

Media Effects on Crime and Crime Style

Viridian Rios
Department of Political Science
Purdue University

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Abstract

Evidence about the relationship between exposure to media violence and criminal activity remains mixed. While some scholars argue that exposure to violent media contents "triggers" crime and aggression, others contend that media may influence crime, but only as a source of information about techniques and styles (copycat), not as a motivation for crime. This debate has critical implications for criminal justice academics as calls for policy are regularly made on the bases of research in this area. This article contributes to this literature by presenting detailed, not self-reported, empirical evidence of how media coverage of violent crimes affects crimes perpetrated by drug traffickers at the US-Mexico border, and their crime style. With an empirical model that addresses possible bidirectionalities between criminal violence and media coverage, we tracked 31,676 homicides, its stylistic characteristics, and its coverage by the press. Our results show that when media covers criminal violence it influences the probability that other criminals use similar styles of crimes, but it does not change overall rates of criminal activity. This is evidence against the "trigger" hypothesis, and in favor of "copycat" effects.

Keywords: Violent crime, media violence, meta-analysis, aggression, US-Mexico border, traffickers.

A substantial and important portion of criminal justice research is concerned with environmental, situational, or systemic factors that cause, or are likely to cause, criminal behavior. As part of this rich literature, the role that media coverage has in shaping criminal behavior and beliefs about the justice system has long been an interest of criminal justice studies.

In essence, there are two sides to the debate. The first, identified with the "General Aggression Model" (Bushman & Anderson, 2002; DeWall, Anderson, & Bushman, 2011), argues that exposure to media coverage of violent crimes "triggers" the development of aggressive attitudes or behaviors and desensitizes people to actual violence (Greene & Bynum, 1982; Phillips & Hensley, 1984; Laser, Luster, & Oshio, 2007; Anderson, Bushman, Donnerstein, Hummer, & Warburton, 2015; Gentile, 2016). In opposition to this first theory, advocates of theories such as "Uses and Gratifications" (Sherry, Lucas, Greenberg, & Lachlan, 2006) and "Self-Determination" (Przybylski, Rigby, & Ryan, 2010), have found no solid evidence of such effects. These scholars feel more comfortable interpreting media coverage of violent crimes as a "rudder" of crime, meaning a factor that can shape criminal behavior, influencing, for example, the style of a crime ("copycat"), but does not cause it (Ferguson et al., 2008; Savage & Yancey, 2008; Doley et al., 2013; Surette, 2013). Media coverage of violent crimes provide stylistic inspiration (Coyne, 2007; Surette, 2011, Surette, 2014; Surette, 2015; Ferguson & Colwell, 2017).

Overall, evidence regarding the relationship between exposure to media coverage of violent crimes, and violent crime remains weak and mixed (Savage & Yancey, 2008; Doley et al., 2013). To advance these debate, scholars have identify the need to obtaining better measures (Coyne, 2007; Surette, 2014), exploring fictional and non-fictional media portrayals (Ferguson et al., 2008; Savage & Yancey, 2008), and delving into different types of crimes (Surette, 2013).

This paper contributes to advancing criminal justice literature by developing a study that addresses these concerns. We test the relationship between exposure to media coverage of violent crimes, and violent crime, using a uniquely detailed, non self-reported measures of media coverage and criminal behaviour.

Criminal justice researchers trying to quantitatively test the possible effects of media coverage of violent crimes may find interesting insights in our study because of the level of detail of the measures we gathered. We recorded 31,676 homicides carried out by drug traffickers, and we measured the stylistic characteristics of each crime, whether each of these homicides was covered by the media, and how it was covered. This panel of 169 weeks allowed us to identify, for example, the share of drug traffickers' homicides that were covered by the printed press, and whether the details of such crimes, including stylistic characteristics, were published. Importantly, crime rates and rates of copycat crime are not self-reported my offenders but obtained from official statistics.

The results of our study provide empirical evidence to sustain that "Uses and Gratifications" and "Self-Determination" theories are better positioned to explain how exposure to media coverage of violent crimes affects criminal behaviour. When media covers the violent crimes of drug traffickers, these do not by commit more violent crimes, but they do use similar crime styles to the crimes that were covered by the press. In other words, traffickers are more prone to be "copycats" than to be "triggered" into violence by the media.

Our paper should be understood as part of a trend to conduct research in places outside the US, to enlighten relevant criminal justice debates. For example, Brazil has been used to study psychopathy in criminal and forensic psychiatric populations (De Oliveira-Souza, Moll, Azecedo Ignácio, & Hare, 2008), England and Wales to identify triggers of violence in prisoners and forensic patients (Freestone, Ullrich, & Coid, 2017), Australia to validate the Ontario Domestic Assault Risk Assessment (Lauria, McEwan, Luebbers, Simmons, & Ogloff 2017), and China to test whether distributive justice and procedural justice are predictors of job satisfaction among community correctional staff (Jiang et al., 2016).

The rest of the paper proceeds as follows. The first section discusses the existing literature about media coverage of violent crimes, and crime. The second section present the hypotheses and presents the case study. The third section presents the empirical test. The fourth and fifth sections present results and additional testing. We conclude by discussing how the paper contributes to the literature, and by suggesting possible avenues for future research.

Media Coverage of Violent Crimes, and Crime

The question of whether media coverage of violent crimes may have effects on crime rates or on styles remains highly controversial (Ferguson et al., 2008; Savage & Yancey, 2008; Doley, Ferguson, & Surette, 2013).

Ovearll, two theories have been used to explain the effects that media coverage of violent crimes may have on criminal behavior: The General Aggression Model (Anderson & Bushman, 2001; Bushman & Anderson, 2002; DeWall et al., 2011), and the theories of Self-Determination (Przybylski et al., 2010) and Uses and Gratifications (Sherry et al., 2006). For simplicity, Self-Determination and Uses and Gratifications will be combined and referred to as the "rudder" theory, while the General Aggression Model is referred to as the "trigger" theory.

Supporters of the General Aggression Model are confident that exposure to media coverage of violent crimes is one of the factors that "triggers" human aggression (Phillips & Hensley, 1984; Anderson, Carnagey, & Eubanks, 2003; Gentile, 2016). These scholars contend that the media is partially responsible for deviant behavior (Laser et al., 2007), and contributes to violence by desensitizing people to the pain and suffering of others (Bushman & Huesmann, 2014). In support of this model, there is evidence that criminals such as fire setters (Doley et al., 2013) and terrorist groups tend to perform more attacks when the press has covered similar attacks in the past (Rohner & Frey, 2007; Jetter, 2017).

Those who favor the General Aggression Model contend that prolonged exposure to violent media can fundamentally alter a person's personality, causing them to become callous and volatile. For example, some believe that at least 30 separate occurrences of gun violence were inspired by the Russian Roulette scene from the movie *The Deer Hunter* (Gunter, 2008), that the shooter in The University of Virginia Tech massacre was copying events from an action movie (Nizza, 2013), and that there have been many instances of copycat crime inspired by movies (Sparks, 2015).

Interestingly, consumption of fictional violent content among children could also be related to less prosocial behavior later in the school year (Ostrov, Gentile, & Crick, 2006; Gentile, Coyne, & Walsh, 2011; Gentile, 2016), and in their adult life (Huesmann, Moise-Titus, Podolski, & Eron, 2003). Some scholars have also found evidence of increased hostility and engagement in physical fights among individuals exposed to violent video games (Anderson, Gentile, & Buckley, 2007; Saleem, Anderson, & Gentile, 2012), particularly those with much profanity (Ivory & Kaestle, 2013), and violent song lyrics (Anderson et al., 2003).

Notwithstanding the research above, many studies have shown a lack of correlation, or lack of causality, between media coverage of violent crimes, and aggression (Ferguson et al., 2008; Ferguson & Dyck, 2012; Savage & Yancey, 2008; Surette, 2013; Doley et al., 2013; Ferguson & Colwell, 2017).

Thus, in opposition to the General Aggression Model, some scholars have developed a series of theories that characterize media as a "rudder" of crime. These scholars point out that we are living in the most peaceful epoch in human history, despite the ubiquity of media coverage of violent crimes (Pinker, 2011). They also argue that if significant and causal media effects could be found, they would not be large enough to change aggregated crime rates in notable ways (DeCamp & Ferguson, 2017; Surette, 2013).

Indeed, research has shown that media coverage of violent crimes does not reduce empathy for the victims of real violence (Ramos, Ferguson, Frailing, & Romero-Ramirez, 2013) and does not create more aggressive behavior (Savage & Yancey, 2008). Also, several studies have shown that playing violent videogames or watching violent TV does not have a criminogenic impact (Savage, 2004; Ferguson et al., 2008; Ferguson & Savage, 2012; Ferguson, San Miguel, Garza, & Jerabeck, 2012; Surette & Maze, 2015; Elson, Breuer, Van Looy, Kneer, & Quandt 2015). Interestingly, some studies have even claimed that violent movies and videogames reduce societal violence (Valadez & Ferguson, 2012; Markey, Makey, & French, 2015).

Those endorsing the "rudder" theory refuse to assume that individuals are "passive receptacles of learning", and instead conceive individuals as "active shapers and processors of media culture" (Elson & Ferguson, 2014; Ferguson, 2015). In other words, these models hold that the interaction between media and behavior is intermediated by the media user (Phippen, 2017). Furthermore, proponents of these theories argue that environmental factors and psychological predispositions are behind disruptive behavior disorders, rather than just exposure to media (Ferguson & Dyck, 2012; Ferguson & Savage, 2012). These arguments are consistent with empirical evidence showing that media coverage of violent crimes affects individuals that already have violent tendencies, rather than the general population (Adachi & Willoughby, 2011). For example, violent media tends to be watched the most by those with a relatively higher taste for violence (Huesmann et al., 2003; Savage, 2004; Huesmann & Taylor, 2006; Coyne, 2007; Savage, 2008; Savage & Yancey, 2008).

Adherents of the "rudder" theory admit that media might provide stylistic ideas to potential criminals. i.e. promote copycat crime (Surette, 2011; Doley et al., 2013; Surette & Gardiner-Bess, 2013; Surette, 2015). In other words, media is source to identify crime techniques, but not a crime motivator. The work of Surette (2013), for example, analyzed anonymous surveys of 574 male and female correctional inmates. Surette concluded that the media influenced the style of crimes by providing instructional models to predisposed individuals, yet it did not prompt crime per se. He coined the term "ruddering" to illustrate how media portrayals of criminality shape the stylistic form the crime takes on, instead of acting as a direct catalyst for the crime itself.

Research design

An important difficulty contributing to the empirical intractability of the aforementioned debate is the fact that the relationship between media coverage of violent crimes, and crime may be a vicious cycle (Savage & Yancey, 2008).

On one hand, to the extent that the media is driven by sensationalism, the media has an incentive to pay more attention to more gruesome stories (Chermak & Chapman, 2007). These hypotheses are relevant because that media front-pages prioritize content with higher audience ratings and editor's approval (; Reiner & Newburn, 2007; Fink & Schudson, 2014; Coddington, 2014). In other words, the media operates under criteria of newsworthiness (Gruenewald, 2009). Thus, criminal events may induce media coverage if crimes are strategically planned to be scandalous and provocative (Wu, 2000; Nacos, 2002). Furthermore, traffickers are clearly a newsworthy and lucrative topic for the media as they are one of the most popular topics of media attention within the crime genre (Rawlinson, 2016).

On the other hand, to the extent that criminals benefit from the direct/indirect reputational gains of coverage, criminals have an incentive to make their crimes increasingly gruesome. Because of these dynamics, it is difficult to tell who is really influencing who. We know that criminals, particularly when they operate in groups, may have an interest in committing overtly violent actions for strategic purposes. Criminals could be expected to copy "crime styles" featured by the press, not only because the media could function as an "instructional model" (Surette, 2011, 2014), but also because criminals

may want media attention. Criminal groups may benefit from visibility because it helps them to intimidate their enemies (see for example Durán Martínez (2015) and Brown (2017)).

To address the bidirectionality of media coverage and criminal behaviour, and to determine whether these relationship follows the logic of "trigger" or "rudder" arguments, four hypothesis will be tested.

Two basic hypotheses:

H1 (i.e. trigger): The higher the level of media coverage of violent crimes, the greater is the likelihood that criminals are violent.

H2 (i.e. rudder): The higher the level of media coverage of violent crimes, the greater is the likelihood that criminals use styles of violence similar to the ones that had been covered by the media.

Two reciprocal hypotheses:

H3: The higher violent crime is, the greater the likelihood that media covers it.

H4: The most common certain styles of crimes are, the greater the likelihood that media covers those styles.

We will use drug traffickers operating at the US-Mexico border as our object of study because it is a novel case with much potential to directly address some of the gaps that scholars studying the relationship between media coverage of violent crime, and criminal behaviour, have identified. This case allowed us to develop innovative ways to measure media coverage and crime (Coyne, 2007; Surette, 2014), (ii) explore non-fictional media portrayals (Ferguson et al., 2008; Savage & Yancey, 2008), and (iii) delve into crime styles (Surette, 2013).

First, measures of drug trafficking crimes can be rich because traffickers have notably different stylistic patterns (Martin, 2012), and large geographical and temporal variance in their crime rates (Author et al., 2012a; Author et al., 2012b). Stylistic differences can be found in the use of specific types of weapons, victims' characteristics, types of torture, the display of dismembered or decapitated bodies at the crime scene, and in the use of other intentionally public displays, such as banners, that explain their motivations or intents (Shirk & Wallman, 2015; Durán Martínez, 2015). Drug traffickers' crimes can be observed across 1,068 municipalities, from border cities like Río Bravo and Tamaulipas that had only 18 homicides from 2008 to 2010, to places like Juárez that endured 6,300 homicides during the same period.

Second, there is plenty of non-fictional media coverage of drug traffickers' violence (non-fictional violence). That makes our measures of media coverage to be centralized and comparable, an advantage for studies of crime effects and copycats (Surette, 2014, 2015)ⁱ. Following more recent studies, this study care allows us to rely on evidence gathered from post-crime interviews with offenders (Surette, 2013, 2015). The goal of these types of measurements is to avoid offenders rationalizing their criminal behavior by attributing it to the impact of the media, or to other third parties. In other words, the goal is to find a way to measure whether stylistic patterns of a crime were copied, objectively, without being duped by criminals attempting to shift the blame.

Finally, drug trafficking is a form of crime that has not been yet formally explored under the lenses of the media effects debate. A burgeoning literature seeks to understand the levels of violence in Mexico (Author, 2015; Dell, 2015; Shirk and Wallman, 2015; Osorio, 2015; Calderón, Robles, Díaz-Cayeros, & Magaloni, 2015; Trejo & Ley, 2017) but research analyzing the dynamics within the conflict, such as the relationship between media coverage and criminal behaviour has not been developed.

Overall, it is somehow surprising that there are not very many studies that measure the effects of media violence on drug traffickers and smuggles, given the increased relevance of this form of

crime for the judicial system (Decker & Curry, 2002; Benson & Decker, 2010; Mercille, 2011; Payan, 2016), and the existence of several unique state/weekly panel datasets that we collected to describe crime rates and crime styles among drug traffickers operating at the US-Mexico border.

Interestingly, similar incentives seem to exist for terrorists (Hoffman, 1997; Surette, Hansen, & Noble, 2009) e.g. (Iqbal, 2015). Terrorists use press coverage to promote an appearance of strength (Kearns, Conlon, & Young, 2014; Conrad & Greene, 2015) with the goal of advancing their criminal objectives by inducing fear or spreading propaganda (Wright, 2009; Hoffman, 2010; Abrahms & Conrad, 2017). Actually, there is some evidence that these organizations may time their attacks to coincide with the news cycle (Krueger, 2008), and follow media coverage to better target their cross-border attacks (Asal & Hoffman, 2016). Furthermore, TV news outlets play an important role in mediating terrorist messages (Iqbal, 2015). In fact, some criminal organizations run their own newspapers, radio stations, or websites (Hoffman, Shelton, & Cleven, 2013), and even have proved skillful in the use of social media and cyber technology (Farwell, 2014). For example, social media has played an essential role in the Jihadists' operational strategy in Syria, Iraq, and beyond (Klausen, 2015).

Data

To measure the effects of media coverage of violent crime on criminal behaviour, we measured crime rates (homicides), crime style ("credit-taking" style), media coverage, and quality of media coverage.

First, to measure "Homicides", we obtained official registries of drug traffickers' homicides.. These are homicides that were officially attributed to drug traffickers by Mexican intelligence and security institutions (SNSP, 2011). "Homicides" takes values from 0 to 102 for 169 weeks from 2008 to 2010.

To construct this variable, we gathered information about 31,676 drug traffickers' homicides. During a short sui generis period (2007-2011), Mexican authorities allowed public access to a database that recorded whether a homicide was conducted by a drug trafficker. This gave us the unique opportunity to identify traffickers' violence in a state-level panel. A homicide was considered as conducted by a drug trafficker if it met six criteria¹. Overall, drug traffickers' homicides represent 95% of all homicides perpetrated during those years and in those areas.

Second, to measure "Crime Style", we constructed a database that identifies a stylistic feature that sometimes accompany traffickers' homicides: credit-taking banners ("Credit-taking Style"). Credit-taking banners, also known as "narco-messages" (Campbell & Hansen, 2014; Martin, 2012; Durán Martínez, 2015; Mendoza Rockwell, 2016; Atuesta, 2017) are used by drug traffickers' to take-credit for their criminal actions, or to clarify their degree of responsibility for them. Narco-messages may also be displayed to intimidate potential victims, to communicate with local citizens, or to give instructions to investigators, policemen, or journalists (Martin, 2012).

The content of the banners may be a threatening maxim like "you cannot be on good terms with both God and the Devil", or an appeal to the public, like the claim that "this (battle for turf) is for the good of all", or like the banner dedicated to "the brave, noble, and loyal people" wishing them "Merry Christmas, ho, ho, ho". Narco-messages are a creepy stylistic innovation that stretches the boundaries of traditional graffiti with its bizarre mimicry of the formality of Mexican political

¹ These were (i) use of high-caliber firearms, (ii) signs of torture or severe lesions in victims, (iii) bodies found at the crime scene or in a vehicle, (iv) victims that were taped, wrapped, or gagged, (v) murders that happened in a prison and involved criminal organizations, and (vi) if one of several "special circumstances" occurred. Among these "special circumstances" are whether the victim was abducted prior to assassination (known as a "levantón" in Spanish), ambushed or chased, whether the victim was an alleged member of a criminal organization, and whether a criminal organization publicly claimed responsibility for the murder (Author et al., 2012).

campaign propaganda (Salopek, 2011).

The use of credit-taking messages is not exclusive to Mexico. Similar criminal messaging has happened in places such as Colombia, Southern Italy, and in numerous U.S. cities (see Cowell (1992), Martin (2012), and Ortiz (2013) as cited by Author et al. (2017b)).

Criminal messaging is also a major part of terrorism, which has been described as violent propaganda or violent communication (e.g. Schmid & De Graaf (1982)). A line of research has examined why terrorist groups sometimes claim their attacks (Wright, 2009). Among reasons for doing so are intergroup competition (Hoffman, Jengelly, Duncan, Buehler, & Rees, 2010), communication within the group (Brown & Hamilton-Giachritsis, 2005), and operation in democratic countries (Min, 2013). However, this literature also established that there are reasons militant groups do not seek credit. Such reasons could be that the attack was especially heinous, or the desire to avoid a bad reputation (Hoffman, 2010, Abrahms & Conrad, 2017).

To gather information about credit-taking banners, we performed massive amounts of queries with online search engines using "narco-message" as our keyword. Following Author et al. (2012a), we relied on Google as our main search engine to obtain content, but unlike them, we gathered a team of researchers to read, filter, and classify all the results. We extracted information about narco-messages from public blogs and forums ran by citizens who collect information about narco-messages (e.g. Blog del Narco), specialized online websites, and scanned printed editions of local/national newspapers.

One of the notable challenges we faced, besides the enormous amount of data, was how to ensure that each narco-banner was not double counted if it was covered by different media sources. To deal with these cases, we used human checks and Google news conglomeration algorithms. If a narco-message contained the same text, was displayed in the same municipality, and around the same date, we assumed it could be duplicated coverage. Non-algorithmic (i.e. human) checks of these cases were performed.

Our measure, "Credit-taking Style" is the share of traffickers' homicides that were publicly claimed with a credit-taking banner. The measure takes values from 0 to 1 because, in some instances all homicides in a particular week were claimed with a banner..

To create the variable "Media Coverage", we identified the amount of traffickers' homicides that were covered by the press. Beginning in 2007, news-media organizations closely followed traffickers' homicides, keeping count independent of government sources. The most comprehensive coverage was done by Reforma, a major national newspaper with a large pool of local correspondents and alliances with local newspapers in every state. Other national newspapers like Milenio and El Universal also had their own independent counts, alliances, and correspondents (Author et al., 2012b). The "Justice in Mexico Program" has also gathered statistics regarding media coverage of traffickers' homicides from 2006 to 2017 (Reforma, 2017; Milenio, 2017).

Per each state i , and week t , the measure of "Media Coverage" is:

$$z_{it} = |CoveredHomicides_{it} - TotalHomicides_{it}| \quad (1)$$

Out of the 32,199 homicides officially classified as perpetrated by drug traffickers 23,737 were covered by the press. Coverage is very different across time and geography. For example, although the press covered 76% of the homicides in 2010, in 2007 it only covered 63%. Also, in Oaxaca, 26% of drug traffickers' homicides were not covered, meanwhile, in Querétaro, all of them were covered by the press. It is important to note that Mexican news outlets and the Mexican government used a similar methodology to classify a homicide as conducted by drug traffickers.

Finally, to identify the quality of media coverage, we measured the share of credit-taking

banners that were covered in detail. We classified coverage as “detailed” when the specific content of the narco-message was reported. This means that messages like "Esto les va a pasar a los que no respeten a los grandes jefes de La Familia" (this will happen to those that don't respect La Familia's great chiefs) could be read in their entirety in the newspaper (El Sol de Toluca 2009). Coverage classified as "non-detailed" was when the reporter only hinted at the existence of a narco-message without explicitly quoting its content. The share of detailed messages over total messages is represented by the variable "Media Coverage Quality". Out of our total sample, 24% of the narco-messages were detailed.

Our final dataset is thus a weekly/state panel with a total of 5,408 observations. These observations cover a period of 169 weeks for 32 states between 2007 and 2010ⁱⁱ. We exploit state-level variations in measures of the extent and quality of media coverage, and in measures of the relative frequency of the credit-taking style crimes.

Descriptive statistics of our measures of homicides, media coverage, quality of media coverage, and credit-taking crime style are shown in Table 1. Of the total events covered by the media, on average only 11% are reported in detail. On average, the media fails to cover 3.12 homicides per week, per state; and there are 5.95 murders per week. Also, on average, drug traffickers take credit for 8% of their homicides.

Empirical Test

To model bidirectionalities between media coverage of violent crimes, and crime, we rely on panel vector autoregression, and Granger causality tests as our main empirical specifications. These methods are an efficient way to show the co-movements of multiple time series. A large empirical literature supports the use of Granger causality tests (Granger, 1969) for testing cycles (Jaeger & Paserman, 2008; Huang, Hwang, & Yang, 2008; Gambacorta, Hofmann, & Peersman, 2014) and argues that it is a relevant tool for crime studies with time series analysis (Saridakis, 2004; Ramirez, 2013; Hsu & McDowall, 2017).

Our panel vector autoregression consists of n lags of media coverage and crime in the following two equations:

$$x_{it} = \beta_0 + \sum_{j=1}^n \beta_{1j} x_{i(t-j)} + \sum_{j=1}^n \beta_{2j} z_{i(t-j)} + e_{x_{it}} \quad (2)$$

$$z_{it} = \beta_0 + \sum_{j=1}^n \beta_{1j} z_{i(t-j)} + \sum_{j=1}^n \beta_{2j} x_{i(t-j)} + e_{z_{it}} \quad (3)$$

Note that β_1 's and β_2 's are matrices of coefficients for each state, in week. We have 32 states, 169 weeks, and 4 lags. The terms z (crime rates or crime style, depending on the identification) and x (media coverage or media quality, depending on the identification) are vectors of exogenous variables that may shift the reaction function up or down, and e_x and e_z are the vector error terms

Every panel vector auto-regression model is accompanied by a Granger test, which is a joint significance test to check the significance of the coefficient of our lagged impulse and response variables. As robustness tests, available upon request, we also performed panel fixed effects models to control for constant unobservable factors potentially affecting the outcome of interest.

Our Granger test amounts to testing the joint significance of the coefficients on lagged values of the impulse variable in a regression of the response variable on lagged values of both response and impulse variables. If the signs of the impulse variable are significant, we would have found evidence that the response is “Granger-causing” it. The impulse variable will be reacting to the response

variable if, conditional on lagged values of the response variable, lagged values of the impulse variable have predictive power for the current value of the response variable. Overall, the model we propose is useful to analyze a phenomenon without imposing prior assumptions. We allow the data to speak for itself.

The null hypothesis that x does not Granger-cause y is accepted if, and only if, no lagged values of x are individually significant according to their t-statistics, provided that collectively they add explanatory power to the regression according to an F-test. The null hypothesis of the F-test is that there is not explanatory power jointly added by the x 's. If our coefficients for the impulse variable are significant, we can reject the hypothesis that the impulse variable is not causing the response variable to change. If the lagged values of the impulse variable affects the current value of the response variable, this means that the impulse variable is reacting to the response variable. To be further sure of this reaction, we also control for the lagged values of the response variable.

When estimating a panel vector auto-regression, we are generally not interested in our coefficients. Instead, we are interested in the dynamic responses of the variables to shocks. Therefore, we provide additional post-estimation analysis like non parametric impulse reaction functions and forecast error in variance decomposition. An impulse-reaction function is a signal processing technique that allowed us to take our defined dynamic system with an input signal, called an impulse, and to describe the reaction of the system to it as a function of time.

We followed (Love & Zicchino, 2006) to transform the system of equations into a recursive auto-regressor vector with Choleski decomposition of variance-covariance matrix residuals. Note that residuals need to be orthogonal to control for other shocks. The forecast error in variance decomposition is useful to measure how relevant each shock is to the explanation of each variable in the equation system. This is the same as obtaining the size of the forecast error in variance for each variable, due to each shock at each period.

It is important to restate that our empirical test, and the goal of this paper, is to identify if there are bidirectionalities between media coverage of violent crimes, and crime. More research would be needed to evaluate how other factors may be impacting media coverage. Future papers could address whether high levels of literacy, intense conflict among criminals, violence against the press, or other variables are also presenting correlations.

Results

Table 2 shows the results for the models that test combinations of variables for media coverage of violent crimes, and crime. For both reaction functions, we estimated panel vector auto-regressors with four lags. Columns (1) and (2) show the relationship between media coverage of violent crimes, and crime rates (H1 & H3). Columns (3) and (4) show the relationship between the quality of media coverage of violent crimes, and crime rates (H1 & H3).

Results show that in general media coverage of violent crimes does not trigger an increase in violent crime, and that media coverage of violent crimes does not react to crime rates. Actually, the only two lags that are statistically significant are negative. Our Granger test supports these results, showing that we fail to reject the hypothesis that media coverage does not "Granger-cause" crime rates. Interestingly, we can reject the hypothesis that crime rates does not "Granger-cause" media coverage. As expected, the Granger test shows that the quality of media coverage does not impact crime rates. Moreover, we found that crime rates may have an impact on the quality of media coverage, but this effect is inconsistent and small.

Tables 3 presents the relation between quality of media coverage and credit-taking crime style

(columns 1 and 2), and between media coverage and credit-taking crime style (columns 3 and 4) (H2 & H4).

Results indicate that credit-taking styles of crime increase in a statistically significant way when similar crimes have been covered in previous weeks, this effect is particularly significant in weeks one, two and four. The Granger test supports this result, showing that quality of media coverage helps to predict credit-taking behavior (2% significance level)..

Overall, our results show that drug traffickers tend to take credit for their crimes more often when the media has previously covered similar crimes in detail, and the forecast error in variance decomposition supports this finding.

According to our findings, as much as 53% of the error in the prediction of credit-taking crimes is due to the quality of media coverage. In other words, about half of the variance in credit-taking style is explained by increased and detailed media coverage of credit-taking crimes.

Table 3 also shows the relationship between media coverage and credit-taking crime styles. The results are consistent with previous models, showing that credit-taking style increase when media covers violent crimes; this effect is significant during the four weeks. Yet, the media coverage of violent crimes does not react to credit-taking style crimes.

The quality of media coverage influences credit-taking style crimes perpetrated by drug traffickers operating at the US-Mexico border, but does not motivate more crime. Detailed media coverage influences crime style, but not crime rates.

Overall, our results show that violent media content can influence the characteristics of crime, but does not cause the crime itself. This is consistent with many recent findings showing that drug traffickers care about being covered by the media and devote energy to getting attention (Gambetta, 2009; Durán Martínez, 2015; Atuesta, 2017)ⁱⁱⁱ. Drug traffickers could care about media coverage because attention may help trigger specific state reactions (Durán Martínez, 2015). For example, media coverage provides power to drug traffickers' executions by spreading performative acts of fear (Lantz, 2016). Also, the mafia seeks media coverage to portray the toughness and power of its organization (Gambetta, 2009). Militarized international conflicts and civil wars have similar dynamics (Bell, Frank, & Macharia 2013; Miller & Albert, 2015; Miller & Bokemper, 2016).

Additional Results

To interrogate our data further, we tested for heterogeneous effects driven by the strength of the drug cartels' territorial entrenchment. If media coverage serves as inspiration for crime style (H2), as we proved in our previous models, then we could expect that media coverage may have a larger effect in areas where drug cartels are more entrenched. This is straightforward. We should expect that having more criminal organizations is a proxy of having more criminals that could be susceptible to be influenced by the media.

We determine whether a state is drug cartel territory by identifying the presence of drug cartels in different territories over time.

To measure drug cartel presence, we relied on a published big-data framework that uses a text-analysis algorithm to extract web content about recorded criminal activities by subnational economy. The algorithm "reads" digitalized records, news content, blogs, and Google-News indexed content searching for instances in which drug cartel operations are mentioned. The Python crawler was created to extract JavaScript Object Notation using unambiguous query terms to perform text analysis. The final data, cleaned using a hyper-geometric cumulative distribution function, includes 2,449 subnational economies, and 178 "actor terms" associated with traffickers and drug cartel organizations. Each actor was classified accordingly as part of one of the 13 drug cartels and as a residual category. We know about 13 drug cartels operating in Mexico for 19 years (1991 - 2010). Drug cartel

organizations operate in 713 municipalities in Mexico, and along most of the US-Mexico border. A more detailed description of the methodology that we followed can be found in the published paper Author et al. (2012a).

This framework allowed us to obtain information about a phenomenon that would otherwise require large scale, expensive intelligence exercises. Most importantly, this procedure helped us to disentangle drug cartels performing violent crimes from drug traffickers that are not violent. Many of the recorded drug cartel operations are non-violent, and consist of peacefully trading, transporting, producing, or cultivating illegal drugs. This data set has also been used to study criminal activity in many other published papers (Castillo, Mejía, & Restrepo, 2014; Osorio, 2015, Dube, García-Ponce, & Thom, 2016; Author et al., 2017a).

Table 4 shows our estimates for the quality of media coverage and credit-taking style for two subsets: areas that are geographical bastions for drug cartels, and areas that are not. The results indicate that, if drug cartels are entrenched, crimes with credit-taking style react in a statistically significant way on the first, second, and fourth week as detailed coverage increases. Meanwhile, locations where drug cartels are not entrenched only exhibit association between media content and the stylistic decisions made by criminals during the first week.

The Granger test bolsters these findings, showing that media coverage helps to predict credit-taking crimes (4% significance level) in places where drug cartels are entrenched, but fails to do so otherwise (35% significance level). Furthermore, the forecast error in variance decomposition supports our findings. We can see that as much as 52% of the error in the forecast for credit-taking crimes is due to the quality of media coverage.

Conclusion

Our research was inspired by an enduring controversy: whether exposure to violent media content causes crime by "triggering" delinquency (Phillips & Hensley, 1984; Laser et al., 2007; Anderson et al., 2015; Gentile, 2016) or just provides "rudders" that guide individuals already intending to commit crime (Savage & Yancey, 2008; Ferguson et al., 2008; Ferguson & Dyck, 2012; Doley et al., 2013; Surette, 2013; Ferguson & Colwell, 2017). That is to say, the debate between the adherents of the General Aggression Model (Bushman & Anderson, 2002; DeWall et al., 2011), and the advocates of theories such as Uses and Gratifications (Sherry et al., 2006) and Self-Determination (Przybylski et al., 2010).

This debate has been difficult to resolve because measuring copycat crime presents major empirical challenges (Coyne, 2007; Surette, 2014), but also because media content and crime rates may be modeled as a self-reinforcing cycle. This would mean that media coverage may induce criminal events, and criminal events may also induce increases in violent media content, if such events are interesting for audiences.

To provide insight into the controversy, we set out to determine whether media coverage of violent crimes committed by drug traffickers operating at the US-Mexico border influenced their crime rates and crime styles.

We were able to overcome the empirical challenges noted in the literature by leveraging two exceptionally fruitful and unique datasets, and by using simultaneous equation modeling. In addition, we developed an empirical specification that address the possibility that the relationship between media coverage and criminal behavior may be bidirectional. Specifically, we defined reaction functions and Granger causality tests to identify the relationships between media coverage, or media quality, and crime rates, or crime styles.

Our results give support to the "rudder" hypothesis, rather than to the "trigger" one. We show that detailed media coverage of crime provides criminals with stylistic inspiration (H2 accepted), but

is not associated with an increase in crime rates (H1 rejected).

Specifically, we found evidence that credit-taking crime style tend to react to detailed media coverage. When the media covers crimes in larger detail, criminals increase the use of credit-taking style. As much as 53% of the variance in credit-taking styles of crime is explained by changes in the quality of media coverage. Our additional results also show that, as expected, we find stronger effects in territories where drug cartels are more entrenched.

Additionally, contrary to common assumptions, a strong Granger causality from detailed media coverage to credit-taking crime style shows that this relationship is mostly unidirectional (H3 and H4 are rejected in most models).

Although this paper has contributed to a better understanding of the relationship between the press and criminal behavior, future research would need to test for causal relationships beyond Granger causality. Furthering this area of research is critical to the social sciences and to democratic governance because it exposes the tension between two important values: freedom of the press and the elimination of publicity-seeking crime. In addition to guiding us as we consider this issue, this research will assist with the development of better strategies to stifle terrorism, drug trafficking, copycat criminals, and deviant individuals who aspire to notoriety.

Tables

Table 1: Descriptive statistics

Variable	Mean	SD	Min	Max
Media quality	0.11	0.30	0	1
Media coverage	3.12	5.40	0	77.62
Homicides	5.95	12.72	0	102
Credit-taking style crimes	0.08	0.26	0	1

Note. SD=Standard Deviation.

Table 2: Crime and Media

Variable	Media coverage	Homicides	Media quality	Homicides
Media quality(t-1)			0.1070***	0.2556
Media quality(t-2)			0.0749***	0.0466
Media quality(t-3)			0.0097	0.0719
Media quality(t-4)			0.0392*	0.3318
Media coverage (t-1)	0.0448	-0.0575*		
Media coverage (t-2)	-0.003	0.0082		
Media coverage (t-3)	-0.0124	0.0253		
Media coverage (t-4)	-0.0074	-0.0057		
Homicides (t-1)	0.1826	1.2404***	0.0042	1.2361***
Homicides (t-2)	-0.0324	-0.2535***	-0.0041	-0.2650***
Homicides (t-3)	0.1143	0.0602	0.0076**	0.0701
Homicides (t-4)	-0.2104**	0.0083	-0.0061*	0.01427
Granger test (Prob>chi2)	0.007***	0.296	0.069*	0.481

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 3: Media and crime style

Variable	Media quality	Credit-taking	Media coverage	Credit-taking
Media quality(t-1)	0.0689**	0.0701**		
Media quality(t-2)	0.0217	0.0438*		
Media quality(t-3)	-0.0089	0.0182		
Media quality(t-4)	0.0285	0.0581**		
Media coverage (t-1)			0.0833	0.0088**
Media coverage (t-2)			0.0024	0.0061**
Media coverage (t-3)			-0.0322	0.0073**
Media coverage (t-4)			-0.0498	0.0059**
Credit-taking (t-1)	0.0422	0.1048***	-0.9194**	0.1793***
Credit-taking (t-2)	0.0692**	0.1009***	-0.6360	0.1536***
Credit-taking (t-3)	0.0130	0.0542*	-0.4909	0.0844***
Credit-taking (t-4)	-0.0015	0.0158	-0.7382*	0.0770***
Granger test (Prob>chi2)	0.201	0.020**	0.335	0.153

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table 4: Strength of drug cartel territorial entrenchment

Variable	Operations		No operations	
	Media quality	Credit-taking	Media quality	Credit-taking
Media quality(t-1)	0.0689	0.0785**	0.0688	0.0634*
Media quality(t-2)	0.0234	0.0677**	0.0175	-0.0020
Media quality(t-3)	-0.0161	0.0310	0.0057	-0.0112
Media quality(t-4)	0.0257	0.0767**	0.0344	0.0185
Credit-taking (t-1)	0.0451	0.1311***	0.0338	0.0219
Credit-taking (t-2)	0.0673*	0.0947**	0.0738	0.0989**
Credit-taking (t-3)	0.0148	0.0391	0.0103	0.0861
Credit-taking (t-4)	0.0000	0.0179	-0.0046	0.0102
Granger test (Prob>chi2)	0.484	0.040**	0.696	0.351

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

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ⁱ Gathering data on media coverage of violent crimes, and copycat criminals is generally complicated due to self-justification and perception biases (Surette, 2011; Doley et al., 2013). Self-justification is problematic because criminals may want to shift the blame to the media or third parties. Perception biases are a problem because even if two crimes appear to be similar, scholars cannot be certain that they were inspired by the same source (Stack, 2000; Coleman, 2004; Surette & Maze, 2015). Initially, some studies tried to overcome this problem by "shocking" individuals with fictional media coverage of violent crimes, and measuring their reactions (Kaplan, 1984). Yet, this technique was questionable because it did not provide an accurate paradigm to understand how real-world violent media is delivered and consumed in normal settings (Felson, 1996; Freedman, 2002).

ⁱⁱ We use weeks as our frequency measure because media coverage measures were only available per week (Reforma, 2017; Milenio, 2017). We only have information from December of 2007 to September of 2011.

ⁱⁱⁱ In the case of Mexican drug cartels, it has been documented that the drug lord Joaquin Guzman, alias "El Chapo", thought that his media profile was an unfair image of his business (Rawlinson, 2016). Thus, attempting to run his own public relations campaign, he contacted famous actors, like Sean Penn, to direct a movie that was a fair representation of his motivations (The Economist (2016) cited by Rawlinson, (2016))