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Does Movie Violence Increase Violent Crime?*

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Abstract

What is the short-run impact of media violence on crime? Laboratory experiments in psychology find that exposure to media violence increases aggression. In this paper, we provide field evidence on this question. We exploit variation in violence of blockbuster movies between 1995 and 2002, and study the effect on same-day assaults. We find that violent crime *decreases* on days with higher theater audiences for violent movies. The effect is mostly driven by incapacitation: between 6PM and 12AM, an increase of one million in the audience for violent movies reduces violent crime by 1.5 to 2 percent. After the exposure to the movie, between 12AM and 6AM, crime is still reduced but the effect is smaller and less robust. We obtain similar, but noisier, results using data on DVD and VHS rentals. Overall, we find no evidence of a temporary surge in violent crime due to exposure to movie violence. Rather, our estimates suggest that in the short-run violent movies deter over 200 assaults daily. We discuss the endogeneity of releases. Potential interpretations for our results include a cathartic effect of movies, displacement of crime, and decrease in alcohol consumption. The differences with the experimental results may be due to experimental procedures, or to sorting into violent movies. Our design does not allow us to estimate long-run effects.

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1 Introduction

Does violence in the media trigger violent crime? This question is important for policy and scientific research alike. In 2000, the Federal Trade Commission issued a report at the request of the President and of Congress, surveying the scientific evidence and warning of risks. In the same year, the American Medical Association, together with five other public-health organizations, issued a joint statement on the risks of exposure to media violence (Joint Statement, 2000).

Warnings about media violence are largely based on the psychological research. As Anderson and Buschman (2001) summarize it, "*Five decades of research into the effects of exposure to violent television and movies have produced thoroughly documented [...] research findings. It is now known that even brief exposure to violent TV or movie scenes causes significant increases in aggression, [...] and that media violence is a significant risk factor in youth violence. [...] The consistency of findings within and between the three types of TV- and movie-violence studies makes this one of the strongest research platforms in all of psychology.*" Other surveys reach similar conclusions (Anderson et al., 2003).

The research in psychology, however, stops short of establishing a causal impact of media violence on crime. The evidence from psychology, summarized in Table 1, is of two types. A first set of experiments, starting with Lovaas (1961) and Bandura, Ross, and Ross (1963), expose subjects (typically kids) to short, violent video clips. These experiments find a sharp increase in aggressive behavior immediately after the media exposure, compared to a control group. This literature provides causal evidence on the short-run impact of media violence on aggressiveness, but not on crime.

A second literature (including Johnson et al., 2002) shows that survey respondents who watched more violent media are substantially more likely to be involved in self-reported violence and crime. This second type of evidence, while indeed linking media violence and crime, is plagued by problems of endogeneity and reverse causation. In sum, the research in psychology does not answer the question on media violence and crime.[1]

In this paper, we attempt to provide causal evidence on the short-run effect of media violence on violent crime. We exploit the natural experiment induced by time-series variation in the violence of movies shown at the theater. As in the psychology experiments, we estimate the impact of exposure to violence in the short-run. Unlike in the experiments, our outcome variable is violent crime, rather than aggressiveness in the laboratory.

We measure the violence content of movies using a 0-10 rating developed by *kids-in-mind.com*, a non-profit organization. (Appendix Table A lists some examples of ratings.)

[1] In sociology there is a smaller literature that uses natural experiments in media programming. The most important studies consider the impact of television boxing prizefights on homicides and the effect of suicide episodes in soap operas on suicides (Phillips, 1982 and 1983).

A movie is strongly violent if it has a rating of 8 or above ("Hannibal"), and mildly violent if it has a rating of 5 to 7 ("Spider-Man"). Combining the rating of movies with their daily revenue, we generate a daily measure of box office audience for strongly violent, mildly violent, and non-violent movies. Since blockbuster movies differ significantly in violence rating, and movie sales are concentrated in the initial weekends since release of a movie, there is substantial variation in exposure to movie violence over time. The box office audience for strongly violent movies is as high as 10 million people on some weekends, and is close to zero on others. (Figures 1a-1b) We also exploit the variation across weekdays within a week (Figure 2).

Using this variation, we estimate the same-day[2] impact of exposure to violent movies on violent crime, holding constant the total movie audience. We use data from the National Incidence Based Reporting System (NIBRS) for the years 1995-2002 in 264 cities to measure physical and sexual assaults. We use a Poisson specification to account for the discrete nature of crime.

Our findings offer little support for the theory that exposure to violence increases violent behavior in the short-run. On days with a high audience for violent movies, violent crime is significantly *lower*. To interpret this puzzling result, we separately estimate the effect on crime in four 6-hour blocks. We find that exposure to violent movies has no impact on crime in the morning hours (6AM-12PM) or in the afternoon (12PM-6PM), as expected: movie attendance in these hours is minimal. In the evening hours (6PM-12AM), instead, we detect a strong negative effect on crime. For each million people watching a strongly violent movie, violent crimes decrease by 1.94 percent. We find a smaller, but still large, impact for exposure to mildly violent movies. We interpret these results as incapacitation. On evenings with high attendance of violent movies, potential criminals are in the movie theater, and hence incapacitated from committing crimes. We show that the magnitudes of the effects are consistent with incapacitation, once we allow for sorting of potential criminals into more violent movies.

Finally, we present evidence for the morning hours following the movie showing (12AM-6AM), which allow us to test the short-run effect of movie exposure on violent crime. Over this time period, we detect a negative, though smaller, effect on violent crime of exposure to movie violence. While this effect is not always significant, it is sufficiently precise that we can always reject sizeable positive effects on crime. Unlike in the psychology experiments, therefore, media violence does not appear to induce more violent crime in the short-run. One note of caution is that we also find a positive effect of exposure to all movies on violence in the morning hours, an effect that is hard to interpret.

We present disaggregate effects by two-hour time block, and by individual violence level from 0 to 10. The results are consistent with the pattern of the baseline results. We also replicate the results using an alternative measure of movie violence that uses the MPAA ratings,

[2]We define day t to run from 6AM of day t to 6AM of day $t+1$. This allows us to include in the analysis the hours right after the movie exposure.

and using weekend data rather than daily data. In both cases, the results are less precisely estimated, but are consistent with the main results. We also show that, while the effects appear to be there for all demographics groups, they are strongest in percentage terms for the group aged 15-24. Finally, we introduce a placebo treatment by reassigning the weekend movie violence measure to the corresponding weekend in the previous year, or the previous two years. We do not find any effect in these placebo treatments.

Our final set of results exploits the variation in movie violence from rentals of DVDs and VHSs. As in theater showings, a large share of rentals involves newly-released films. Since the release of movies in DVDs and VHSs is staggered relative to the release in the theaters, this variation provides a second, independent test of the effect in the paper. Using weekly data on rentals from July 1999 to December 2002, we obtain similar, though noisier results as with theater data: evidence of incapacitation and (some) evidence of a negative impact on crime following the movie exposure.

In Section 4 we evaluate the magnitudes of the findings and provide interpretations. A simple calibration of the results indicates that strongly violent movies in the evening hours prevent, on average, about 55 assaults daily across the US, out of 6,010 assaults. Mildly violent movies, which are more common, appear to prevent 132 assaults. The incapacitation effect that we document, and which the previous literature had overlooked, is substantial. The estimates of the short-run impact on violence after the movies (12AM-6AM) are smaller. The point estimates suggest that violent movies decrease the number of assaults by 12 assaults daily. The largest increase in assaults due to movie violence that we cannot reject is an increase of 8 assaults. These effects are substantially different from the large positive effects of media violence on crime that the experimental literature finds in Psychology.

We discuss two limitations of the analysis. A first limit of our research design is that we cannot answer the question on the long-run impact of media violence. Second, in the current draft we have not yet addressed the potential endogeneity of movie releases, that may be correlated with factors that themselves affect crime. Even in the presence of such correlation, the results should not be affected to the extent that the correlation of violent movies with these factors is the same as the correlation of non-violent movies.

We discuss three main interpretations for our results. (i) *Catharsis.* The consumption of movie violence may have a cathartic effect, freeing tensions away from violent acts, as first proposed in Aristotle's *Poetics.* (ii) *Displacement.* The showing of movies may displace crimes temporarily: once a criminal exits the movie theater, it is too late to engage in crime. (iii) *Sobriety.* Theater attendance may reduce the consumption of alcohol, which in turn reduces the incidence of violent crime. This does not explain, however, the results for DVD and VHS rentals, which can be consumed with alcohol.

These explanations also suggest two reasons why the results in the field and in the laboratory are different. First, the design of the exposure to violence is very different in the laboratory

studies and in the field. In the laboratory exposure to violence neither displaces logistically possibilities of aggression, nor reduces alcohol consumption. Further, the violent clips used in the experiments typically consist of 5-10 minutes of sequences of extreme violence. In the field, instead, actual media violence also includes meaningful acts of reconciliation, apprehension of criminals, and non-violent sequences. Second, the laboratory experiments do not take into account sorting into violent media (Lazear, Malmendier, and Weber, 2005; Levitt and List, 2006). The experimental subjects are exposed to extreme violence that they had neither demanded nor anticipated. Individuals watching violent movies at the movie theater, instead, pay for such exposure, possibly because they are looking for a way to channel tensions.

The paper is related to a growing literature in economics on the effect of the media on economic outcomes. Among others, Besley and Burgess (2002), Green and Gerber (2004), Stromberg (2004), Gentzkow (2006), and DellaVigna and Kaplan (2006) provide evidence that media exposure affects political outcomes. More relatedly, Gentzkow and Shapiro (2006) show that the introduction of television did not have adverse effects on educational outcomes. As in this paper, media exposure did not have a negative impact, though Gentzkow and Shapiro estimate long-term, rather than short-run, elasticities. Finally, Card and Dahl (2006) show that on days of baseball matches, domestic violence spikes, and specially so for upset losses of the local team. Disappointing outcomes, therefore, appear to induce frustration and impact certain crimes.

The paper also complements the previous evidence on incapacitation. The evidence ranges from the effect of school attendance (Jacob and Lefgren, 2003) to the effect of imprisonment (DiIulio and Piehl, 1991; Levitt, 1996; Spelman, 1993).

The remainder of the paper is structured as follows. In Section 2 we describe the data. In Section 3 we present the empirical results. In Section 4 we present calibrations of the results and interpretations and in Section 5 we conclude.

2 Data

Movie data. We obtain the data on box-office revenue from *www.the-numbers.com*, which use the studios and Exhibitor Relations as data source. Data on weekend box-office sales is available for the top 50 movies consistently from January 1995 until the present[3]. Daily data is available for the top 10 movies from October 1997 to the present. In most of the analysis, we focus on the finer, daily time intervals. We deflate both the weekend and the daily box office sales by the average price of a ticket to obtain an estimate of the number of people in the movie theater audience.

For the period January 1995-August 1997 and for all movies that do not make the daily top

[3]In the more recent years, the data covers all movies. We keep only the data for the top 50 movies to ensure consistency with the older data.

10 list, we impute the daily box office revenues, whenever missing, using the weekend sale for the same movie in the same week. The imputation procedure, described in Appendix A, takes advantage of the regularity in the within-week pattern of sales. Ticket sales peak on Saturday, Friday, and Sunday (in decreasing order) and are lowest on Tuesday-Thursday (Figure 2). The accuracy of the imputation is high. In the sub-sample for which both the daily and the weekend data are available, a regression of predicted daily revenue on actual daily revenue yields a slope coefficient of .9842 with an R^2 of .9190.

We match the box office data to violence ratings from *www.kids-in-mind.com*. Since 1992, this non-profit organization has assigned a 10-point violence rating to (almost) all movies with substantial sales. The ratings are performed by volunteer-trained members who, after watching the movie, follow guidelines to assign the rating. In Appendix Table 1, we illustrate the rating system by listing the three movies with the highest weekend audiences within each rating category. As Column 2 shows, ratings 3-6 account for most of the audience data. Within each violence category, we list the top-3 blockbuster movies (Column 3), the weekend date (Column 4), and the weekend audience (Column 5). Movies with ratings between 0 and 4 have very little violence such as "Runaway Bride" and "Toy Story"; their rating ranges from G to R (in the latter case, for sexual content or profanity). Movies with ratings between 5 and 7 contain a fair amount of violence, with some variability across titles ("Spider Man" vs. "Mummy Returns"). These movies are typically rated PG-13 or R. Movies with a rating of 8 and above are violent and almost uniformly rated R. Examples are "Hannibal" and "Saving Private Ryan". Compared to other movies, violent movies are disproportionately more likely to be in the "Action/Adventure" and "Horror" genre and are very unlikely to be in the "Comedy" genre. For a very small number of movies (such as "Perfect Murder") the rating is not available. These movies have almost always smaller audiences.[4]

After cleaning the title of the movie, we match the ratings data to the box office data. The match quality is very high for movies in the top-20 list. Overall, we can assign a violence rating to 95.64 percent of the box office revenue.

Movie violence measures. We define the number of people (in millions) exposed to movies of violence level v on day t as $A_t^v = \sum_{j \in J} d_j^v a_{j,t}$, where $a_{j,t}$ is the audience of movie j on day t, d_j^v is an indicator for film j belonging to violence level v, and J is the set of all movies. The violence level varies between 0 and 11, where 11 indicates that the violence measure is missing. The measure of overall exposure to movies on day t is the audience for all movies on day t, $A_t = \sum_{v=0}^{11} A_t^v$. To deal with missing violence rating, we define the share of movies on day t with non-missing violence measure as $s_t = \sum_{v=0}^{10} A_t^v / \sum_{v=0}^{11} A_t^v$. The average of this share across days is 95.89 percent.

We define two measures of exposure to violent movies on day t. The measure of exposure

[4]The re-releases of Star Wars V and VI in 1997 were also not rated because the original movie pre-dates kids-in-mind. We assigned them the violence rating 5, the same rating as for the other rated Star Wars movies.

to strong violence on day t is the audience for movies of violence levels between 8 and 10, $A_t^{[8,10]} = \sum_{v=8}^{10} A_t^v / s_t$. The measure of exposure to mild violence on day t is the audience for movies of violence level between 5 and 7, $A_t^{[5,7]} = \sum_{v=5}^{7} A_t^v / s_t$. Both measures are adjusted by the share s_t, to compensate for missing data on movie violence.

Figure 1a plots the measure of strong movie violence, $A_t^{[8,10]}$, over the sample period 1995 to 2002. To improve the readability, we use the weekend measure of audience instead of the daily measure. We identify the top-10 weekends with the name of the movie responsible for the spike. The series exhibits sharp fluctuations. Several weekends have close to zero violent movie audience. On other weekends, up to 12 million people watch violent movies. The spikes in the movie violence series are distributed fairly uniformly across the years, and decay within 2-3 weeks of the release of a violent blockbuster. There is some seasonality in the release of violent movies, with lower exposure to movie violence between February and May.

Figure 1b plots the corresponding information for the measure of mild movie violence, $A_t^{[5,7]}$. Since more movies are included in this category, the average weekend audience for mildly violent movies is higher than for violent movies, with peaks of up to 25 million people.

Violence data. The source of violence data is the National Incident-Based Reporting System (NIBRS), which contains all reports of crime from 1995 to 2002 for the agencies reporting. Since reporting agencies enter and exit the sample, we keep in the sample in each year only agencies that report crimes at least 300 days in that year. For these agencies and years, we set the crime rate to zero on days when no crime is reported. We also drop agencies with a population of less than 25,000 people.

Our main measure of violence is the number of assaults on day t in town k, $V_{t,k}$. In most specifications, we separate the assaults into 4 time periods, assaults occurring between 6AM and 12PM of day t, $V_{t,k}^{mor}$, assaults occurring between 12PM and 6PM of day t, $V_{t,k}^{aft}$, assaults occurring between 6PM and 12AM of day t, $V_{t,k}^{eve}$, and assaults occurring between 12AM and 6AM of day $t+1$, $V_{t,k}^{nig}$. (We index the assaults occurring in the night between day t and day $t+1$ with day t to match them to movies played on day t). In some specifications, we present separate series by age and gender of the offender, and by type of offense. These series are constructed in a similar way.

Figure 1c plots the average number of weekend assaults $V_{t,k}$ across cities (per 100,000 people). The series is seasonal, with troughs in assaults in the winter months, and higher assault rates in 1996 and 2002 than in the other years. The series reports also the top-10 weekends for assaults, the top-10 weekends for strongly violent movies, and those for mildly violent movies. As the figure makes apparent, there is no obvious relationship between the assaults series and the violent movies series. For example, the top-10 weekends for strongly violent movies are equally distributed on days with above- and below-average assault rates. While this does not rule out a relationship between violent movies and crime, such a relationship is not apparent from a simple plot.

Summary Statistics. After matching the panel of assaults with the time series of movie violence, the resulting data set includes 425,559 city-day observations, covering the time period from January 1995 to December 2002. Table 2 reports the summary statistics. The average number of assaults on any given day across the cities in our sample is 3.66, translating into an assault rate of 5.57 assaults per 100,000 inhabitants. The assaults occur mostly in the evening (6PM-12AM), but are also common in the afternoon (12PM-6PM) and in the night (12M-6AM). Across weekdays, assault rates are highest on Friday and Saturday (Figure 2). Across demographic features, assaults rates are decreasing in the age of the offender, and are three times larger for males than for females.

Table 2 also reports the summary statistics of the daily movie audience data. The average daily movie audience is 3.73 million people, while the audience for strongly and mildly violent movies is respectively 0.47 million and 1.62 million. The Table also presents information on an alternative system of classification of violent movies and on rentals, which we discuss below in Section 3.

3 Empirical Results

3.1 Theater Audience – Main Results

Baseline effect. In the first empirical specification we test whether there are short-run effects of exposure to violent movies on violent crime. We focus on the effect of same-day[5] exposure, an horizon similar to the one considered in the psychology experiments.

Since the number of assaults is a count variable, we use a Poisson process. We model the distribution of agency k's crime count on day t as

$$V_{t,k} \sim Poisson(\mu_{t,k} = \lambda_{t,k}) \qquad k = 1, ..., K;\ t = 1, ..., T$$

with $\lambda_{t,k} = \exp(x_{t,k}\beta)$. Since $\lambda_{t,k}$ has an exponential form

$$E[v_{t,k}|x_{t,k}] = \mu_{t,k} = \exp(x_{t,k}\beta)$$

Notice that consistency of the maximum likelihood estimate for this model only requires the correct specification of the conditional mean. Consistency does not require the distribution to be correctly specified. However, miss-specifying the variance will lead to inconsistent standard errors. The Poisson model restricts the mean to be equal to the variance, which can be an issue in count models as often there is overdispersion. To assess whether overdispersion is likely to be an issue for our regressions, we also report negative binomial regression results below.

[5] As we stated above, we define day t to run from 6AM of day t to 6AM of day $t + 1$.

The coefficient β_j can be interpreted as the proportionate change in the conditional mean if the jth regressor changes by one unit, i.e.,

$$\beta_j = \frac{\delta E[v|x]}{\delta x_j} \frac{1}{E[v|x]}$$

That is, the conditional mean of the dependent variable is $1 + \beta_j$ units larger for a one unit change in the j-th regressor. For indicator variables, the effect of variable j is $\exp(\beta_j)$, which for small values of β_j is approximately equal to $1 + \beta_j$.

The determinants of the probability of an assault include the following covariates

$$x_{t,k} = \beta^{[8,10]} A_t^{[8,10]} + \beta^{[5,7]} A_t^{[5,7]} + \beta A_t + \Gamma X_t. \tag{1}$$

The number of assaults depends on the exposure to strongly violent movies ($A_t^{[8,10]}$) and mildly violent movies ($A_t^{[5,7]}$), controlling for total audience for all movies (A_t). The coefficient $\beta^{[8,10]}$ can be interpreted as the percent increase in assaults for each million people watching movies of violence level between 8 and 10 on day t, controlling for the total movie audience. The interpretation of the coefficient $\beta^{[5,7]}$ is similar. The variables X_t are a set of control variables: indicators for year, month, day of week, and for holidays[6]. (The full set of holiday indicators is described in Appendix A.) The standard errors are robust and clustered by date, to allow for arbitrary correlation of errors across agencies k on the same day.

Notice that, given the nature of our data, the variables of interest do not vary at the city level. Thus, the estimates of the effects of exposure to violent movies are unaffected by the inclusion of city fixed effects, and we will not include them. While cities do enter and exit the sample at the yearly level, within a given year, the set of cities is constant. As described above, our sample includes cities with populations of 25,000 or more that report any crime for at least 300 days a year. For any remaining missing days in the year, we assign a value of zero crime for that day. A set of year dummies in the Poisson regressions accounts for the variation in the sample of cities across years.

In Column 1 of Table 3 we estimate (1) including only year controls. (The year controls are necessary since the number of towns in the sample varies year-by-year) This is the equivalent of running a simple time-series regression of assaults on exposure to movie violence. The results indicate that exposure to media violence appears to increases crime, consistently with the evidence from the psychology experiments. For each additional one million people exposed to a violent movie, the probability of assault increases by 1.4-1.6 percent, depending on whether we consider the mild violence measure ($A_t^{[5,7]}$) or the strong violence measure ($A_t^{[8,10]}$). In addition, we obtain the (puzzling) result that exposure to any movie (as captured by A_t) increases crime significantly.

[6]The results are similar, though less precisely estimated, if we introduce controls alternatively for day-of-week*month, day-of-week*year, month*year.

In Columns 2 through 4 we include additional controls: indicators for day-of-week (Column 2), for month in the year (Column 3), and for holidays (Column 4). These indicators are significant determinants of assault rates, since violent crime varies by weekday (Figure 2) and has important seasonal patterns (Figure 1c). As we add these control variables, the coefficients $\beta^{[5,7]}$ and $\beta^{[8,10]}$on the violence measures flip sign and become significantly *negative*, with the coefficient on strong violence becoming larger in absolute value. With the full set of controls, an increase in one million in the audience for violent movies decreases violent crime by .64 percent (mildly violent movies) or .96 percent (strongly violent movies), substantial effects on violence. In addition, exposure to non-violent movies, as captured by A_t, is no longer a significant determinant of assaults, once all the controls are added.

In Columns 5 through 8 of Table 3 we present robustness results for the benchmark specification with all controls (Column 4). The results are similar, though the estimates are somewhat less precise if we do not use the imputation procedure for the daily data. This limits the sample period to September 1997-December 2002 (Column 5, see Appendix A for details on the imputation) The results do not change if we estimate a negative binomial regression, allowing for overdispersion of the dependent variable (Column 6). We obtain similar estimates also using an OLS model with assaults per capita as the dependent variable (Column 7), though the magnitudes are not directly comparable to the other specifications. Finally, we obtain directionally similar, but less precise results for an OLS specification with log(assaults per capita) as dependent variable (Column 8). The loss in power is not surprising since observations with no assaults are dropped. Since these specifications do not affect substantially the results, we do not repeat them below.

The initial result that exposure to violent media increases violent crime appears to be due to the within-week and within-year timing of movie releases and of assaults. Once we control for seasonal patterns, exposure to violent movies appears to diminish crime in the short-run, and more so the more violent the crimes, a result in contrast to the finding of the psychology experiments.

Time of day. To clarify this puzzling result, we examine separately the effect of violent movies on violent crime by time of day. We include the full set of controls X_t. In Table 4, we present the results of specification (1) for assaults committed between 6AM and 12PM, ($V_{t,k}^{mor}$, Column 1), between 12PM and 6PM ($V_{t,k}^{aft}$, Column 2), between 6PM and 12AM ($V_{t,k}^{eve}$, Column 3), and between 12AM and 6AM of the next day ($V_{t,k}^{nig}$, Column 4).

Since movie audiences are unlikely to watch movies in the morning and in the afternoon, and especially so for violent movies, we expect to find no effect of exposure to violent movies in the first two time blocks. Indeed, exposure to violent movies has no differential impact on assaults in the morning (Column 1), or in the afternoon (Column 2). Since we consistently find similar effects for these two time periods, we pool them in the next Tables to save space.

Over the evening hours (Column 3), we find, instead, a strong negative effect of exposure

to violent movies. An increase in the audience of mildly violent movies of one million decreases violent crimes by $\exp(-.0132) - 1$, that is, 1.31 percent. Exposure to strongly violent movies has an even larger effect. Exposure of one million additional people reduces assaults by $\exp(-.0194) - 1$, that is, 1.92 percent. Exposure to violent movies incapacitates people who may otherwise be committing crimes. The larger effect for more violent crimes reflects the fact that the audiences of the more violent crimes are more likely to be selected among the potential criminals. Below, we argue that the magnitude of the coefficients $\beta^{[5,7]}$ and $\beta^{[8,10]}$ is consistent with a pure incapacitation effect.

Over the night hours following the exposure to the movie, violent movies appear to have a negative impact on crime, but the results are smaller and less precisely estimated. Exposure to mildly violent movies for one million people decreases violent crimes (significantly) by $\exp(-.0095) - 1$, that is, .95 percent; the effect for strongly violent movies is $\exp(-.0073) - 1$, that is, -.73 percent, but is not significant. These mild negative effects imply that we can reject a positive short-run impact of violent movies on crime implied by the psychology evidence. These results lend some support to the catharsis hypothesis, that violent movies dissipate the negative feelings. Alternatively, they may be interpreted as mild evidence that an evening at the movies displaces violent crime, since the latter takes a whole evening.

While the results on the effect of violent movies are interpretable, we also find a puzzling effect of non-violent movies. Over the morning hours and in the afternoon, a higher exposure to non-violent movies lowers crime significantly. While there is no impact on evening assaults, non-violent movies significantly increase assaults in the night following the movie exposure. These results appear to reflect the effect of an unobservable variable that affects both crime and movie attendance, such as weather or TV programming. Consistently with this interpretation, these effects are 2 to 3 times larger in regressions without controls (results not shown). While these results suggest caution in the interpretation of the findings on violent movies, the potential presence of an unobservable variable does not bias the findings on the effect of violent movies to the extent that this variable affects all movie audiences in the same way, which seems plausible.

In Columns 5-7 we replicate the results of Columns 1-4 allowing for a non-linear effect of total movie sales A_t in (1). We pool the time periods in Columns 1 and 2 to save space. The estimates of the impact of violent movies are very similar to the benchmark estimates within each time period.

To provide more evidence on the timing of the effect of violent movies, we re-run specification (1) separately by two-hour time blocks. In Figure 3 we plot the coefficients, with confidence intervals, for the measure of strong violence $A_t^{[8,10]}$ and mild violence $A_t^{[5,7]}$ (in addition, the total audience variable A_t is included in the regressions). To interpret the coefficients, one should regard the time stamp as indicating either the time of the assault, or the time of the police report. As such, the crime is likely to have occurred in the indicated time block, or

in the previous one. Over the same-day morning hours and over the afternoon, no coefficient is significantly different from zero, and no pattern is apparent, consistent with the results of Columns 1 and 2 of Table 4. In the time block 6PM-8PM, exposure to strong violence has a negative significant effect, and over the time blocks 8PM–10PM and 10PM-12AM, both measures of violence have a significant and sizeable negative effect. The timing of this effect is exactly consistent with incapacitation from movie attendance: since most movie showing take place between 6PM and 10PM, and incapacitation may affect also the two hours surrounding the movie showing, the decrease in crime should start from around 4PM and taper off around midnight. Over the time periods 12AM-2AM, 2AM-4AM, and 4AM-6AM, exposure to violent movies has mostly a negative impact on assaults, but the coefficients are smaller and mostly not significant. This is again consistent with the results in Table 4 indicating no short-run positive impact of violent movies on violent crime.

3.2 Theater Audience – Robustness

Disaggregate effects. To complement the findings in Table 4, we present evidence on the effect of the broadcast of movies of different violence categories on street crimes. We run the regression

$$x_{t,k} = \sum_{v=0}^{10} \beta^v A_t^v + \Gamma X_t,$$

that is, we estimate separately the effect on assaults of exposure to movies of violence level v, with $v = 0, 1, ..., 10$. In Figure 4, we plot the coefficients β^v for evening assaults A_t^{eve} and for night assaults A_t^{nig}. Over the evening hours (6PM-12AM), the effect of movies on assaults is fairly monotonic in the violence level of the movie. As we found in Table 4, the more violent the movie, the lower the frequency of assaults, consistent with incapacitation. Over the night hours (12AM-6AM), the pattern is not so clear-cut. Exposure to low-violence movies appear to increase assaults, probably capturing a time-series component that is not included in the controls. Compared to low-violence movies, movies with higher violence level lead to reductions of violence. The effect is fairly monotonic till violence level 8, while violence levels 9 and especially 10 are associated with a higher violence level. The only evidence, therefore, of a positive impact of violent movies on crime is for the rare movies that attain the highest violence level.

Alternative Movie Violence Measure. We cross-validate the results using the MPAA ratings of each movies. In addition to the rating of a movie ("R", "PG", etc.), the MPAA summarizes in one sentence the sex, violence, and gore features of each movie. We characterize as mildly violent movies for which the MPAA Rating contains the word "Violence" or "Violent", with two exceptions: (i) If the reference to violence is qualified by "Brief", "Mild", or "Some", we classify the movie as non-violent. (ii) If the word violence is qualified as either "Bloody",

"Brutal", "Disturbing", "Graphic", "Grisly", "Gruesome", or "Strong", we classify the movie as strongly violent. We then construct a daily measure of mild and strong movie violence along similar lines to the procedure described in Section 2 for the benchmark measures.[7] The average MPAA-based mild violence measure averages 1.26 million in audience, compared to 1.62 million for the *kids-in-mind*-based mild violence measure (Table 2). The two measures have a correlation of .80 across the 2847 days in the sample when they are both non-missing. The MPAA-based measure of strong violence is substantially more restrictive than the *kids-in-mind*-based-measure, averaging an audience of .27 millions, compared to .47 million for the *kids-in-mind* measure. The correlation between these two measures is .63.

In Columns (1) through (3) of Table 5 we replicate the results of Table 4 using the MPAA-based measure of movie violence. Over the morning and afternoon period (Column 1), we find no significant effect of exposure to mild violence, but, surprisingly, we find a significant negative effect of exposure to violent movies on assaults. Over the evening period (6PM-12PM, Column 2), we find a significant incapacitation effect for exposure to mildly violent movies, and a larger, also significant incapacitation effect for exposure to strongly violent movies. The estimates are quite similar to the benchmark estimates in Table 4. Over the night following the exposure (12AM-6AM, Column 3), we find a significant negative effect of mild violence and a similarly negative but insignificant effect of strong movie violence. When we replicate these results using both the MPAA-based measures of violence and the *kids-in-mind*-based measures of violence (Column 4-6), we find that the effects on assaults depend mostly on the *kids-in-mind* measures.

Overall, the alternative MPAA measure of movie violence produces similar, but somewhat less precise, results. (The one surprising difference is the finding of a negative effect on violence in the 6AM-6PM period, according to one measure.) Overall, the *kids-in-mind* measure appears to be a more detailed measure of movie violence, which is not surprising given that the *kids-in-mind* raters refine the MPAA rating with an extensive review and transform it into a 0-10 scale. We therefore use the *kids-in-mind* ratings in the rest of the paper.

Demographics. So far, we have presented the impact of movie violence on assaults regardless of demographics. We now present separate effects by age groups and gender. According to the Motion Picture Association (2005), the age group 16-24 is responsible for 27 percent of theater admission in 2004, while constituting only 15 percent of the population. Males and females are equally represented. While we do not know which demographic groups are more likely to attend violent movies, the over-representation of young people at the movie theater leads us to expect that the results should be larger for the younger cohorts. (Since the Poisson coefficients capture proportional changes, differences in average assault rates across

[7] In the first weeks of 1995, the NPAA rating is missing for a number of movies; we set the NPAA violence measure missing for the 10 weeks in which the rating is available for less than 70 percent of the movie audience for that week.

demographics do not matter to a first approximation.)

In Table 6 we replicate the specifications of Columns (3) and (4) of Table 4 for different age and gender groups. We do not report the results for the morning and afternoon hours, for which we consistently find no impact. Across age groups, we find the strongest incapacitation results for the youngest age group (15-24, Column 1), even though the results are large and significant also for the older age groups (25-34 and 34-44, Columns 3 and 5). In the night hours following the movie exposure, we find broadly a negative impact of exposure to violent movies, though the result is significant only for one measure for the younger age group (Column 2). As for the gender split, the incapacitation effect is strong and significant both for males and females (Columns 7 and 9). In the night following the movie exposure (Columns 8 and 10), we find a negative impact of violent movies on crime that is stronger for women.

Weekend Results. The results above rely on two forms of variation in exposure to violent movies, week-to-week variation and within-week variation. The week-to-week variation is captured by Figures 1a-1b, which show the sharp changes in the audience of violent movies from one week to the next. In addition, within any given week there is also substantial variation in exposure to movies, captured by Figure 2. Saturday has the highest audience, followed by Friday and Sunday; the other days of the week have only one fourth as much audience for violent movies as the other days.

We now present results using the week-to-week variation by estimating expression (1) using weekend sales only, that is, the sales from Friday to Sunday. The advantage of using weekend data, as opposed to daily data, is that weekend revenue data is readily available, while daily revenue data is partly imputed. The cost is the loss of precision due to the aggregation across Friday, Saturday, and Sunday, as well as the neglect of data for the other weekdays. The dependent variable for the Poisson regressions is the total number of assaults in weekend t, and the independent variables are the measures of audience over weekend t. The set of controls includes year indicators and 52 indicators for week-of-the-year. These last indicators subsume the holiday controls, since holidays usually fall on the same week across years.

As Table 7 shows, there is no significant impact of audience of violent movies on the number of assaults in the morning and afternoon period (Column 1), as expected. Over the evening period (6PM-12PM), when people are expected to be watching movies, we find a significant incapacitation effect for exposure to strongly violent movies. An increase of one million in the weekend audience significantly decreases the total weekend assaults by $\exp(-.0051)$, that is, by -.51 percent. We find a smaller, not significant impact for exposure to mildly violent movies, $\exp(-.0014)$, that is, -.14 percent. Finally, over the late night hours (12AM-6AM) we find essentially no effect of exposure to violent movies.

These estimates appear, at first, substantially smaller than the corresponding estimates for daily data (Table 4). The two magnitudes, however, are easy to reconcile. Each person exposed to a violent movie in weekend t watches a movie on only one of the three days composing

the weekend. Any incapacitation effect, therefore, applies to only one of three days, and therefore should be approximately only a third as large as the corresponding effect from the daily regressions in Table 4. Multiplying the magnitudes of the effect by three, the estimates in Column 2 of Table 7 imply incapacitation effects of $.51 * 3 = 1.53$ percent for violent movies and of $.14 * 3 = .42$ percent for mildly violent movies. The first point estimate is in line with the finding of a 1.92 percent decrease in daily assaults per one million audience of violent movies (Column 3 in Table 4). The point estimate for the mildly violent movies from the weekend data is smaller than the corresponding point estimate from the daily data (Column 4 in Table 4), but the result is sufficiently noisy that similar results cannot be rejected.

The results using weekend data confirm the presence of an incapacitation effect, though the effect is less precisely estimated than in the daily data. We find no effect of exposure to movies in the night. The lower point estimates and lower precision in this sample are not surprising, given that this sample does not use the within-week variation and it considers the average exposure over the weekend, as opposed to the exact daily exposure.

Placebo Results. As a test of whether the results are driven by seasonal patterns in movie releases, we construct a placebo treatment by running a regression as in (1) with the assault data lagged by one or two years. In particular, in Columns (4) through (6) of Table 7 we replicate the results of Columns (1) through (3) but replace the outcome variable with assaults in the corresponding weekend the year before. For movie exposure in 1995, we use the assaults in the corresponding week in 2002 as outcome variable. In Columns (7) through (9) of Table 7 we present the results of similar specifications in which we take the assault data for the corresponding weekend two years before. For movie exposure in 1996 (1995), we use the assaults for the corresponding weekend in 2002 (2001).

To the extent that the apparent incapacitation effect is explained by seasonal patterns or special releases corresponding to holidays, we should find a similar effect in the placebo treatments. If the effect is a causal effect due to release of violent movies, we should not find an effect in the placebo treatment. In both placebo treatments, we do not find any significant effect of movie exposure in these placebo regression in any time interval.

3.3 DVD and VHS Rentals

While most of the paper focuses on the effect of violent movies released in theaters, a similar design exploits the release of violent movies in VHS/DVD. This release typically occurs a few months after the theatrical release, and has similar features to the release in theaters. The rental of newly released DVD/VHSs peaks in the first week of release and decays quickly in the following weeks. Moreover, the top 1-2 movies capture a large share of the rental revenue.

We use data on weekly DVD/VHS rentals from *www.boxofficemojo.com* over the period July 1999-December 2002. The data for the top 25 DVD weekly rentals is available from July 2000

to December 2002. The data on VHS weekly rentals covers the top 10 rentals over the period July 1999-October 2000, and the top 40 rentals over the period June 2001-July 2002. Since over part of this sample either the DVD series or the VHS series is not available, we impute the rentals for the missing series (if any) using the rentals for the other series, and compute the sum of the two series. We present details on the imputation procedure in Appendix A.

Combining this data with the violence ratings from *kids-in-mind*, we compute a weekly measure of audience for mildly violent and violent movies. Unlike the theater measures, this measure captures week-long rentals. Since most of the rentals take place on the weekend, we match it to weekend assaults. The average number of weekly rentals of any movie is 21.44 millions (Table 2). The weekly rentals of violent (mildly violent) movies are 3.71 (10.40) millions. The weekly audience reached by DVD and VHS rentals, therefore, is comparable to the audience reached in a week at the theater. In addition, one should take into account that multiple people may view a rental, which boosts the DVD/VHS numbers. As we stated above, the audience measures of violence for DVD and VHS rentals are only mildly correlated to the box office measure in the corresponding week. The correlation between the two measures of strong violence is -.01, while the correlation between the two measures of mild violence is .35.

In Table 8, we replicate the specifications of Columns (1)-(3) in Table 7 with weekend assault as dependent variable and with DVD/VHS rentals of violent movies as independent variables. While, as expected, there is no effect in the morning and afternoon (Column 1), we identify a significant incapacitation effect for the exposure to mildly violent movies, and an insignificant effect for the strongly violent movies for the evening hours (Column 2). The effect on the night hours (Column 3) is less clear: the mild violence measure is associated with a significant decrease in violent crimes, but the strong violence measure is associated with an (insignificant) increase.

Importantly, these results hold when the measures of theater audience are also introduced in the regressions (Columns 4 through 5). This is not surprising since the theater measures of movie violence and the DVD/VHS measures are essentially uncorrelated. The results on DVD/VHS releases, therefore, provide independent evidence supporting the finding of an incapacitation effect; in addition, they provide additional evidence that violent movies are unlikely to induce a short-run burst in violence.

4 Magnitudes and Interpretations

Magnitudes. We first interpret the magnitudes of the benchmark findings by time of day (Table 4). The first main finding is that, in the evening hours (6PM-12AM, Column 3), one million additional audience for strongly violent movies reduces violent crime by 1.92 percent. Extrapolating this effect out of sample, this implies that on a day with 52 million people in the audience for strongly violent movies, violent crimes would be zero. This may at first seem an

implausibly large effect since the American population near 300 million, but it is likely not. In the midpoint of our sample, in 1998, the US Population was about 276 million; excluding people aged below 14 and above 65 which are very unlikely to be attending violent movies (almost always rated "R") yields 180 million people. Among the 180 million people aged 15-64, the at-risk population of potential criminals is likely to be highly over-represented in the audience for violent movies. For example, in a laboratory setting, Bushman (1995) offers subjects the choice whether to watch a violent or non-violent movie, and observes that subjects that rank high in self-reported aggressiveness are more likely to choose a violent movie. The point estimates in Column 3 of Table 4 are compatible with an incapacitation effect if the potential criminals are approximately four times more likely to watch a violent movie. Although we do not have an estimate for this form of sorting, we find it quite possible in light of the fact that the 15-24 age group is both highly represented among movie goers and among criminals.

The second main finding is that, in the night hours following the movie exposure (12AM-6AM), one million additional audience for strongly violent movies reduces violent crime (insignificantly) by .75 percent, with a confidence interval (-1.98,+.45). We can therefore reject increases in crime larger than .5 percent for increase of one million people in the audience. For mildly violent movies, the effect is significantly negative (-1.01 percent decrease in crime per one-million people in the audience), and we can therefore reject any positive effect. In order to evaluate this effect further, we compare it to the short-run impact of movie violence estimated in the Psychology experiments.

The top part of Table 1 summarizes the results of representative experiments. Columns (1) and (2) present the features of the treatment and of the control group. Columns (3) thorough (5) summarize the age group of the subjects, the location of the experiment, and the sample size. Finally, Column (6) defines the measure of violence, and Columns (7) and (8) present the average measure of violence for the treatment and control group. The first experiments (Lovaas, 1961; Bandura, Ross, and Ross, 1963), dating to the 1960s, were run mostly on small samples of children, while the more recent studies (Bushman, 1995; Josephson, 1997; Leyens et al., 1975) are run with larger samples and on more varied populations. Across the different experiments, the treatment usually consist in exposure to a 5- to 15-minute video of violent scenes from a violent movie. The scenes are often explicitly chosen to induce violence, depicting violence in a positive light. The control group usually watches a video of comparable length with non-violent scenes. Finally, the measures of violence vary from aggressive play with dolls for the children (Lovaas, 1961; Bandura, Ross, and Ross, 1963) to the imposition of electric shocks or noxious noises on other subjects (Geen and O'Neill, 1969; Bushman, 1995), and to aggressive play during a hockey game (Josephson, 1987). In all cases, the violence proxies are measured within an hour of the treatment. The effect of the exposure to movie violence is large. In four out of first five experiments of Table 1, exposure to the violent movie doubles the incidence of violence. The large size of this effect, though, masks some heterogeneity. In

the Geen and O'Neal (1969) study, for example, the effect of the violent movie is significant only for the group that was exposed to a frustration manipulation (2 minutes of loud white noise). (In fact, most of the experiments embed a frustration manipulation)

Leyens et al. (1975) stands out from the other experiments because it studies aggression and violence in a more realistic context. Young people in a juvenile detention facility in Belgium are exposed to 5 consecutive days of commercial violent movies (the treatment) or commercial non-violent movies (the control). Therefore, unlike in the other experiments, subjects are exposed to full-length movies. The violence measure is a record of the percent of subjects that engage in acts of physical aggression in a monitoring period of 1.5 minutes. Interestingly, exposure to violent movies significantly increases aggression in the evening, right after the movies are shown, but not at noon, after a night's sleep. These results suggest that the effects of media violence, when present, are likely to be short-lived.

A second set of evidence in Psychology comes from cross-section or longitudinal surveys. In these studies, self-reported measures of media exposure are correlated with measures of aggressiveness and violence. An example is Johnson et al. (2002), who find that the share of people committing assaults that can cause injury at age 16-22 is four times larger for people that (at age 14) watched at least 3 hours of television a day, as opposed to less than an hour. These studies, which generally imply very large effects of the media, are plagued by problems of endogeneity and reverse causation.

Overall, the studies from psychology suggest a large impact of media violence on violent behavior in the time period immediately following the exposure to the media violence. While it is hard to quantify this effect, most papers in Table 1 find that violent behavior doubles. In our findings, instead, we find a negative effect of media violence on violent crime, and can reject sizeable positive effects. We discuss how to reconcile the two findings below.

Predicted Impact on Assaults. We now take as given the magnitudes of the effects in the paper and estimate the impact of movie violence on the average number of assaults in the US. More precisely, we estimate the change in assaults that would occur if all violent movies were substituted by non-violent movies with the same audience numbers. These predictions rely on a number of restrictive assumptions: (i) no impact of media violence on assaults beyond the night of the media exposure; (ii) replacement by non-violent movies with the same audience; (iii) the effects for the whole population is the same as for the set of cities in the sample.

We present these results in Table 9. For each relevant time period (6PM-12AM and 12AM-6AM), given the average daily assault rate (Column 2) and the US population (Column 3), we compute the average number of assaults occurring daily in the time interval (Column (4)): 6,010 in the evening hours and 3,468 during the night. To this number, we compare the predicted change in number of assaults that would occur if violent movies were replaced by non-violent movies. To do so, we multiply the effect of violent movies estimated in Table 4 by the average daily audience of violent movies (Column 5 in Table 9); since this number affects

proportionally the number of assaults, we multiply it by the number of assaults (Column 5). The predicted change in assaults due to the presence of violent movies is in Column (6).

The results are as follows. On average, strongly violent movies in the evening hours (6PM-12AM) prevent about 55 assaults daily across the US, out of 6,010 assaults. Mildly violent movies (that are more common) are predicted to prevent 132 assaults. The estimates for the short-run impact on violence in the night hours (12AM-6AM) are smaller. Strongly violent movies are predicted to decrease the number of night assaults by 12, and mildly violent movies by 57. In addition to the point estimates, we compute 95 percent confidence intervals taking into account the uncertainty in the estimates of the effect of violent movies in Table 4.[8] Even taking into account the uncertainty, the largest increase in assaults due to movie violence that we cannot reject is an increase of 7 assaults in the night due to strongly violent movies. This is clearly a much smaller effect than what the psychology literature could have led one to predict.

To summarize, we have derived predictions on the impact of violent movies on assaults based on the estimates. As we discussed, these predictions should be taken with caution, since they rely on a number of restrictive assumptions. This being said, these predictions indicate that media violence has a sizeable impact on violent crime in the short-run. In particular, the incapacitation effect, which had been overlooked by the previous literature, is substantial, accounting for a potential decrease by 187 assaults of the total number of daily assaults.

Interpretations. The main results in the paper are that exposure to violent movies (i) decreases significantly same-day violent crime in the evening; (ii) it decreases to a smaller extent violent crime in the morning after. While the first result in the paper is easy to interpret as an incapacitation effect, the interpretation of the second result is less clear, specially in light of the opposite experimental results summarized above. We provide these interpretations for this result: catharsis, displacement, and sobriety.

1. *Catharsis.* The consumption of movie violence may have a cathartic effect, freeing tensions that could have been expressed otherwise in violent acts. This was a leading theory among psychologists in the 1950s and 1960s before the experiments on media violence and aggressiveness (leading to the opposite result) were run.

2. *Disruption.* If violent crime requires a whole evening to plan and/or execute, the visit to the movie theater may have disrupted criminal plans: once a criminal exits the movie theater, it is too late to engage in crime.

3. *Sobriety.* Theater attendance is likely to reduces the consumption of alcohol, which in turn reduces the incidence of violent crime. This may explain the results on theater

[8]The confidence intervals in Column 6 of Table 9 do not take into account uncertainty in either the average number of assaults, or the average movie audience.

releases, but it does not explain as well the results for DVD and VHS rentals, since rentals may be associated with high alcohol consumption at home.

While these explanations address the findings in this paper, they do not explain the difference in findings with the experimental evidence. Reconciling the differences is important not only to better understand the effect of media violence on violence, but also more generally to understand the relationship between experimental and field evidence. We believe that there are two sets of reasons for the differences, the first having to do with the design of the experiments, and the second with sorting.

The first reason is differences in the logistics of the treatment. In the experiments, subjects typically watch a 5-10 minute video clip consisting of sequences of extreme violence taken out of context from a movie. In the field, people sit at a movie theater and watch two hours of a movie in which acts of violence are mixed with meaningful acts of reconciliation, apprehension of criminals, and non-violent sequences. This implies three substantial differences: (i) the movie experience in the field lasts much longer and, as such, can incapacitate an act of violence, and can disrupt plans for violence; (ii) in most violent movies, the acts of violence often follow a logic, inducing potentially a different reaction compared to exposure to random acts or violence; (iii) the limited availability of alcoholic beverages in theaters reduces the alcoholic consumption moviegoers, who may otherwise have spent the evening drinking. These differences underscore the need for more realistic settings for experiments which approximate more closely the field settings to increase external validity.

The second reason is sorting into movie violence. The experimental subjects are exposed to extreme violence that they had neither demanded nor anticipated. Individuals watching violent movies at the movie theater, instead, pay for such exposure, possibly because they are looking for a way to channel tensions. Sorting into media violence, therefore, could explain the different results in the experiments and in the field. This reflects a more general difference between laboratory and field evidence that is a source of debate (Lazear, Malmendier, and Weber, 2006; Levitt and List, 2006).

In the current context, field evidence and laboratory experiments help to evaluate different treatments. The laboratory experiments evaluate the treatment for people that are (coercedly) exposed to an unusually elevated level of violence. The setting may approximate the reaction of audiences to the first instances of media violence. The field evidence in this paper evaluates the treatment to elevated violence of people that choose to expose themselves to violence, and have seen violence before. This experiment evaluates the effect of a marginal increase in violence over an habituation level.

5 Conclusions

We have attempted to provide causal evidence on the short-run effect of exposure to media violence on violent crime. We exploit the natural experiment induced by the time-series variation in the violence of movies at the box office. We show that exposure to violent movies has two effects on violent crimes: (i) It reduces significantly violent crime in the evening of the day of exposure. (ii) To a lesser extent, it reduces violent crime during the night hours following the exposure.

We interpret the first finding as incapacitation: potential criminals cannot commit crimes while at the movie theater. As simple as this finding is, it had been neglected in the literature, despite its quantitative importance. Based on our estimates, we compute that incapacitation due to violent movies deters about 60 assaults per evening in the US. We interpret the second finding as suggesting that exposure to violent movies does not cause a temporary surge in violence. We attribute the difference in results from the psychology experiments to differences in the details of exposure to media violence, and to sorting in the field.

This paper cannot, unfortunately, address the important question on the long-run effect of exposure to movie violence. As such, it should not be used to inform policy on the effects of limiting the level of violence allowed in the media. Instead, it provides evidence on the effect of broadcasting an additional violent movie to consumers that are already exposed to violence—the additional exposure appears, if anything, to reduce violent crime.

In ongoing work, we plan to explore further impacts of movie content, such as the impact of sexual content on sexual assaults. This allows us to test in the field the laboratory findings that indicate a strong effect of sexual arousal on willingness to engage in behavior that may lead to a date rape. (Ariely and Loewenstein, forthcoming).

A Appendix A - Data

Imputation of daily box-office audience. The daily box-office movies data is available starting from September 1997, and it covers the 10 highest-selling movies on that day. To expand the coverage to the period January 1995-August 1997 and to the movies that do not make the daily top 10 list, we impute the daily data, whenever missing, using the weekend box-office data for the same movie in the same week. Fortunately, the weekend data is available throughout the whole sample for the 50 highest-selling movies. For the imputation, we exploit the regularity in the within-week pattern of sales (Figure 2). Ticket sales peak on Saturday, Friday, and Sunday (in decreasing order) and are lowest on Tuesday (Figure 2).

For the imputation, we use the following model. Denote by $a_{j,t}$ the daily audience of movie j on date t, and by $a^w_{j,w(t)}$ the weekend audience of movie j on weekend $w(t)$ corresponding to date t. (Since most movies are released on Friday, the function $w(t)$ assigns the days from Monday through Thursday to the previous weekend.) We assume that the daily audience is a share s of the weekend audience, where the share allowed to depend on a set of controls Y, $s(Y)$: $a_{j,t} = s(X)\, a^w_{j,w(t)}$. After taking logs, the model can be written as $\ln(a_{j,t}) = \ln(s(Y)) + \ln(a^w_{j,w(t)})$. The most important control for the share $\ln(s(Y))$ is the set of day-of-week indicators d^d_t: different weekdays capture a different share of the overall revenue (Figure 2). We allow the weekday share to differ by month (in the summer the Monday-Thursday audience is larger), rating type (G/PG/PG-13/R/NC-17/Unrated/Missing Rating) and in the first week of release. This set of controls X (month indicators, rating indicators, and indicator for first week) therefore, is interacted with the day-of-week dummies, as well as present in levels. Finally, we control for a set of holidays H_t, described below. We estimate

$$\ln(a_{j,t}) - \ln(a^w_{j,w(t)}) = \sum_{d\in D} \beta^d d^d_t + \sum_{d\in D} \Gamma^{d,X} d^d_t * X_{j,t} + \Gamma X_{j,t} + \Phi H_t + \varepsilon_{j,t}$$

over the set of movie-day observations (j,t) for which we observe both the daily audience $a_{j,t}$ and the weekend audience $a^w_{j,w(t)}$. We use the predicted values from the regressions, $\ln(a_{j,t}) - \widehat{\ln(a^w_{j,w(t)})}$, to obtain the predicted daily audience $\hat{a}_{j,t}$, as follows: $\hat{a}_{j,t} = \exp[\ln(a^w_{j,w(t)}) + \ln(a_{j,t}) - \widehat{\ln(a^w_{j,w(t)})}]$. The final daily box-office audience data is defined as the actual box-office data $a_{j,t}$ whenever available, and the predicted value otherwise.

The accuracy of the imputation is high. Over the sample on which both the daily and the weekend data are available, a regression of predicted daily revenue $\hat{a}_{j,t}$ on actual daily revenue $a_{j,t}$ yields a slope coefficient of .9842 with an R^2 of .9190.

Holidays. We define a fairly exhaustive set of holiday indicators to take into account that (i) holidays generally increase movie attendance; (ii) the effect of different holidays on attendance is quite different (attendance on Labor Day is much higher than on Memorial Day); (iii) attendance increases also the day before a Holiday, and for major holidays in the week surrounding. Taking into account these facts, we include separate indicators for Martin Luther King Day, President Day, Memorial Day, Labor Day, and Columbus Day, and separate indicators for the Sunday preceding each of these holidays. We also include an indicator for Independence Day, three Easter indicators (Friday, Saturday, and Sunday), three Thanksgiving indicators (Wednesday, Thursday, and Thanksgiving weekend), four Christmas indicators (December 20-23, December 24, December 25, and December 26-30), and three New Year indicators (December 31, January 1, and January 2-3). In addition, we include an indicator for holidays observed on a Monday or a Friday if they fall on a weekend (Independence Day,

Christmas, New Year, Veteran's Day), and an indicator for Sunday before these holidays, if they are observed on Monday. Finally, we include an indicator for St. Patrick Day, Valentine Day, Halloween, Cinco de Mayo, Mother's Day, and Superbowl.

Imputation of DVD/VHS data. The data on weekly DVD and VHS rentals is less complete than the data on theater attendance. The data for the top 25 DVD weekly rentals is available from July 2000 to December 2002[9]. The data on VHS weekly rentals covers the top 10 rentals over the period July 1999-October 2000, and the top 40 rentals over the period June 2001-July 2002. In order to construct a continuous series, we exploit the fact that the high-rental VHSs in a given week are highly correlated with the high-rental DVDs in the same week. We denote by $a_{j,t}^{DVD}$ the number of rentals of DVDs of movie j in week t, and by $a_{j,t}^{VHS}$ the corresponding number of VHSs rentals. We then impute the number of DVD rentals, whenever missing, using the model $\log\left(a_{j,t}^{DVD}\right) = \alpha + \beta \log\left(a_{j,t}^{VHS}\right) + \eta_y + t + \varepsilon_{j,t}$, where η_y is a set of year indicators, and t is a linear time trend that captures the fact that over time DVD rentals replaced VHS rentals. Similarly, whenever the number of VHS rentals is missing, we impute it using the model $\log\left(a_{j,t}^{VHS}\right) = \alpha + \beta \log\left(a_{j,t}^{DVD}\right) + \eta_y + t + \varepsilon_{j,t}$. A regression of the predicted rental series on the actual series yields an R^2 of .9031 for DVDs and .8603 for VHSs. The final measure of DVD and VHS rentals is the sum of the DVD and the VHS series, including the imputed values.

[9] In some weeks in the year 2000, the data covers only the top-20 rentals.

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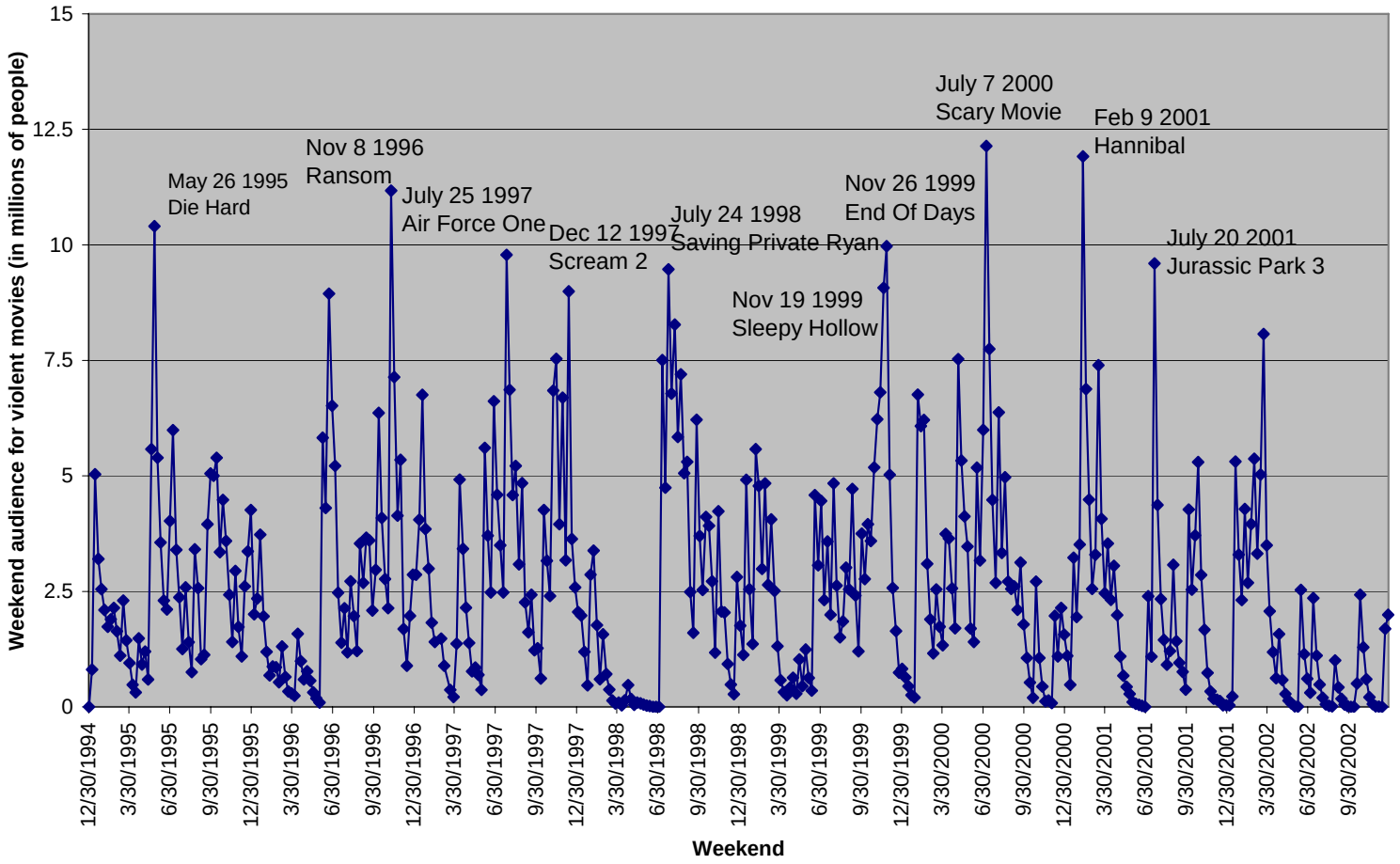
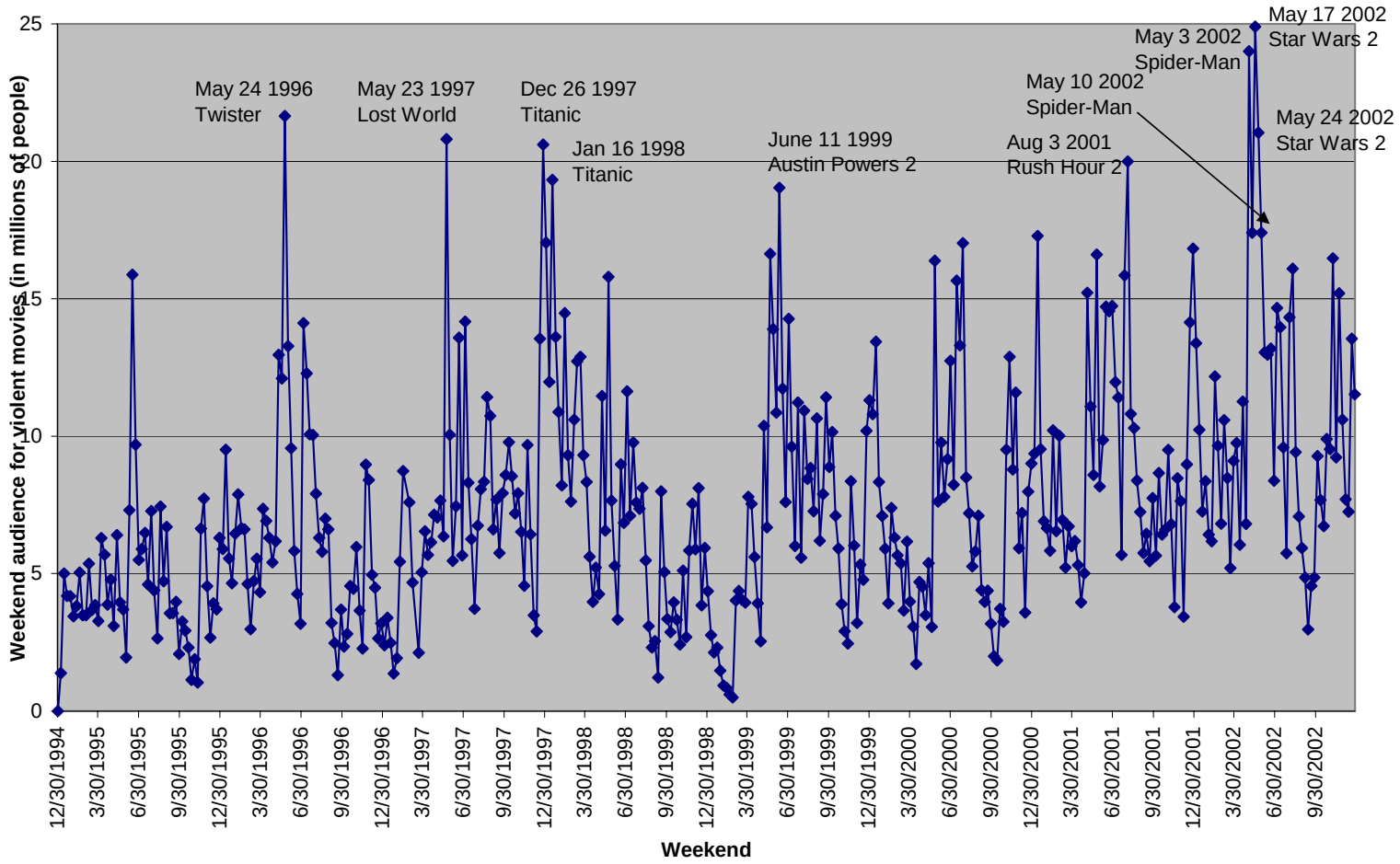
Figure 1a. Weekend Theater Audience of Strongly Violent Movies



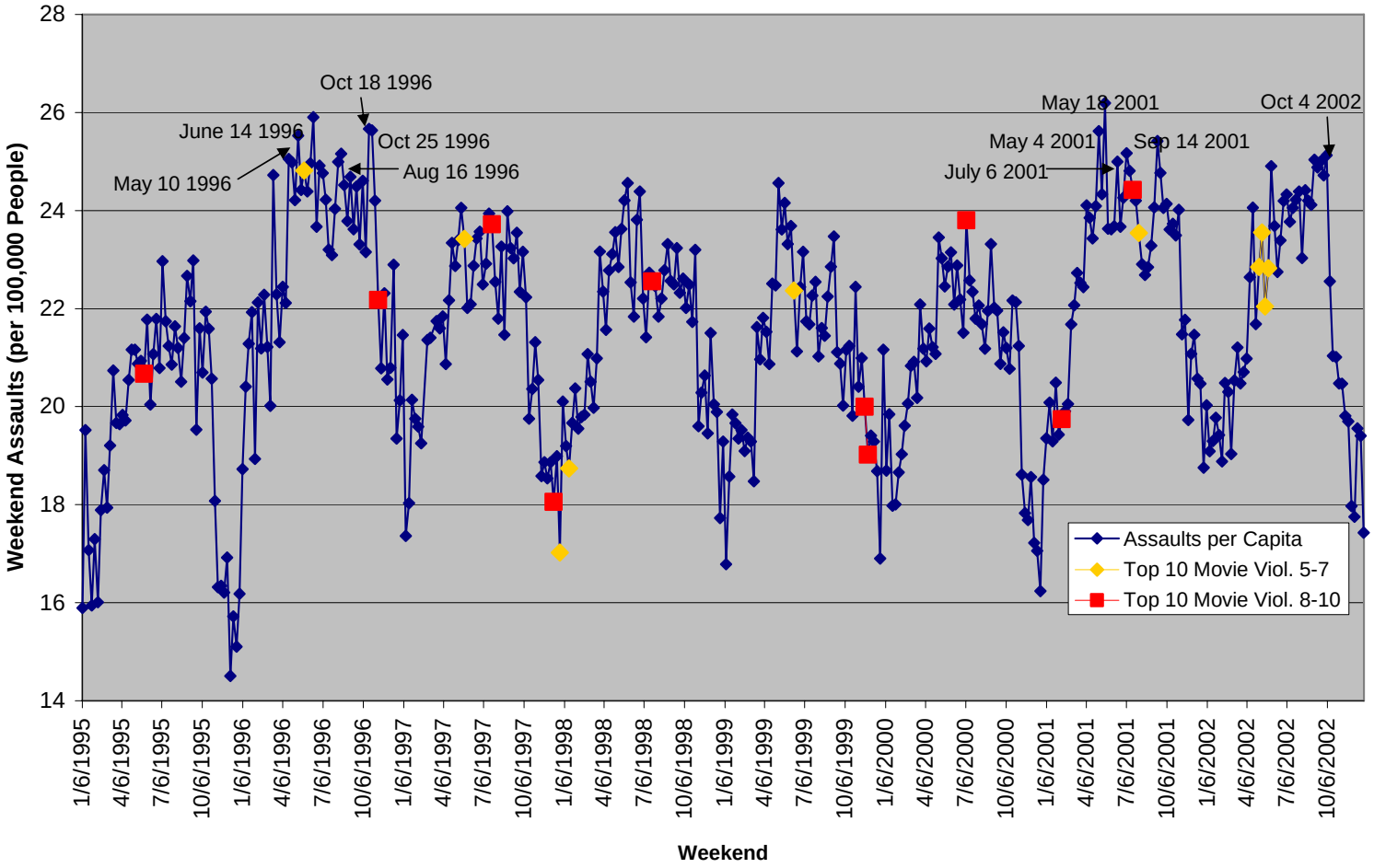
Notes: Plot of weekend box-office audience (in millions of people) for movies rated as strongly violent. The 10 weekends with the highest audience for strongly violent movies are labeled in the Figure. Movies are rated as strongly violent if they have a kids-in-mind.com rating 8-10. The audience data is obtained from box-office sales (from the-numbers.com) deflated by the average price of a ticket.

Figure 1b. Weekend Theater Audience of Mildly Violent Movies



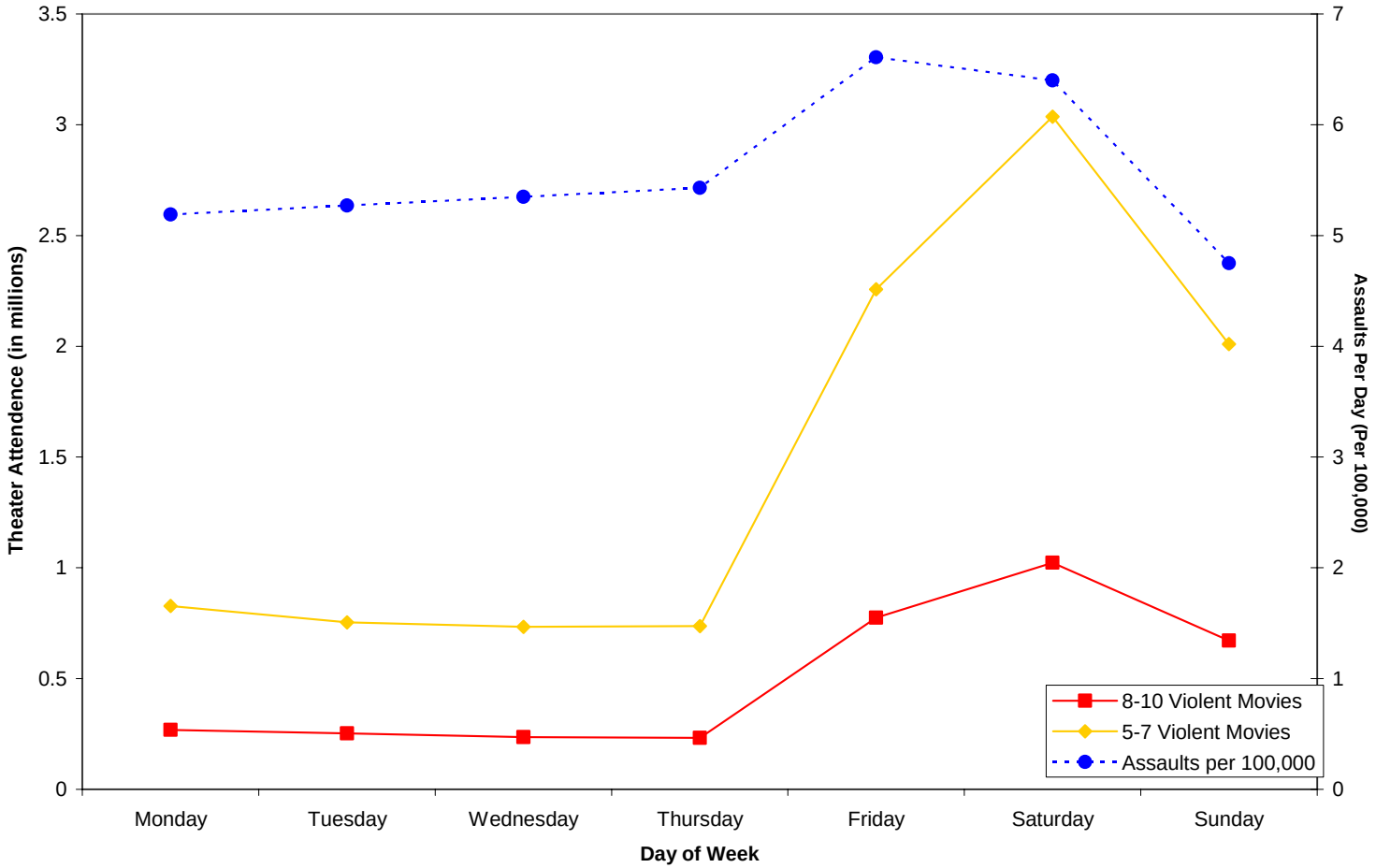
Notes: Plot of weekend box-office audience (in millions of people) for movies rated as mildly violent. The 10 weekends with the highest audience for mildly violent movies are labeled in the Figure. Movies are rated as mildly violent if they have a kids-in-mind.com rating 5-7. The audience data is obtained from box-office sales (from the-numbers.com) deflated by the average price of a ticket.

Figure 1c. Weekend Assault Rate



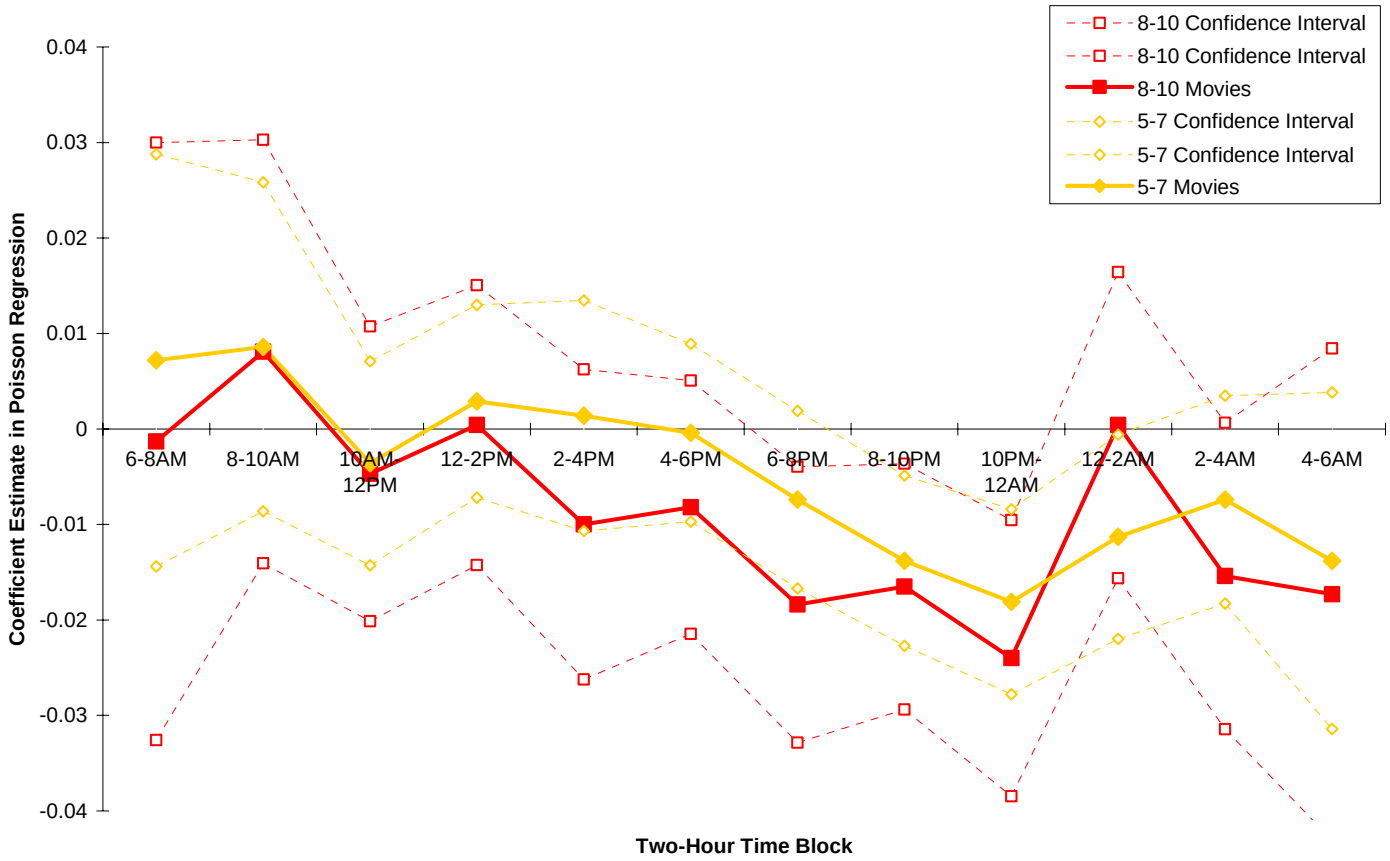
Notes: Plot of weekend assault rates per 100,000 people. The assault data is from NIBRS. The 10 weekends with the highest assault rates are listed in the Figure, together with the 10 weekends with the highest strong movie violence audience (Figure 1a) and the 10 weekends with the highest mild movie violence audience (Figure 1b).

Figure 2. Violent Movie Attendence and Assault Rate by Day of Week



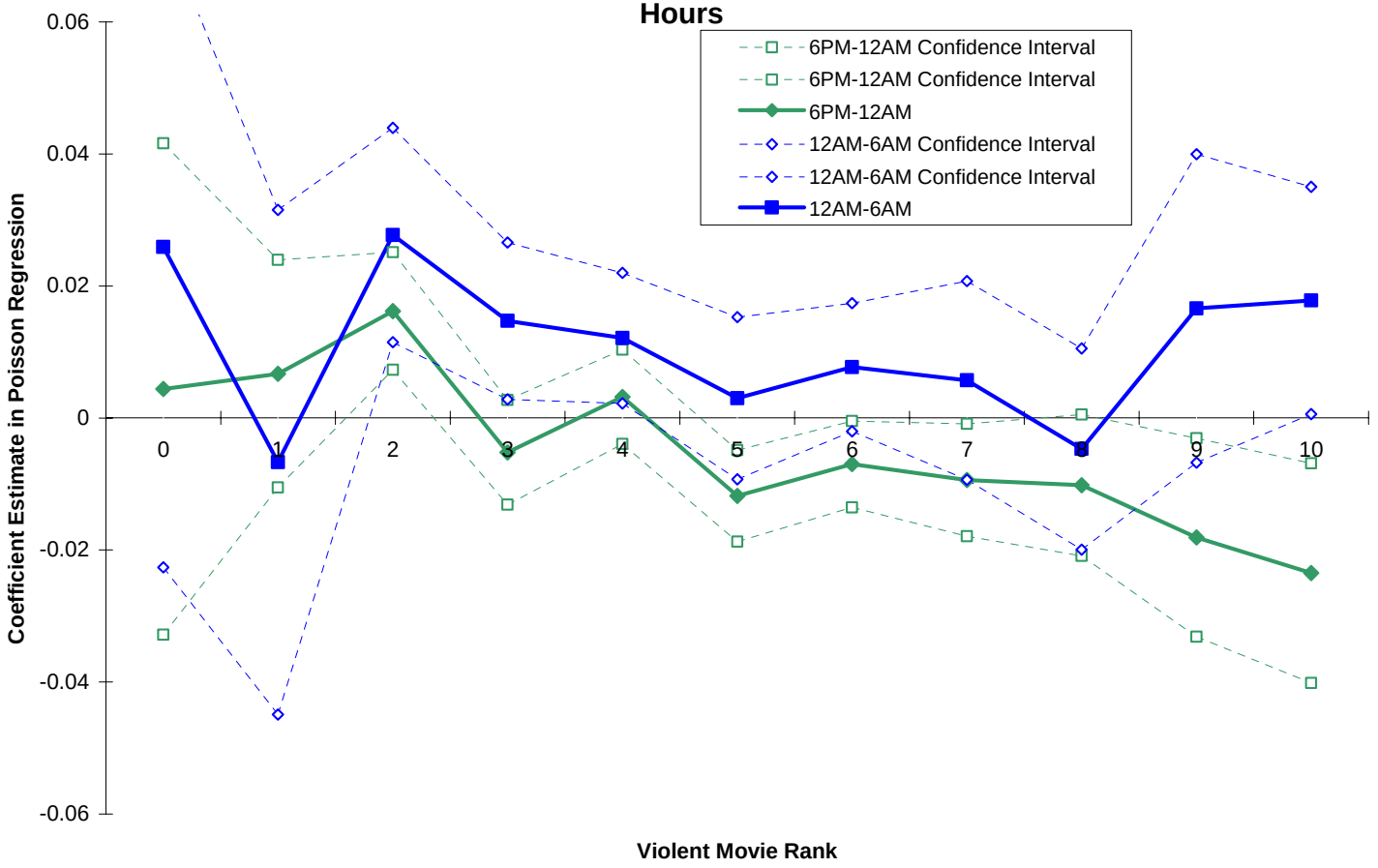
Notes: Plot of average daily box-office audience (in millions of people) for movies rated as strongly violent or mildly violent, and for assaults (per 100,000) by day of week. Movies are rated as strongly violent (mildly violent) if they have a kids-in-mind.com rating 8-10 (5-7). The audience data is obtained from box-office sales (from the-numbers.com) deflated by the average price of a ticket.

Figure 3. Effect of Movie Violence By Two-Hour Time Blocks



Notes: Plot of coefficient from separate Poisson regressions of assaults in two-hour time block (X axis) on daily audience for strongly violent movies (red line) and daily audience for mildly violent movies (orange line), controlling for daily total movie audience (coefficients not shown). The plot also shows 95% confidence intervals. The coefficients can be interpreted as the percent change in assaults for an increase of one million in the audience for violent movies, holding constant the total movie audience. Movies are rated as strongly violent (mildly violent) if they have a kids-in-mind.com rating 8-10 (5-7). The audience data is obtained from box office sales (from the-numbers.com) deflated by the average price of a ticket.

Figure 4. Effect of Movie Violence by Violence Level for Evening and Night Hours



Notes: Plot of coefficients from Poisson regression of assaults on 11 variables for the daily audience for movies of violence level *v* (*v=0,1,…,10* on the right axis). The regressions are run separately for assaults in the 6PM-12AM and 12AM-6AM time period. The plot also shows 95% confidence intervals. The coefficients can be interpreted as the percent change in assaults for an increase of one million in the audience for movies of violence *v*. The violence rating of movies is from kids-in-mind.com. The audience data is obtained from box office sales (from the-numbers.com) deflated by the average price of a ticket.

Table 1. Examples of Studies of Media Effects on Violence in Psychology

Paper	Exposure to violence (Type of movie)	Control Group	Subjects	Location	Sample Size	Measure of Violence *t*	Treatment Group t_T	Control Group t_C
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Laboratory Experiments								
Lovaas (1961)	5-min. Extract from "Rassling Match" -- cartoon violence	5-min. Non-Violent Clip from "Bear Facts"	Children of Nursery School	Playroom	10 + 10	Time Spent Playing with Aggressive Doll (hits other doll)	98.2	58.6
Bandura, Ross, and Ross (1963)	10-min. Scenes of Aggression of Doll	No Movie	Children of Nursery School	Playroom	24 + 24	Aggression toward Doll	91.5	54.3
Geen and O'Neal (1969)	7-min. Prizefight Scene from "Champion" + 2 min. White Noise	7-min. Scenes on Non-violent Sport + 2 min. White Noise	College Students	Laboratory	12 + 12	Intensity Electric Shock Inflicted on Other Subject	22.2	10.3
	7-min. Prizefight Scene from "Champion"	7-min. Scenes on Non-violent Sport					12.7	14.7
Bushman (1995)	15-min. Violent Scenes from "Karate Kid III"	15-min. non-violent scenes from "Gorillas in The Mist"	College Students	Laboratory	738	Level of Noise Inflicted On Other Subject For Slow Answer	4.6	3.9
Josephson (1987)	14-min. Scenes of Killing of Police Officer and SWAT team in Action	14-min. Scenes of Motorcross Bike-Racing Team	Grades 2-3, Boys	School	396	Aggression in 9 Min. of Floor Hockey Game	6.6	3.6
Leyens et al. (1975)	Showing of 5 Violent Movies On 5 Consecutive Days	Showing of 5 Non-Violent Movies On 5 Consecutive Days	Juvenile Detention	Cottage in Belgium	85	% Committing Phys. Aggression In Evening After Movie	4.0%	.2%
						% Committing Phys. Aggression At Noon Day After Movie	2.1%	1.5%
Surveys								
Johnson et al. (2002)	High (Self-reported) Television Viewing at Age 14 (>=3 hrs./day)	Low (Self-reported) Television Viewing at Age 14 (<1 hrs./day)	Random Sample	NY State	707	% Committing Assaults Causing Injury, at Age 16-22	25.3%	5.7%

Notes: Calculations of effects on violence are by the authors based on data from the papers cited. Columns (7) and (8) report the level of violence in the Treatment and Control group. The difference is always significant at the 5% level, except for the second comparison in the Geen and O"Neal (1969) paper and the second comparison in Leyens et al. (1975).

Table 2. Summary Statistics

	Assaults (per day)		Assault Rate (per 100,000 pop)	
	mean (1)	std dev (2)	mean (3)	std dev (4)
Overall	3.66	6.42	5.57	6.15
By time of day				
6:00 am to 11:59 am	0.52	1.24	0.74	1.67
12:00 pm to 5:59 pm	1.11	2.20	1.59	2.65
6:00 pm to 11:59pm	1.45	2.73	2.01	3.14
12:00 am to 5:59 am	1.25	2.45	1.16	2.42
not known	0.05	0.33	0.08	0.65
By day of week				
Monday	3.41	6.00	5.19	5.87
Tuesday	3.47	6.07	5.27	5.87
Wednesday	3.51	6.11	5.35	5.93
Thursday	3.56	6.22	5.43	5.97
Friday	4.32	7.26	6.61	6.83
Saturday	4.20	7.25	6.40	6.85
Sunday	3.16	5.75	4.75	5.37
By age (of offender)				
15 to 24	1.16	2.37	1.76	2.90
25 to 34	0.89	1.92	1.32	2.27
35 to 44	0.64	1.36	0.97	1.83
other age or age not known	0.97	1.91	1.52	2.56
By gender (of offender)				
male	2.74	4.94	4.17	4.86
female	0.92	1.87	1.41	2.46

	Movie / Rental Audience (in millions of tickets / rentals)	
	mean (5)	std dev (6)
Overall movie audience (daily data)	3.73	2.77
Movie audience by Kids-in-Mind rating		
Strongly violent (12.6%)	0.47	0.63
Mildly violent (43%)	1.62	1.49
Movie audience by alternative MPAA rating		
Strongly violent (5%)	0.28	0.43
Mildly violent (36%)	1.26	1.25
DVD and VHS rentals (weekly data)	21.44	7.14
Rentals by Kids-in-Mind rating		
Strongly violent (17%)	3.71	2.86
Moderately violent (49%)	10.40	4.82
N	425559, 264 cities	
Average City Population	59155	

Notes: An observation is an agency-day observation over the years 1995-2002. The sample includes all agencies with population of at least 25,000 and reporting crimes in at least 300 days in the year. The movie audience numbers are obtained from daily box-office revenue divided by the average price per ticket. The DVD and VHS rental numbers are obtained from weekly rental revenue divided by the average price of a rental, and are only available for July 1999 - December 2002. The ratings of violent movies are from www.kids-in-mind.com. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The audience of strongly violent movies is the audience of all movies with a violence rating 8-10. The alternative MPAA rating is based on the presence of key words used to describe why a movie received a certain rating by the MPAA.

Table 3. The Effect of Movie Violence on Same-Day Assaults

Specification:	Poisson Regression					Negative Binomial	OLS Regression	
Dep. Var.:	Number of Assaults in Town k in Day t						Assaults per Capita	Log (Assaults per Capita)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Audience Of Strongly Violent Movies	0.0158	0.0034	-0.0095	-0.0096	-0.0101	-0.0087	-0.5429	-0.0049
(in millions of people in Day t)	(0.0066)**	(0.0050)	(0.0033)***	(0.0032)***	(0.0037)***	(0.0032)***	(0.2017)***	(0.0027)*
Audience Of Mildly Violent Movies	0.0145	0.0142	-0.0061	-0.0064	-0.0046	-0.0056	-0.4194	-0.0041
(in millions of people in Day t)	(0.0045)***	(0.0032)***	(0.0026)**	(0.0023)***	(0.0027)*	(0.0023)**	(0.1395)***	(0.0018)**
Audience Of All Movies	0.0102	-0.0127	-0.0026	-0.003	-0.0031	-0.0023	-0.2254	-0.0025
(in millions of people in Day t)	(0.0027)***	(0.0027)***	(0.0023)	(0.0021)	(0.0024)	(0.0021)	(0.1288)*	(0.0017)
Control Variables:								
Year Indicators	X	X	X	X	X	X	X	X
Day-of-Week Indicators		X	X	X	X	X	X	X
Month Indicators			X	X	X	X	X	X
Holiday Indicators				X	X	X	X	X
Use Only Non-Imputed Daily Audience Data					X			
N	N = 425559	N = 425559	N = 425559	N = 425559	N = 353215	N = 425559	N = 425559	N = 308987

Notes: An observation is an agency-day observation over the years 1995-2002. The sample includes all agencies with population of at least 25,000 and reporting crimes in at least 300 days in the year. The audience numbers are obtained from daily box-office revenue divided by the average price per ticket. The ratings of violent movies are from www.kids-in-mind.com. The audience of strongly violent movies is the audience of all movies with a violence rating 8-10. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The specifications in Columns (1) through (5) are Poisson regressions with the number of assault occurring in day t in an agency as dependent variable. The specification in Column (5) does not use the imputation of daily audience data from the weekend data. The specification in Column (6) is a Negative Binomial regression. The specifications in Columns (7) and (8) are OLS regressions with assaults per capita (Column (7)) and log (assaults per capita) (Column (8)) as dependent variables. Robust standard errors clustered by date in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4. The Effect of Movie Violence on Same-Day Assaults by Time of Day

Specification:	**Poisson Regression**						
Dep. Var.:	**Number of Assaults in Town k in Day t in Time Window**						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Audience Of Strongly Violent Movies	0.0002	-0.0064	-0.0196	-0.0075	-0.0023	-0.0207	-0.0104
(in millions of people in Day t)	(0.0069)	(0.0046)	(0.0044)***	(0.0061)	(0.0042)	(0.0044)***	(0.0059)*
Audience Of Mildly Violent Movies	0.0025	0.0013	-0.0136	-0.0101	0.0014	-0.0131	-0.0102
(in millions of people in Day t)	(0.0051)	(0.0035)	(0.0031)***	(0.0042)**	(0.0033)	(0.0030)***	(0.0043)**
Audience Of All Movies	-0.0216	-0.0179	0.0039	0.015	-0.0695	0.0409	0.1144
(in millions of people in Day t)	(0.0049)***	(0.0032)***	(0.0027)	(0.0044)***	(0.0076)***	(0.0063)***	(0.0127)***
(Audience Of All Movies)^2					0.0058	-0.0043	-0.0101
(in millions of people in Day t)					(0.0010)***	(0.0007)***	(0.0013)***
(Audience Of All Movies)^3					-0.0002	0.0001	0.0003
(in millions of people in Day t)					(0.0001)***	(0.0000)***	(0.0000)***
Time of Day	6AM-12PM	12PM-6PM	6PM-12AM	12AM-6AM next day	6AM-6PM	6PM-12AM	12AM-6AM next day
Control Variables:							
Year Indicators	X	X	X	X	X	X	X
Day-of-Week Indicators	X	X	X	X	X	X	X
Month Indicators	X	X	X	X	X	X	X
Holiday Indicators	X	X	X	X	X	X	X
N	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559

Notes: An observation is an agency-day observation over the years 1995-2002. The sample includes all agencies with population of at least 25,000 and reporting crimes in at least 300 days in the year. The audience numbers are obtained from daily box-office revenue divided by the average price per ticket. The ratings of violent movies are from www.kids-in-mind.com. The audience of strongly violent movies is the audience of all movies with a violence rating 8-10. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The specifications in Columns (1) through (7) are Poisson regressions with the number of assault occurring in day t in an agency as dependent variable. Robust standard errors clustered by date in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. The Effect of Movie Violence on Same-Day Assaults -- Alternative Movie Violence Measure

Specification:	**Poisson Regressions**					
Dep. Var.:	**Number of Assaults in Town k in Day t in Time Window**					
	(1)	(2)	(3)	(4)	(5)	(6)
Audience Of Strongly Violent Movies - NPAA Meas.	-0.0146	-0.0174	-0.0069	-0.0158	-0.0063	-0.0051
(in millions of people in day t)	(0.0055)***	(0.0060)***	(0.0082)	(0.0071)**	(0.0073)	(0.0103)
Audience Of Mildly Violent Movies - NPAA Meas.	0.0035	-0.0116	-0.0079	0.0028	-0.0062	-0.0046
(in millions of people in day t)	(0.0030)	(0.0026)***	(0.0040)**	(0.0037)	(0.0033)*	(0.0052)
Audience Of Strongly Violent Movies - Stand. Meas.				0.0017	-0.0149	-0.0035
(in millions of people in day t)				(0.0059)	(0.0057)***	(0.0081)
Audience Of Mildly Violent Movies - Stand. Meas.				0.0013	-0.0093	-0.0067
(in millions of people in day t)				(0.0040)	(0.0038)**	(0.0055)
Theater Audience Of All Movies	-0.0202	0.001	0.0131	-0.0207	0.0042	0.015
(in millions of people in day t)	(0.0027)***	(0.0025)	(0.0044)***	(0.0032)***	(0.0027)	(0.0045)***
Time of Day	6AM-6PM	6PM-12AM	12AM-6AM next day	6AM-6PM	6PM-12AM	12AM-6AM next day
Control Variables:						
Year Indicators	X	X	X	X	X	X
Day-of-week Indicators	X	X	X	X	X	X
Month Indicators	X	X	X	X	X	X
Holiday Indicators	X	X	X	X	X	X
N	N = 420799	N = 420799	N = 420799	N = 420799	N = 420799	N = 420799

Notes: An observation is an agency-day observation over the years 1995-2002. The sample includes all agencies with population of at least 25,000 and reporting crimes in at least 300 days in the year. The audience numbers are obtained from daily box-office revenue divided by the average price per ticket. The NPAA ratings are obtained using the one-line NPAA summary of the movie. We characterize as mildly violent movies for which the NPAA Rating contains the word "Violence" of "Violent", with two exceptions: (i) If the reference to reference is qualified by "Brief", "Mild", or "Some", we classify the movie as non-violent; (ii) If the word violence is qualified by either "Bloody", "Brutal", "Disturbing", "Graphic", "Grisly", "Gruesome", or "Strong", we classify the movie as strongly violent. The standard ratings of violent movies are from www.kids-in-mind.com. The audience of strongly violent movies is the audience of all movies with a violence rating 8-10. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The specifications are Poisson regressions with the number of assault occurring in day t in an agency as dependent variable. Robust standard errors clustered by date in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6. The Effect of Movie Violence on Same-Day Assaults, By Age Group and Gender

Specification:	**Poisson Regressions**									
Dep. Var.:	**Number of Assaults in Town k in Day t in Time Window**									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Audience Of Strongly Violent Movies	-0.0227	-0.0085	-0.0179	-0.0027	-0.0204	-0.0065	-0.0193	-0.0048	-0.0205	-0.0182
(in millions of people in day t)	(0.0070)***	(0.0098)	(0.0070)**	(0.0079)	(0.0074)***	(0.0092)	(0.0045)***	(0.0063)	(0.0075)***	(0.0097)*
Audience Of Mildly Violent Movies	-0.0146	-0.0156	-0.0103	0.0025	-0.0115	-0.0083	-0.0141	-0.009	-0.0114	-0.0141
(in millions of people in day t)	(0.0047)***	(0.0062)**	(0.0048)**	(0.0056)	(0.0051)**	(0.0069)	(0.0034)***	(0.0045)**	(0.0048)**	(0.0060)**
Audience Of All Movies	0.0061	0.0202	0.0032	0.0063	0.0006	0.0072	0.0041	0.0143	0.0031	0.0178
(in millions of people in day t)	(0.0043)	(0.0061)***	(0.0043)	(0.0056)	(0.0044)	(0.0066)	(0.0028)	(0.0046)***	(0.0044)	(0.0060)***
Age Group of Criminal	15-24	15-24	25-34	25-34	35-44	35-44	All	All	All	All
Gender of Criminal	All	All	All	All	All	All	Male	Male	Female	Female
Time of Day	6PM-12AM	12AM-6AM next day	6PM-12AM	12AM-6AM next day	6PM-12AM	12AM-6AM next day	6PM-12AM	12AM-6AM next day	6PM-12AM	12AM-6AM next day
Control Variables:										
Year Indicators	X	X	X	X	X	X	X	X	X	X
Day-of-week Indicators	X	X	X	X	X	X	X	X	X	X
Month Indicators	X	X	X	X	X	X	X	X	X	X
Holiday Indicators	X	X	X	X	X	X	X	X	X	X
N	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559	N = 425559

Notes: An observation is an agency-day observation over the years 1995-2002. The sample includes all agencies with population of at least 25,000 and reporting crimes in at least 300 days in the year. The audience numbers are obtained from daily box-office revenue divided by the average price per ticket. The ratings of violent movies are from www.kids-in-mind.com. The audience of strongly violent movies is the audience of all movies with a violence rating 8-10. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The specifications are Poisson regressions with the number of assault occurring in day t in an agency as dependent variable. Robust standard errors clustered by date in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7. The Effect of Movie Violence on Weekend Assaults; Placebo Specifications

Specification:	Poisson Regressions			Placebo Poisson Regressions					
Dep. Var.:	Number of Assaults in Town k in Weekend t			Number of Assaults in Town k in Weekend t in Previous Year			Number of Assaults in Town k in Weekend t Two Years Before		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Audience Of Strongly Violent Movies	-0.003	-0.0051	0.0001	0.0011	0.0015	0.0012	-0.0001	0.0026	0.0026
(in millions per day in weekend t)	(0.0018)	(0.0019)***	(0.0023)	(0.0017)	(0.0019)	(0.0023)	(0.0018)	(0.0019)	(0.0023)
Audience Of Mildly Violent Movies	0.0005	-0.0014	-0.0007	-0.0019	0.0005	0.0011	0.0003	-0.0001	0.0016
(in millions per day in weekend t)	(0.0014)	(0.0013)	(0.0020)	(0.0012)	(0.0013)	(0.0020)	(0.0014)	(0.0014)	(0.0020)
Audience Of All Movies	-0.0054	-0.0021	-0.0024	0.0018	0.0015	0.0008	-0.0008	0.0004	-0.0037
(in millions per day in weekend t)	(0.0016)***	(0.0014)	(0.0026)	(0.0015)	(0.0014)	(0.0024)	(0.0016)	(0.0014)	(0.0019)*
Time of Day	6AM-6PM	6PM-12AM	12AM-6AM next day	6AM-6PM	6PM-12AM	12AM-6AM next day	6AM-6PM	6PM-12AM	12AM-6AM next day
Control Variables:									
Year Indicators	X	X	X	X	X	X	X	X	X
52 Week-of-the-Year Indicators	X	X	X	X	X	X	X	X	X
N	N = 60570	N = 60570	N = 60570	N = 60634	N = 60634	N = 60634	N = 60660	N = 60660	N = 60660

Notes: An observation is an agency-week observation over the years 1995-2002. The sample includes all agencies with population of at least 25,000 and reporting crimes in at least 300 days in the year. The audience numbers are obtained from weekend box-office revenue divided by the average price per ticket. The ratings of violent movies are from www.kids-in-mind.com. The audience of strongly violent movies is the audience of all movies with a violence rating 8-10. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The specifications in Columns (1) through (4) are Poisson regressions with the number of assaults occurring on weekend t in an agency as dependent variable. The specifications in Columns (5) through (8) are placebo Poisson regressions with the number of assaults occurring on weekend t one year before in an agency as dependent variable (for 1995 movies, the assaults refer to 2002); similarly, the number of assaults in Columns (9) through (12) refers to assaults occurring on the corresponding weekend two years before (for 1995 (1996) movies, the assaults refer to 2001 (2002)). Robust standard errors clustered by date in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 8. The Effect of DVD/VHS Movie Violence on Weekend Assaults

Specification:	**Poisson Regressions**					
Dep. Var.:	**Number of Assaults in Town k in Weekend t in Time Window**					
	(1)	(2)	(3)	(4)	(5)	(6)
DVD/VHS Rentals Of Strongly Violent Movies	-0.0018	-0.0032	0.0043	-0.0007	-0.0028	0.0049
(in millions of people in weekend t)	(0.0020)	(0.0021)	(0.0038)	(0.0021)	(0.0021)	(0.0040)
DVD/VHS Rentals Of Mildly Violent Movies	0.0006	-0.0057	-0.0065	0.0018	-0.0044	-0.0057
(in millions of people in weekend t)	(0.0021)	(0.0018)***	(0.0028)**	(0.0022)	(0.0019)**	(0.0027)**
DVD/VHS Rentals Of All Movies	-0.0041	-0.0006	0.0016	-0.0037	-0.0009	0.002
(in millions of people in weekend t)	(0.0020)**	(0.0018)	(0.0045)	(0.0020)*	(0.0017)	(0.0044)
Theater Audience Of Strongly Violent Movies				-0.0015	-0.0036	0.0046
(in millions of people in week t)				(0.0022)	(0.0026)	(0.0029)
Theater Audience Of Mildly Violent Movies				-0.0013	-0.0041	-0.0014
(in millions of people in week t)				(0.0018)	(0.0016)***	(0.0026)
Theater Audience Of All Movies				-0.005	-0.0001	-0.0048
(in millions of people in week t)				(0.0022)**	(0.0018)	(0.0039)
Time of Day	6AM-6PM	6PM-12AM	12AM-6AM next day	6AM-6PM	6PM-12AM	12AM-6AM next day
Control Variables:						
Year Indicators	X	X	X	X	X	X
52 Week-of-the-Year Indicators	X	X	X	X	X	X
N	N = 37828	N = 37828	N = 37828	N = 37828	N = 37828	N = 37828

Notes: An observation is an agency-week observation over the period September 1999-2002. The sample includes all agencies with population of at least 25,000 and reporting crimes in at least 300 days in the year. The audience numbers are obtained from daily box-office revenue divided by the average price per ticket. The ratings of violent movies are from www.kids-in-mind.com. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The audience of violent movies is the audience of all movies with a violence rating 8-10. The specifications in Columns (1) through (6) are Poisson regressions with the number of assaults occurring on weekend t in an agency as dependent variable. Robust standard errors clustered by date in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 9. Calibration on the Short-Run Impact of Movie Violence on Assaults

Variable:	Estimated Effect on Assaults, with Conf. Interval (Table 4)	Assault Rate in Time Interval per 1m (Table 2)	US Population (in 2006)	Total Assaults in Time Interval	Average Audience of Violent Movie in 1m (Table 2)	Predicted Effect on Number of Assaults with Conf. Intervals
	(1)	(2)	(3)	(4)	(5)	(6)
6PM-12AM						
Strongly Violent movies	-0.0196 (-.0283,-.0108)	20.1	299,000,000	6,010	0.47	-55 (-80,-31)
Midly Violent Movies	-0.0136 (-.0197,-.0075)	20.1	299,000,000	6,010	1.62	-132 (-192,-73)
12AM-6AM						
Strongly Violent movies	-0.0075 (-.0195,.0046)	11.6	299,000,000	3,468	0.47	-12 (-32,7)
Midly Violent Movies	-0.0101 (-.0162,-.0039)	11.6	299,000,000	3,468	1.62	-57 (-91,-22)
TOTAL						-257

Notes: This Table presents the results of a calibration on the aggregate impact of violent movies on US daily assaults, based on the estimates in this paper. The final estimate is reported in Column (6), including confidence intervals. Columns (1) through (5) detail the procedure. Column (1) presents the estimated impact of movie violence on assaults in the indicated time period. Columns (2) through (4) present information on the assault rate, the US population, and the total number of US daily assaults in the time interval. Column (5) presents the average daily audience of violent movies. The predicted impact on assaults in Column (6) is computed as the product of the numbers in Columns (1), (4), and (5). 95 percent confidence intervals are computed taking into account the uncertainty in the estimates in Column (1). The audience numbers are obtained from daily box-office revenue divided by the average price per ticket. The ratings of violent movies are from www.kids-in-mind.com. The audience of mildly violent movies is the audience of all movies with a violence rating 5-7. The audience of violent movies is the audience of all movies with a violence rating 8-10.

Appendix Table 1. Movie Blockbusters by Violence Level

Violence Rating (1)	Fraction Audience (2)	Title of Blockbuster (3)	Weekend Date (4)	Weekend Theater Audience (5)
0	0.013	Birdcage	8-Mar-96	4,134,803
		You'Ve Got Mail	18-Dec-98	3,928,944
		You'Ve Got Mail	25-Dec-98	3,859,694
1	0.038	Runaway Bride	30-Jul-99	6,900,700
		Erin Brockovich	17-Mar-00	5,220,494
		Contact	11-Jul-97	4,484,729
2	0.115	Liar Liar	21-Mar-97	6,845,975
		Toy Story	24-Nov-95	6,698,992
		Space Jam	15-Nov-96	6,228,174
3	0.161	Toy Story 2	26-Nov-99	11,297,016
		How The Grinch Stole Christmas	17-Nov-00	10,356,276
		How The Grinch Stole Christmas	24-Nov-00	9,669,470
4	0.134	Harry Potter And The Sorcerer'S Stone	16-Nov-01	15,953,113
		Harry Potter And The Chamber Of Secrets	15-Nov-02	15,207,829
		Austin Powers In Goldmember	26-Jul-02	12,576,797
5	0.132	Star Wars: Episode 2 - Attack Of The Clones	17-May-02	13,774,150
		Star Wars Episode I: The Phantom Menace	21-May-99	12,758,065
		Batman Forever	16-Jun-95	12,134,352
6	0.160	Spider-Man	3-May-02	19,766,629
		Spider-Man	10-May-02	12,292,173
		Planet Of The Apes	27-Jul-01	12,108,297
7	0.112	Lost World: Jurassic Park	23-May-97	15,715,204
		Mummy Returns	4-May-01	12,038,699
		Independence Day	5-Jul-96	11,363,861
8	0.068	Jurassic Park 3	20-Jul-01	8,970,255
		Air Force One	25-Jul-97	8,089,870
		Scary Movie	7-Jul-00	7,856,525
9	0.048	Saving Private Ryan	24-Jul-98	6,519,425
		Sleepy Hollow	19-Nov-99	5,917,415
		Eraser	21-Jun-96	5,558,019
10	0.020	Hannibal	9-Feb-01	10,247,901
		Gladiator	5-May-00	6,459,929
		Hannibal	16-Feb-01	5,918,994
Missing		A Perfect Murder	5-Jun-98	3,542,794
		A Perfect Murder	12-Jun-98	2,404,636
		Demon Knight	13-Jan-95	2,303,346

Notes: The audience numbers are obtained from daily boxoffice revenue divided by the average price per ticket. The ratings of movie violence in Column (1) are from www.kids-in-mind.com. Column (2) reports the average share of audience captured by movies with violence rating *j*. Columns (3) through (5) report the title (Column (3)), the weekend (Column (4)), and the weekend audience (Column (5)) for the 3 movies with highest weekend sales in violence category j. The last category includes movies for which the violence rating is not available.