Do Surveillance Cameras Affect Unruly Behavior? A Close Look at Grandstands

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Abstract

This paper studies how surveillance cameras affect unruly spectator behaviour in the highest Swedish soccer league. Swedish stadiums introduced surveillance cameras at different points in time during the years 2000 and 2001. I exploit the exogenous variation that occurred due to differences across stadiums in the processing time to get permits to use cameras as well as delays in the supply of the equipment. Conditioning on stadium fixed effects, I find that the unruly behavior was approximately 65 percent lower in stadiums with cameras compared to stadiums without. The natural experiment provides a unique possibility to address problems regarding endogeneity, simultaneous policy interventions and displacement effects.

JEL Code: K40, J01.

Keywords: surveillance cameras, crime, natural experiments.

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1 Introduction

Surveillance cameras have become a popular method in many countries in the attempts to combat crime. Only in the United Kingdom, estimates show that over four million cameras have been installed (The Associated Press 2007). While the cameras may reduce crime, this could come at large costs, both in terms of management and, in particular, in intrusion upon privacy. The American fourth amendment, for example, which opponents to surveillance cameras often call upon, states that "The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated...".

To motivate the use of surveillance cameras, they should consequently exhibit significant benefits. This paper studies the effects of surveillance cameras on unruly spectator behavior inside soccer stadiums by exploiting a natural experiment from the highest Swedish soccer league. The data on this type of behavior is filed by the referees game by game in the time period 1999 to 2005.

The costs of policing soccer games are vast. In Sweden, the annual cost of policing is approximately 7 500 000 euro (Dagens Nyheter, February 12, 2007). In the larger league in Italy, Serie A, these costs amount to approximately 40 000 000 euro (De Biasi 1997). It is important to study the effects of surveillance cameras because if they deter unruly behavior, then the use of cameras could potentially reduce these costs. Moreover, even though the analysis focuses on unruly spectator behavior, it may suggest how surveillance cameras affect unruly behavior elsewhere in the society.

The Swedish stadiums have at various points in time installed surveillance cameras at the grandstands. Only three stadiums had cameras in the 1990s. Due to a new regulation from the Swedish Football Association, all stadiums hosting clubs in the highest league had to have cameras installed either in 2000 or in 2001.

The dates at which cameras were introduced were to a large extent exogenous to previous unruly behavior. According to a senior official at the Swedish Football Association, the change in the policy was not that spectators were particularly unruly during the previous seasons, but rather that the Swedish arena safety was lagging

behind the safety norms issued by UEFA. Surveillance cameras have for example been used in England since the 1980s (www.footballnetwork.org).[1] Moreover, the dates for the installation of cameras were not uniform but differed across stadiums during the years 2000 and 2001 due to administrative and budgetary reasons as well as to different delays in the provision of the camera equipment.[2] The administrative processing time to issue permits to use cameras typically varied from 30 days to 90 days, and in one case it was as high as 413 days.[3]

I use the different timing of the introduction of surveillance cameras inside the stadiums to estimate their effect on the number of incidents where objects, such as coins, bottles, and lighters, were thrown onto the field by spectators. During the soccer seasons 1999 to 2005, there were on average 0.26 incidents per game before the cameras were installed. Conditioning on stadium fixed effects, I find that games in stadiums with surveillance cameras experienced approximately 65 percent less unruly behavior inside the stadiums relative to before they were installed.

In the literature on police and crime it is often suggested that if crime is reduced in one area, it may be displaced to other areas. It is however difficult to empirically assess this hypothesis since crime can be displaced to many different locations. I am able to address this issue, using unique data not only on unruly supporter behavior inside stadiums, but also on unruly supporter behavior outside stadiums where the use of surveillance cameras is not permitted. I first analyze a data set from the Swedish National Police Force, which covers unruly behavior, such as spontaneous fighting or the throwing of missiles at other supporters or the police, outside the stadiums where surveillance cameras are not permitted. I then use information on organized hooligan fights in Sweden, reported by the violent organization "Firman Boys", supporting the Stockholm club AIK. The results show that the unruly supporter behavior that was

[1] According to the official, "it is likely that experiences from outside Sweden, in particular from England, led to the decision to use surveillance cameras".

[2] According to the employee responsible for the installations of the camera equipment, the working load both of the firms doing the cabel work and the firm installing the cameras affected the final installation dates substantially.

[3] In addition, in contrast to other clubs, the Stockholm clubs did not get financial assistance from the municipality, which delayed their applications for permits.

reduced inside stadiums due to the surveillance cameras was not displaced to unruly supporter behavior outside the stadiums.

There does to my knowledge not exist any work in the economics literature that isolates the effects of surveillance cameras on crime. But the paper is closely related to a recent literature, which addresses the causal relationship between policing and crime. Levitt (1997) uses gubernal elections as an instrument for policing and finds that policing tends to reduce crime.[4] Using natural experiments, Di Tella and Schargrodsky (2004) and Klick and Tabarrok (2005) show that policing tends to reduce in particular auto theft.[5]

The present analysis adds to this literature by addressing the effects of surveillance cameras rather than street police. In addition, while Di Tella and Schargrodsky (2004) use one policy intervention where the allocation of police changed, and Klick and Tabarrok (2005) use four, in the natural experiment I exploit there are as many as thirteen different policy interventions where stadiums introduced surveillance cameras at different points in time.

There exists a relatively large criminology literature and a number of British government reports that study how surveillance cameras affect street crime, burglary and auto theft (see Welsh and Farrington 2002 and 2008 for detailed reviews). However, this literature typically suffers either from the fact that the installation of surveillance cameras was endogenous to previous crime[6], or that several types of policing were adopted at the same time, or both. Moreover, the cameras themselves may in addition to influencing the criminals also influence the behavior of the potential victims of crime, which makes it difficult to isolate their deterrent effect.[7] Finally, the simple fact that

[4]However, McCrary (2002) shows that after adjusting for a computational error (see also Levitt's reply, 2002) the results are not statistically significant.

[5]Klick and Tabarrok (2005) make use of the fact that elevated terror-alert levels in Washington led to a number of precautions made by the government, in particular an approximately 50-percent increase in street police, but also to an activation of the closed-circuit camera system that covers sensitive areas of their treatment group, the national mall. The isolated effect of the cameras can however not be analyzed.

[6]For example, if surveillance cameras are installed due to an increased level of crime, then individuals potentially subjects to crime may change their behavior due to the elevated crime level rather than to the cameras.

[7]Individuals could for example report more crime to encourage the use of cameras, or take more

more crimes are spotted by the cameras also blurs their deterrent effect.

Using unique data, I will be able to address these concerns. The endogeneity problem is by and large excluded, and, importantly, there were no other policy interventions at the same time as the installation of the cameras in 2000 and 2001. The deterrent effect of the cameras can furthermore be isolated since the referees who file the reports on unruly behavior do not use information from the cameras. Also, in contrast to many other types of crime, the victims of the type of unruly behavior I consider (players, referees and other supporters) can hardly change their behavior due to the existence of the cameras.

The outline is the following. Section 2 describes the data and the empirical strategy. Section 3 shows the results. The displacement effect is analyzed in Section 4 and Section 5 concludes.

2 Data

I use information on the use of closed circuit television surveillance system (surveillance cameras) in the different soccer stadiums in the highest league Swedish soccer league, "Allsvenskan". Because Sweden hosted the European Championship in 1992, cameras were installed in that year in several stadiums, but they were only continued to be used in Nya Ullevi Stadium in Gothenburg and in Råsunda Stadium in Solna, Stockholm. Apart from Olympia in the city Helsingborg, which had cameras installed before the soccer season 1999, the other stadiums did not have surveillance cameras at work during the 1990s. But before the season in the year 2000 a decision was taken by the Swedish Football Association that surveillance cameras had to be installed within two years in all stadiums where soccer in the highest league was played. A reason for this decision was that Sweden was lagging behind the European safety standards in soccer stadiums set by The Union of European Football Associations (UEFA). According to officials at the Swedish football association, the change in policy regarding the cameras was in any event not due to any previous change in unruly spectator behavior.

risks in response to the existence of cameras.

Surveillance cameras were installed in the stadiums at different points in time during 2000 and 2001 (or later if a newcomer entered the league). The timing of the installations differed for several reasons. Permits to use surveillance cameras are issued by county administrative boards, and local administrative delays differed across the country. In addition, in contrast to municipalities outside Stockholm, the Stockholm municipality did not financially assist the clubs when buying and installing the cameras, which delayed the applications in Stockholm.[8] Moreover, according to the employee responsible for the installation of the cameras, delays in the provision of the cabel work and the camera equipment affected the dates of the installations in the various stadiums. The permits are issued to the owner of the stadium, and the Swedish National Police Force operates the cameras. Table 1 shows the processing time to get permits for the various clubs, and the time at which surveillance cameras were installed. The time varied from 30 days (Ryavallen, used by IF Elfsborg) to 413 days (Söderstadion, used by Hammarby IF).[9] The installation of the cameras took place in the time period July 4, 2000 to April 4, 2001.

According to Swedish law, surveillance cameras must be indicated by clear signs. In the arenas, this is publicly indicated with signs showing a picture of a surveillance camera, typically placed at all entrances as well as inside the stadiums. The directives from the Swedish Football Association regarding the position of the cameras are that they "should be able to cover the whole arena". The licenses do, however, not allow any surveillance outside the stadiums.

I use the variation in the timing of the installation in surveillance cameras to analyze how they affect unruly spectator behavior. Spectators sometimes throw objects, such as coins, bottles, lighters, firecrackers, batteries and snuff boxes, etc. According to the head of the so called Sport Intelligence and Tactical Unit at the Swedish National Police Force, these individuals are not necessarily violent hooligans that systematically fight

[8]The information on surveillance cameras has been provided by the Swedish Football Association, the head of the Sport Intelligence and Tactical Unit at the Swedish National Police Force in Stockholm, the previous head of the arena security department of the club Hammarby IF, and the employee in charge of the installations of the cameras at the firm MKS Säkerhetsprodukter.

[9]It took much longer to issue the permit to Nya Ullevi in 1992 but this is outside the time period I consider.

each other but more "ordinary" supporters. It takes a fair amount of determination to hit the pitch, and the aim is, presumably, to hit either players or referees. This is of course unlawful behavior, which can be dangerous. There are two types of punishments for unruly spectator behavior. In serious cases when somebody is hit by objects for example, the case can go to court. In addition, the club may have to pay a fine which amounts to 10 000 to 250 000 Swedish crowns (11 000 to 27 000 Euro).

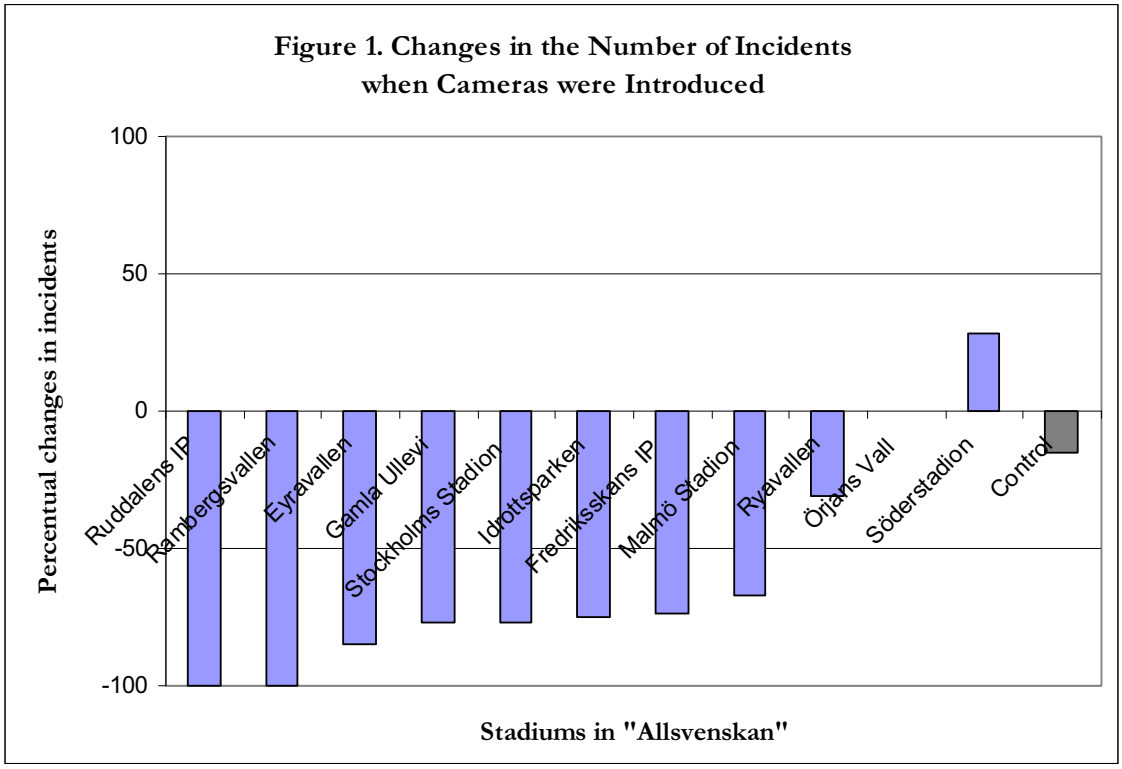
The referees report the number of incidents when objects are thrown onto the field, and from which supporter section the objects came from, in their regular "game-report". I have access to information from these reports in the time period 1999 to 2005. Out of the total 1273 games, 211 games were played without surveillance cameras. Table 2 shows the summary statistics on unruly behavior. There were, on average, 0.26 incidents per game without surveillance cameras and 0.21 incidents per game with cameras. As a robustness check, I also construct a variable which takes on one if there were one or more incidents in a game and zero otherwise. There were incidents in 16 percent of the games with cameras and in 12 percent in games without cameras.

Figure 1 depicts changes in percent in the number of unruly incidents inside stadiums due to the introduction of surveillance cameras. It shows that nine stadiums exhibited fewer incidents in the periods with surveillance cameras compared to without. Eight of the reductions were very large, well over 50 percent. One stadium had the same number of incidents per game with and without cameras, and one stadium in fact experienced more incidents in the period with cameras.[10] The stadiums Nya Ullevi in Gothenburg, Råsundastadion outside Stockholm, and Olympia in Helsingborg, had cameras before the season 1999 and serve as a control group.[11] Taken together, they

[10] Because there were no incidents at all before the cameras were introduced in Norrportens Arena (where IFK Sundsvall plays), and Vångavallen (where Trelleborgs FF plays), these observations cannot be reported in the figure. In the case of Norrportens Arena, this is partly due to the fact that there were only five observations before the introduction of the cameras. There were however slight absolute increases in unruly behavior in the periods when cameras were used (0.07 incidents per game in Norrportens arena and 0.14 in Vångavallen).

[11] All Stockholm derbies between AIK, Djurgårdens IF (that normally plays at Stockholms Stadion) and Hammarby IF (that normally plays at Söderstadion) have been taking place at Råsundastadion where surveillance cameras were in use throughout the time period considered. These derbies are therefore included in the control group.

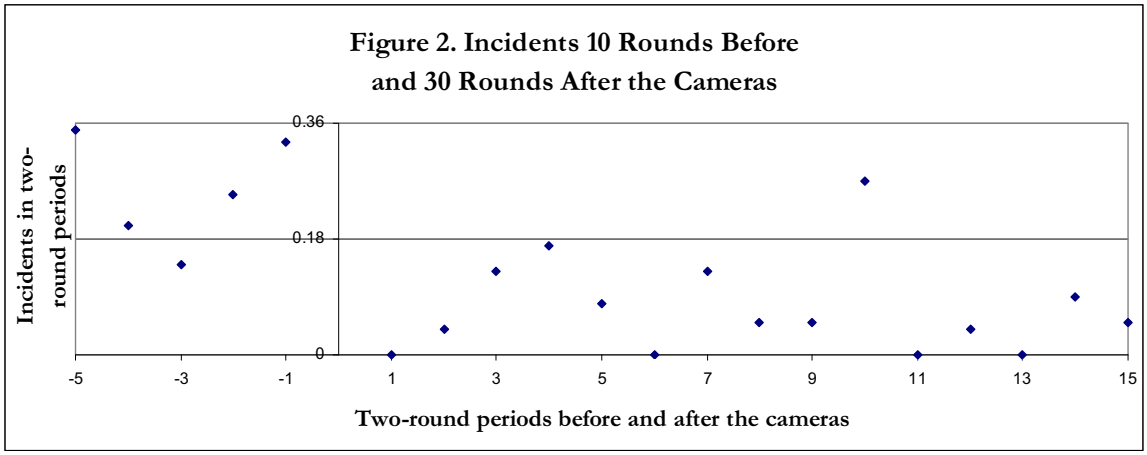
experienced a very small reduction in unruly behavior in the period with cameras.[12]



To exclude the possibility that the reduction in the number of incidents did not take place already before the installation of cameras, the analysis will be focused on the number of incidents in the periods before and after the introduction of surveillance cameras. In Figure 2, I collapse the number of incidents in two-week periods stadium by stadium and depict five such periods before the installation of cameras and fifteen periods after. In other words, the data is now normalized around the date of the introduction of the cameras. There is a clear downward jump at the time of the introduction of cameras. In the five two-round periods before the installation of cameras there were, on average, 0.25 incidents per game. In the fifteen two-round periods after, on the other hand, the average was 0.07 incidents per game. Hence, in this interval, the reduction in the number of incidents amounts to 72 percent.[13]

[12] In order to illustrate the changes in the control group, an assumption has to be made regarding the timing of the introduction of cameras. I take it to be that of the second largest stadium in the city or region (July 4, 2000 for Nya Ullevi, August 18, 2000 for Råsundastadion, and April 4, 2001 for Olympia).

[13] The figure only includes stadiums that had games both with and without surveillance cameras.



To test if surveillance cameras affect the extent to which spectators throw objects, I use the following set up. Let Y_{ij} denote the number of incidents in stadium i in game j. I will run the regression

$$Y_{ij} = \alpha_i + \beta camera_{ij} + v_{ij}, \tag{1}$$

where α_i is a stadium fixed effect.[14] The parameter β measures the effect of having cameras on the unruly behavior by spectators. In other words, I compare the behavior of supporters in the same stadium in a game with cameras to a game without cameras.[15]

The full data set contains games from 1999 to 2005. One way of controlling for time trends in the outcome variable is to use a full set of dummy variables for every round. However, this will not be feasible in practice since the panel data set consist of only 13 cross-sectional units but there are 182 rounds. I instead control for time trends with monthly fixed effects because there may be seasonal variation in unruly spectator behavior. It is for example possible that it is increased in the beginning and

Kalmar FF played in the highest league without cameras in 1999 and then again in 2002 with cameras. Due to the large time difference, Kalmar FF is not included in the figure. Including this club does however not affect the results substantially.

[14] As mentioned above, Djurgårdens IF and Hammarby IF have played their derby home games against each other and against AIK at Råsundastadion. I treat Djurgården's and Hammarby's home games at Råsunda separately and differently from when they play in there normal home stadiums (Stockholms Stadion and Söderstadion). The results are however not sensitive to this assumption.

[15] I use OLS specifications. The results are also robust to the use of Probit or Poisson specifications.

in the end of the soccer seasons. Thus, since the season begins in April and ends in November, I will add nine indicator variables for the month in which the game took place. Another possibility is that there are stadium-specific trends, which I also will control for. The most convincing method is perhaps to reduce the sample size and focus on what happened in the short periods before and after the introduction of cameras at the different stadiums. Because the introduction of the cameras took place at different points in time, in a sufficiently short time interval trends cannot be important for the results. I therefore focus on this method in the subsequent regressions. I will first include games one year before and one year after the introduction of cameras. Each team plays 13 games in a year.[16] I then use a sample with six games before and six games after the introduction of cameras, which is followed by four games before and after. I finally include only two games before and after the introduction of cameras.

3 Results

Table 3 and Table 4 report the main results. Column 1 in Table 3 shows the results for the full sample (1999 to 2005) using only stadium fixed effects. The estimated effect is that games with cameras had 0.16 fewer incidents than games without cameras. This amounts to a 64 percent reduction compared to the average number of incidents without cameras, 0.26. In column 2 I add month fixed effects. The estimated effect and the standard error remains almost the same. In column 3 I add stadium specific linear trends. The coefficient is if anything increased and the significance remains the same. In Table 4, the sample size is reduced to focus on the effects in the time periods close to the introduction of the cameras. As expected, when the sample size is reduced, the precision in the estimates is also somewhat reduced. Importantly, the estimated effect of the variable "surveillance cameras" remains strikingly similar independently of the sample size. It fluctuates between 0.16 and 0.21. When using a larger sample size, a potential concern is that trends might bias the results. But since the coefficient

[16] For some stadiums, which are included in the regressions, there are less than 13 observations before the cameras were introduced.

remains almost identical, this does not seem to influence the results. The analysis therefore strongly suggests that the introduction of cameras reduced unruly behavior inside the stadiums.

As the number of incidents per game varies, I next check that not a few games with many incidents drive the results. The dependent variable now takes on 1 if there was one or more incidents in a game and 0 otherwise. Table 5 shows the results for the full sample. Column 1 shows that the number of games with incidents was 9 percent lower in games with cameras compared to games without cameras. This amounts to a 56-percent reduction since there, on average, were incidents in 16 percent of the games without cameras. The result is significant at the 5 percent level. Column 2 adds month-fixed effects and the estimated effect is the same. The significance remains high also when adding a stadium specific linear trend in Column 3. Table 6 shows that the estimated effect is similar when reducing the sample size. If anything, it is larger in the interval close to the introduction of the cameras. The results are significant in all specifications.

A concern with these OLS regressions is that because of potential serial correlation, they may underestimate the standard errors. As a robustness test, I therefore collapse the whole data set for each stadium into two observations, one before the introduction of cameras, and one after. Table 7 reports the results. The estimated effect is similar to before, -0.18, and the significance remains high.

It is possible that more spectators come to the soccer games due to the cameras if they feel safer, and this could change the total amount of unruly behavior. When the composition of the spectators change, a nicer atmosphere could for example arise, which would reduce the total number of incidents. To control for this, I use total number of incidents per game and per spectator (multiplied by 1000) as the dependent variable. The average for this dependent variable in games without cameras is 0.04. Column 1 in Table 8 shows that the use of cameras reduces the number of incidents per spectators by 75 percent. While the standard error is reduced somewhat when the sample size is reduced, the estimated effect is very similar.

A potential problem when studying surveillance cameras and crime, and police and crime in general, is that many interventions are often made at the same time. If the number of police officers is increased at the same time as cameras are installed, then only the joint effect can be estimated. On the other hand, less police may also be ordered in consequence to the installation of the cameras since the two types of law enforcements may be complements. In my contact with police sources, I have found no evidence that the number of police officers at the games was changed around the time when the surveillance cameras were installed. Nevertheless, I will perform a placebo treatment to study if the number of police officers at the games were different in the games with cameras compared to the games without.

The data on the number of police officers at the games is obtained from the Swedish National Police Force. On average, there were 19 police officers per game without cameras, and 25 police officers per game with cameras. Table 9 shows how the use of cameras is related to the number of police officers. The Table shows that there is no significant difference in the number of police officers before and after the installation of surveillance cameras. This reinforces the information from the police force, that the number of police officers working with unruly spectator behavior has not been related to the use of surveillance cameras. The reduction in unruly behavior can therefore fully be derived from the use of cameras.

In sum, all specifications point in the same way, namely that the introduction of surveillance cameras in the soccer stadiums had a very large deterrent impact on unruly supporter behavior.

4 Displacement Effects

A classical problem in the literature on crime is that when unruly behavior in one place is reduced, it may be displaced elsewhere. It is however difficult to address this issue empirically because crime may be displaced to so many locations. I have access to unique data on unruly behavior outside stadiums, which I will use to study this effect. If incidents are reduced inside the stadium, then the displacement theory predicts that

there would be more incidents outside the stadiums where cameras are not permitted. I first use information from the Swedish National Police Force on disturbances outside the stadiums. The police data captures fights or throwing of stones or bottles between supporters of different teams or against the police. The location is often immediately outside the stadium and sometimes in the town where the game is played. Importantly, the cameras are permitted inside the stadiums only and can therefore not affect this unruly behavior directly.

I also make use of self-reported data on organized violence reported by the violent hooligan organization "Firman Boys", which supports the club AIK[17]. It contains very detailed information on every larger hooligan incident in Sweden since 1992. Organized hooliganism takes place between two groups supporting different sports teams. They call each other in advance to set the stage for the fight. The fights typically take place on the game day. The individuals that engage in organized violence are, according to the head of the Sport Intelligence and Tactical Unit at the Swedish National Police Force, not necessarily the same individuals as those who throw missiles inside the stadiums. But to the extent they are the same individuals, it is possible that they displace their unruly behavior.

Table 10 shows the summary statistics for the two variables for the periods before and after the introduction of cameras. The dependent variable "Disorder outside the stadiums" takes on 1 if a disorder has occurred and 0 otherwise. There were on average 0.08 incidents before the introduction of cameras and 0.10 incidents per game after. Similarly, the variable "Organized hooliganism" takes on 1 if violence has occurred and 0 otherwise. There were 0.04 such incidents per game before the introduction of the cameras and 0.08 incidents after.

To study if there were any changes in unruly supporter behavior before and after cameras were introduced inside the stadiums I estimate equation 1 first with disorder outside stadiums as the dependent variable and then with organized hooliganism as the dependent variable. Table 11 shows the results when the dependent variable is disorder

[17] See www.sverigescenen.com.

outside the stadium. I first use the full sample and then a smaller sample containing games from one year before and one year after the introduction of cameras.[18] Column 1 shows that unruly behavior outside stadiums was not significantly different in games with cameras compared to in games without cameras. Column 2 confirms this when the smaller sample is used. Table 12 shows a similar pattern for hooligan violence. There was no significant difference in this type of violence in games with cameras compared to in games without cameras.[19] This result remains independently of the sample size used.

In sum, the data strongly suggests that the unruly behavior inside the stadiums that was reduced after the introduction of the cameras was not displaced to unruly supporter behavior outside the stadiums.

5 Concluding Remarks

The use of surveillance cameras has become a widespread method to reduce crime. However, intrusion upon privacy is a serious concern, and it is therefore important to carefully evaluate the effectiveness of the cameras. But the study of their deterrent effects is associated with a number of deep problems. Cameras are for example often adopted when crime is particularly severe, and together with other measures. The deterrent effects are furthermore blurred by the fact that cameras may affect the precautions taken by potential victims of crime, and also change the intensity by which they report crime. In addition, whenever cameras are used to detect crime, their deterrent effect is blurred.

This paper uses a natural experiment and unique data on unruly spectator behavior to address these concerns. I have argued that the timing of the introduction of the cameras was to a large extent exogenous to previous unruly behavior. There were no other policy interventions at the same time as the introduction of the cameras. In

[18] The police have not reported information from the year 2000. Since most observations would be missing, it is not sensible to use smaller windows around the time of the introduction of cameras.

[19] The results do not change if controlling for month fixed effects or linear trends.

addition, the referees filing the reports on unruly behavior did not take information from the cameras into account. This way I am able to isolate the effect of surveillance cameras on unruly spectator behavior.

The results show that there was much less unruly behavior inside stadiums when surveillance cameras were used compared to the games when they were not used. The various specifications reveal that the reduction was at least 65 percent. I have also shown that the unruly behavior inside stadiums was not displaced to unruly behavior outside stadiums or to organized hooligan violence.

The results of the analysis show that unruly spectators are deterred by surveillance cameras to a large extent, which suggests that, at least in soccer stadiums, the benefits of using cameras may dominate the costs in terms of intrusion upon privacy and management. It is tempting to extrapolate these findings to other types of unruly behavior, such as for example crimes on the streets, in subways, schools, shops, or in apartment complexes. My view is that this may well be at least in parts possible. However, additional empirical research, which addresses the particular problems mentioned above, would certainly help policy makers to evaluate whether the potential positive effects of the cameras dominate the costs.

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TABLE 1. THE INTRODUCTION OF SURVEILLANCE CAMERAS

Name of stadium	Home club	Applied	Accepted	Processing time (days)	Installed
Råsundastadion	AIK	August 17, 1987	October 12, 1987	57	1987
Nya Ullevi	Göteborg	January 25, 1989	January 25, 1991	730	1991
Olympia	Helsingborg	June 8, 1998	July 7, 1998	30	April 9, 1999
Gamla Ullevi	Örgryte, GAIS	November 7, 1999	February 7, 2000	90	July 4, 2000
Örjans Vall	Halmstad	June 20, 2000	July 20, 2000	31	July 13, 2000
Idrottsparken Sundsvall	Sundsvall	Feb 25, 2000	April 27, 2000	62	July 13, 2000
Ruddalens IP	Västra Frölunda	February 10, 2000	March 21, 2000	41	July 14, 2000
Rambergsvallen	Häcken	February 5, 2000	March 21, 2000	46	July 14, 2000
Parken	Norrköping	March 12, 2001	Maj 3, 2001	52	July 19, 2000
Eyravallen	Örebro	August 8, 2000	September 12, 2000	35	July 21, 2000
Stockholms Stadion	Djurgården	March 12, 2001	June 6, 2001	85	August 18, 2000
Ryavallen	Elfsborg	April 8, 2000	May 8, 2000	30	September 7, 2000
Vångavallen	Trelleborg	June 13, 2000	August 23, 2000	71	October 9, 2000
Söderstadion	Hammarby	February 22, 2000	April 11, 2001	413	October 13, 2000
Malmö Stadion	Malmö	January 18, 2001	March 09, 2001	49	April 4, 2001

TABLE 2. SUMMARY STATISTICS FOR INCIDENTS INSIDE STADIUMS

		Mean	St. Dev.	Min	Max	Obs
Before camera	Total number of incidents per game	0.26	0.72	0	4	211
	Games with incidents = 1	0.16	0.36	0	1	211
After camera	Total number of incidents per game	0.21	0.68	0	5	1062
	Games with incidents = 1	0.12	0.32	0	1	1062

TABLE 3. SURVEILLANCE CAMERAS AND UNRULY BEHAVIOR INSIDE STADIUMS

Dependent variable: Number of incidents with objects thrown onto field			
Sample	[1]	[2]	[3]
Surveillance cameras	-0.16**	-0.16**	-0.27**
	(0.07)	(0.08)	(0.11)
Month fixed effects	No	Yes	Yes
Linear stadium specific trend	No	No	Yes
R^2	0.11	0.11	0.13
Observations	1273	1273	1273

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The full data set (1999-2005) is used. The regressions include stadium fixed effects and the standard errors are clustered at the level of the stadiums.

TABLE 4. SURVEILLANCE CAMERAS AND UNRULY BEHAVIOR INSIDE STADIUMS, REDUCED SAMPLE SIZE

Dependent variable: Number of incidents with objects thrown onto field				
Sample	One year	Six rounds	Four rounds	Two rounds
Surveillance cameras	-0.21**	-0.16**	-0.20	-0.21
	(0.09)	(0.06)	(0.11)	(0.17)
R^2	0.09	0.12	0.19	0.3
Observations	354	165	112	56

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The regressions include stadium fixed effects and the standard errors are clustered at the level of the stadiums.

TABLE 5. SURVEILLANCE CAMERAS AND
UNRULY BEHAVIOR INSIDE STADIUMS (0,1)

Dependent variable: Games with objects thrown onto field (0,1)			
Sample	[1]	[2]	[3]
Surveillance cameras	-0.09**	-0.08**	-0.14**
	(0.04)	(0.04)	(0.08)
Month fixed effects	No	Yes	Yes
Linear stadium specific trend	No	No	Yes
R^2	0.09	0.09	0.13
Observations	1273	1273	1273

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The full data set (1999-2005) is used. The regressions include stadium fixed effects and the standard errors are clustered at the level of the stadiums.

TABLE 6. SURVEILLANCE CAMERAS AND UNRULY BEHAVIOR
INSIDE STADIUMS, REDUCED SAMPLE SIZE (0,1)

Dependent variable: Games with objects thrown onto field (0,1)				
Sample	One year	Six rounds	Four rounds	Two rounds
Surveillance cameras	-0.12**	-0.10**	-0.14**	-0.18*
	(0.05)	(0.04)	(0.05)	(0.09)
R^2	0.09	0.10	0.21	0.38
Observations	354	165	112	56

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The regressions include stadium fixed effects and the standard errors are clustered at the level of the stadiums.

TABLE 7. SURVEILLANCE CAMERAS AND UNRULY BEHAVIOR INSIDE THE STADIUMS, COLLAPSED DATA

Dependent variable: Number of incidents with objects thrown onto field	
Sample	[1]
Surveillance cameras	-0.18**
	(0.07)
R^2	0.73
Observations	36

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The regression includes stadium fixed effects and the standard errors are clustered at the level of the stadiums.

TABLE 8. SURVEILLANCE CAMERAS AND UNRULY BEHAVIOR BEHAVIOR PER SPECTATOR INSIDE STADIUMS

Dependent variable: Number of incidents with objects thrown onto field					
Sample	Full data set	One year	Six rounds	Four rounds	Two rounds
Surveillance cameras	-0.03**	-0.04**	-0.03*	-0.04**	-0.04
	(0.01)	(0.02)	(0.01)	(0.02)	(0.03)
R^2	0.05	0.08	0.08	0.18	0.28
Observations	1272	354	165	112	56

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The regressions include stadium fixed effects and the standard errors are clustered at the the level of the stadiums. The first regression includes month fixed effects and stadium specific linear trends.

TABLE 9. SURVEILLANCE CAMERAS AND
THE NUMBER OF POLICE OFFICERS

Dependent variable: Surveillance cameras (0,1)		
Sample	Full data set	One year
Number of police officers per game	0.14	-1.10
	(0.25)	(1.12)
R^2	0.28	0.26
Observations	785	153

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The regressions include stadium fixed effects and the standard errors are clustered at the level of the stadiums.

TABLE 10. SUMMARY STATISTICS FOR DISPLACEMENT EFFECT

		Mean	St.Dev.	Min	Max	Observations
Before camera	Disorder outside stadiums	0.08	0.27	0	1	116
	Organized hooliganism	0.04	0.20	0	1	212
After camera	Disorder outside stadiums	0.10	0.3	0	1	744
	Organized hooliganism	0.08	0.27	0	1	1061

TABLE 11. SURVEILLANCE CAMERAS AND
UNRULY BEHAVIOR OUTSIDE STADIUMS

Dependent variable: Disorder outside the stadium (0,1)		
Sample	Full data set	One year
Surveillance cameras	-0.01	-0.02
	(0.02)	(0.06)
R^2	0.10	0.09
Observations	860	169

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The regressions include stadium fixed effects and the standard errors are clustered at the level of the stadiums.

TABLE 12. SURVEILLANCE CAMERAS AND
ORGANIZED HOOLIGAN VIOLENCE

Dependent variable: Organized hooligan violence (0,1)					
Sample	Full data set	One year	Six rounds	Four rounds	Two rounds
Surveillance cameras	-0.01	-0.01	0.01	0.02	-0.04
	(0.01)	(0.02)	(0.03)	(0.03)	(0.06)
R^2	0.15	0.07	0.09	0.14	0.21
Observations	1273	354	165	112	56

Note: *** indicates signficance at the 1 percent level, ** at the 5 percent level and * at the 1 percent level. The regressions include stadium fixed effects and the standard errors are clustered at the level of the stadiums.

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