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THE EFFECT OF MEDIA EXPOSURE OF SUSPECTS ON SOLVING CRIME*

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In this study we investigate the effect of showing suspects of crime in a TV programme on the probability of apprehension. We exploit exogenous variation in the number of viewers of the crime programme induced by Champions League games broadcast on competing channels. The estimates show that an increase in the number of viewers of the TV programme increases the probability of solving crime, especially for criminal cases with many potential observers or cases for which it is easier to recognise suspects due to the quality of the images. The implication of our findings is that media can be effectively used for detection of crime suspects.

Internet and social media have created unlimited opportunities for police agencies to distribute media images of crime suspects. Individual citizens increasingly publish photographs of alleged offenders as well, as happened after the 2011 British riots.[1] This trend stems from a general belief that the public may be of assistance in solving crime (Innes, 1999; Reiner, 2007). However, showing crime suspects to the public may also have negative effects: it may lead to increased ‘naming and shaming’ and disproportional punishment of offenders, and inhibit offender reintegration (Karp, 1998; Kohm, 2009). Reality crime programmes may also contribute to public fear of crime (Fishman and Cavender, 1998; Altheide, 2002; Reiner, 2007). It is therefore important for law enforcement agencies to base the use of publicity on solid evidence of (the conditions for) its effectiveness.

Establishing the causal effect of public exposure of suspects on solving crime is difficult because criminal cases that are shown to the public might be different from criminal cases not shown to the public. Typically, cases broadcast by TV programmes will not be randomly selected but will be chosen based on various reasons related to attracting a high number of viewers. For instance, cases might be selected for broadcasting on television on the basis of their seriousness; of their ‘entertainment’ value; or of their potential to raise public support for the police effort to combat crime (Fishman and Cavender, 1998; Reiner, 2007). Miles (2005) suggests that the Federal

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[1] Both British police and individuals used Facebook to spread images of plunderers and rioters, for example through a page named ‘Catch a looter’ (http://www.facebook.com/media/set/?set=a.107217329378949.8460.107213176046031&type=1 and http://www.facebook.com/pages/Catch-a-Looter/217514101633224; accessed 28 March 2012).

Bureau of Investigation (FBI's) Ten Most Wanted List primarily signals the FBI's priorities rather than hastens the apprehension of criminals, because the FBI selects suspects whose apprehension is considered urgent rather than suspects who are most likely to be found with the aid of citizens. This selection of cases can bias estimates of the effect of public exposure based on a comparison of cases that have been broadcast with cases that have not been shown to the public. Similarly, criminal cases that attract a high number of viewers might be different from cases that attract a low number of viewers. Random variation in the number of viewers of cases can solve this selection problem and yield an unbiased estimate of the causal effect of public exposure of crime. To our knowledge the only empirical studies in this field focused on the effect of 'America's Most Wanted' (Miles, 2005) and the FBI's Ten Most Wanted List (Miles, 2008). The first of these studies compares the apprehension rates of suspects shown in 'America's Most Wanted' and suspects posted on the Internet. The estimates indicate large effects of exposure through the programme. However, the endogeneity issues mentioned above might be a concern for these estimates.

In this study we exploit a natural experiment that induced exogenous variation in the number of viewers of a crime programme on Dutch TV. The number of viewers drops on average 20% on evenings when competing channels broadcast Champions League football. As a result, criminal cases that are broadcast on Champions League evenings attract substantially fewer viewers than criminal cases broadcast on other evenings. We use this variation to establish the causal effect of media exposure on solving crime. Our identification strategy is similar in spirit to the work by Eisensee and Strömberg (2007) which looks at the impact of news coverage on foreign aid. They exploit the crowding out of news coverage by other newsworthy events, such as the Olympic Games, to establish the causal effect of mass media on government response. We study the effect of an exogenous change in the number of viewers of the programme on the probability of solving criminal cases. In assessing the effect of a change in the number of viewers of the programme it is important to take into account that criminal cases might also be solved by other investigative methods of the police. For instance, it is possible that an increase in the number of viewers of the programme causes an increase in the number of cases solved by the programme but that these additionally solved cases would have been solved by the police anyway. In that case the total number of criminal cases solved by the police would remain unaffected and the programme would only induce a substitution effect. The data used in this article allow us to investigate both the 'gross' effectiveness of the programme as the 'net' effectiveness of the programme, which is the effect that is obtained after taking the potential substitution effect into account. Both effects are relevant for public policy. The 'net' effect shows whether more crime can be solved by exploiting public exposure of suspects. The 'gross' effect and the substitution effect can be used for comparisons with other police investigative methods, and may facilitate decisions on the allocation of the budget for crime investigations.

Our estimates suggest that public exposure matters for solving crime, especially for cases with many potential observers, for cases with high-quality images, or cases with more attention/broadcasting time in the programme. A decrease of the number of viewers by 100,000, approximately 10% of the total number of viewers, decreases the probability that a case will be solved by 3–9 percentage points relative to a mean of 26–

29%, depending on the type of case. These estimates should be interpreted as the 'gross' effect of the programme. We also find evidence for substitution effects. The 'net effect' of a change in the number of viewers of the programme by 100,000 is estimated at 1–8 percentage points relative to a mean of 38%. The TV programme is most effective in solving cases with many potential observers, high-quality images or more broadcasting time and solves cases that would not have been solved by other investigative methods of the police.

Our article contributes to the literature on the economics of crime by providing empirical evidence based on a quasi-experimental design about the effect of media-exposure on solving crime. The existing literature about the impact of media on solving crime is very limited (Miles, 2005, 2008). A recent paper also investigates the effect of internet on committing sex crimes (Bhuller *et al.*, 2013). Our article also contributes to the literature that investigates the effects of media on social and political outcomes. For instance, this literature has investigated the role of newspapers and radio on the decisions of politicians (Besley and Burgess, 2002; Strömberg, 2004), the effects of the media on voters' behaviour (Gentzkow, 2006; Della Vigna and Kaplan, 2007), the effects of television on children's school performance (Gentzkow and Shapiro, 2008), the impact of cable TV on female autonomy, school enrolment and fertility (Jensen and Oster, 2009) and the effect of soap operas on fertility (La Ferrara *et al.*, 2012). Moreover, our article contributes to the criminological literature on the relationship between media and crime. This literature has investigated the effect of the media on public fear of crime (Fishman and Cavender, 1998; Altheide, 2002; Reiner, 2007), the direct effect of the media on crime through copycat behaviour or glorification of criminals, and the stigmatising effect of 'naming and shaming' convicted offenders in the media (Fishman and Cavender, 1998; Karp, 1998; Altheide, 2002; Reiner, 2007; Kohm, 2009). This article adds to that literature by investigating a potentially more beneficial effect of media; the impact of media on solving crime.

The remainder of this article is organised as follows: The next Section explains our empirical strategy. Section 2 describes the data. The main estimation results are shown in Section 3. The robustness of the findings is investigated in Section 4. In Section 5 we address the external validity of our findings. We draw our conclusions in Section 6.

1. Empirical Strategy

This article investigates whether more public exposure indicated by a higher number of viewers increases the probability that a criminal case will be solved. The criminal cases analysed in this study have been broadcast by the Dutch TV programme 'Wanted' (in Dutch, 'Opsporing Verzocht'). The most straightforward approach for estimating the effect of public exposure would be to regress the dependent variable – solving the case or not – on the number of viewers of a criminal case and include various controls for observed differences between criminal cases. Hence, we would estimate the following equation:

$$Y_i = \beta_0 + \beta_1 V_i + \boldsymbol{\beta}_2 \boldsymbol{X_i} + \varepsilon_i, \tag{1}$$

where Y is a dummy for solving criminal case i, V is the number of viewers and $\boldsymbol{X}$ is a vector of control variables, ε is the error term. This would give an unbiased estimate of the effect of the number of viewers on solving the case if the number of viewers were unrelated with unobserved factors of the criminal cases. Hence, we would assume that, conditional on the observed characteristics, the number of viewers of a case would be random. However, if some cases attracted more viewers because of unobserved factors that are correlated with the probability of solving the case, the estimates will suffer from omitted variable bias. We address this problem by exploiting exogenous variation in the number of viewers of the programme.

The number of people that watch the programme drops sharply when competing channels broadcast Champions League (CL) soccer games. Figure 1 shows the number of viewers by broadcasting evening in 2009 and 2010, and distinguishes regular and football evenings.

On regular evenings, 'Wanted' is watched by approximately 1.2 million people, on CL evenings this is less than 1 million. The difference is approximately 250,000 viewers. We exploit this variation in an instrumental variable approach. In the first stage equation we regress the number of viewers on a dummy variable for the broadcasting of Champions League games on the same evening as the programme 'Wanted'(CL) and include a vector of control variables. The predicted number of viewers is used in the second stage equation:

$$V_i = \gamma_0 + \gamma_1 CL + \boldsymbol{\gamma}_2 \boldsymbol{X}_i + \varepsilon_i, \tag{2}$$

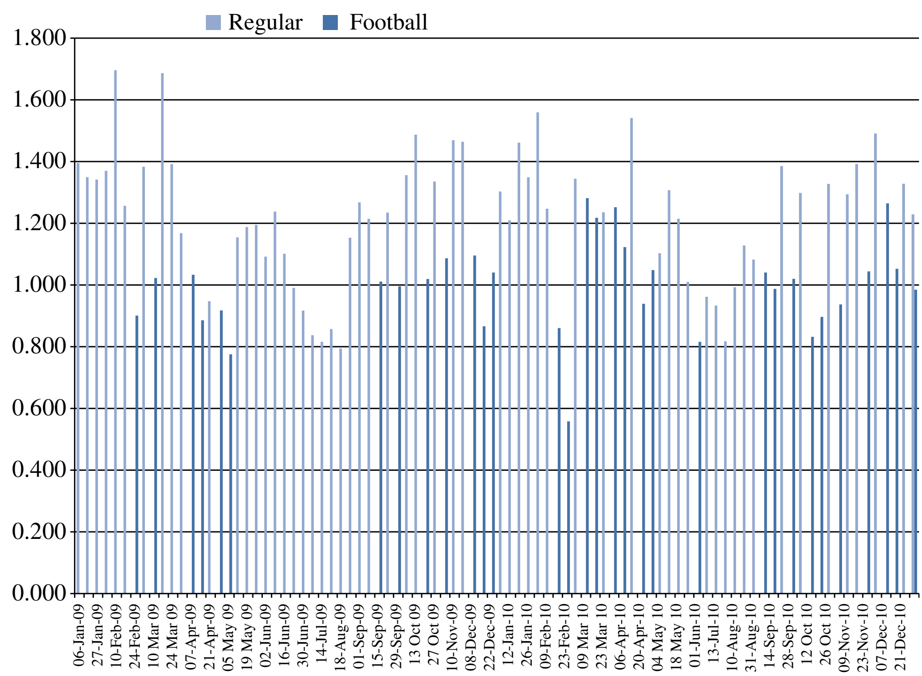

Fig. 1. *Number of Viewers (Million) by Type of Broadcasting Evening 2009–10*

$$Y_i = \beta_0 + \beta_1 \hat{V}_i + \boldsymbol{\beta}_2 \boldsymbol{X_i} + \eta_i. \tag{3}$$

The IV-estimate of the parameter β_1 can be interpreted as the causal effect of the number of viewers on the probability of solving the case. The main assumption in exploiting this variation for estimating the causal effect of the number of viewers on solving crime is that the instrument is not correlated with the error term of the second stage equation. This means that cases broadcast on CL evenings should not be different from cases broadcast on regular evenings. The cases broadcast on the two types of evenings might be different because the selection of cases might be adapted to the preferences of the expected audience on those evenings. CL evenings might also differ from regular evenings because there are times of the year in which there are no CL games and there are other breaks for Fédération Internationale de Football Association (FIFA) official matches of national teams or other competitions. Seasonal effects might also bias the estimation, for example, the audience might differ between summer and winter.

We investigate the issue of the similarity of the cases on the two types of evenings in three ways. First, our identification strategy assumes that the production of the programme and the selection of cases for the programme are constant over time. We directly asked the programme producers of the broadcasting company and the national police production team responsible for collecting cases and providing content to the programme whether they selected the cases for the programme differently on a Champion's League evening. Both the programme producers and the police production team reported that they were not able to alter the selection of cases in the programme on Champion's League nights, due to the limited stream of cases local police units offer to the national police production team. 'Filling' the programme is a weekly challenge for the police team that collects and coordinates cases and monitors the content of the programme, because not all criminal cases are suitable for broadcasting and also because local police units are somewhat reluctant to hand over 'their' cases to the media (Huey and Broll, 2011). Hence, practical reasons seem to prevent the selection of cases for specific evenings. Second, we investigated differences in covariates between the two types of evenings (see next Section). These analyses show that the cases from the two types of evenings are quite similar but that there are also small differences. Third, we tried to assess the importance of the small differences in all the covariates by constructing a measure for the difficulty of solving a case. We estimated a probit model for the probability of solving the cases based on all covariates using the sample of cases broadcast on regular evenings. For each case in the total sample we predicted the probability that the case would be solved. For the cases broadcast on Champions League evenings this prediction can be interpreted as the probability that these cases would have been solved if they had been broadcast on regular evenings. Next, we calculated the average probability for all cases broadcast on regular evenings and for all cases broadcast on CL evenings. The difference between the two types of evenings captures the joint effect of all the differences in covariates. We have found that cases broadcast on CL evenings on average have a likelihood of being solved by the programme of 29%. For cases broadcast on regular evenings this is 26%. Hence, cases broadcast on regular evenings (with more viewers) seem somewhat more difficult to solve than cases broadcast on football evenings. Controlling for these differences in the estimation improves the comparability of the two evenings and, therefore, also improves the independence of our instrument. Hence, including these controls is important for achieving conditional independence of our instrument. In addition, this result is indicative for the type of bias that might result from the small differences in covariates. Not including these covariates would yield a downward bias for the estimates because the cases from regular evenings have characteristics that make them somewhat more difficult to solve than cases from CL evenings; the IV-estimate is based on a comparison of the probability of solving cases on the two types of evenings.

The difference in the timing of the CL evenings and regular evenings might be important if some cases are harder to solve during some periods of the year. We address this issue by including quarter of the year as control in the main models. In addition, we perform various sensitivity analyses with respect to the summer period in which there are no CL games and by estimating specifications that use month of the year instead of quarter of the year.

1.1. *Heterogeneous Effects of Public Exposure*

To establish the causality of public exposure on the probability of solving criminal cases further we exploit the heterogeneity within the sample of cases. It seems likely that the effects of public exposure on solving criminal cases will also depend on characteristics of the case and the type of information shown to the public. For instance, public exposure is expected to generate more tips for the police if more people have witnessed the crime. If nobody has observed the crime we do not expect an effect of public exposure. When a larger number of witnesses exists, it becomes more likely that a witness with information about the case will watch the programme and, as a result, will give a tip to the police. Therefore, those crimes that have been witnessed by a large number of people are more likely to benefit from an increase in the number of viewers. It seems also relevant to note that the programme has a large audience, on average 1.2 million people watch the weekly programme, that is 7.5% of the total Dutch population including children. An increase in the number of viewers will probably not matter for cases with low-quality images where it is difficult to recognise suspects. For cases with high-quality images we expect that more viewers will have a larger effect on the probability of solving the crime. In our data we can distinguish between cases with many potential observers and cases with few potential observers and between cases with high-quality images and cases with low-quality images. If the programme has a causal effect on the apprehension of suspects we expect a larger effect for cases with many potential observers and for cases with high-quality images. Moreover, we expect larger effects for cases that are given more attention in the programme. We have information about the duration of the broadcasting time of a specific case in the programme. Hence, we can estimate the effect of the number of viewers for samples of cases that received more broadcasting time. Approximately 45% of the cases in our sample concerned a dramatised reconstruction of the crime. This reconstruction aims to show the crime location and to create sympathy for the victim, in order to increase the probability of remembering and recognising relevant information and the willingness to report. Remarkably, these reconstructions are also tactically used by the police to create pressure on suspects in cases in which the police already has suspects under observation. For example, suspects' reactions to the programme on wired telephone conversations might reveal their involvement in the crime (Innes, 1999) – wiretapping suspects is a very common police practice in the Netherlands. Finally, we exploit differences in the difficulties of solving the case. Based on the full set of covariates we have created a group of difficult cases and a group of easy cases (Section 3 explains the classification of the cases). If the programme has a causal effect on the probability of solving the case we expect a larger effect of the number of viewers for cases that can be solved relatively easily than for cases that are relatively difficult to solve.

1.2. *The 'Gross' and 'Net' Effect of the Programme*

For all criminal cases in our data we have obtained information whether a case has been solved (T), and whether the case has been solved by the programme (P) or by other investigative strategies of the police (O) (the next Section provides details about these measures). Hence, the total number of cases solved is: $T = P + O$. An increase in the number of viewers of the programme can have an effect on P. For instance, if more viewers provide more tips to the policy this might lead to a positive effect on P. The effect of an increase in the number of viewers on the total number of cases solved by the police (T) will be equal to the effect on P if there is no change in the number of cases solved by other investigative strategies of the police (O). However, the programme might solve cases that would have been solved by the police anyway. In that case, an increase in P will coincide with a decrease in O because of substitution effects, and the effect on T will be smaller than the effect on P. Our data allow us to investigate both the 'gross' effect and the 'net' effect of the programme. We estimate the effect of an increase of the number of viewers of the programme on both outcomes:

(*i*) case solved thanks to also the programme (P),
(*ii*) case solved by the programme or by other types of criminal investigations (T).

The 'gross' effect is the effect on the number of cases solved thanks to the programme (P). The 'net' effect is the effect on the total number of cases solved by the police (T). The differences between the two effects can be interpreted as substitution effects.

2. Data

The criminal cases analysed in this study have been broadcast by the Dutch TV programme 'Wanted' ('Opsporing Verzocht').[2] The programme is broadcast on one of the Dutch public channels on Tuesday evenings during prime time and repeated the next morning. The programme's average length is 40 minutes. 'Wanted' is entirely devoted to solving crime cases and shows closed-circuit TV (CCTV) footage of suspects;

[2] The programme's website www.avro.nl/tv/programmas_a-z/opsporing_verzocht/ gives access to selected fragments.

dramatised reconstructions of cases; interviews with victims; family members and police; as well as composition drawings of suspects. Viewers who recognise suspects are asked to contact the police either anonymously or non-anonymously. The programme is produced by the largest Dutch public broadcasting organisation, AVRO, in cooperation with and entirely under the responsibility of the Dutch criminal justice authorities. According to Dutch law, the right to publish images of crime suspects is reserved for criminal justice authorities.

The data that are used come from three sources. We obtained 89 'Wanted' episodes, dating from 2009 and 2010, on DVD. Three research assistants watched the episodes and coded all relevant cases using a checklist of variables on crime.[3] To improve the inter-observer reliability for those checklist items that required interpretation, such as quality of images, the coding of several episodes was compared and discussed beforehand and re-coded in cases of doubt after internal discussion on the fragment in question.

2.1. *The Outcome Variable*

The dependent variable in this study is the probability of solving a criminal case. From the national police we obtained information about apprehensions of suspects in all broadcasted cases. We use this information as our main outcome variable, although we recognise that apprehension of a suspect might not be the same as actually solving the case because a suspect may prove to be innocent. We obtained additional information about how the case was solved:

(*i*) as a result of the programme;
(*ii*) partly as a result of the programme; and
(*iii*) case solved but not as a result of the programme (e.g. by detective work).

The coding was done by the national police team responsible for the programme and based on information collected by this team from the local police chiefs that investigated the specific cases. The national police team collects this information through telephone interviews with all local police chiefs who have provided cases to the programme, allowing sufficient time for cases to be solved. We are aware that information of the police may not be entirely reliable, but since no other records are systematically kept by the police, this was our only data source. The police team has indicated that they discuss the correct coding with the police chiefs during the telephone conversation. Coding (1) means that the case was solved through a tip during or shortly after the programme (in which the informant mentions that he/she reacts to the programme). Coding (2) means a combination of the broadcast and additional investigations of the police. For instance, in some cases suspects report themselves or the police wiretap suspects before and/or after the programme and observe how they or their environment reacts to the programme. For some cases, this may mean that the broadcast, not a tip from the audience, leads to the apprehension of a suspect. In other cases, a tip from the audience is a clue to further investigation,

[3] The checklist used for coding all the variables is shown in the online Appendix.

which eventually leads to the apprehension of a suspect. Sometimes items from the programme also get attention in regional programmes which might help in solving the case. Coding (3) are cases whose solution is unrelated to the programme, for instance, cases that are solved by DNA investigations or apprehension of suspects during road controls. From this information we constructed two dependent variables. Our first dependent variable is a dummy that has value 1 in case of (1) or (2) and value 0 otherwise, which includes (3) and cases that are not solved. We use this variable to measure the 'gross' effect of the programme, which is the effect of an increase in the number of viewers on the probability that a case is solved as a result of (also) the programme. Our second dependent variable is a dummy that has value 1 in case of (1), (2) and (3) and value 0 otherwise. We use this dependent variables to measure the 'net effect' of the programme on solving crime.

2.2. *The Independent Variable and the Instrument*

The main independent variable in this study is the number of viewers of the programme. We obtained the number of viewers per minute of the programme from the Dutch TV audience survey organisation (NOS/KLO). By using information about the time spent in the programme on a specific case we could link the number of viewers per minute to every criminal case of the episodes broadcast in 2009 and 2010. If a case had a duration of more than one minute we used the maximum number of viewers for these minutes as this indicates the total exposure of the case. In Section 4 we investigate the robustness of this measure for the number of viewers by using the average number of viewers per case or the average number of viewers per evening. In addition, our data also include the number of viewers of the repeated broadcast of the programme the morning after the initial broadcast. We test the robustness of our findings by constructing the total number of viewers (Section 4). Our instrument is a dummy which has value 1 if competing channels broadcast Champions League games or other major football events on this evening and which has value 0 for regular evenings. We only include Champions League games played in the main tournament. Pre-tournament games played in the summer period (June, July and August) are not included because they do not attract many viewers and are often not broadcast. In addition, we included four evenings on which major football events competed with the TV programme 'Wanted'.[4] These evenings had a similar impact on the number of viewers as the Champions League games. Including these four additional evenings increases the exogenous shock on the number of viewers. In Section 4 we replicate the analysis with an instrument that is only based on the Champions League games.

2.3. *Other Variables*

We can use a large set of covariates in this study, collected by three research assistants who watched the programmes from 2009 and 2010. Information was collected about the type, location and time of crime, number of perpetrators, victims and witnesses. In

[4] This includes two games of the Dutch national team and two evenings on which the major sport prizes were awarded.

addition, various features of the way the case has been shown to the public have been coded, for instance the time spent on the case and the type and quality of the images shown to the public.

Cases about missing persons, unknown dead persons, found objects, cases without information about suspects and cold cases have not been coded. These cases were excluded because they do not or only very indirectly relate to a suspected person. In addition, we do not include two atypical cases (the beach riots in Hoek van Holland and a large street riot in The Hague) because they had many offenders, which complicate the use of the dependent variable. In total, information has been collected of 89 episodes including 556 criminal cases.

Table 1 shows sample statistics by type of evening for the main variables and the main samples used in this study: the total sample of cases, the sample with cases not occurring during night time (those outside the midnight – 8 a.m. range) and the sample of cases with average or high-quality images. The second sample contains cases that are likely to have more potential observers. The third sample contains cases with a better quality of the images. The top panel shows the main dependent and independent variables. The number of viewers of the programme 'Wanted' is approximately 250,000 higher on regular evenings than on evenings when competing channels broadcast Champions League games. We also observe that on regular evenings 26% of the cases have been solved as a result of the programme and on football evenings 22% of the cases have been solved. The difference between the two types of evenings is larger when we look at the two specific samples of cases. First, if we focus on cases with more potential observers, cases that did not occur during night time (those outside the midnight – 8 a.m. range), we observe a difference of 8.8% points. For cases between 5 a.m. and midnight this difference is 7.3% points. The right columns of Table 1 show that this difference is 11.7% points for the sample of cases with average or high-quality images. Hence, these sample statistics show that more cases have been solved as a result of the programme on evenings with more viewers. In the middle and bottom panel of Table 1 the statistics for the covariates are shown. A comparison of the covariates might reveal whether cases shown on regular evenings are similar to the cases shown on football evenings. For nearly all covariates the differences between the two types of evenings are statistically insignificant. The type of offences on both evenings is very similar. We only find a statistically significant difference in all three samples with respect to the location of the offence. Offences in private houses or firms are more likely to be broadcast on football evenings; offences in public buildings are more likely to be broadcast on regular evenings. This difference seems coincidental since the programme editors do not purposefully select cases on this criterion. The probability of solving offences in private houses or firms is 25%; for offences in public buildings this is 24%. Hence, the non-randomness in the location of offences seems not to be important for the difficulty of solving cases on specific evenings. In the next Section we further assess the importance of this non-randomness for our estimation results by comparing the estimates of models that control for the location of the offence with the estimates of models that do not include this control. The other differences between the two types of evenings (days since offence, number of witnesses and reward offered) are not consistently found for all samples.

Table 1

Sample Statistics by Type of Broadcasting Evening for Three Samples of Cases

Sample	All cases			8 a.m. – midnight			Average or high-quality image		
Type of evening	Regular	Football	p	Regular	Football	p	Regular	Football	p
Viewers (million)	1.222	0.987	***	1.217	0.984	***	1.203	0.976	***
Solved thanks to programme (%)	26.0	22.0		28.5	19.7	**	29.3	17.6	*
Solved by programme or otherwise (%)	37.6	37.5		40.4	35.0		38.2	29.7	
Log Days since offence	4.0	3.8	*	4.0	3.8	*	4.1	4.1	
Duration of case (seconds)	238	232		229	226		195	201	
Item number in programme	5.3	5.0		5.2	4.8		5.2	4.9	
Type of offence									
Violent offence	9.0	14.9		9.4	11.7		6.3	12.2	
Murder	16.8	17.9		16.0	19.7		3.7	6.8	
Assault	40.2	36.9		42.6	36.5		49.7	46.0	
Theft	15.2	11.9		16.3	13.9		22.5	18.9	
Other	18.8	18.5		15.7	18.3		17.8	16.2	
No. perpetrators	1.6	1.5		1.6	1.4		1.9	1.8	
No. victims	1.2	1.1		1.2	1.0		1.1	1.0	
No. witnesses	0.7	0.6		0.7	0.5	*	0.5	0.4	
Reward offered (%)	9.3	9.5		8.8	8.0		1.5	6.8	**
Reconstruction offence (%)	43.8	44.6		41.7	43.0		31.4	35.1	
Face of suspect shown (%)	44.8	44.0		49.2	48.9		80.6	82.4	
High-quality image (%)	32.6	29.8		36.5	34.3		66.0	67.6	
Harm/injuries shown (%)	43.0	39.9		39.8	38.7		33.0	28.4	
Hour of offence	12.6	11.6		15.3	14.3		13.8	12.9	
Location of offence (%)			***			***			***
Private house/firm	24.7	37.5		23.8	38.7		14.1	37.8	
Public building	45.4	36.3		46.4	35.0		63.9	46.0	
Public space	20.4	14.3		19.8	13.1		16.8	6.8	
Other	9.5	11.9		10.0	13.1		5.2	9.5	
Police region (%)									
West (Randstad)	22.9	24.4		23.2	24.1		19.9	28.4	
Rest of the country	62.4	61.9		61.1	62.0		66.5	59.5	
Other	14.7	13.7		15.7	13.9		13.6	12.2	
Previously broadcast in 'Wanted' (%)	10.5	8.3		10.7	7.3		5.2	6.8	
No. cases	388	168		319	137		191	74	
No. evenings	60	29		60	29		56	26	

Notes. The sample '8 a.m. – midnight' includes only cases committed during this time of the day, the sample 'Average or high-quality image' includes only cases with average or high-quality images. *, **, ***Statistically significant at the 10%, 5%, 1% level.

3. Main Estimation Results

This Section shows the main estimation results of the effect of the number of viewers on the probability of solving the case. We use two dependent variables:

(*i*) case solved thanks to the programme; and
(*ii*) case solved by the programme or by other instruments of the police.

The estimated effects on the first variable show the 'gross' effect of the programme. The estimated effects on the second variable show the 'net' effect of the programme, which is the change in solving crime by the police. The difference between the 'gross' effect and the 'net' effect can be interpreted as the substitution effect of the programme. We estimate the effect for the total sample of cases and for specific samples of cases with more potential observers or cases with average or high-quality images. If the programme has a causal effect on the probability of solving cases we expect a larger effect for these specific samples. The main estimation results are shown in Tables 2 and 3.

Table 2 shows OLS-estimates for both dependent variables. Table 3 shows the first and second stage estimates of the IV models. The estimates for the sample of all cases are shown in column (1) and (2), for the sample of cases that happened between early morning and midnight in column (3)–(6) and for the cases with average or high-quality images in column (7) and (8). The odd numbered columns include basic controls: type of offence, timing (hour) of the offence, days since offence, year and quarter of the year. The even numbered columns include the full set of controls (see note below in Table 2). The standard errors have been adjusted for clustering at the evening level.

The OLS-estimates in Table 2 do not show a clear pattern for the effect of the number of viewers on both dependent variables. Nearly all point estimates are positive but statistically insignificant. These estimates are based on the assumption that there are no unobserved differences between cases that are both related to the number of viewers and to the probability of solving the case. As it seems not likely that the number of viewers of a specific case will be random we further investigate the relationship between the number of viewers and the probability of solving the case by using an instrumental variable approach.

Table 3 shows the IV estimates for both dependent variables. The first stage results show that a Champions League evening reduces the number of viewers with 200,000 to

Table 2

OLS Estimates of the Effect of the Number of Viewers on the Probability of Solving the Case

	All cases		5 a.m. – midnight		8 a.m. – midnight		Average or high-quality images	
Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel (a): OLS-estimation								
Dependent variable: case solved by the TV programme								
Viewers (× 100,000)	0.004	0.011	0.004	0.011	0.006	0.016	−0.002	0.002
	(0.008)	(0.009)	(0.008)	(0.009)	(0.009)	(0.010)	(0.012)	(0.016)
Panel (b): OLS-estimation								
Dependent variable: cases solved (by TV programme or otherwise)								
Viewers (× 100,000)	−0.002	0.000	−0.001	0.000	0.003	0.005	−0.005	0.004
	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)	(0.012)	(0.012)	(0.016)
No. cases	556	556	491	491	456	456	265	265
Full set of controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes. All columns control for year, quarter of the year, days since offence, type of offence and timing (hour) of offence. Columns (2), (4), (6) and (8) also control for: location of offence, police region, no. perpetrators, no. victims, no. witnesses, reward offered, previously broadcast on 'Wanted', item number in the programme, face of suspect shown, quality of images, harm or injuries mentioned, coding assistant. The sample '5 (8) a.m. – midnight' includes only cases committed during this time of the day, the sample 'Average or high-quality image' includes only cases with average or high-quality images. ***, **, *Statistically significant at the 1%, 5%, or 10% level; Standard errors are clustered by evening.

Table 3

IV Estimates of the Effect of the Number of Viewers on the Probability of Solving the Case

	All cases		5 a.m. – midnight		8 a.m. – midnight		Average or high-quality images	
Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel (a): First stage								
Dependent variable: number of viewers (× 100,000)								
CL on competing channel	−2.376	−2.265	−2.413	−2.323	−2.410	−2.296	−2.342	−1.957
	(0.411)***	(0.390)***	(0.426)***	(0.392)***	(0.415)***	(0.379)***	(0.582)***	(0.507)***
F-value excluded instrument	33.4	33.7	32.1	35.1	33.7	36.7	16.2	14.9
Panel (b): Second stage								
Dependent variable: case solved by TV programme								
Viewers (× 100,000)	0.029	0.038	0.040	0.050	0.046	0.064	0.060	0.092
	(0.015)*	(0.017)**	(0.018)**	(0.020)**	(0.020)**	(0.022)***	(0.030)**	(0.045)**
Mean of dependent variable	26.0	26.0	27.0	27.0	28.5	28.5	29.3	29.3
Dependent variable: case solved (by TV programme or otherwise)								
Viewers (× 100,000)	0.014	0.025	0.030	0.042	0.034	0.054	0.040	0.082
	(0.021)	(0.021)	(0.023)	(0.023)*	(0.025)	(0.026)**	(0.030)	(0.043)*
Mean of dependent variable	37.6	37.6	39.2	39.2	40.4	40.4	38.2	38.2
No. cases	556	556	491	491	456	456	265	265
Full set of controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes. All columns control for year, quarter of the year, days since offence, type of offence and timing (hour) of offence. Column (2), (4), (6) and (8) also control for: location of offence, police region, no. perpetrators, no. victims, no. witnesses, reward offered, previously broadcast on 'Wanted', item number in the programme, face of suspect shown, quality of images, harm or injuries mentioned, coding assistant. The sample '5 (8) a.m. – midnight' includes only cases committed during this time of the day, the sample 'Average or high-quality image' includes only cases with average or high-quality images. ***, **, *Statistically significant at the 1%, 5%, or 10% level; Standard errors are clustered by evening.

240,000. The F-statistic of the excluded instrument depends on the sample and specification but is at least 14.9 and in most models much higher. As such, there is no concern for a weak instrument problem. The second stage estimates of the 'gross' effectiveness of the programme (panel (*b*)) show that an increase in the number of viewers increases the probability of solving a case. For the sample of all cases we find that a reduction of 100,000 viewers decreases the probability of solving a case by 2.9% points relative to a mean of 26% (column 1). Including covariates increases the estimated effect, which is in line with our previous discussion about the similarity of the covariates for the two types of evenings (Section 2). We expect that cases that occurred during night time (after midnight and before 5 a.m. or after midnight and before 8 a.m.) when most people will be asleep will have fewer potential observers than other cases. These cases are excluded from the estimation samples used for columns (3)–(6). The estimated effects increase when we focus on these samples of cases. Again we observe that including more controls increases the estimated effect of the number of viewers. The quality of images is important for recognising suspects or relevant characteristics of the offence. For approximately 50% of all cases there are no images or low-quality images. We excluded these cases from the estimation sample used for columns (7) and (8). This increases the estimated effect of a decrease of 100,000 viewers on the probability of solving cases to 6–9% points relative to a mean of 29%. In the previous Section we found that the location of the offence differed slightly between the two types of evenings. Controlling for the location of the offence slightly increases the size of the estimated effect. This suggests that the non-randomness in the location of the offences in our data does not bias our estimation results.

The bottom panel of Table 3 shows the estimated effects of a change in the number of viewers of the programme on the total number of cases solved. We observe that the 'net' effectiveness of the programme is smaller than the 'gross' effectiveness of the programme which implies that there are substitution effects. However, the estimates in columns (4), (6) and (8) show that an increase in the number of viewers also has a statistically significant 'net' effect on solving these types of cases. This means that the TV programme solves cases that would probably not have been solved by other detection methods of the police.

3.1. *Exposure in the Programme and 'Easy or Tough' Cases*

We further investigated whether the effect of a change in the number of viewers is larger for cases with more exposure in the programme. Table 4 shows the IV estimates of the 'gross' and 'net' effectiveness of the programme for samples of cases with a duration of at least 120 or 180 seconds and for cases for which a dramatised reconstruction of the offence has been shown (columns 1–3).

The estimates in Table 4 show that a decrease in the number of viewers has a negative and statistically significant effect on both outcomes. We also observe that the 'net' effectiveness of the programme is slightly larger than the 'gross' effectiveness. This means that for these cases substitution effects are not important. Moreover, the small increase in the estimated 'net' effects suggests that the number of viewers can also have a positive contribution to the effectiveness of other investigative methods of the police. This might work through increased media attention that puts additional

Table 4

IV Estimates of the Effect of the Number of Viewers on the Probability of Solving Cases with more Exposure and for 'Tough' or 'Easy' Cases

	> 120 seconds	> 180 seconds	Reconstruction	Tough cases	Easy cases
Sample	(1)	(2)	(3)	(4)	(5)
Panel (a): First stage					
Dependent variable: number of viewers					
CL on competing channel	−2.253	−2.355	−2.193	−1.773	−2.412
	(0.394)***	(0.414)***	(0.391)***	(0.416)***	(0.459)***
Panel (b): Second stage					
Dependent variable: case solved by the TV programme					
Viewers (× 100,000)	0.043	0.037	0.061	−0.019	0.096
	(0.022)*	(0.022)*	(0.024)**	(0.021)	(0.031)***
Mean of dependent variable	27.3	27.6	24.7	9.6	43.5
Dependent variable: case solved (by the TV programme or otherwise)					
Viewers (× 100,000)	0.055	0.054	0.078	−0.079	0.067
	(0.030)*	(0.028)*	(0.033)**	(0.051)	(0.033)**
Mean of dependent variable	42.0	41.9	39.4	20.2	56.8
No. cases	343	302	245	278	278

Notes. All models use the full set of controls as in column (2) of Table 2. The sample '> 120 (180) seconds' excludes cases with a duration in the programme of less than 120 (180) seconds, the sample 'reconstruction' consists of cases for which a dramatised reconstruction of the crime has been broadcasted. Easy (tough) cases have above (below) median probability of being solved based on all observed covariates of cases of regular evenings.

pressure on police teams to solve the case. This might also result from misreporting by the police, claiming that other investigative instruments and not the programme solved the criminal case. The estimated effects for these cases with more exposure in the programme are larger than the estimates for all cases shown in columns (1) and (2) of Table 4, which suggests that exposure matters for the probability of solving a case.

In our data the probability that a case has been solved (as a result of the programme) is on average 38 (25)%. However, there can be substantial variation between cases in the probability of being solved. Some cases will be easy to solve, for instance due to clear CCTV images of suspects. Other cases can be very difficult to solve. If the programme has a causal effect on the probability of solving cases we expect that a major shock in the number of viewers will have a larger effect for cases with above average probability of being solved. We investigated this expectation by comparing IV-estimates for cases that we qualify as 'easy' or as 'tough'. For determining the qualification of cases we estimated a probit model for the probability of being solved as a result of the programme using all covariates for the sample of cases broadcast on regular evenings. We used these estimates to predict the probability that a case will be solved. Cases with a predicted probability above the median of the predicted values were classified as 'easy', cases with a predicted probability below the median were classified as 'tough'. Next, we repeated the IV estimation for the samples of 'easy' and 'tough' cases. The last two columns of Table 4 show the estimates for the 'gross' and 'net' effectiveness of the programme for 'easy' and 'tough' cases. We find a dramatic difference in the estimated effect of a decrease in the number of viewers for both outcomes. For the sample of tough cases we find an insignificant effect of the number of viewers on both outcomes. It could be argued that the variation in the sample of tough cases might be too small for detecting effects as there might be great uncertainty attached to the estimated coefficient. However, the effect for the first outcome that uses a sample in which only 10% of the cases has been solved is estimated quite precisely considering the small standard error. For the sample of easy cases (column 5) we find large effects of a change of 100,000 viewers for both outcomes.

In sum, we find that a decrease in the number of viewers due to the broadcasting of a football game on a competing channel is related to a decrease in the probability of solving a criminal case, thanks also to the programme. In addition, we find that the estimated effect of the number of viewers is larger for cases with more potential observers, for cases with images of better quality, for cases that received more attention or broadcasting time and for cases that can be solved relatively easily. These findings can be considered as evidence supporting a causal effect of the programme on the probability of solving a criminal case. We also find evidence for substitution effects. In general, the 'net' effectiveness of the programme is smaller than the 'gross' effectiveness but for all specific samples of cases we find a statistical significant effect of a decrease in the number of viewers on the total number of cases solved.

4. Sensitivity Analysis

In this Section we perform various sensitivity analyses related to the construction of the main independent variable and the construction of the instrumental variable. In addition, we investigate the robustness of the findings with respect to seasonal patterns. We have performed these sensitivity analyses for both dependent variables used in this article; Table 5 shows the results for the first dependent variable, Table A1 in the Appendix shows the results using the second dependent variable.

We constructed our main independent variable by linking the timing of the cases within the programme to information about the number of viewers for each minute of the programme. If a case had a duration of more than one minute we used the maximum number of viewers for these minutes as this indicates the total exposure of the case. To investigate the sensitivity of our findings for this choice we re-estimated our models with different measures of the number of viewers. First, we use the average number of viewers for each case. Next, we use the average number of viewers for the total programme. The results of these analyses are shown in the top panel of Table 5. The dependent variable in this Table is the probability that the case is solved by the programme. We observe that the estimates are very similar to the previous estimates, which suggests that our results are robust to different measures of the independent variable. A further sensitivity analysis focuses on the repeated broadcast of the programme. Our data also include the average number of viewers for these programmes. The next morning the programme is watched by 85,000 people on average. The number of viewers is slightly higher after a football evening than after a regular evening (87,000 *versus* 83,000 people) suggesting that approximately 2% of the viewers that did not watch the programme because of the football game, watches the programme the next morning. Unfortunately, we only have the average number of viewers of the morning programme but not the number of viewers for every minute of

Table 5

IV Estimates of the Effect of the Number of Viewers on the Probability of Solving the Case Using Different Measures of the Number of Viewers, Using Only CL Evenings as Instrument or Excluding the Summer Period

Sample	All cases (1)	5 a.m.– midnight (2)	8 a.m. – midnight (3)	High quality (4)	Reconstruction (5)	Easy cases (6)
Dependent variable: case solved by the TV programme						
Average viewers per case	0.039 (0.018)**	0.050 (0.020)**	0.064 (0.022)***	0.091 (0.044)**	0.065 (0.026)**	0.096 (0.030)***
No. cases	556	491	456	265	245	278
Average viewers per evening	0.038 (0.017)**	0.050 (0.021)**	0.065 (0.023)***	0.093 (0.045)**	0.067 (0.029)**	0.097 (0.031)***
No. cases	556	491	456	265	245	278
All viewers (evening + morning)	0.050 (0.027)*	0.066 (0.034)*	0.086 (0.041)**	0.140 (0.092)	0.079 (0.035)**	0.126 (0.054)**
No. cases	556	491	456	265	245	278
Sample without summer period						
Viewers	0.030 (0.013)**	0.034 (0.014)**	0.046 (0.016)***	0.059 (0.027)**	0.051 (0.021)**	0.074 (0.024)***
No. cases	447	399	367	211	203	225
Monthly fixed effects						
Viewers	0.026 (0.012)**	0.031 (0.013)**	0.045 (0.015)***	0.051 (0.029)*	0.043 (0.019)**	0.060 (0.022)***
No. cases	556	491	456	265	245	278
Only CL evening as instrument						
Viewers	0.038 (0.019)*	0.047 (0.023)**	0.064 (0.027)***	0.081 (0.046)*	0.061 (0.028)**	0.091 (0.033)***
No. cases	556	491	456	265	245	278

Notes. All models include the full set of controls as in column (2) of Table 2. The samples of cases have been constructed as in Tables 2 and 4.

the programme. To test the sensitivity of our findings we added the average number of viewers of the evening and the average number of viewers of the morning programme and used the total number of viewers as our independent variable. The middle panel of Table 5 shows the estimation results. We find that the estimates are larger but quite similar to the previous findings. Finally, we investigated the sensitivity of the results with respect to the specification of the independent variable. The results remain quantitatively similar in models in which we include the natural logarithm of the number of viewers instead of the number of viewers (not shown in Table 5).

In our main models we adjust for the seasonal pattern in the number of viewers by including controls for year and quarter of the year. However, during the summer period there is no Champions League Football at all. To investigate the potential bias of this atypical period we excluded from our estimation sample cases that were broadcast in June, July and August. The estimates, shown in the bottom panel of Table 5, are smaller than the main estimates in Table 2, more precisely estimated and statistically significant. This suggests that the summer period is somewhat different from the other months but does not change the main pattern of findings.

Furthermore, we did a sensitivity test using monthly fixed effects. Using this specification reduces the estimated effects but they are more precise and remain statistically significant in all samples. We also investigated the potential problem that cases might be too recent for there to be any success in solving it. As a robustness test we excluded the most recent cases from our estimation sample. The results remain very similar if we exclude all cases from the last three months, the last two months or the last month of our data collection from the estimation sample (not shown in Table 5).

The instrumental variable we used in the previous Section was a dummy for the broadcasting of a Champions League game, extended to four evenings on which other major football events took place. To investigate the robustness of our estimates we re-estimated the main model with an instrument that is only based on Champions League games. The bottom panel of Table 5 shows the estimation results when we use this instrumental variable. The second stage estimates are quite similar to the previous findings but the standard errors are larger which can be explained by the fact that we treat some football evenings as a regular evening.

We have performed the same sensitivity tests for models with the second dependent variable (cases solved by the programme or other instruments of the police). These results are shown in Table A1 in the Appendix. The estimates show that the results are robust to all sensitivity tests. However, the specification that includes monthly fixed effects produces positive point estimates that are statistically insignificant. This can be interpreted as evidence that an increase in the number of viewers of the programme primarily produces substitution effects; the programme only solves cases that otherwise would also have been solved by the police. However, it should be noted that this specification is quite demanding with respect to statistical power as it only exploits variation between weekly programmes within months. Grouping weekly programmes within months seems quite restrictive also considering our sample size. We have also experimented with less demanding sensitivity tests with respect to the time trends. The results remain robust to including polynomials of the month of the year, instead of dummies for quarter of the year, in the main models. The estimated coefficients slightly decrease after including higher order polynomials (order 4 to 6) but the standard errors are also lower.

To summarise, in this Section we have performed various sensitivity tests. The estimation results are robust to changes in the main independent variable, changes in the construction of the instrumental variable and the exclusion of the atypical summer.

5. External Validity

The results in the previous Section are based on a specific shock in the number of viewers and are based on a sample of criminal cases that have been broadcast by a TV programme. In this Section we investigate these two issues that are important for the external validity of the findings in the previous Sections.

5.1. *Who are the Switching Viewers?*

A first aspect of the external validity of our findings is related to the type of viewer that is used for the identification of the effects in this article. The change in the

Table 6

Characteristics of Viewers by Type of Evening

Type of evening	Regular (R)		Football (F)		Difference (R − F)	
Viewers (× 1,000)	Mean	%	Mean	%	Mean	%
Total	1,176	100	960	100	216	100
Male	525	44.6	403	42	122	56.4
Female	651	55.3	557	58	94	43.6
Age						
6–12	10	0.9	9	0.9	2	0.7
13–19	29	2.5	26	2.8	3	1.3
20–34	119	10.1	108	11.3	10	4.8
35–49	206	17.5	185	19.3	21	9.7
50–64	350	29.8	278	28.9	72	33.6
65+	461	39.2	354	36.9	108	49.8
Completed education						
Primary	69	5.8	52	5.5	16	7.5
Lower vocational	289	24.6	229	23.8	60	27.8
General secondary	286	24.3	238	24.7	48	22.4
Intermediate vocational	316	26.9	262	27.3	54	25
Higher education	205	17.4	170	17.7	35	16.2
No. evenings	60		29			

Notes. The number of viewers for the regular evenings and for the football evenings is respectively the average taken over 60 programmes or the average over 29 programmes.

number of viewers which we use as treatment is induced by football matches. It is likely that the viewers that change because of football matches are not a random draw from the population. For investigating this issue we obtained profiles of viewers for all episodes used in the previous analyses based on the representative samples of the Dutch Television Audience Measurement Services. For each episode we obtained the number of viewers by gender, age (six categories) and completed education (five categories). Table 6 shows the profiles of the viewers by type of evening. The column for the regular (football) evenings shows the average number of viewers of the 60 (29) programmes broadcast on regular (football) evenings. The right columns show the difference between the average numbers of viewers on regular evenings and on football evenings. This difference is induced by the broadcasting of football matches on competing channels and provides insight into the type of viewers that switches between channels. The last columns of Table 6 show a difference in the averages of the two types of evenings of 216,000 viewers.[5]

The composition of the switching viewers differs from the composition of the viewers on regular evenings, especially by gender and age. Male viewers and viewers aged 50 or older are more likely to switch channels to football. Moreover, viewers that have only completed the two lowest levels of education are somewhat more likely to

[5] The Figures in Table 6 slightly differ from those in Table 1 because Table 1 focuses on the maximum number of viewers for all individual cases and not on the average number of viewers per evening.

switch channels. Hence, the variation in the number of viewers used in this article mainly comes from male viewers and viewers aged 50 or older. The external validity of our results depends on whether this subgroup of the viewers is more or less likely to provide good tips to the police than the average viewer. Criminological research into reporting behaviour has shown that women are generally more likely than men to report crime in situations when reporting is planned and not risky to them (Eagly and Crowley, 1986; Laner *et al.*, 2001; Manji *et al.*, 2014; Nicksa, 2014). For our subgroup of changing viewers with a larger proportion of men than women this might imply that they are less willing to report a crime to the police than the general population. Hence, if the viewers that change programme were a random draw from the population we might expect more reporting to the police and also a larger impact of the programme on solving crime.

5.2. *Which Cases are Broadcast?*

The broadcast cases are not a representative sample of all crime happening in the country. Dutch law states that the publication of images of suspects is only allowed in serious criminal cases and only when publication is proportional in relation to the crime. Also, the national police team responsible for the selection of cases sets the condition that the local police guarantee sufficient detective capacity to follow up on tips. This condition is often not met, and is a reason for not broadcasting the case. Other criteria for selection of cases for broadcasting are the likelihood of relevant tips from the viewers; which for example depends on the availability of CCTV images. In cases with identifiable victims, their consent is another condition. As a result of these criteria, robbery and murder are overrepresented in the programme. In our data 38.7% of the cases concerns robbery; 16.9% are murder cases, whereas the entire category of violent crime represents only 9.5% of all registered crime in the Netherlands in 2012 (Kalidien and Heer-de Lange, 2013, table 4.7). Sex offences, theft, street robbery and fraud are underrepresented when compared to crime statistics. These differences need to be taken into account when interpreting the results.

6. Conclusions and Discussion

The increased technological possibilities for showing images of crime suspects and the growing involvement of the public in solving crime have created a need for evidence-based media strategies in crime control. This article aims to provide this evidence by investigating the effect of public exposure of suspects of crime on the probability of apprehension. Public exposure has been measured as the number of viewers of cases broadcast by the Dutch TV programme ‘Wanted’. We use exogenous variation in the number of viewers induced by Champions League games that are broadcast on competing channels to establish the causal effect of the number of viewers on the probability of solving the case. The data allow us to investigate both the ‘gross’ effectiveness of the programme and the ‘net’ effectiveness of the programme. The difference between these two effects can be interpreted as substitution. An increase in the number of viewers of the programme might increase the number of cases solved by the programme. However, it is possible that these additional solved cases would also have been solved by the police if the programme had been less effective. We find that a decrease in the number of viewers due to the broadcasting of a football game on a competing channel is related with a decrease in the probability of solving a criminal case. This suggests a causal effect of the number of viewers on the probability of solving a criminal case. In addition, we find that the estimated effect of the number of viewers is larger for cases with more potential observers, for cases with images of better quality, for cases that received more attention or broadcasting time and for cases that can be solved relatively easily. These findings can be considered as additional evidence supporting a causal effect of the programme on the probability of solving a criminal case. We also find evidence for substitution effects; the 'net effectiveness' of the TV programme is lower than the 'gross effectiveness'. But, for all specific samples of cases the 'net effect' of the TV programme is statistically significant. This means that the TV programme solves cases that would probably not have been solved by other detection methods of the police. The robustness analyses focused on the construction of the main independent variables, the construction of the instrumental variable and seasonal patterns confirm the main findings.

Some cautionary words about these findings are in order. First, our findings are based on a natural experiment which is not a perfectly randomised situation. Inspection of the covariates of the two types of evenings shows, that there are slight differences in the observables. As we do not know what could have happened with the unobservables, some caution seems appropriate. Second, one of the sensitivity tests (including monthly fixed effects) suggests that the programme produces mere substitution effects. Although we believe that this sensitivity test is too demanding for our sample, some caution seems appropriate here also.

Two aspects of the external validity of our findings deserve special attention. First, the variation in the number of viewers that is used in this article for identifying the effects of the programme is induced by football matches. It is likely that the viewers that change because of football matches are not a random draw from the population. A comparison of the profiles of the viewers on regular evenings and on football evenings shows that male viewers and viewers aged 50 or older are more likely to switch channels. Criminological research suggests that women are more likely to report to the police than men. This would imply that our results should be considered as lower bounds for the effect of a general increase in the number of viewers.

Second, cases that are shown in the programme are not a random sample of all criminal cases. In accordance with Dutch law, the publication of images of suspects is only allowed in serious crime cases. Also, the national police team responsible for the selection of cases sets the condition that the local police guarantee sufficient detective capacity to follow-up on tips. As a result, robbery and murder cases are overrepresented in the programme.

It should also be noted that our findings may be related to certain aspects of the Dutch programme 'Wanted'. The effectiveness of exposure might also depend on the public's willingness to share information with the police. This willingness may be positively influenced by the audience's appreciation of the programme. During the 30 years of existence, 'Wanted' has attracted a stable audience of 6–8% of the entire Dutch population. The prerequisite for broadcasting that the police have sufficient capacity to follow-up on tips may also contribute to the programme's effectiveness. In addition, the programme is carefully edited to disclose only those aspects of cases that are expected to benefit from public participation, as media attention may also ruin a case (Huey and Broll, 2011). The programme also operates within clear boundaries set by criminal justice authorities on the proportionality and subsidiarity of publication. Petty crimes are left out and the programme avoids overt stigmatisation of suspects. Nevertheless, the impact of exposure on suspects is an important issue for future research, particularly in connection with the ease of spreading and maintaining information on the internet. Also, the impact of broadcasting realistic crime footage on feelings of fear of the public and on actual crime is beyond the scope of this article (Carrabine, 2008; Kohm, 2009).

Our main conclusion is that media-exposure can contribute to the apprehension of crime suspects. Crime-watch programmes, variations of which are broadcast in almost every country, can be effective tools for criminal investigation. The empirical analysis shows that the programme has both a net effect and a substitution effect on solving crime. Both effects are relevant for decisions on the allocation of the budget for crime investigations as the costs of TV broadcasting are relatively low compared to other detective work. This study also leads to recommendations for the use of TV broadcasts as a criminal investigation strategy. Because the number of cases that can be broadcast is limited, strategic programming to maximise the number of viewers, for example, by generating extra publicity around crime-watch programmes, can be expected to contribute to solving crime. The programme is most effective for cases with more potential observers or cases with higher quality images. Prioritising these types of cases in 'Wanted' programmes will increase the public benefits of solving crime. Our findings also indicate several conditions for effectiveness that may be relevant for the use of media by the police in other countries or settings. The effectiveness of the Dutch programme 'Opsporing Verzocht' – 'Wanted' – depends on a large audience of several millions of people; a focus on serious crime; stringent control by the police over the broadcast to avoid ruining the case; sufficient police capacity to follow-up on tips; and the tactical use of the broadcast to retrieve information from suspects. These conditions are often absent in publication of CCTV footage on police or crime-related websites on the internet and social media, as is increasingly common. Our findings therefore suggest that a careful media strategy by the police in involving citizens in crime detection can be an effective tool for solving crime. However, a random and unlimited publication of images of crime on the internet, either by citizens or the police, might be counterproductive.

Appendix A. IV Estimates

Table A1

IV Estimates of the Effect of the Number of Viewers on the Probability of Solving the Case Using Different Measures of the Number of Viewers, Using Only CL Evenings as Instrument or Excluding the Summer Period

Sample	All cases	5 a.m. – midnight	8 a.m. – midnight	High quality	Reconstruction	Easy cases
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: case solved						
Average viewers per case	0.025	0.042	0.054	0.081	0.084	0.057
	(0.022)	(0.024)*	(0.027)**	(0.043)*	(0.035)**	(0.032)*
No. cases	556	491	456	265	245	278
Average viewers per evening	0.025	0.042	0.055	0.083	0.086	0.057
	(0.021)	(0.024)*	(0.027)**	(0.044)*	(0.037)**	(0.032)*
No. cases	556	491	456	265	245	278
All viewers (evening + morning)	0.033	0.056	0.073	0.125	0.101	0.074
	(0.030)	(0.036)	(0.043)*	(0.088)	(0.047)**	(0.050)
No. cases	556	491	456	265	245	278
Sample without summer period						
Viewers	0.024	0.032	0.044	0.057	0.050	0.051
	(0.017)	(0.018)*	(0.020)**	(0.029)*	(0.026)*	(0.025)*
No. cases	447	399	367	211	203	225
Monthly fixed effects						
Viewers	0.007	0.015	0.029	0.044	0.027	0.029
	(0.015)	(0.016)	(0.019)	(0.027)	(0.020)	(0.021)
No. cases	556	491	456	265	245	278
Only CL evening as instrument						
Viewers	0.034	0.054	0.069	0.071	0.093	0.048
	(0.025)	(0.028)*	(0.032)**	(0.044)	(0.039)**	(0.035)
No. cases	556	491	456	265	245	278

Notes. The dependent variable is the probability of solving the case by the programme or otherwise. All models include the full set of controls as in column (2) of Table 2. The samples of cases have been constructed as in Tables 2 and 4.

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Additional Supporting Information may be found in the online version of this article:

Data S1.

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