the case of Key Arena, the structure and other events held in the arena appear to be sufficient to support nearby property values, even when a team in a major sports league leaves the facility. The results suggest that the team and the games played by the team generated disamenity effects in the local economy, perhaps reflecting the importance of traffic, trash, crime, crowds, or other negative aspects of professional sports events.

Key Arena and the SuperSonics

Key Arena is a multi-purpose sports arena located in downtown Seattle, Washington. It opened on 21 April 1962 and cost $7 million to build ($55.8 million in 2014 dollars). It was 100% publicly financed. After a $74.5 million renovation in 1995 ($119 million in 2014 dollars), the arena seated

17,072 spectators for basketball games, 15,177 for ice hockey games, and 17,459 for concerts. The City of Seattle owns and operates the facility.

From 1967 through the end of the 2007-2008 season, Key Arena was home to the Seattle SuperSonics of the NBA.[2] In July 2006 the owner of the SuperSonics, Starbucks CEO Howard Schultz, sold the SuperSonics, and the Storm of the WNBA, to an ownership group led by Clayton Bennett for $350 million. At that time, the team had a lease to play in Key Arena until 2010. The new ownership group immediately requested that Seattle, and King County, publicly fund a new $500 million arena in Renton, a Suburb of Seattle. This request was denied.

In November 2007, Bennett informed NBA commissioner David Stern that the SuperSonics would be moved to Oklahoma City, Oklahoma, as soon as the team could get out of the Key Arena lease. Soon after, the team requested arbitration with the City of Seattle in order to terminate the lease. When this was denied, the city sued Bennett and the ownership group to force them to play in Key Arena until 2010. The case went to trial; on 2 July 2008 the team and city reached an agreement, before a ruling in the suit, that allowed the team to move to Oklahoma City in exchange for a $45 million payment.[3] The team moved to Oklahoma City, and began play in October 2008 as the Oklahoma City Thunder. Under the terms of this agreement, the city kept the SuperSonics name and team history. Most imporant to this study, Key Arena continued to host concerts, WNBA games, and other sporting events after the departure of the SuperSonics; the team's departure did not affect the other events held in this facility.

The move of the team to Oklahoma City following the 2 July 2008 settlement represents a "natural experiment" that motivates a quasi-experimental differences-in-differences analysis of the effect of the presence of the SuperSonics playing games in Key Arena on nearby residential property values. The continuing presence of the team in Key Arena was determined by the outcome of a court case, and the outcome of this case was not clear until the last minute settlement was reached between the team and city after both sides had rested their case. We posit that the team could have been reasonably expected to remain in Key Arena until 2010, and perhaps beyond, had the

[2]From 2000 to the present, it has been the home of the Seattle Storm of the Women's National Basketball Association. It has was also home to various minor league hockey and indoor professional soccer teams over the years. The University of Washington basketball team played in Key Arena in 1999-2000 while their on-campus arena underwent renovation.

[3]One of the authors of this paper, Humphreys, was employed by the SuperSonics to provide expert testimony during this trial. This research is unrelated to that trial, and no part of this research is related to his testimony.

court found for the city in this suit. Dehring et al. (2007) exploit similar announcements to analyze the effects of a planned new football stadium on property values in Arlington, Texas.

Sports Facilities and Property Values

A growing body of research examines the relationship between the presence of professional sports teams and facilities and nearby property values. Ahlfeldt and Kavetsos (2012b) point out that this relationship can be motivated by a standard bid-rent function in the context of utility maximizing consumers making decisions on where to live that includes a trade-off between housing consumption and non-housing consumption. In this framework, utility maximizing consumers maximize their well-being by choosing their place of residence. Utility from housing depends on the size and quality of their residence and the quality of the location where they choose to live. The locational quality is a composite good that reflects access to employment, natural amenities including environmental quality, public services, and potentially access to a professional sports facility and the events that take place in this facility.

Professional sports facilities are a locational amenity available in many large cities. Residents may derive utility from proximity to a professional sports facility and the services provided in this facility, including transportation cost savings related to proximity. This utility may also reflect the sense of community or civic pride associated with a local sports team. Johnson and Whitehead (2000), Johnson et al. (2001), and Fenn and Crooker (2009) estimate the value of intangible benefits of a local sports team using the Contingent Valuation Method (CVM) approach and find substantial dollar value estimates of this public good associated with professional sport. Professional sports facilities could also represent a disamenity, due to increased traffic, crime, trash, and other undesirable elements gnerated by large crowds of people attending events in these facilities.

In the presence of competitive real estate markets and markets for goods and other services, the utility of mobile local residents depends on proximity to a sports facility and team, and other location and non-location characteristics of their residence. At the margin, any increase in utility generated by any locational or non-locational property characteristic will be offset by a corresponding increase in rent. This implies a standard bid-rent function that links rent to locational and non-locational characteristics and proximity to a professional sports facility.

Ahlfeldt and Kavetsos (2012b) point out that identification of the effect of proximity to a professional sports facility depends on the ability to separate the facility effect from the effect of other observable and unobservable locational characteristics generated by factors that are correlated with distance from a sports facility. This correlation can arise because many sports facilities are located in downtown areas of large cities. If the impact of a sports facility cannot be separated from the impact of these other locational factors, then the estimated impact of proximity to a sports facility will be biased. Ahlfeldt and Kavetsos (2012b) recommend a quasi-experimental approach to mitigate this bias, pooling housing price data into in space-time cells and comparing property prices before some event related to a professional sports team and facility, like the opening of a new facility or the renovation of a facility, relative to prices after this event; Ahlfeldt and Kavetsos (2012b) also recommend conditioning on observable characteristics of dwellings.

Tu (2005), Dehring et al. (2007), Ahlfeldt and Maennig (2009), Ahlfeldt and Maennig (2010b), Kavetsos (2012) and Ahlfeldt and Kavetsos (2014) employ a quasi-experimental difference-in-difference approach to estimate the effect of a new sports facility on housing prices using data from before and after the opening of facilites. Tu (2005) found a 13% increase following the opening of FedEx Field, a football stadium, in suburban Washington DC in 1997. Dehring et al. (2007) found a 1.5% decrease in property values after two announcements of different locations for a new football stadium in Arlington Texas in 2004 and 2005. Ahlfeldt and Maennig (2009) and Ahlfeldt and Maennig (2010b) found a 2.5% increase in property values after the opening of Velodrom arena in Berlin, Germany, and a 15% increase after the opening of Max-Schmeling Arena in Berlin; both were opened in the 1990s. Kavetsos (2012) found a 2.5% to 3% increase in property values after the opening of the new Olympic Stadium in London, England in 2007. Ahlfeldt and Kavetsos (2014) found a 15% increase in property values after the opening of New Wembley Arena in London, England in 2007. In all of these cases, the opening of the facility coincided with the arrival of sport franchises or other sporting events in the facilities; the price effect of these franchises or sporting events on property values can not be disentangled from the the price effect of the facility and non-sporting events associated with the facility.

Empirical Analysis

Econometric Approach

This study tests for changes in the net flow of services generated by proximity to Key Arena before and after the departure of the Seattle SuperSonics in 2008. We focus primarily on condominiums located close to the arena. We test for a change in the net flow of services to properties in the vicinity of Key Arena using an augmented repeat sales regression (RSR) approach. RSR models can be derived from a standard hedonic price model for property transaction prices. The hedonic model assumes the quality and quantity of the flow of services, and the price of these services, determine property transaction prices. Formally, the log price of property j at time t is

$$p_{jt} = \delta_t + f(X_{jt}, Z_j, \beta_t) + d_j \times 1(t \geq Year) \times \theta + u_{jt} \tag{1}$$

where, p_{jt} is the log of the observed property transaction price, δ_t is a time-varying average price level, $f(X_{jt}, Z_j, \beta_t)$ is a function that maps time-varying and time-invariant property attributes, X_{jt} and Z_j, into service flows, d_j is measure of the distance of property j to Key Arena, $1(t \geq Year)$ is an indicator function that is equal to one if the property is sold after some reference year and 0 otherwise, θ measures excess price appreciation due to the changing amenity value of Key Arena after the reference year, and u_{jt} is an unobserved error term reflecting all other factors that affect property transaction prices. Two choices for the reference year are examined that are associated with the Sonics departure: 2008 and 2009. In addition, two distance metrics are examined: $d_j = min(1mi, distance_j)$ and $d_j = 1(distance_j \leq 1)$ where $distance_j$ is the straight-line distance between property j and Key Arena measured in miles.

Repeat sales are defined as those sales in the data for which there exists a previous sale of the same property. For property j sold at times s and $s \leq t$, the change in price is given by differencing Equation (1)

$$\Delta p_{jt} = p_{jt} - p_{js} = \delta_t - \delta_s + f_{jt}(X_{jt}, Z_j, \beta_t) - f_{js}(X_{js}, Z_j, \beta_s) + d_j \times 1(t \geq Year > s) \times \theta + u_{jt} - u_{js} \tag{2}$$

Where $1(t \geq Year \geq s)$ is an indicator function that is equal to one if the second observed sale

occurs after the reference year while the first observed sale occurs before the reference year. The indicator function is equal to zero if either both sales occur before the reference year, or both sales occur after the reference year. We define any repeat sales where $1(t \geq Year \geq s) = 1$ as an identifying sale. In such instances, we do not have both a control group (a sale before the reference year) and a treatment group (a sale after the reference year). We define a repeat sale where $1(t \geq Year \geq s) = 1$ as an *identifying sale* as it allows us to identify θ.

The RSR is used in lieu of the hedonic model in Equation (1) because the RSR 1) obviates the need to fully specify functional form and 2) reduces the burden on the researcher to collect property attributes in X_{jt} and Z_j. As discussed below, both of these benefits are important as the Key Arena surrounding area contains time-invariant factors that are difficult to quantify. Researchers estimating an RSR models need not make any assumptions on the functional form of $f(\cdot)$ beyond the assumption

$$f_{jt}(X_{jt}, Z_j, \beta_t) - f_{js}(X_{js}, Z_j, \beta_s) = \omega_{jt}$$

where ω_{jt} is a random variable with $E[\omega_{jt}] = 0$. Instead, assumptions are made regarding the second moment of the error term. For example, Bailey et al. (1963) assume independence, Case and Shiller (1989) assume a random walk of length $t - s$ and Hill et al. (1997) assume ω_{jt} contains an autoregressive error term. In unreported results, weighted least-squares estimators using either the autoregressive or random walk assumption produce t-statistics that are very similar to ordinary least-squares coefficients with standard White-Huber heteroskedasticity-consistent standard errors.

The estimation of the unobservable parameters in Equation (2) uses an unbalanced panel of property transaction prices; some properties have multiple repeat sales in the sample while most have only a single repeat sale. By using differenced sales prices, any unobserved fixed effect in u_{jt} is removed. The covariance matrix for Δu_{jt} is not diagonal. For those properties with only a single repeat sale, the Δu_{jt} contains unobserved effects unique to property j and is uncorrelated with any other $\Delta u_{k \neq jt}$. However, properties with two or more repeat sales will have correlation in the consecutive Δu_{jt}. For these properties, the covariance matrix of the Δu_{jt} is a band matrix with non-zero values along the first off-diagonal entries due to the presence of u_{jt} in consecutive sale-pairs Δu_{js} and Δu_{jt}. Performing feasible generalized least-squares on the data produced coefficient

estimates and estimated standard errors that were quite similar to the least-squares estimates and standard errors generated using the White-Huber heteroskedasticity correction and did not alter any of the conclusions that emerge from the empirical analysis. All results produced use ordinaly least-squares coefficients and White-Huber standard errors.

Regardless of the estimation procedure used, Equation (2) can be written more compactly as

$$\Delta p_{jt} = p_{jt} - p_{js} = \delta_t - \delta_s + d_j \times 1(t \geq Year > s) \times \theta + \Delta u_{jt}. \tag{3}$$

Equation (3) emphasizes that price changes for property j are determined by market-wide changes in the price level, distance from Key Arena, the timing of the two sales repeat, and an error term given by $\Delta u_{jt} = \omega_{jt} + u_{jt} - u_{js}$. For repeat sales where $1(t \geq Year > s) = 0$, expected price appreciation is given by marketwide changes over time: $\delta_t - \delta_s$. For identifying sales, excess price appreciation is captured by $d_j \times \theta$.

Data Description

The data come from the King County, Washington, Assessor's office. King County includes the City of Seattle and other surrounding areas in the Seattle metropolitan area. The data are publicly available from the Assessors office website. The final data set was assembled from two files: a Sale file containing data on all residential property sales in King county over the period January 2000 to December 2013 including the property location and sale price, and a Property Description file containing information on observable characteristics of properties transacted, including area, bedrooms, bathrooms, and other information. The merged data file includes transaction prices and attributes for all residential properties in King County and was cleaned using reasonable filters for hedonic housing variables. We analyze only residential property – single family homes and condos – sales. Because the study examines the effect of proximity to Key Arena on residential property values, we keep only those sales in King County that have a Seattle address. A property is defined as having a Seattle address if it is in ZIP codes numbered from 98101 to 98199. After filtering, our final data set contains 194,048 residential property transactions; 149,675 single-family home transactions and 44,373 condominium transactions.

We restrict the impact area of Key Arena amenities to transactions involving residential prop-

erties within one mile of Key Arena. Since the arena continued to be used for concerts, WNBA, NCAA and minor league sports events, and others, after the departure of the team, we assume that the departure of the SuperSonics primarily affected car and foot traffic near the facility on game day, including any positive or negative externalities generated by the large crowds that typically attend NBA games. These externalities are more likely to affect properties near the arena where parking, crowds, trash, and noise would be concentrated. In other words, we estimate the net effect of the departure of the SuperSonics in mid 2008, and not the gross effect of the presence of Key Arena in Seattle, on nearby property values. We do not know if any of the property transactions in our data involve foreclosures, or are near properties in foreclosure; Gerardi et al. (2015) show that the effect of properties in foreclosure on nearby property values is small enough to be undetectable.

Figure 1 shows Key Arena and the location of all residential repeat sale transactions within one mile of Key Arena in the data set. Note that the arena is located next to the Seattle Center complex, the area north west of the Space Needle on Figure 1 with no transactions present. The Seattle Center complex was built for the 1962 World's Fair and contains the iconic Space Needle, museums, a children's theatre, a large fountain, other cultural amenities, and green space. Condominium buildings are shown as boxes and single-family home sales as dots on 1. Condominium sales were more prevalent near Key Arena, especially south of the arena, while single-family home sales were more prevalent in neighborhoods to the north. There does not appear to be any single-family home sales within one mile of Key Arena to the south of the arena. This is to be expected as the area immediately south of Key Arena is the downtown area of Seattle. It is possible that there could exist multiple markets for condominiums within one mile of Key Arena: condominiums in a residential setting to the north and condominiums in the downtown area to the south.

Figure 1 identifies three potential housing markets in proximity to the arena. The two potential markets north of the arena are divided by Queen Anne Street, and contain both condo and single-family home repeat sales. Queene Anne Street is a popular commercial strip that represents a reasonable way to split the two residential zones. We experimented with other dividing lines but find the results robust to the choice of sub-market definitions. The area south of the arena contains only condo repeat sales. In the empirical analysis, we report empirical results using all transactions within one mile of the arena and subsamples based on the different markets shown on Figure 1. The areas between the three zones contain commercial properties.

Figure 1: Property Sale Locations - One Mile Radius

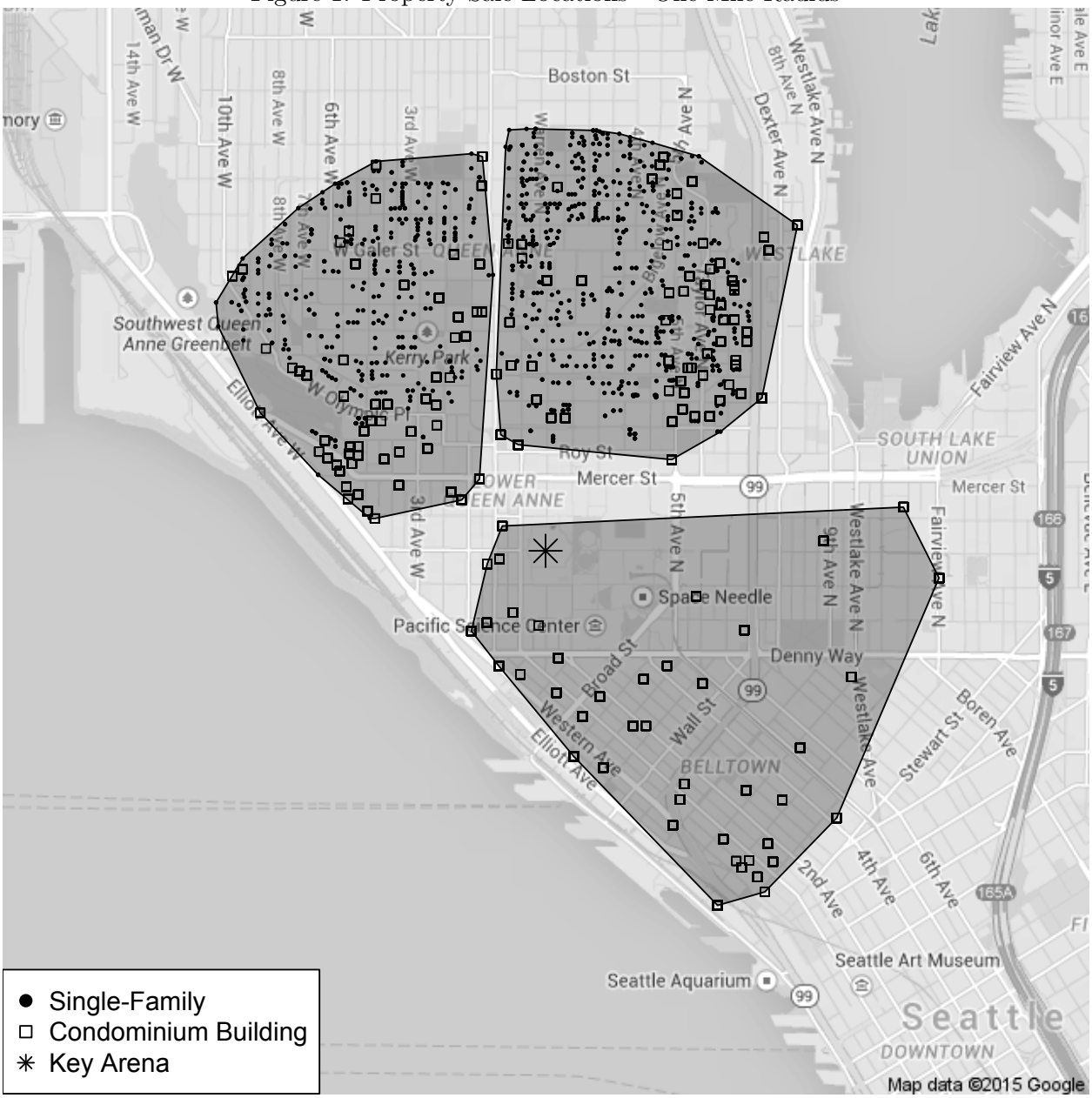


Table 1 displays descriptive statistics for the full sample in the left panel and for residential properties within one mile of Key Arena in the right panel; Figure 1 shows only the properties summarized on the right panel. The properties located near Key Arena are newer, smaller, and more expensive than average residential real estate transactions across King County. Most notably, 87.7% of the transactions within one mile of Key Arena are condominiums compared with 22.9% in the full sample from all of King County. The composition of the housing stock sold in the vicinity of

Table 1: Summary Statistics - Dwelling Characteristics

	Full Sample		Within 1 mile of Arena	
Variable	Mean	Std Dev	Mean	Std Dev
Transaction Price ($1,000s)	368	279	440	372
Age in Years	49.1	30.8	25.8	32.5
# Baths	1.38	0.62	1.30	0.52
# Bedrooms	2.80	1.17	1.54	1.03
Area in ft^2 (000)	1.59	0.81	1.09	0.74
Sale Year	2005	3.7	2005	3.6
Condo	0.229	0.42	0.877	0.329
Sale Post 2008	0.244	0.429	0.230	0.421
Repeat Sale	0.365	0.481	0.388	0.487
Repeat Sale Post 2008	0.09	0.29	0.09	0.29
Distance to Key Arena	5.9	3.7	0.58	0.23
Distance to arena < 1mi	0.053	0.225	–	–
Number of Transactions	194,048		10,361	

Key Arena over this period is not representative of the housing stock sold throughout King County over the same period.

However, the timing of residential property sales near Key Arena is representative of the entire sample: 23% to 24% of transactions took place after 2008, 36% to 38% of transactions can be paired with a previous same-property sale (repeat sales), and 9% of post 2008 transactions are repeat sales county wide and within one mile of Key Arena over the period. As mentioned in the previous section, estimating θ requires identifying sales. Table 2 shows the number of identifying repeat sales for various sub-markets used in the analysis. The first 6 rows in the table contain the number of identifying sales within a 1 mile radius of the arena. The last two rows display the number of identifying sales within a 0.5 mile radius and sales between 0.5 miles and 1 miles, respectively. Although the single family homes have 154 and 126 identifying sales in the two impact periods, the number of sales in the Northwest and Northeast sub-markets are not as large. However, the number of condo sales in these sub-markets appears large enough to provide sufficient variation. We emphasize that the single family home results are not as convincing as the results for condos.

Again, we analyze residential property transactions that have a Seattle zip code, including those in close proximity to Key Arena. From Figure 1, the geographic features in Seattle, and the specific location of Key Arena relative to other local landmarks like the Space Needle and the

Table 2: Identifying Sales - Transactions within 1 Mile of Key Arena

Type	Sumbarket	2008-'13	2009-'13
House	-	154	126
House	NW	49	37
House	NE	105	89
Condo	-	1161	1002
Condo	NW	243	210
Condo	NE	254	221
Condo	South	664	571
Condo	0-0.5mi	495	431
Condo	0.5-1mi	666	571

cultural amenities located in the Seattle Center complex, potentially pose problems for a hedonic model when analyzing property values, since many factors that are difficult to both measure and model may affect property values. For example, the numerous bodies of water in Seattle, and the associated coastlines, define a significant number of areas where views of the water, and access to water, can significantly impact property values. The proximate presence of the Space Needle and several museums and theaters in the Seattle Center complex might also affect property values. Specifying exactly how view, water access, and other nearby amenities enter into $f(\cdot)$ in Equation (1) can be difficult. RSR models mitigate this model misspecification issue, and any resulting omitted-variable bias, by comparing transaction prices for the same properties at different points in time. Since the other factors like views of Puget Sound or the Space Needle, or water access, or access to museums are assumed to not change over time, an analysis of repeat sales eliminates any time invariant factors that affect residential property property values. These factors do not change after mid-2008, when the SuperSonics left Seattle for Oklahoma City. Ahlfeldt and Kavetsos (2012a) make a similar point in terms of other sports facilities in a city.

Transaction Price Trends Near Key Arena

Figure 1 shows that the residential real estate repeat transactions in the sample are not uniformly distributed around Key Arena. Many condo transactions occurred to the south of the arena and in specific areas north of the arena, while all of the single-family home transactions occurred to the north and west of the arena. To assess the extent to which condos and single-family homes constitute separate markets, we constructed several unconditional RSR annual housing transaction

price indexes for different types of dwellings in King County and within one mile of Key Arena. We constructed these indexes using Equation (3) for the period 2000 through 2013. Parameter estimates on these dummy variables constitute an unconditional housing price index and can be interpreted as log price changes relative to the base period which are approximately equal to annual real residential estate appreciation rates.

Estimated time coefficients are shown on Figure 2.[4] Three unconditional price indexes, one for each of the three areas around Key Arena identified on Figure 1, are estimated, each using 2002 as the base period. The series reflect log price changes relative to the base period which are approximately equal to appreciation rates. All three peak in 2007 and have similar trends before the departure of the team in 2008.

Figure 2, and Figure 4 in the Appendix, contain evidence that the single-family home and condominium market price dynamics differ in Seattle; however, the price dynamics for condominiums are similar to the price dynamics for all properties located within one mile of Key Arena. Because of the evidence in these figures, we separately estimate Equation (3) for single-family homes and condominiums within one mile of the arena. This estimation strategy provides us with two coefficient estimates reflecting the net change in the amenity value of Key Arena, θ: one estimate for single-family homes and another for condominiums.

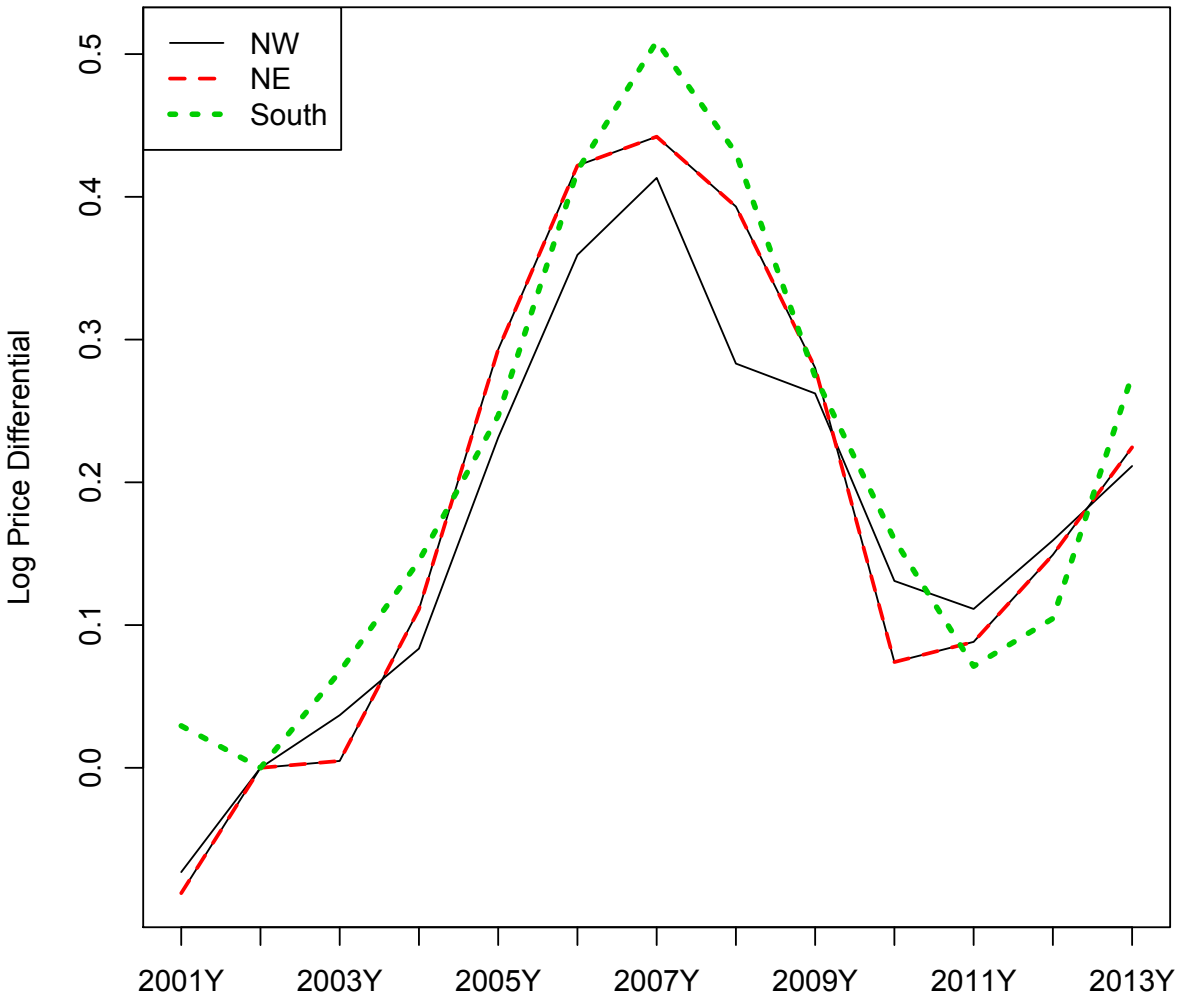
RSR Model Results

Table 3 contains estimates of the parameter that captures the effect of proximity to Key Arena after the departure of the SuperSonics, $\widehat{\theta}$, in the RSR model shown by Equation 3, for a number of different areas in proximity to Key Arena. The price index was estimated at an annual frequency; estimates from a quarterly time index produced nearly identical results.

Two alternative proximity measures are used: straight-line distance from each property to Key Arena and an indicator variable that identifies all transactions within one mile, or one half mile, of Key Arena. The distance measure assumes that the marginal effect of the arena on property values is equal for each unit of distance from the arena, and that the effect changes with distance. The indicator variable measure assumes that the effect of the arena on property values is the same

[4]Due to the relatively small sample size, the indexes on this figure use annual, not quarterly dummy variables. Quarterly indexes for the full sample can be seen in Figure 4 in the Appendix.

Figure 2: Repeat Sale Price Indexes, Log Price Differential Relative to 2000



for all residential properties within a certain radius of the arena. Both measures have been used in the literature on sports facilities and property values.

The one mile radius proximity indicator variable used in in Table 3 was also selected after examining the cumulative distribution of single-family home and condo sales by distance from Key Arena. Figure 3 in the Appendix shows this cumulative distribution function. Again, Key Arena is located on the west end of the Seattle Center complex, a 74-acre park that is roughly 0.25 miles

across in either direction. Choosing a cutoff value of 0.25 miles or less would exclude all properties east of the Seattle Center while including many properties west of Key Arena. From Figure 3, a 0.5 mile cutoff incorporates 4,527 transacted dwellings; increasing the cutoff to 1 mile increases the number of transacted dwellings to 10,324. Most previous studies on the effect of sports facilities on property values use relatively small impact areas. Tu (2005)finds a significant impact within one mile of an NFL stadium; Ahlfeldt and Maennig (2010b) find a significant impact within about 1 mile; Ahlfeldt and Kavetsos (2014) find a significant impact within about 2 miles.

We also investigate two alternative impact periods over which the departure of the SuperSonics might affect property values. The first period begins on January 1, 2008, which includes several months prior to the trial that resulted in the breaking of the lease and departure of the team. This impact period assumes that individuals anticipated that the Sonics would leave before the outcome of the trial was known. The second impact period begins on January 1, 2009, which is after the team left Seattle and began play in Oklahoma City as the Thunder in October 2008. This impact period assumes that it took some time before residents, and potential residents, of the impact area learned what the effect of the SuperSonics departure would be on services generated by proximity to Key Arena. Equation (3) is estimated using both distance measures for the subsamples of only single-family homes and only condominiums. Estimated standard errors are corrected for heteroskedasticly using the White-Huber "sandwich" correction.

Table 3: RSR Regression Results - Transactions within 1 Mile of Key Arena

	(1)	(2)	(3)	(4)	(5)	(6)
NW	0.094	0.132***	0.039	0.09***	—	—
	(1.907)	(2.873)	(1.776)	(3.352)	—	—
NE	0.033	0.033	0.019	0.029	—	—
	(0.931)	(0.864)	(0.949)	(1.321)	—	—
South	—	—	0.047***	0.057***	—	—
	—	—	(3.303)	(3.5)	—	—
0-0.5mi	—	—	—	—	0.047***	0.068***
	—	—	—	—	(3.716)	(4.222)
0.5-1mi	—	—	—	—	0.034**	0.05***
	—	—	—	—	(2.149)	(2.877)
Dwelling Type	House	House	Condo	Condo	Condo	Condo
Impact Period	2008-'13	2009-'13	2008-'13	2009-'13	2008-'13	2009-'13
# Repeat Sales	54,191	54,191	15,626	15,626	15,626	15,626

,* significant at the 5% and 1% level, respectively

Models (1) and (2) of Table 3 show the parameter estimates for when only single-family homes are used to estimate Equation 3. Two models are estimated corresponding to the two possible impact periods. In each model, we include seperate indicator variables for the Northwest and Northeast subsections in Equation 3. There were no single-family home transactions south of the arena. Only single-family homes north west of the arena after 2009 are statistically different from zero below the 1% level. However, from Table 2, this subsample contains a small number of identifying sales. Based on these estimated coefficients, it would appear that the departure of the SuperSonics from Seattle had no effect on single-family home values.

Recall that single-family home prices and condo prices appear to differ systematically in this setting. Models (3)-(6) on Table 3 show the parameter estimates using only condo repeat sales for different impact areas around the arena. Models (3) and (4) include three indicator variables corresponding to the Northwest, Northeast and South regions in 1. Note that there are significantly more condos than single-family homes near the arena. The results on the middle panel of Table 3 suggest that the departure of the SuperSonics in mid 2008 had an impact on condo sale prices no matter which impact period is used. The parameter estimates are positive and statistically significant for repeat sale transactions on condos in three of the six model specifications and range in size from about 5% to 9%, suggesting that condo sales prices were higher after the SuperSonics left Key Arena, relative to market wide prices in Seattle. Again, this reflects the net effect of the departure of the team from the arena and not the overall effect of the arena on nearby property values. The statistically significant parameter estimates are for the areas north west and south of the arena; the parameter estimates from transactions north east of the arena are not significantly different from zero in either impact period.

We interpret this as evidence that the presence of the SuperSonics in Key Arena generated disamenities in nearby areas. These disamenities flow from the additional traffic, noise, trash, and other undesirable features associated with large crowds of people attending NBA games in the arena. The systematic difference in this effect in different areas around the arena likely reflects different patterns of fan parking and travel to the arena for NBA games. These results are consistent with those in Ahlfeldt and Maennig (2010a) and Ahlfeldt and Maennig (2009) who found that professional sports arenas have no effect on real estate prices on properties in close proximity; positive price effects only appear at a "safe" distance from the arena.

Since these disameninties flow from game-related traffic and crowds, they should be stronger closer to the arena where the traffic and crowds are more concentrated and weaker farther from the arena, where the traffic and crowds are less concentrated. Models (5) and (6) in Table 3 investigate this by estimating the impact on those areas less than one half mile from the arena and transactions between one half mile and one mile of the arena. Condos located less than one half mile from the arena arena are likely to be more strongly affected by NBA game day traffic and crowds than condos farther from the arena.

The parameter estimates on the bottom panel of Table 3 indicate that condos within one half mile of Key Arena experienced larger excess price appreciation after the SuperSonics left than condos located between one half mile and one mile of the arena, no matter what impact period is used. The excess price appreciation for the closest condos was about 4.7% using the post 2008 impact period and about 6.8% using the post 2009 impact period. The excess appreciation on condos located another half mile from the arena was positive, but smaller, given the estimated standard errors. Again, these results support the idea that crowds and traffic associated with NBA games in the arena generated disamenities that affected condo values while the team was present that disappeared when the team left for Oklahoma City. Ahlfeldt and Kavetsos (2014) report similar results, in that proximity to a sports facility generally increases property values, but being located on streets fans use to get to and from the facilityreduces property values substantially, using micro-level data from London.

Robustness Check: Alternative Proximity Measures

The results on Table 3 indicate a significant price appreciation differential for condos located in a one mile radius of Key Arena, primarily in areas north west and south of the arena. As a robustness check, we estimate RSR models that use straight line distance (in miles) as a proximity measure instead of an indicator variable. Again, using straight-line distance as a proximity measure forces the marginal effects of the arena-related amenities or disamenities on property values to be the same for each unit of distance from the arena, and for the effect to uniformly change with distance. In order to focus on properties within a one mile radius of Key Arena, a modified measure of straight line distance is used: $d_j = min(1mi, distance_j)$. Alternative choices for the cutoff were experimented with but did not alter the sign or significance of the estimated coefficients.

Table 4 shows the estimates of the parameter that captures the effect of proximity to Key Arena after the departure of the SuperSonics, $\widehat{\theta}$, in the RSR model shown by Equation 3, when proximity is measured by modified straight-line distance from the arena. The parameter estimates are negative and statistically different from zero at conventional levels for both impact periods and for both areas around the arena. The negative parameter estimates indicate that property values decline with distance from the arena after the SuperSonics left. This is consistent with the estimates on the bottom panel of Table 3, which shows that excess price increases in the impact periods were smaller for condos located between one half mile and one mile of the arena than for condos located less than one half mile from the arena. These results also suggest that the effects of the departure of the SuperSonics on condos north of the arena were smaller than the effect on condos south of the arena, which are closer to downtown Seattle.

Table 4: RSR Regression Results - Alternative Distance Measure

	(1)	(2)
NW	-0.027^{***}	-0.032^{***}
	(-3.683)	(-4.15)
NE	-0.032^{***}	-0.042^{***}
	(-6.826)	(-7.979)
South	-0.061^{***}	-0.082^{***}
	(-11.118)	(-13.087)
Type	Condo	Condo
Period	2008-'13	2009-'13
Repeat Sales	15626	15626

**,*** significant at the 5% and 1% level, respectively

We believe that the one mile or one half mile radius proximity measure should be preferred to the linear distance measure of proximity in this setting. From Figure 1, condos in Seattle are not uniformly distributed around Key Arena. Water views and industrial areas are irregularly distributed around the arena and several interstate highways are relatively close to the arena. The linear distance measure assumes that the marginal effect of distance on amenities or disamenities flowing from the arena are likely to be constant for small distances as distance increases. This may not match the spatial patterns of dwellings and other geographic features in Seattle.

Robustness Check: Changing Perceived Benefits From Sports

As both a counterfactual experiment and a robustness check, we also examined the effect of the departure of the SuperSonics on residential property values price using a counterfactual departure of Seattles two other major sports teams: the Seattle Seahawks of the National Football League and the Seattle Mariners Major League Baseball team. It may be possible that the price premiums generated by Key Arena discussed above are a result of a change in perceived citywide intangible benefits from sporting events. Specifically, it could be that Seattle residents began to value sporting events less beginning in 2008 after the departure of the SuperSonics. This change could reflect "gain-loss" utility generated by loss aversion on the part of fans (Humphreys and Zhou, 2015). This utility loss would explain the excess price appreciation discussed above for properties near Key Arena and would also imply a decrease in property prices for those properties located near other sporting venues. CenturyLink Field (formerly Qwest Field) and Safeco Field are both located between Interstate-5 and Puget Sound, 3 miles south of Key Arena; the stadiums are located less than one block away from each other. The Seattle Seahawks football franchise plays home games at CenturyLink Field and the Seattle Mariners play home games at Safeco Field.

Because both stadiums are located near one another, we define the location of both stadiums as the intersection of South Royal Brougham Way and Occidental Ave South. Both stadiums are less than 500 feet from this intersection. Using this location, we perform the same analysis above and estimate Equation (3) using this intersection as the reference point for all distance calculations. In unreported results, none of the estimated coefficients were statistically significant at the 10% level or below except for the condominium modified distance measure using a 3 mile cutoff. However, after excluding condominiums north of Key Arena (those more affected by proximity to Key Arena), the price premium became statistically insignificant.

Thus, there is no evidence of excess price appreciation or price depreciation in property values for single-family homes or condos located near CenturyLink Field and Safeco Field following the departure of the SuperSonics in 2008. This precludes the possible explanation that perceived intangible benefits from sporting events in Seattle changed because of the SuperSonics' departure. Only property prices near Key Arena experienced excess price appreciation following the SuperSonics departure. The above discussion suggests that the presence of the Seattle Supersonics was a net

negative for residents near Key Arena. The excess price appreciation is a result of a decrease in the disamenities associated with the team and not a change in the preference for sporting events, citywide.

Conclusions

This paper investigates the impact of the departure of the Seattle SuperSonics on residential property prices near Key Arena in Seattle, the team's longtime home. Previous research analyzed the simultaneous effect of new facility and team arrivals on nearby property values. This setting allows us to estimate the net effect of a team departure from an existing facility, which helps to disentangle the effect of concerts and other non-major sporting events from the effect of a top-level professional sports team on property values. Distinguishing team effects from facility effects is important because top-level professional sports teams, and the special anti-trust status granted leagues, provides the leverage for sports facility construction subsidies (Humphreys and Zhou, 2015).

We estimate a repeat sales regression model that removes the effect of any unobserved property and location attributes from the estimated effect of proximity to the arena. This is important, as Seattle has a large number of waterfront properties with significant, unobserved quality, and Key Arena is located near a number of cultural amenities and iconic structures including the Space Needle. We provide evidence that single-family houses and condominiums have different market-wide price dynamics that must be accounted for. After controlling for these different price dynamics, we find that the departure of the Seattle SuperSonics resulted in positive excess price appreciation for condominiums located within one mile of Key Arena. This result is robust to various measures of distance from Key Arena and impact periods over which the departure of the team might affect property values. The evidence supports the idea that the traffic, crowds, noise, trash, and other activities associated with NBA games in Key Arena represented a disamenity in the immediate neighborhood.

The results have important policy implications. Sports facilities and teams have generally been thought to generate positive amenity effects in nearby neighborhoods. Recently, TIF districts have become a popular financial mechanism for publicly funded stadium and arena construction projects. If these facilities generate important local disamenities, then TIF districts may not

generate sufficient new tax revenues to pay for the facility construction, especially if the TIF district is relatively small. Also, existing local residents who live near new sports facilities may experience declines in the value of their dwellings, reducing local welfare suggesting transfers to local residents from the owners of sports franchises are more appropriate.

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Appendix: Full Sample Results and Other Models

Table 6 contains estimates of the RSR model parameter that captures the effect of proximity to Key Arena after the departure of the SuperSonics, $\widehat{\theta}$, in Equation 3, for the two alternative proximity to Key Arena measures. Again, the distance measure assumes that the marginal effect of the arena on property values to be the same for each unit of distance from the arena. The indicator variable measure assumes that the effect of the arena on property values is the same for all residential properties within a certain radius of the arena. Table 6 contains results for the full pooled sample, and for condos and single-family homes separately. Table 5 shows summary statistics for the condo only and single-family home only subsamples.

Properties located far away from Key Arena may be leveraged and could significantly influence the parameter estimates from Equation (3). However, we would also like to test the robustness of our 1 mile cutoff and use a 3 mile cutoff. In order to mitigate the impact of properties located more than 3 miles from Key Arena on the estimated distance coefficient, we calculate distance as $min(3, distance_j)$ where $distance_j$ is the actual distance between each property and Key Arena. The conclusions reached in the paper are not affected by a choice of a 1, 2, 4, or 5 mile cutoff. Some residential properties located southwest of downtown Seattle across Puget Sound are less than 3 miles from Key Arena. However, in order to reach Key Arena by car from this West Seattle area, residents must travel much more than 3 miles. We set the distance between Key Arena and these properties to 3 miles. Thus, our measure of mileage can be roughly thought of as a measure of distance to Key Arena by car and not a distance to Key Arena 'as the crow flies.'

Again, we investigate two alternative impact periods over which the departure of the SuperSonics might affect property values. The first period begins on January 1, 2008, which includes several months prior to the trial that resulted in the breaking of the lease and departure of the team. This impact period assumes that individuals anticipated that the Sonics would leave before the outcome of the trial was known. The second impact period begins on January 1, 2009, which is well after the team left Seattle and began play in Oklahoma City as the Thunder in October 2008. This impact period assumes that it took some time before residents, and potential residents, of the impact area learned what the effect of the Sonics departure would be on services from Key Arena. Equation (3) is estimated using both distance measures and both impact periods the pooled sample of houses and

Table 5: Summary Statistics - Houses and Condos

	Houses		Condos	
Variable	Mean	Std Dev	Mean	Std Dev
Price ($1,000s)	390	286	294	241
Age in years	56.8	28.7	23.4	22.8
# of Baths	1.4	0.6	1.3	0.5
# of Bedrooms	3.2	1.0	1.6	0.7
Area ft^2 (1,000s)	1.786	0.799	0.945	0.382
Sale Year	2005	3.749	2006	3.608
Sale Post 2008	0.245	0.43	0.239	0.427
Repeat Sale	0.364	0.481	0.369	0.483
Repeat Sale Post 2008	0.091	0.288	0.093	0.29
Distance to Key Arena	6.4	3.4	4.2	4.1
Distance to Arena < 1mi	0.009	0.092	0.205	0.403

condos, as well as the subsamples of only single-family homes and only condominiums. Standard errors are corrected for heteroskedasticly using the standard White-Huber "sandwich" correction.

Table 6: RSR Regression Results - Full Sample with Proximity to Key Arena

Dwelling	Proximity Measure	Period	$\widehat{\theta}$	S.E.	$P(>\|t\|)$	N
House & Condo	Distance to Arena	Post '08	0.003	0.004	0.417	69,817
House & Condo	Distance to Arena	Post '09	-0.003	0.005	0.584	69,817
House & Condo	In 1 mile radius	Post '08	-0.044	0.012	< 0.001	69,817
House & Condo	In 1 mile radius	Post '09	-0.048	0.013	< 0.001	69,817
Condo	Distance to Arena	Post '08	-0.044	0.005	< 0.001	15,626
Condo	Distance to Arena	Post '09	-0.061	0.005	< 0.001	15,626
Condo	In 1 mile radius	Post '08	0.044	0.012	< 0.001	15,626
Condo	In 1 mile radius	Post '09	0.060	0.013	< 0.001	15,626
House	Distance to Arena	Post '08	-0.055	0.009	< 0.001	54,191
House	Distance to Arena	Post '09	-0.078	0.010	< 0.001	54,191
House	In 1 mile radius	Post '08	0.050	0.037	0.185	54,191
House	In 1 mile radius	Post '09	0.059	0.041	0.149	54,191

The first four rows of Table 6 show the parameter estimates using the entire pooled sample of condos and single-family homes. The distance coefficients are not significantly different from zero. However, the one mile radius indicator measure finds properties within a 1 mile radius had price appreciations that were 4.4% smaller in the post 2008 impact period and 4.8% smaller in the post 2009 impact period. Based on these estimated coefficients, it would appear that the departure of

the SuperSonics from Seattle was a net-negative in terms of the effect on property values.

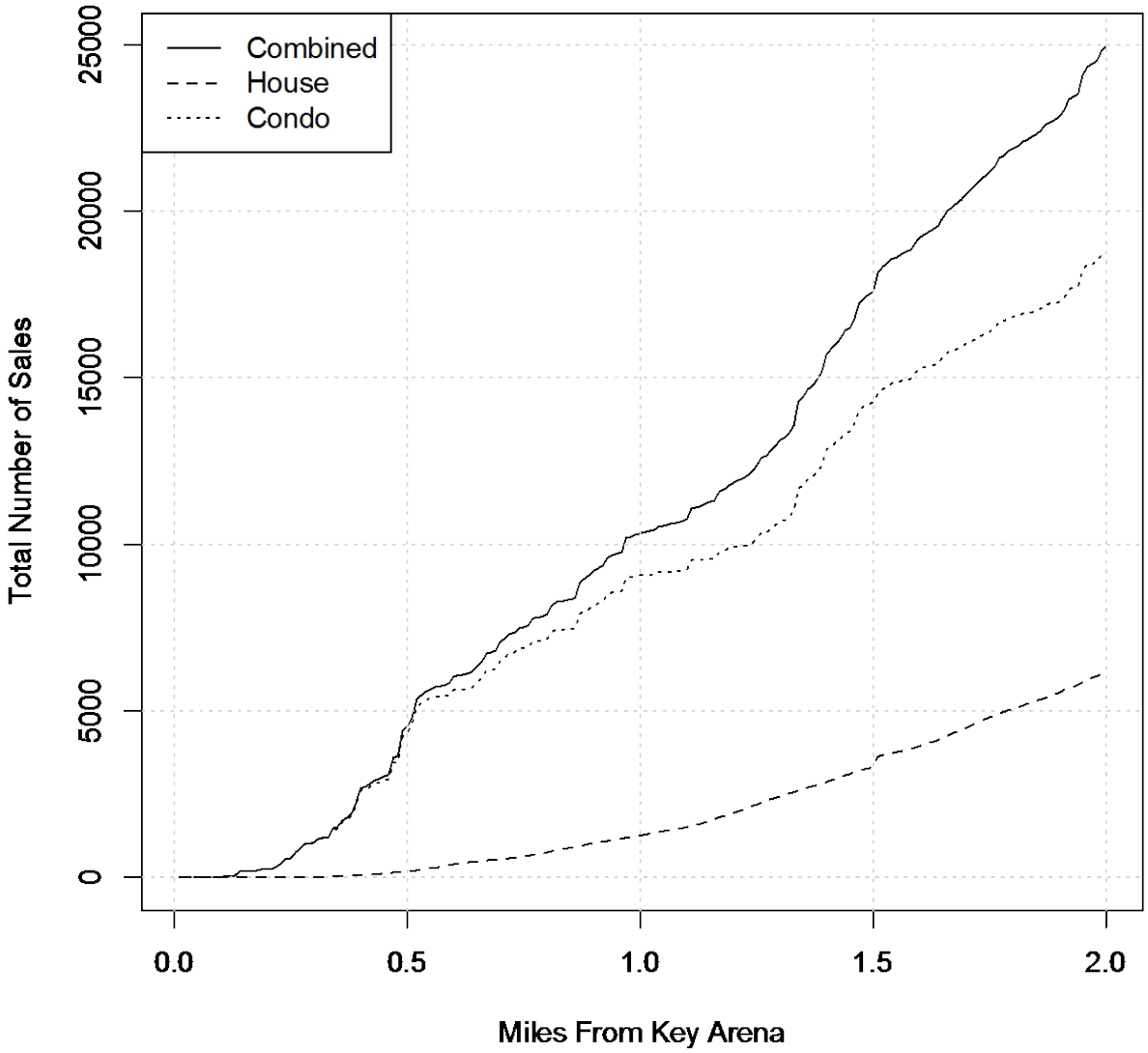
However, as mentioned above, Figure 2 provides evidence that single-family home prices and condo prices differ systematically. Thus, any estimated excess price appreciation or depreciation calculated from the pooled sample of condos and single-family homes cannot be easily interpreted as the regression model is misspecified. When we separately estimate Equation (3) using condo prices and single-family home prices, we reach a different conclusion about the effect of Key Arena on property values. From the bottom part of Table 6, the impact of proximity on condo prices is negative for the linear measure for both impact periods. The interpretation of the proximity parameter estimate for the post 2008 impact period is as follows: increasing distance from Key Arena by 1 mile (up to 3 miles) slowed price appreciation by 4.4% over the period. For example, properties located 2 miles away from Key Arena will have price appreciation 4.4% smaller than properties 1 mile from Key Arena.

Figure 3 shows the cumulative distribution of the variable reflecting the distance between each repeat sales transaction and Key Arena for the entire sample. Note the presence of a clear break in trend in the distribution for condos at about one half mile from the arena.

Figure 4 shows full sample price indexes and selected sub indexes. These indexes were constructed using regression models where the dependent variable is the log of the transaction prices in the sample and the explanatory variables are quarter-specific dummy variables for each quarter from 2000 quarter 1 through 2013 quarter 3. The parameter estimates on these quarterly dummy variables constitute an unconditional housing price index and can be interpreted as log price changes relative to the base period which are approximately equal to quarterly real residential estate appreciation rates. Four series of quarterly time coefficients are estimated, each using 2000 Q1 as the base period. The series reflect log price changes relative to the base period which are approximately equal to appreciation rates. The first series (Combined on the Figure) reflects all condominium and single-family home repeat sales in Seattle. This series peaks in 2007 Q2 where property prices are 70% above 2000 Q1 levels.

Two additional repeat sale price indexes were estimated using only condominium repeat sales (Only Condos on the figure) and only single-family home repeat sales (Only Houses). Both indexes exhibit similar behavior over the sample period. However, the condominium index peaks at 60.8% above 2000 Q1 levels while the single-family home series peaks at 73.9%. Following the peak, the

Figure 3: Cumulative Distribution - Distance of Properties from Key Arena



single-family home index reaches a minimum of 35.1% in 2012 Q1. The condominium index reaches a minimum of -4.8% in 2012 Q1.

We also estimate a repeat sale price index for all properties located within one mile of Key Arena (Combined: <1 Mile). As expected, the price dynamics for properties located within one mile of Key Arena are more similar to the price dynamics of the condominium transaction price index. However, prices near Key Arena do not fall as low as the condominium index and rebound to a higher level than the condominium index at the end of the sample period. Although all property values fell following 2007 Q2, Figure 2 provides initial evidence that properties located

near Key Arena did not fall as much as condominium prices throughout Seattle, but fell further than single-family housing prices.

Figure 4: Full Sample Price Indexes, Log Price Differential Relative to 2000 Q1