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Does the Presence of Professional Football Cause Crime in a City? Evidence from Pontiac, Michigan

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Abstract

We empirically explore the relationship between the National Football League (NFL) and crime using daily panel data from Detroit. We exploit the natural experiment of the Detroit Lions movement from Pontiac MI to downtown Detroit in 2002 to examine the impact of NFL games on crime in a jurisdiction. Pontiac is used as a treatment city and other suburban cities are used as a comparison group. Employing a triple difference-in-difference approach, we find little to no change in crime on a home game day in Pontiac compared to other suburban cities. There is no difference in crime between the football season and off-season, among the groups, after the Lions moved. While not conclusive, our results are suggestive that professional football does not create additional crime except for larceny.

Keywords: National Football League, stadium, National Incident-Based Reporting System, crime, externality

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Introduction

In the early 1990s, professional sports teams in North America experienced a boom in the construction of professional sports stadiums and arenas. For example, from 2000 to 2010, 14 new National Football League (NFL) stadiums were built. Approximately 44% of the total construction costs of these facilities came from public funding (Fort, 2011). To justify these significant public subsidies, a direct economic benefit from a new facility might be expected. A large number of carefully done studies on this topic, however, find little or no economic benefits (Baade et al., 2008; Coates and Humphreys, 2002, 2003; Siegfried and Zimbalist, 2000). Proponents of public funding for new stadiums also point to intangible benefits, such as civic pride from the presence of professional sports franchises. Several papers estimate this benefit using contingent valuation methods, and largely find that benefits, to the extent they exist, do not cover construction costs (Johnson et al., 2001; Owen, 2006; Groothuis et al., 2004; Johnson et al., 2007).

In addition to any positive economic and social benefits professional sports might have to metropolitan areas, the potential negative impact of sporting facilities and events needs to be considered. Very few studies have done so, however, and those that have been conducted primarily focus on American football and crime. There are are at least three possible reasons why professional football games are associated with an increase in crime. First, because of the aggressive nature of American football, games might make attendees or viewers more violent and therefore likely to commit crime. Second, a large amount of alcohol is consumed during games and pre-game tailgates. Excessive consumption of alcohol during games makes it more likely that football fans will be involved in alcohol-related offenses and crimes such as assaults, vandalism, and disorderly conduct. Third, criminals might face a lower opportunity cost of committing crimes on game day as a large number of individuals are away from home and clustered together in a contained area.[1]

For example, Rees and Schnepel (2009) examine the relationship between crime and college football games using the National Incident-Based Reporting System (NIBRS). They find sharp increases in assaults, vandalism, arrests for disorderly conduct, and arrests for alcohol-related offenses on game day in hosting communities. Using this same data, Card and Dahl (2011) explore the impact of NFL games on family crime and they find that upset losses by the home team in-

[1] On this point but with data from college basketball, Yu et al. (2016) find that home games (but not away games) are associated with robberies.

crease domestic violence against women. Kalist and Lee (2014) also find that NFL home games are associated with an increase in total crime, specifically, larceny and motor vehicle theft. All of these studies use daily data and examine the changes in the number of crimes on game day compared to other days. The only study not to find any effect between professional football and crime is Baumann et al. (2012). Using annual data, they find little to no evidence supporting the relationship between crime and NFL games. None of these studies provides evidence of a causal relationship, rather they just report the statistical association (or lack thereof) between professional football and crime.

These mixed results in the literature generate at least two hypotheses. It could be that professional football leads to more crime and that findings using annual data are too aggregated to find the true effect. Conversely, it could be that professional football does not lead to crime and papers using daily data are largely showing that crime concentrates on game days. Much like spending on professional sports, which comes from reduced spending elsewhere in the local economy, crime on game days might be the result of reduced behavior during the rest of the time. For example, robberies committed on game days would instead be spread out throughout the week. If the latter hypothesis is true, the total number of crimes annually in cities with professional football would not differ from those without a team.

This paper examines the extent to which professional football causes more crime. We use the Detroit Lions' migration to a new stadium as a natural experiment to examine the true effect of professional football on crime. If professional football causes crime in the city where the games are played, there should be a decline in crime following a team's departure. Using daily NIBRS data and a triple difference-in-difference approach, we find little to no evidence for a causal relationship between professional football and crime, with the exception of larceny. While our study has several limitations, which we discuss in our summary, it is an important first step towards answering the causal question and thereby possibly advancing the empirical literature on football and crime. In addition, using Pontiac as a treatment city has an important advantage. Pontiac has a population of less than 70,000. Average attendance per Detroit Lions game before the move was greater than 70,000. If the effect of football games on crime is positive, the case of Pontiac should show it. Urban policymakers should also find our results of use, as a number of professional football franchises are currently rumored to be moving or obtaining new stadiums.

Data and Empirical Approach

After 2000, 3 NFL teams migrated to new stadiums in a different jurisdiction in the same Metropolitan Statistical Area (MSA). In 2002, the Detroit Lions migrated from Pontiac to Detroit. The Arizona Cardinals migrated from Tempe to Glendale in 2006 and the Dallas Cowboys moved from Irving to Arlington in 2009. Unfortunately, none of the jurisdictions housing the Arizona Cardinals and Dallas Cowboys provided crime data to the NIBRS, so we were unable to include these two cases in our study. Our need to use daily data causes us to focus solely on the Lions move from Pontiac to Detroit. We set Pontiac, which lost the Lions in 2002, as our treatment city and other available cities in Detroit MSA (Dearborn, Farmington Hills, Southfield, Taylor, Troy, and Warren) are used as a comparison group.[2] Characteristics of the sample cities are shown in Table 1. Warren has the highest population (138,247), while the population in Pontiac and Taylor are under 70,000. Pontiac and Southfield have the highest African-American percentage while other cities have less than 10%. Pontiac also records the highest unemployment rate. Farmington Hills and Troy are top two cities in terms of median income, education rate, and relatively low annual crime rate.

Table 1: General Characteristics for Sample Cities

	Treatment group	Comparison group					
	Pontiac	Dearborn	Farmington Hills	Southfield	Taylor	Troy	Warren
Population	66,337	97,775	82,111	78,296	65,868	80,959	138,247
Female%	51.3	50.3	51.6	54.1	51.8	50.5	51.1
Median age	30.0	34.5	38.6	38.3	33.9	38.1	37.9
Black%	49.9	1.5	6.9	54.2	8.7	2.1	2.7
College grad or higher%	10.3	26.4	47.9	36.7	7.0	50.0	13.0
Unemployment rate	10.3	5.3	2.9	4.6	6.5	3.3	4.7
Median income	31,207	44,560	67,498	51,802	42,944	77,538	44,626
Assaults	846	787	150	817	223	64	559
Thefts	1,760	3,197	1,375	2,757	2,004	1,663	2,584
Auto thefts	546	1,176	164	828	525	205	1,462

Data are from The U.S. Census 2000 and Uniform Crime Reports in 2001.

We employ data 3 years before and after migration day. Our sample period is therefore from 1999 to 2004. Following Rees and Schnepel (2009) and Card and Dahl (2011), we use daily NIBRS data in this study and estimate the effect of professional football on assaults, vandalism, larceny and motor

[2]Detroit and Livonia are not included in this paper as they do not report crime data to the NIBRS during the sample period.

vehicle theft separately. The Federal Bureau of Investigation(FBI) categorizes assaults as including assault offenses, aggravated assaults, simple assaults and intimidation. Larceny includes pocket-picking, purse-snatching, shoplifting, theft from buildings, theft from coin-operated machines or devices, theft from motor vehicles, parts/accessories, and all other larceny. Descriptive statistics for daily crime data by cities are shown in Table 2. The mean number of assaults occurred in Pontiac per day is the highest, but the number of crimes in other categories are comparable across our treatment and comparison cities. Except for assaults, Dearborn has the highest number of crimes per day among all cities. For all categories, Farmington Hills and Troy have the lowest number of daily crimes in these categories.

Table 2: Descriptive Statistics of Daily Crime Data for Sample Cities

			Assaults	Larceny	Auto theft	Vandalism
Treatment Group	Pontiac	mean	6.35	3.58	1.12	2.85
		sd	4.16	2.79	1.24	2.39
Comparison Group	Dearborn	mean	5.72	9.42	2.96	3.92
		sd	2.68	3.84	1.97	2.48
	Farmington Hills	mean	2.35	3.63	0.41	1.74
		sd	1.62	2.31	0.69	1.78
	Southfield	mean	3.61	7.21	2.57	1.84
		sd	2.07	3.56	1.87	1.69
	Taylor	mean	3.22	5.86	1.61	2.51
		sd	1.94	2.77	1.45	1.79
	Troy	mean	1.79	4.63	0.43	1.51
		sd	1.37	2.53	0.71	1.51
	Warren	mean	3.70	5.75	2.58	2.97
		sd	2.77	3.89	2.32	2.63

As mentioned previously, our dependent variables of interests are assaults, vandalism, larceny and motor vehicle thefts observed daily. We look at each crime variable one by one. Following Rees and Schnepel (2009) and Kalist and Lee (2014), a negative binomial approach is used, with a modification for employing triple difference-in-difference approach. The number of crimes reported, y_{it}, in city i on day t is the function of following;

$$\ln E(y_{it}) = \beta_1 + \beta_2 game_t + \beta_3 post_t * tgroup_i + \beta_4 game_t * tgroup_i + \beta_5 game_t * post_t + \beta_6 game_t * tgroup_i * post_t + \gamma' \mathbf{X}_{it} + u_i + \epsilon_{it} \quad (1)$$

where $game_t$ is equal to 1 if the Detroit Lions has a game on day t; $tgroup_i$ is equal to 1 for Pontiac, $post_t$ is equal to 1 after the Lions moves to a new stadium. $\mathbf{X}$ is a vector of control variables, including dummy variables for whether the day is a holiday or a college bowl game, and day, month, and year specific fixed effects. In addition, as the stadium in Pontiac have hosted the Motor City Bowl during the sample period, we also include a bowl game dummy variable. The variable u_i indicates city specific fixed effects and ϵ_{it} is an error term. Note that $tgroup_i$ and $post_t$ are excluded as the effect of these variable will be captured by city or year fixed effects. The coefficient β_6 will capture the change in crime on game day in Pontiac after the Lions moved compared to other cities in the comparison group. Therefore, if the presence of professional football games in a jurisdiction causes more crime, β_6 is expected to be negative (i.e., crime will decrease after the Lions moved from Pontiac compared to all other cities in the comparison group). We also employ this same estimation except we use $hgame_t$ instead of $game_t$ to see if crime is driven by attendance at the game instead of non-attendance game day behaviors. In this estimation, $hgame_t$ is equal 1 if Detroit Lions has a home game on day t.

It is possible that some portion of game attendees commit football-related crimes before or after game day. For example, assaults following a Sunday night game that occur in the early hours of Monday morning. This effect is not captured with equation (1). A dummy variable for the NFL season could be used as an additional comparison group because the NFL season is relative short (September to December usually). Therefore, if football games cause more crime, we should observe more crimes being committed during the football season compared to the off-season. This approach has the advantage of avoiding the possible aggregation issue of annual data. To estimate this effect, a triple difference-in-difference approach is used to see the difference in daily crime between season and non-season, between Pontiac and other comparison cities, between before and after team moving, and difference in all three differences. $seas_t$ is equal to 1 if NFL season is progressing. Other variables are exactly same with those in equation (1). The equation for our triple difference-in-difference is:

$$\ln E(y_{it}) = \delta_1 + \delta_2 seas_t + \delta_3 seas_t * tgroup_i + \delta_4 seas_t * post_t + \delta_5 tgroup_i * post_t + \delta_6 seas_t * tgroup_i * post_t + \gamma' \mathbf{X}_{it} + u_i + \epsilon_{it} \quad (2)$$

Similar to equation (1), if the presence of a professional football game in a city causes more crime in that city, δ_6 is expected to be negative.

Empirical Results

The results for Equation (1) are shown in Table 3. Columns (1), (3), (5), and (7) use *game* while the even columns use *hgame* for the target explanatory variable.[3] For all dependent variables, the coefficients on *game* and *hgame* are not statistically significant except vandalism (on *game*) and larceny (on *hgame*). Vandalism is reduced on days with home games while vandalism goes up.

Recall, however, that the coefficients on *game* and *hgame* in this paper estimate change in crime on a game day in *every* sample city, not just in a city with a football stadium. The interaction terms between *post* and *game* or *hgame*, *tgroup* and *game* or *hgame* are not significant for all models. Theses coefficients capture the change in crime on a game day in sample cities, and treatment city (Pontiac) specific effects on crime on a game day. One notable result from the interaction terms between *post* and *tgroup* is that they are all positive and statistically significant for every model, except auto theft which is negative and statistically significant. These interaction terms capture changes in crime on a game day in Pontiac after the Lions moved. Our results show that daily crimes such as assaults, larceny, and vandalism increased after the Lions moved, while auto thefts fell.

These results suggest that losing the Lions to Detroit was bad for Pontiac in terms of measured assaults, larceny, and vandalism. The decline in auto thefts following the Lions' move could be related to the loss of professional football in Pontiac. However, the coefficient on *game*∗*post*∗*tgroup* is positive and not statistically significant, suggesting that auto thefts on game days in Pontiac after the Lions move to Detroit did not decline. This makes it less likely that the decline in auto thefts in

[3]Note that all coefficients for daily, monthly, yearly, and city specific fixed effects are jointly significant but not reported in Table 3 in the interests of space.

Pontiac post-departure are due to fewer automobiles coming to Pontiac for football games. Looking at the coefficients on $game * post * tgroup$ and $hgame * post * tgroup$ they are not statistically significant except for larceny during home games. This coefficient, suggests that there was less larceny in Pontiac compared to other cities on days with a Lions home game *after* the Lions moved to Detroit.

Table 4 shows the results of equation (2).[4] As theory would predict, the impacts of holidays on crime is negative as all dependent variables are negatively related to holidays, although the results are statistically significant only for larceny and auto theft. The presence of the Motor City Bowl actually lowers vandalism in a statistically significant manner. Presumably, this could be the result of heightened policing events with a number of out-of-town fans in attendance. For all dependent variables, coefficients on *seas* are positive and significant except auto theft. This suggests that these crimes are higher during football season. The interaction terms, $seas * post$ and $seas * tgroup$ captures time trend in crime or treatment city-specific effects, respectively, which are not expected to be related to football games. Similar with the result from the equation (1), the interaction terms between *post* and *tgroup* are statistically significant for every model, with assaults, larceny, and vandalism increasing and auto thefts declining.

[4]Similar to the results of Table 3, all coefficients for daily, monthly, yearly, and city specific fixed effects are jointly significant respectively though they are not shown in Table 4.

Table 3: Triple difference-in-difference result of coefficient on *game* and *hgame*

Dependent variable	Assaults		Larceny		Auto theft		Vandalism	
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
game	-0.0533		-0.0309		-0.0242		0.1024**	
	(0.0428)		(0.0373)		(0.0609)		(0.0493)	
game ∗ *post*	0.0844		0.0365		0.0698		-0.0822	
	(0.0558)		(0.0499)		(0.0779)		(0.0682)	
game ∗ *tgroup*	-0.0283		-0.1432		-0.1704		-0.1048	
	(0.0924)		(0.1135)		(0.1767)		(0.1226)	
game ∗ *post* ∗ *tgroup*	-0.0764		-0.0055		0.0372		0.0097	
	(0.1248)		(0.1615)		(0.2483)		(0.1750)	
hgame		-0.0573		-0.1791***		-0.0234		0.0868
		(0.0588)		(0.0531)		(0.0833)		(0.0694)
hgame ∗ *post*		0.0274		0.1318*		-0.0258		-0.0896
		(0.0796)		(0.0724)		(0.1119)		(0.0957)
hgame ∗ *tgroup*		0.0213		0.1658		-0.1373		-0.1264
		(0.1296)		(0.1539)		(0.2511)		(0.1745)
hgame ∗ *post* ∗ *tgroup*		-0.0212		-0.4238*		0.0948		-0.0317
		(0.1738)		(0.2287)		(0.3517)		(0.2489)
post ∗ *tgroup*	0.4224***	0.4199***	0.1044***	0.1089***	-0.1300***	-0.1314***	0.0929**	0.0931***
	(0.0253)	(0.0250)	(0.0294)	(0.0291)	(0.0489)	(0.0484)	(0.0367)	(0.0362)
holiday	-0.0019	-0.0005	-0.3769***	-0.3673***	-0.2071***	-0.1965***	-0.0864*	-0.0844*
	(0.0361)	(0.0362)	(0.0341)	(0.0343)	(0.0549)	(0.0551)	(0.0477)	(0.0479)
collegebowl	-0.0709	-0.0703	-0.1716*	-0.1733*	-0.0347	-0.0403	-0.5218***	-0.5258***
	(0.1124)	(0.1124)	(0.0991)	(0.0990)	(0.1567)	(0.1566)	(0.1706)	(0.1706)
constant	0.7443***	0.7426***	1.6367***	1.6357***	0.6773***	0.6726***	0.5304***	0.5306***
	(0.0293)	(0.0292)	(0.0247)	(0.0247)	(0.0406)	(0.0406)	(0.0376)	(0.0376)
observation	15344	15344	15344	15344	15344	15344	15344	15344
log likelihood	-33115.446	-33116.866	-38023.063	-38017.821	-23597.982	-23599.258	-29516.862	-29517.819

Standard error in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$, respectively
Year, month, day, and city specific effects are fixed in the model

What is the impact on Pontiac compared to the comparison cities after losing the Lions? To answer that question we look at the coefficients on $seas * post * tgroup$. None of the coefficients are negative, and auto-theft is positive and statistically significant. A positive coefficient is interpreted that there is an increase in auto theft during football season in Pontiac after the Lions moved compared to other cities. Other results of target variables show no evidence for supporting the causal relationship between football games in a jurisdiction and crime in that jurisdiction.

Table 4: Triple difference-in-difference of coefficient on *seas*

Dependent variable	Assaults	Larceny	Auto theft	Vandalism
seas	0.0810**	0.0692**	0.0516	0.1204***
	(0.0333)	(0.0291)	(0.0489)	(0.0439)
$seas * post$	-0.0317	0.0009	0.0743**	-0.0768***
	(0.0238)	(0.0199)	(0.0331)	(0.0299)
$seas * tgroup$	-0.1361***	-0.1403***	-0.1684**	-0.0889*
	(0.0384)	(0.0425)	(0.0701)	(0.0522)
$post * tgroup$	0.4249***	0.1002***	-0.1918***	0.0779*
	(0.0300)	(0.0353)	(0.0598)	(0.0442)
$seas * post * tgroup$	0.0361	0.0533	0.1921*	0.0777
	(0.0542)	(0.0629)	(0.1028)	(0.0775)
holiday	-0.0000	-0.3731***	-0.1919***	-0.0743
	(0.0361)	(0.0342)	(0.0549)	(0.0478)
collegebowl	-0.0565	-0.1621	-0.0392	-0.5056***
	(0.1123)	(0.0992)	(0.1569)	(0.1708)
constant	0.7278***	1.6295***	0.6812***	0.5093***
	(0.0296)	(0.0249)	(0.0411)	(0.0381)
observation	15344	15344	15344	15344
log likelihood	-33106.083	-38016.160	-23591.218	-29513.067

Standard error in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$, respectively
Year, month, day, and city specific effects are fixed in the model

Robustness Check

Table 1 shows that there is considerable heterogeneity among the cities in our sample. Specially, Farmington Hills and Taylor have relatively high median income, low unemployment rate, and highly educated residents compared to the other cities. This heterogeneity might deter us from finding the true relationship between crime and the presence of a football stadium in Pontiac. For a robustness check, we employ the same empirical approach as earlier but excluding Farmington Hills and Taylor. These robustness results are shown in Table 5, with only our primary explanatory variables presented. Coefficients on $game * post * tgroup$ and $hgame * post * tgroup$ are from the

equation (1) and coefficient on $seas * post * tgroup$ from equation (2). Coefficients in the row labeled sample (1) indicate results from the full samples in the previous tables. Coefficients in the row labeled sample (2) are results from the restricted sample excluding Farmington Hills and Taylor. Our general finding that the loss of the Lions did not lead to a decline in crime remains, with the exception of larceny during home games, which declined on home game days post-Lions move to Detroit. Therefore, even after excluding two most rich and educated cities, the results does not change.

Table 5: Result of robustness check

Target Coefficient		$game * post * tgroup$	$hgame * post * tgroup$	$seas * post * tgroup$
Dependent variable	Sample			
Assaults	(1)	-0.0764	-0.0212	0.0361
		(0.1248)	(0.1738)	(0.0542)
	(2)	-0.0845	-0.0218	0.0451
		(0.1304)	(0.1819)	(0.0565)
Larceny	(1)	-0.0055	-0.4238*	0.0533
		(0.1615)	(0.2287)	(0.0629)
	(2)	-0.0421	-0.4955**	0.0318
		(0.1675)	(0.2373)	(0.0656)
Auto theft	(1)	0.0372	0.0948	0.1921*
		(0.2483)	(0.3517)	(0.1028)
	(2)	0.0278	0.1123	0.2032**
		(0.2509)	(0.3551)	(0.1038)
Vandalism	(1)	0.0097	-0.0317	0.0777
		(0.1750)	(0.2489)	(0.0775)
	(2)	-0.0233	-0.0157	0.0692
		(0.1818)	(0.2584)	(0.0803)

Standard error in parentheses. * $p < 0.1$, ** $p < 0.05$, ***$p < 0.01$, respectively
Year, month, day, and city specific effects are fixed in the model

Conclusion

This paper explores the relationship between the presence of professional football in a city and crime. Using daily data on Pontiac and other Detroit suburbs before and after the Lions moved from Pontiac to downtown Detroit, we employ a triple difference-in-difference method to look for the causal effect of the presence of football games on crime. Our results provide weak support for the proposition that a causal relationship exists between home football games and larceny.[5] Similarly, we find that auto theft actually increases during football season in Pontiac *after* the

[5]We say weak, because we find no evidence when using *seas* variable.

Lions' move. Whether this reflects new behavior by Pontiac residents and visitors or increased attention to auto theft by Pontiac police during football season following the Lions departure cannot be determined by our data. While we fail to find a strong relationship between crime and the presence of professional football, clearly additional research is needed. Much like the literature on casinos and crime, different approaches are likely to yield different results (Grinols and Mustard, 2006; Walker, 2008; Reece, 2010).

There are three important caveats to make with respect to our results. First, as we focus only on Detroit suburbs it might be difficult to generalize this to all NFL cities. Our results in this paper might explain specific features of Pontiac rather than the presence of professional football. Second, since our paper does not include data on Detroit and Livonia due to a lack of daily data, we cannot speak to the overall effect of professional football in the Detroit MSA. Our findings only relate to the direct impact of professional football on crime in a hosting city, not externalities in criminal activities due to football games. Third, our approach assumes that criminal activities are unrelated to the Lions moving. While our comparison group and robustness check attempt to minimize this problem, our empirical approach cannot adequately deal with this concern.

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