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GY460 - Techniques of Spatial Economic Analysis

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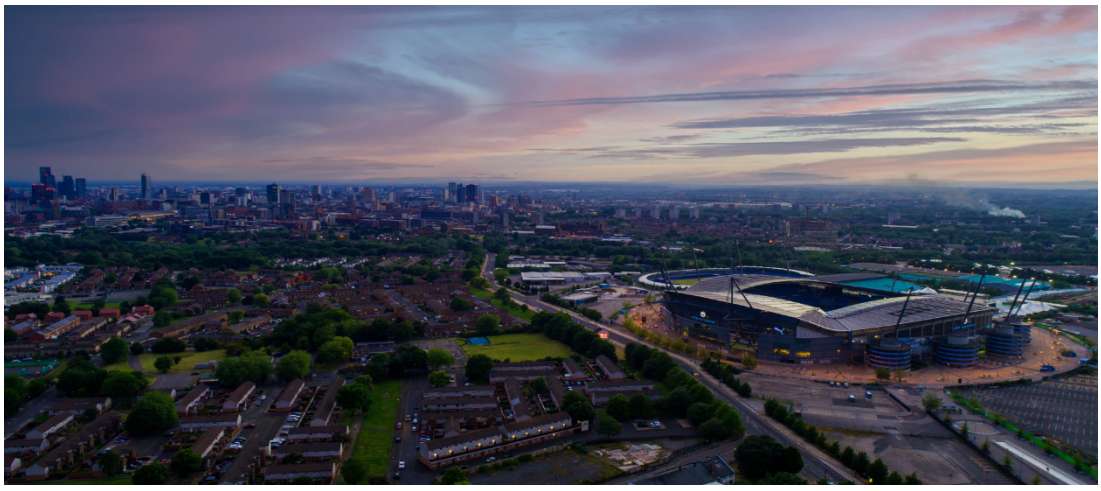
Analysis of the Impact of Sports Arenas on House Prices Using Spatial Econometrics: Case of Etihad Stadium in Manchester



Picture 1

Abstract:

In the United Kingdom, there has been a positive movement in urban policy toward the use of sporting facilities as a catalyst for revitalizing declining areas. In this paper I will study the impact of the Etihad sport stadium on house prices by performing spatial econometric analysis. Using different data sources and an identification strategy (difference – in – difference approach) in two time periods; pre-construction of the stadium and post-construction. I find that the construction of the Stadium led to an increase in the house prices in areas near the stadium by around 20,000£ and played a role in developing positive neighborhood spillovers on house values. Another finding suggests that the further we get away from the stadium the effect of the stadium on house prices decreases. Since more sports

stadiums are being constructed, this study provides important lessons and policy recommendations for cities who are willing to build sport stadiums.

Research Questions and Hypothesis:

Do sports stadiums affect house prices in neighborhood areas? What is the impact of the Etihad Stadium on house prices in Manchester? To what extent does the Etihad stadium explain these patterns (of increased house prices)? What evidence is in the data that the house prices are ‘contagious’ and tends to spill over from one neighborhood to another. Are there spatial concentrations of the outcome variable that are not explained by the Etihad Stadium? What are the patterns, and what factors explain them? In this paper I will try to answer these questions. The hypothesis of the study is that sports arenas have a positive impact on nearby house prices.

Introduction:

Investing in sports arenas has been an ongoing debate between economists and policy makers. "Build the stadium - Create the Jobs!" This slogan was put in the San Francisco stadium to showcase the benefits that a sports stadium can generate for the local economy. For starters, constructing the stadium generates construction jobs to workers nearby. Second, fans who come to the city to attend generate extra spending in the economy. Also, the city's team brings tourists and businesses to the city hosting it, boosting the local economy and employment (Zimbalist A. and Noll R., 1997).

One the other hand, there are some drawbacks to sports stadiums and many critiques argue that the benefits may not outweigh the costs. The costs of constructing the sport arenas are huge, this money could be spent on creating jobs, subsidizing startups, and boosting the economy, which would result in much long-term benefit to the economy than constructing a sports stadium (Zimbalist A. and Noll R., 1997).

Measuring the effects of sports arenas on house prices is a challenging task since house prices might be affected by other external factors, such as interest rates, economic growth,

availability of mortgages, changes in income and population and many more (Pettinjer T., 2019). So how can we know that the changes in house prices were affected solely by the construction of the Etihad Stadium and not by external factors mentioned above? To solve this spatial analysis issue, I will be conducting a difference-in-difference econometric analysis, where I would be calculating the house prices of Manchester before and after the construction of the stadium, and the house prices of Bradford before and after the construction of the Etihad Stadium. Then I will be subtracting (pre – post) of the control group (Bradford) from (pre – post) of the treatment group (Manchester). Thus, most of the external factors that would affect the house prices would be canceled out. Here we are assuming that Bradford and Manchester went through similar economic and demographic changes over the years we are studying, received similar coincidental shocks and the growths in houses prices in both cities were parallel. What we would have left is the difference of house prices between Manchester and Bradford that mainly resulted because of the construction of the Etihad stadium.

The **primary objective** of this paper is to analyze the impact of Etihad sport stadium on the house value in the city of Manchester.

My findings show that sports arenas have positive impact on house prices, this is a significant finding not only as a way for policy makers to boost the economy but also it is an important finding for the real estate market where one can invest in houses in areas that a sport arena is being constructed, since citrus paribus house prices will increase.

The rest of the report is structed as follows. Section two is a literature review about the studies that have been done related to the topic of the effect of sports stadium on house prices and some background information about the Etihad Stadium in Manchester. The third section is about The Data and Methodology, in this section I will be explaining the dataset that I collected and built and the methods that I have undertaken to analyze the data. The fourth section is the results that I got from my data and spatial econometric analysis. The fifth section is the Further Discussion section and finally the sixth section is the Conclusion and Policy Recommendations.

Literature Review:

The overarching theme coming from the literature is that sports stadiums have beneficial impact on the neighborhood's location. Resulting in an increase in the demand of people who want to live in the nearby area of the stadium and their WTP (willingness to pay), thus, leading to an increase in house prices (Robertson R., 2010).

Several studies suggests that sports stadiums increase house prices because of giving the city an economic successful image. Xia Feng done a study on the economic impact of sport arenas on house prices. He found out that sport facilities have a positive impact on residential house prices nearby. According to Feng, sport stadiums built in cities as a part of urban redevelopment project may increase house value by millions of dollars within few km away from the stadium. In addition, sport stadiums built in areas outside the city also increases house prices but at a lesser rate. This may clarify why cities keep on supporting the construction of sport stadiums despite the fact that some research suggest that sport stadiums' costs are greater than its benefits (Feng X, 2008).

According to Carlino (2004), the existence of the NFL (National Football League) increases rent by 8% in the houses near the stadium. This shows how having sport events in sports stadiums increases the local economy and house prices. In addition, building of a new sport stadium offers to contend a larger number of people, create local opportunities and jobs, and enhance the nearby environment. Thus, contributing to the improvement of local economy of the city (Robertson R., 2010).

The majority of research studies have been focusing on the impact of sports stadiums on the creation of jobs and economic growth, whereas the intangible or unmeasurable benefits have been neglected. However, Robertson mentioned in his study these intangible benefits, which are the civic pride, the "feeling good with pride" feeling that people of the city feel and the strengthening the city's image (Robertson R., 2010).

My methodology of DID helps overcome some of the limitations of previous research papers that were affected by spatial autocorrelation, where DID cancels out the external

neighborhood factors that are correlated with the changes in house prices and which tend to bias our estimates.

Etihad Stadium - Background Information:

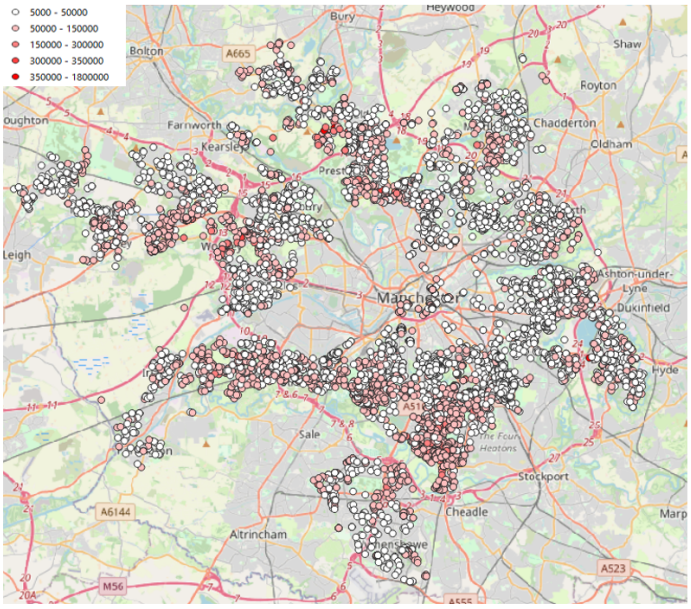
The Etihad Stadium in Manchester was constructed in July 2002. It has a capacity of hosting 54,000 people, putting it in the 5th largest stadiums in the Premier League and the 10th largest stadiums in the United Kingdom. Also, the Etihad Stadium is the home for the famous club Manchester City, that has millions of fans.

Several famous events were hosted at the Etihad Stadium that attracted thousands of tourists. Such as the 2008 UEFA Cup Final, rugby world cup, music concerts for famous people and boxing world title matches. On average $500 million the Etihad Stadium make in revenue every year, increasing the economic growth of the city.

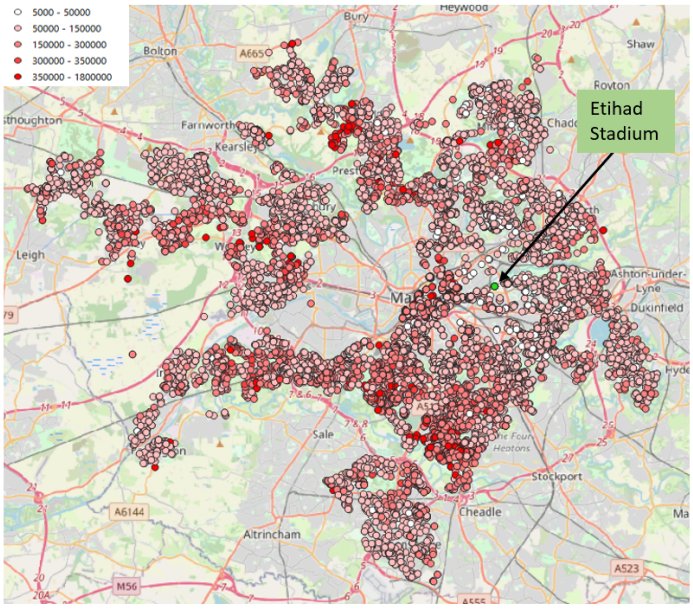
ESDA – Expletory Spatial Data Analysis

In this part we will delve deeper into the geographic distribution of these houses. Spatial econometric approaches are used to identify spatial correlation and make the measurements more accurate (Haining, 2003). In this study I calculated the spatial distances between house prices and the Etihad Stadium to check whether when we get closer to the stadium the house prices change.

We have done expletory spatial data analysis to check for spatial patterns in the data and to visualize on maps it in order to understand it better. It could help us answer these questions: where are the highest prices on the map? Do the house prices change if we get closer to the stadium?



Manchester 1997
Map 1



Manchester 2006
Map 2

Figure 1

Map 1 shows house prices in Manchester in 1997 before the construction of the Etihad stadium and map 2 shows the house prices in Manchester in 2006 after the construction of the stadium. Map 2 shows the Etihad stadium that was constructed in 2002. From the above maps we can see how house prices changed over time in Manchester. This was due to many factors such as economic growth in UK, increase in interest rates, employment and many other factors. From the maps we can see that the houses in the area near the stadium increased in prices, but we can2t directly conclude that the house prices increased in value due to the construction in stadium, because there are other factors as mentioned above that affected the prices. Therefore, in the next sections I will conduct an identification strategy to just measure the effect of the Etihad stadium on house prices nearby.

Spatial econometrics:

Data:

The key challenge is to identify the effect of the stadium on house prices and omitting all other factors that might have an effect on house prices. Since some of the location attributes are unobservable, there's a chance to incorrectly relating their effects to the stadium. This the problem of spillovers and our method in solving this issue based on observing house prices of Manchester before and after the construction of the stadium and subtracting it from house prices in Bradford in years before and after the construction of the Etihad stadium. Bradford is a city similar to Manchester in many aspects but is located quite far from the Etihad Stadium. I chose Bradford which is a city near Manchester but far from the stadium to avoid spillover effects of the treatment (Etihad stadium) on house prices in Bradford. Unobserved factors that affect house prices regardless of the construction of the stadium (the treatment) will be differenced out. This identification strategy method is called difference-in-difference.

The study area covers Manchester and Bradford in year 1997 and 2006. The reason I chose year 1997 is because it was few years before the construction of the Etihad Stadium (2002) and where it was not known that there would be a sports stadium being constructed. This helps our data in not being affected by the treatment. I also chose the year 2006 because it is few years after the construction of the stadium. I didn't want to take further year because there was the financial crisis that took place in 2007 and which affected house prices, I wanted to decrease the external factors that might have an effect on house prices as much as I can.

The price paid dataset included 10 variables, however, the variables that I needed are house prices, postcodes, town, county, district. I created additional variables such as the longtitude and latitude from postcodes, distance, and some dummy variables such as a dummy variable "y2006" if occurred in year 2006 (treatment year), "near_stadium" if houses are near the stadium, "y2006_near_stadium" if occurred in 2006 and near the stadium. These dummy variables were important to measure the effect of the stadium on house values.

To analyze this dataset I used STATA software to check the relationships between the variables and for mapping and further data analysis I used QGIS software.

Methodology:

I got the data from House Price Data UK in 2006. This dataset contained the house prices in all UK that were registered with the government. However, this data included the postcodes of the houses, but not their coordinates. I need the coordinates for two reasons, the first is to measure the distance between the houses in Manchester and the Etihad stadium, the second reason is that I need the coordinates to be able to map them and visualize them on a software called QGIS. Thus, I got another dataset that has the postcodes of houses in UK and their coordinates, the dataset is called ONSPD (links for the datasets can be found in the resource section).

After getting the datasets, I imported the House Price Data into STATA first, which is an econometric software for data analysis. In STATA, I cleaned the data; dropped missing values, removed space for postcodes and checked for outliers. Then, I imported the ONSPD dataset that contains the postcodes and the coordinates. I geocoded House Price Paid Data using the ONSPD data by many to one merge with postcode directory, keeping only matched observations and grid reference from postcode directory.

The final dataset that I got was one that had all houses prices in UK with their coordinates. To get the house prices of houses only in Manchester I dropped everything except houses with the postcode that starts with an M following a number.

Next, I created a dataset for the Etihad Stadium, it contained its postcode and its coordinates. I crossed this dataset with the final dataset that I worked on previously and I got a dataset that had the coordinates of houses, their prices, and the coordinates of the Etihad Stadium.

Later, I wanted to add the variable distance (between the Etihad Stadium and the houses) to the dataset in order to check the impact of proximity of the Etihad Stadium on nearby house prices. I do that through crossing both datasets. Finally, I get the dataset that I need in order

to measure the effect of distance from the Etihad Stadium to house prices and to be able to plot the data and visualize on QGIS.

I did the same steps for data of Manchester house prices but now for year 1997, Bradford house prices in 2008 and Bradford house prices in 1997.

Identification Strategy (Difference-in-Difference):

We use diff-in-diff to measure the causal relationship between sports arenas and house prices. The difference in difference method measures the change in outcomes among treated individuals (period 1 – period 0) + the treatment effect, then we have the change in outcomes among the untreated unit (period 1 – period 0).

The goal is to find the average treatment effect on the treated, but estimation is going to be complicated and harder to achieve whenever we have spillover Effects. Spill over effects is when the effect of treatment (Construction of Etihad Stadium) spreads beyond the treatment boundaries.

Assumptions:

When performing a difference-in-difference method we assume that both the control group and the treatment group are similar other than the fact that the treatment group received the treatment. It is also assumed that groups we are studying have parallel trends in house prices. Such that, if the Etihad Stadium wasn't constructed the treatment and the control groups then the difference between house prices would have stayed consistent over the years. In addition, it is assumed that no coincident shocks affected treatment and control groups differently.

Spillover Effects:

Two problems that take place because of the presence of spillover effects:

- We have spillover effects on the control units, where control units (Bradford's house prices) might get effected by the treatment (Etihad Stadium), by that we wouldn't be able to measure the exact impact of the Etihad Sports stadium.

- The second bias is the spillover onto the treated units, so treated group (Manchester house prices) can be affected by factors other than the treatment (Etihad Stadium), resulting in prices that are affected by the Etihad Stadium and other spillover effects.

To remove the biases as much as we could, we conduct the difference-in-difference method. We measure the effect of the stadium by subtracting the treatment group from control, and we get the effect of the construction of the stadium.

Model:

	Bradford (Control group)	**Manchester (Treatment group)**
1997 (Before the construction of the Etihad Stadium)	$\bar{y}_{00} = \bar{\varepsilon}_{00}$	$\bar{y}_{10} = \bar{\varepsilon}_{10}$
2006 (After the construction of the Etihad Stadium)	$\bar{y}_{01} = \alpha + \bar{\varepsilon}_{01}$	$\bar{y}_{11} = \alpha + \delta + \bar{\varepsilon}_{11}$
Post-pre difference	$\bar{y}_{01} - \bar{y}_{00} = \alpha + \bar{\varepsilon}_{01} - \bar{\varepsilon}_{00}$	$\bar{y}_{11} - \bar{y}_{00} = \alpha + \delta + \bar{\varepsilon}_{11} - \bar{\varepsilon}_{10}$

Figure 2 - (Gibbons S., 2022)

Difference-in-difference:

$$(\bar{y}_{11} - \bar{y}_{10}) - (\bar{y}_{01} - \bar{y}_{00}) = \delta + (\bar{\varepsilon}_{11} - \bar{\varepsilon}_{10}) - (\bar{\varepsilon}_{01} - \bar{\varepsilon}_{00})$$
$$= \delta$$

$\boldsymbol{\delta}$ is the effect of the Etihad Stadium on the house prices

$\bar{\boldsymbol{\varepsilon}}$ are the estimated errors

$\boldsymbol{\alpha}$ are the unobserved external factors that might have affected the house prices other than the stadium

$\bar{\boldsymbol{y}}$ are the estimated house prices on average

Treatment group: Z=1

Control group: Z=0

Pre-treatment in 1997 (0)

Post-treatment in 2006 (1)

$$\left(y_{i1} - y_{i0}\right) = \alpha + \left(z_{i1} - z_{i0}\right)\delta + \left(\varepsilon_{i1} - \varepsilon_{i0}\right)$$

$$E\left(y_{i1} - y_{i0} \mid Z_i = 0\right) = \alpha + E\left(\varepsilon_{i1} - \varepsilon_{i0} \mid Z_i = 0\right)$$

$$E\left(y_{i1} - y_{i0} \mid Z_i = 1\right) = \alpha + \delta + E\left(\varepsilon_{i1} - \varepsilon_{i0} \mid Z_i = 1\right)$$

$$E\left(y_{i1} - y_{i0} \mid Z_i = 1\right) - E\left(y_{i1} - y_{i0} \mid Z_i = 0\right) = \delta$$

What we did in the equations above is that we estimated the difference in house prices in years 1997 and 2006 in Bradford, and we did the same in Manchester. Then we subtracted them from each other to get the $\boldsymbol{\delta}$ which is the effect of the treatment.

After getting the effect of the treatment $\boldsymbol{\delta}$ we check whether the coefficient is positive or negative in order to see whether the construction of the Etihad stadium increased or decreased house prices in the area nearby.

Results:

Sumary statistics of our variables:

Treatment Neighborhood (Manchester)				
Variable	Mean	Std. Dev.	Min.	Max.
House Prices 1997	48900.84	29983.62	5450	392500
House Prices 2006	141872.5	75593.11	10500	1800000

Figure 3

Control Neighborhood (Bradford)				
Variable	Mean	Std. Dev.	Min.	Max.
House Prices 1997	44140.1	25210.98	7550	250000
House Prices 2006	117901.7	59053.3	10000	725000

Figure 4

As shows in figures 3 and 4, house prices increased in both groups (in manchester and in bradford) over the years.

After constructing our dataset and running the difference-in-difference strategy on STATA this is what we get (figure 5):

Source	SS	df	MS	Number of obs	=	26,887
				F(3, 26883)	=	4756.61
Model	5.0307e+13	3	1.6769e+13	Prob > F	=	0.0000
Residual	9.4774e+13	26,883	3.5254e+09	R-squared	=	0.3468
				Adj R-squared	=	0.3467
Total	1.4508e+14	26,886	5.3961e+09	Root MSE	=	59375

house_prices	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
y2006	73761.63	1449.708	50.88	0.000	70920.13	76603.13
near_stadium	4760.735	1344.836	3.54	0.000	2124.787	7396.684
y2006_near_stadium	19204.32	1693.688	11.34	0.000	15884.6	22524.04
_cons	44140.1	1151.885	38.32	0.000	41882.35	46397.85

Figure 5

Explanation of figure 5:

In figure 5 we have conducted a difference-in-difference identification strategy on our final dataset that we worked on.

Variable “y2006” is a dummy variable which is 1 for data in year 2006 and 0 for data in year 1997. It has a coefficient of “73761” and positive which means that throughout the years house prices in both treatment and control increased from 1997 to 2006. This might be because of interest rates, availability of mortgages or economic growth… The results are also significant since “P>|t|” is greater than 0.05.

Variable “near_stadium” is also a dummy variable, which is 1 for treatment group (Manchester) and 0 for control group (Bradford). It has a positive coefficient of “4760” which means that the are close to the stadium regardless of the construction of the stadium had higher house values. The results are also significant since “P>|t|” is greater than 0.05.

Variable “y2006_near_stadium” which is our interaction term and the variable that we care the most about I this study. Canceling out all the external factors that might affect the house prices, **the interaction term has a positive coefficient of “19204” suggesting that the construction of the stadium by itself increased house prices near the stadium by 19204£.** The results are also significant since “P>|t|” is greater than 0.05.

The reason why we are calling this the difference-in-difference strategy is because we are taking the average change in prices in the control group (Bradford) from 1997 to 2006 and we are taking the average change in prices in the treatment group (Manchester) from 1997 to 2006. Then we are taking the difference in those differences.

In figure 6, we can see a summary statistics of our data. We have 12,363 observations in total, and we can see the mean, standard deviation, min and max of each variable.

Variable	Obs	Mean	Std. dev.	Min	Max
house_prices	12,362	141866.8	75597.89	10500	1800000
year	12,362	2006	0	2006	2006
postcode	0				
type	0				
new	0				
freehold	0				
apartment_nb	0				
street	0				
locality	0				
town	0				
district	0				
county	0				
house_east~s	12,362	382410.1	5776.563	365648	393938
house_nort~s	12,362	398175	4843.533	385381	409576
house_msoa11	0				
house_id	12,362	6181.5	3568.746	1	12362
etihad_pos~e	0				
stadium_ea~s	7,695	386639	0	386639	386639
stadium_no~s	7,695	398629	0	398629	398629
stadium_m~11	0				
h_s_distance	12,362	7378.009	4525.553	377.9219	21440.04
lnprice	12,362	11.75218	.4692295	9.25913	14.4033
_Itype_2	12,362	.2877366	.452726	0	1
_Itype_3	12,362	.2932373	.4552647	0	1
_Itype_4	12,362	.3472739	.476123	0	1
_Inew_2	12,362	.2365313	.4249692	0	1
_Ifreehold_2	12,362	.5583239	.4966068	0	1

Figure 6

Limitations of our Diff-in-Diff strategy:

The difference-in-difference method has been used by many to measure the causal relationships.

Even though the difference-in-difference strategy that I have used in this study tries to cancel out some of the external factors that might affect the houses prices (treated group) other than the construction of the stadium; however, this method has some limitations.

The first limitation is that it compares two groups (control and treatment) and assumes that they are similar in all ways other the treatment (construction of the Etihad Stadium). However, even though Manchester and Bradford are similar cities, they are different in many ways. We can't fully assume that the external factors that would affect house prices over the years are the same in both Manchester and Bradford.

Our second drawback is that we are assuming that the control group and the treatment group have parallel trends in houses prices, which means that if the Etihad Stadium wasn't built then Manchester and Bradford would have the same growth rate in house prices over the years.

Different Control Group:

Since one of the limitations in the difference-in-difference approach is that the control group (Bradford) might differ from the treatment group (Manchester) on levels other than the treatment (construction of the stadium). To fix this problem I decided to take the control group as houses that are further away from the Etihad stadium by 5km or more, but which are in Manchester. The treatment group would be houses that are within 5km radius from the Etihad Stadium. By that, both the treatment group and the control group are similar in many aspects, since they are in the same city, going into the same economic growth, economic shocks…. However, these two groups would differ on the proximity of the treatment (Etihad Stadium).

For this analysis I will be using data of house prices in Manchester that are within 5km from the stadium and house prices in Manchester that are further away from the stadium by 5km or more in years 1997 and 2006.

So what I did is that I took the dataset that I had and I removed all the Bradford data and I added two new columns. One takes the house stadium distance field and if it is less than 5000m it saves it and the other column does the same if the distance was greater than 5000m.

Source	SS	df	MS	Number of obs	=	14,656
				F(3, 14652)	=	2812.54
Model	3.3649e+13	3	1.1216e+13	Prob > F	=	0.0000
Residual	5.8431e+13	14,652	3.9879e+09	R-squared	=	0.3654
				Adj R-squared	=	0.3653
Total	9.2080e+13	14,655	6.2831e+09	Root MSE	=	63150

house_prices	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
y2006	103316.2	1464.287	70.56	0.000	100446	106186.4
less_5km	19830.4	1774.701	-11.17	0.000	-23309.04	-16351.77
2006_less_5km	8548.261	2204.768	-3.88	0.000	-12869.88	-4226.637
_cons	54751.39	1113.391	49.18	0.000	52569	56933.78

Figure 7

Explanation of figure 7:

The variable “y2006_less_5km” is a dummy variable for 1 if the house is in year 2006 and less or within 5km in distance from the stadium. In the figure it shows that it has a postivie coefficient of 8548 which means that the closer we are to the stadium within 5km from it the houses prices of that area increase by 8548£ compared to houses further away from 5km from the stadium.

Here we got more accurate results and we eleminated some external factors that we had in our previous analysis when the control group was houses in Bradford, where here we have eliminated the external factors that might have happened in Bradford but not in Manchester and affexcted the prices. Thus, getting better and more accurate results.

Figure 8 shows a summary statistics of this section’s data analysis

Variable	Obs	Mean	Std. dev.	Min	Max
house_prices	19,678	107304.1	77090.94	5450	1800000
year	19,678	2002.654	4.349645	1997	2006
postcode	0				
type	0				
new	0				
freehold	0				
apartment_nb	0				
street	0				
locality	0				
town	0				
district	0				
county	0				
house_east~s	19,678	382307.6	5926.696	365648	393938
house_nort~s	19,678	398213	4918.701	385367	409576
house_msoa11	0				
house_id	19,678	9839.5	5680.694	1	19678
etihad_pos~e	0				
stadium_ea~s	19,678	386639	0	386639	386639
stadium_no~s	19,678	398629	0	398629	398629
stadium_m~11	0				
h_s_distance	12,362	7378.009	4525.553	377.9219	21440.04
y2006	19,678	.6282142	.4832939	0	1
house_stad~e	19,678	7658.138	4427.672	377.9219	21440.04
lnprice	19,678	11.33704	.7462629	8.603371	14.4033
less_5km	19,678	.3572518	.4792021	0	1
greater_5km	19,678	.6427482	.4792021	0	1
y2006_less~m	19,678	.2511434	.4336819	0	1

Figure 8

Source	SS	df	MS		
Model	5.7361e+09	1	5.7361e+09	Prob > F	0.3259
Residual	1.1693e+14	19,676	5.9430e+09	R-squared	0.0000
Total	1.1694e+14	19,677	5.9430e+09	Adj R-squared	-0.0000
				Root MSE	77091

Number of obs = 19,678
F(1, 19676) = 0.97

house_prices	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
ouse_stadium_distance	-.1219423	.124122	-0.98	0.326	-.3652319	.1213474
_cons	108238	1097.974	98.58	0.000	106085.8	110390.1

Figure 9

Figure 9 shows that the further the distance is from the stadium the lower the prices, which supports the hypothesis of this study. Overall, both of our findings suggest that sports stadiums have a positive impact on house prices on neighborhood areas to the stadium.

Further Discussion:

For further study we can do spatial sorting in the area near the Etihad stadium, since price differentials drive sorting so that if the prices go up in that area of Manchester, then it would've attracted certain types of bias. If I want to measure the effect of the stadium while holding everything constant (demographics…) then there might be a concern because part of what I might picking up is the change in the neighbor characteristics that occur in the same time. And to control for that I can do the spatial sorting around the Etihad stadium.

Furthermore, I can get more variables about the houses from the census data, such as the number of bedrooms, bathrooms, sqm and so on and link them with the current data that I have. I can get the data of these variables in 1997 census data and in 2006 census data and control for the changes in demographics and control for some local characteristics.

In addition, there should be more studies on the effect of sports stadiums on houses prices in less developed cities than Manchester. This is useful for policy makers to see whether sports stadium have the same effect in less developed cities or not, and would these sports stadiums boost the economy or decline its growth, this would help them form better policies.

Takeaways and Policy recommendations:

What policy makers and economists can learn from this report is that there are spatial spillovers that they should take care of when conducting econometric analysis, so that they could get better and more accurate results. The second thing that they can learn is that sports stadiums have a positive impact on the economy and in some cases they boost the economic growth, thus, they might consider building a sports stadium in a city as a way to boost its economic growth. Also, real estate agents and investments can benefit from this analysis and invest in houses near a new constructed sports stadium or in a nearby area if it's planned to construct a stadium in it.

Spatial econometrics is important for policy makers to form better decisions. Whether it is studying the impact of public transportation, enhancement of infrastructure or electrification

all affects the economy and the well-being of the citizens nearby. Especially for place-based policies it is important to consider spatial spillovers when measuring treatment effects.

Conclusion:

In conclusion, that results show that the Etihad Stadium had a positive impact on house price values on the nearby area. This paper adds to the literature by demonstrating a new approach of measuring the effect of sports stadiums on house prices. My paper provides a warning for people using this identification strategy that there are spillover biases that we can solve using spatial econometrics techniques. My methodology of Difference-in-difference helps overcome some of the limitations of previous research papers that were affected by spatial autocorrelation, where Difference-in-difference cancels out the external neighborhood factors that are correlated with the changes in house prices other than the construction of the stadium and which tend to bias our estimates. Therefore, this research opens the door for many policy recommendations. If sports stadiums increase house prices and have a positive impact on the economy then there should be some thinking towards sport stadium redevelopment which will contribute to the enhancement of the nearby area. Also, it is important for policy makers and real estate agents to understand the effect of sports arenas on house prices and on the economy. However, the question remains whether constructing sports stadiums in less developed places boost the economy or worsen it?

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