I Read the News Today, oh Boy: The Effect of Crime News Coverage on Crime Perception*

Daniel Velásquez, Santiago Medina, Gustavo Yamada, Pablo Lavado,
Miguel Nunez-del-Prado, Hugo Alatrista-Salas and Juandiego Morzán

July, 2020

Abstract

Crime perception has increased in Peru, as in other developing and developed countries, in spite of the reduction in crime victimization figures. Our hypothesis is that the news industry is partially responsible for such opposing trends. As Peruvians are great consumers of written news, we focus on the written press. Using a unique database of written news, we georeference the location of each reported crime to identify short-term deviations from trend in the coverage of crime news at the province level and estimate their effect on crime perception. We measure coverage as the area an article occupies in cm^2. We find that a spike of negative crime news increases people's perception about the probability of being a crime victim. The effect of positive news is opposite. However, the effect per cm^2 of negative news is almost three times larger than the effect of positive news in absolute value, signaling a potential asymmetry in the revision of people's expectations. The effect of the written press is stronger for men and non-victims. Moreover, perception changes are mostly driven by increases in the fear of house and car theft and common street crime, rather than more violent crimes like kidnapping or sexual abuse. Finally, we delve into the possible consequences of worsening the mismatch between crime perception and crime victimization.

JEL classification: D83, D84, L82

Keywords: Latin America; Peru; information; newspaper; expectation; crime

*Corresponding author; Velásquez: University of Michigan, Department of Economics, 611 Tappan Ave, Ann Arbor, MI 48109 (email: danielvc@umich.edu, phone: +17348825279). Authors; Medina: Universidad del Pacífico (email: santmedinapizarro@gmail.com); Yamada: Universidad del Pacífico (email: yamada_ga@up.edu.pe); Lavado: Universidad del Pacífico (email: P.LavadoPadilla@up.edu.pe); Nunez-del-Prado: Universidad del Pacífico (email: m.nunezdelpradoc@up.edu.pe); Hugo Alatrista-Salas: Universidad del Pacífico (email: h.alatristas@up.edu.pe); Morzán: Universidad del Pacífico (email: j.morzansamame@alum.up.edu.pe). Address, Universidad del Pacífico: Gral. Luis Sánchez Cerro 2141, Jesús María, Lima, Peru. We thank Alberto Chong, Juan Francisco Castro and two anonymous referees for their insightful comments and suggestions. David Mata provided excellent research assistance. All errors are our own. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

1 Introduction

Several countries in the world face large and persistent differences between actual criminality rates and individuals' crime perception. This problem has been particularly acute in Latin America and Peru in the 21-st century, as a large share of the population consistently perceives their countries to be growing in insecurity each year, regardless of the real change in victimization. As can be seen in Figure 1 for the case of six Latinamerican nations, the annual change in victimization can be negative, stable or slightly positive, but a typically large fraction of people will always consider that insecurity has increased in the country.[1] This prominent mismatch, however, is not a particular feature of developing countries. Citizens in the USA and the UK also tend to state that they perceive crime to be higher each year, in spite of decreasing criminality (Office for National Statistics, 2011; Bureau of Justice Statistics, 2016; Gallup, 2019).

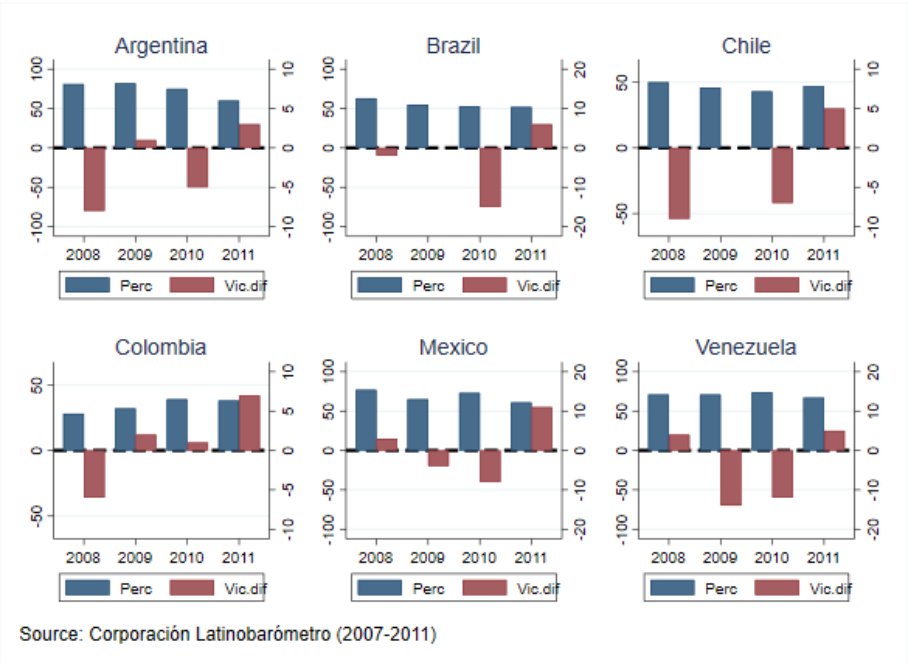
This so-called *perception gap*[2] is a topic worth studying not only due to its global presence, but also due to its potential economic implications regarding welfare and efficiency. There are four ways how this perception gap could be welfare-reducing: i) increases in fear and corresponding health problems, ii) habit changes, iii) irreversible investments, and iv) deterioration of institutions' reputation. First, an overestimation of actual criminality rates may be associated with a higher and unjustified *fear of crime*,[3] which in turn can have negative consequences on general mental health (Whitley and Prince, 2005; Guite et al., 2006; Pearson and Breetzke, 2013). More specific evidence points to consequences on depression, mental distress, mental disorder and anxiety (Green, 2002; Kruger et al., 2007; Stafford et al., 2007; Dustmann and Fasani, 2016) as well as on the frequency of sleep deprivation (Braakmann, 2012). Similarly, there is evidence that crime-related fears and perceptions can impact physical health by affecting leisure time spent on physical activity (McGinn et al., 2008; Ross and

[1] The figure shows the evolution of crime perception and victimization for the 2008-2011 period only, as the years 2007-2011 were the last ones where these two questions were asked simultaneously and without interruption in the yearly survey of Corporación Latinobarómetro (see http://www.latinobarometro.org/latContents.jsp).

[2] Throughout this paper, we will refer to the perception gap as the systematic misperception of either the level or change of actual criminality rates.

[3] According to Fattah and Sacco (2012), questions on the assessment of the likelihood of being a crime victim are a cognitive measure of fear of crime. However, as it is explained in Hale (1996, p. 89), these measures of crime risk "*are distinct from and causally prior to fear of crime*". For our purposes, we will simply refer to fear of crime as the result of an aggregate excess of expected victimization (i.e. when expected victimization is higher than actual average victimization).

Figure 1: Percentage of people who perceive that living in their country is more insecure each day (left axis) and actual change in the victimization rate in Latin American countries (right axis), 2008-2011



Mirowsky, 2001).

Second, individuals may also react to a higher crime perception by changing their habits inefficiently. These reactions can be divided into five categories: avoidance, protective behavior, insurance behavior, communicative behavior and participation behavior (DuBow et al., 1979), all of which can affect both time and money allocations. As a matter of fact, about 30% of Peruvians living in urban areas report to have avoided or have stopped to go out at night due to their fear of crime by 2017. A similar percentage report having stopped using their cellphones on the street for the same reasons, around 20% have stopped taking taxis in the street and even 15% avoid to take a walk in the streets (INEI, 2018). These important changes in habits may impose relevant restrictions on mobility, on labor decisions (Hamermesh, 1999) and even on housing choices (Ellen and O'Regan, 2010).

Third, fear of crime can also lead to economically inefficient investments as individuals can commit into irreversible investments, misguided by short-term deviations in crime perception. For instance, about 10% of urban households in Peru have installed bars in their windows, about 15% have placed a burglar bar door to avoid house theft, and around 15 to 20% have

added locks, latches to their houses and even bought watchdogs (INEI, 2018). All this entails significant initial expenditures and maintenance costs.

Finally, fear of crime can also have politically relevant implications regarding who the public holds accountable for the increase in crime they perceive. If these perceptions are misguided, it could lead to an undeserved deterioration of the reputation of governmental institutions and to misinformed voting behavior. Corbacho et al. (2015) find that crime reduces trust in police and local leadership and harms overall social capital. They argue that this is not only detrimental for development (Tavits, 2006; Horváth, 2013), but also costly because it makes the government spend resources to recover the lost trust.

Having established that increases in perceived crime may have welfare-reducing consequences, it is then natural to seek a better understanding of the reasons explaining the rise in the crime perception gap. In that spirit, the main objective of this study is to estimate the effect of crime news coverage on crime perception in urban Peru for the period 2013-2017. Evidence from developed countries suggests that the news media may be the most relevant source of information for building crime perceptions. Based on survey-data from the UK, Duffy et al. (2008) find that 57% and 48% of respondents mentioned that they believe crime was higher than two years ago because of the TV and newspapers, respectively. The third most common answer was experiences of people known by the interviewee, but this was only mentioned by 24% of the sample.[4]

We use written crime news for our research, as this media outlet is particularly relevant in Peru. According to previous research, Peruvians are the most avid newspaper readers in the region (CERLALC, 2012). For example, this is reflected in the fact that the Peruvian newspaper, *Trome*, is the most read Spanish-language newspaper in the world. By selling around 734,000 copies on a daily basis, it surpasses other well-known Spanish-speaking newspapers like *El País* (Spain), *Clarín* (Argentina), or *El Tiempo* (Colombia) (Mineo, 2014). It is not coincidence that around 78% of the capital city metropolitan area's population (of roughly 12 million persons) reads a newspaper at least once per weak (CPI, 2017).

We use a unique dataset that holds information about the daily content of the most relevant newspapers in Peru, including local newspapers. First, we exploit text mining techniques to filter out crime news and determine whether they were positively or negatively toned.

[4] Another study by Romer et al. (2003) brings more evidence towards this relation. Using US survey-data, they find that viewing local television news is strongly and positively associated with fear of crime.

Second, we link each news to the province were the crime was committed.[5] To do so we apply a procedure of sentiment analysis and of name entity recognition, respectively, which we describe with further detail below. Then, for each province in Peru and in a monthly basis, we calculate the average area in cm^2 that crime news take in the newspapers. With these time-series in hand, we are able to pin down the months in which each province experienced a short-term deviation from the trend in the average area devoted to crime news. We argue that these *area coverage shocks*, after including province and year fixed effects and controlling for the actual number of crime news and violent deaths, are more likely to exhibit an exogenous behavior. Thus, we do not identify the effect of increasing the number of crime news, but the effect of *larger newspaper space* devoted to crime.

We show that *area coverage shocks* of negative news increase crime perception, while the effect of *area coverage shocks* in positive news is opposite-signed. Furthermore, we find that the effect per cm^2 of negative news is almost three times larger than the effect of positive crime news (in absolute value). This suggests that there is an important asymmetry in the way people revise their expectations: to offset an increase in crime perception generated by a certain amount of negative information spilled by the media, it is required to triple such amount of information but in positively toned news. This sheds light on some of the reasons why the perception gap exists and, most importantly, persists. These features are consistent with two well-document types of cognitive biases: confirmatory bias (Lord et al., 1979; Rabin and Schrag, 1999) and negativity bias (Rozin and Royzman, 2001). After performing several robustness checks, we also explore the heterogeneity of the effect and find that (i) the size of crime news increases crime perception mostly on non-victims, which is consistent with the substitution thesis (Weitzer and Kubrin, 2004) and, less clearly, that (ii) the size of crime news tends to have a smaller effect on women than on men. Also, we find that negative crime news increase perception of domestic burglary and of common street robbery more than they increase perception of crimes like sexual abuse or kidnapping.[6]

Last but not least, we delve into some of the four possible consequences of increasing aggregate fear of crime. First, we analyze how individuals have adjusted their habits in response to perceived crime rates in the last years. Second, we explore which political institutions are

[5] Peru as of 2018 was divided into 25 regions, 196 provinces and 1874 districts.

[6] We do not find a clear pattern of heterogeneous effects for positive crime news, although street crime was more responsive.

held accountable by the population, that is how people distribute guilt but also reward. Third, we explore the effect of *area coverage shocks* on other outcomes related to electoral behavior and household expenditures.

Our work speaks to the literature on the relation between media and crime perceptions (Ardanaz et al., 2014). As far as we know, our paper is most closely related to the work by Mastrorocco and Minale (2018). They exploit the staggered introduction of digital TV in Italy to explore how it affected crime perceptions on people aged 50 and over. Ramírez-Álvarez (2017) performs a similar study, but leverages on an industry agreement that aimed to reduce the coverage of violence in Mexico. We expand upon previous research by using richer data and information engineering techniques for classification and creation of variables, which can vastly increase the scope of analysis. More specifically, a first important difference of our study is that we analyze shocks of both positive and negative news. This introduces a second dimension that allows us to study asymmetries and dig deeper into the subject, as opposed to the analysis of a natural experiment which only provides evidence on the impact of media in one direction. Second, we georeference each news according to the location of the reported crime to exploit cross-sectional variability at the geographical level and to identify the effect of news from crimes near to where people live, in contrast to country-wide crime. Third, we use an absolute measure of crime perception as our dependent variable, unlike past studies on the subject.[7] Thus, our coefficients have a very clear interpretation as changes in the share of the population who thinks they can become a crime victim. This has the potential to be more policy-relevant and more closely related to the impact of news on people's welfare and thoughts. Finally, we focus on *size* deviations of the news, not on its number. As far as we know, we are the first to take this approach, which we believe is informative of the role of the media in shaping crime perceptions.

Our paper is also related to other significant research efforts aiming to determine how the audience and message characteristics can influence crime-related perceptions, fears and behavior (Ditton et al., 2004). For example, the communication and criminology literatures have focused on studying how individuals assimilate the information from crime news depending on

[7] Mastrorocco and Minale (2018) resort to relative measures of crime perception, like the position of "crime" in a ranking of a country's problems. We posit that such a measure of crime perception is subject to more noise, as relative crime concern can fall due to other confounding unobserved factors related to any other problem to society. Ramírez-Álvarez (2017) uses a variable that depends upon past personal estimates of criminality.

previous living experiences, ethnicity or gender (Gerbner et al., 1980; Hirsch, 1980; Weaver and Wakshlag, 1986; Chiricos et al., 1997; Gross and Aday, 2003). These literatures have also focused on the role of the perceived realism of crime news (Potter, 1986; Chiricos et al., 2000; Weitzer and Kubrin, 2004). We contribute to these literatures as we show how sex and previous victimization shape the effect of the media, and how these effects differ depending on the tone of the news. Another strand of empirical research has focused on studying the importance of different media channels such as films, television, radio, newspapers and web; and genres such as soap operas, crime drama, news, and reality television (Romer et al., 2003; Holbert et al., 2004; Grabe and Drew, 2007; Custers and den Bulck, 2011; Callanan, 2012). We contribute to these papers by showing how devoting more space to crime news in newspapers can affect crime-related perceptions. Likewise, the proximity and location of crimes have been highlighted as important factors influencing perceptions and fear (Heath, 1984; Liska and Baccaglini, 1990; Eschholz et al., 2003). In our research we confirm these findings as crime news referring to places as close as the province in which one lives can fluster crime perceptions. We also add to previous research focusing on Latin America and the role of the crime media and its consequences on democratic attitudes and views about punishment (Oviedo and Rodríguez, 1999; Caldeira, 2000; Singer et al., 2019).[8]

In addition, there is an extant literature in psychology about the formation of specific beliefs. This research documents how individuals use specific heuristics to judge the probability of occurrence of certain events. For instance, individuals usually determine the probability of occurrence by relying on the ease with which they recall the associated event (Tversky and Kahneman, 1973; Schwarz et al., 1991). According to this literature, individuals may also be prone to other heuristics such as the affect heuristic, which describe how representations labeled with affect, either good or bad, can influence the assessment of risk (Slovic et al., 2004). In this way, vivid representations such as images of a crime can influence individuals crime perceptions (Jackson and Gouseti, 2014). Our research then adds to this literature by providing another case in which these biases may be playing an important role as we focus on how the size devoted to crimes in newspaper affect the individuals' assessment of fear. Furthermore, we also contribute to previous research in psychology that shows that individuals may be prone to cognitive biases such as confirmation bias, the tendency to only search

[8]For a review of the literature about the fear of crime in criminology, please refer to Hale (1996)

and recall information that confirms one's priors (Lord et al., 1979; Rabin and Schrag, 1999), and negativity bias, the tendency of being more affected by things of a negative nature than by things of a positive nature (Rozin and Royzman, 2001). Although, some research in this literature argue that the media may not have the powerful influence on crime perceptions that is commonly believed (Gunter, 1987), we find that the opposite may be as well true as increasing something that may seem innocuous at first sight such as the average size of news while keeping their number fixed may have an immediate effect on crime perception.

Finally, in more general terms, there is a literature to which we also contribute showing how the media affect other outcomes such as voting and electoral outcomes (DellaVigna and Kaplan, 2007; Ferraz and Finan, 2008; Enikolopov et al., 2011; Spenkuch and Toniatti, 2016), political accountability (Snyder Jr. and Strömberg, 2010), civil conflict (Yanagizawa-Drott, 2014), public support for dictatorships (Adena et al., 2015), polarization (Martin and Yurukoglu, 2017), and electoral sanctioning (Larreguy et al., 2018). We also contribute to the literature discussing how it is that the way the information is delivered matters (Arias et al., 2018; Marshall, 2018; Chong et al., 2019).

The rest of this paper is structured as follows: Section 2 briefly presents relevant background on criminality and newspapers in Peru. Section 3 then presents our data and describes the techniques used for the news database. In Section 4, we lay out our identification strategy and, in Section 5, we explain our main results, including robustness checks. Section 6 displays further consequences of crime news and, finally, Section 7 concludes.

2 Background

2.1 Crime in Peru

Crime has been one of Peru's most urgent problems in the eyes of its population over the last decade, particularly so in the last few years. Somewhat paradoxically, between the years 2013 and 2017, the real share of the urban population victim of a crime has exhibited a substantial decrease, whereas crime perception, as measured by the percentage of people who think that they can be a crime victim in the next year, has been mostly stable (see Figure 2). As a result, the perception gap has steadily grown larger by around 10 pp in five years only. By 2017, crime perceptions sits at around 80% and victimization slightly above 20%. Consistent with

these figures, in an unreported descriptive analysis we also see that the share of people who were not crime victims in the past year but who think they can become one have increased in the last years, at the expense of people who believe that their situation will remain the same regardless of their victimization.[9]

2.2 The newspapers market in Peru

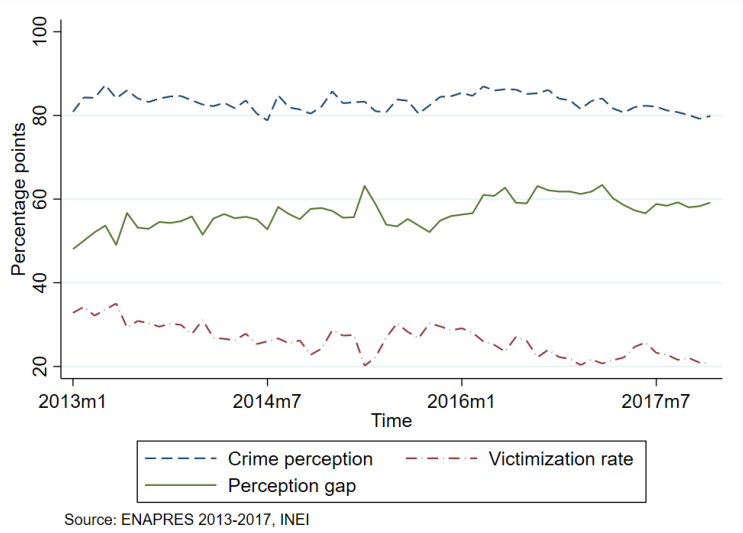
As previously mentioned, newspapers are very popular in Peru. According to independent survey data from CPI (2017), a Peruvian consulting and market research firm, weekly readership in the capital city metropolitan area stood in a high 78.0% by 2016. Moreover, daily readership is never lower than 23.8% and can be as large as 58.5% in the cities present in the survey. This means that most of the city's population aged 15 or older is greatly exposed to news. This information is representative of the year 2016, right in the middle of the time period we are studying.[10] Survey data from Arellano Marketing (2017), another Peruvian research and consulting firm, also confirms most of these findings. Around 80% of the population in Lima reads newspapers weekly and does so on a basis of 1.1 hours per day. In provinces, the share of readers is lower (68%) yet the reading intensity is the same (1.1 hours per day). All this information suggests that, even though there are more media outlets than ever (e.g. TV and internet), the newspaper has not been replaced or crowded out in Peru. This last fact is important for our identification strategy.

On the supply side, the newspaper industry in Peru is heavily concentrated, as in several countries in the world. Around 95% of market share was dominated by three media groups as of 2012: El Comercio (49%), Epensa (29%) and La República (17%). Conversely, smaller local newspapers have only a small fraction of total sales. They are most prevalent in the Northern region of Peru, but their aggregate market share is also rather small (6.61%) (Fernández-Baca, 2014). However, in mid-2013 El Comercio bought Epensa, configurating almost a duopoly in the market in terms of competing firms. Both El Comercio and La República have several newspapers to their name, such as the aforementioned *Trome*, which belongs to El Comercio.

[9] This analysis is available in the working paper version of this research (Velásquez et al., 2018).

[10] According to the same survey, on average men read more newspapers than women in Peru. Moreover, in most of the sampled cities, newspaper readership is slightly tilted towards those older than 38, although the percentage of readers aged 15-25 and 26-37 is not much smaller. Similarly, the share of readers is a bit higher in the socioeconomic status A/B than those in C/D/E. Most of the self-declared readers report to do so at home or at their workplace.

Figure 2: Evolution of crime perception and victimization: urban Peru, 2013-2017



Due to this media concentration and because we also have data on local newspapers, our newspapers' dataset is rather exhaustive in its scope of Peru's written press.[11]

3 Data

3.1 Individual and household-level data

We use individual-level data from the National Survey of Strategic Programs (ENAPRES, for its Spanish acronym) pooled over the years 2013-2017, which is conducted by the National Institute of Statistics and Informatics (INEI), a Peruvian Government agency. As well as other national household surveys, the ENAPRES data is issued yearly, but the surveys are performed on a rolling basis throughout the months of the year.[12] It provides information on people's assessment and experience of criminality in urban areas for 14 crime categories.[13] From this survey we construct our crime perception variable. We define a dummy variable that takes

[11] More details regarding the exhaustivity of our dataset is explained in the following section.

[12] The survey's inference level is at the national-by-month level and as small as the regional-by-year level. Within the region of Lima, it is also representative at the province-by-year level.

[13] These are (1) house theft; (2) automotive vehicle theft (e.g. cars, vans, etc.); (3) automotive vehicle parts theft (e.g. headlights, tires, rims, etc.); (4) motorcycle theft; (5) bicycle theft; (6) money, wallet or cellphone theft; (7) threat or intimidation; (8) physical or psychological abuse by household member; (9) sexual offences (e.g. harassment, molestation, rape, etc.); (10) kidnapping; (11) extortion; (12) fraud; (13) business theft; (14) other.

the value of 1 if the surveyed individual answered positively to the following question: "*In the next 12 months, do you think you can be victim of crime k?*". This exercise is performed for each of the 14 crime categories included in the survey. Based on this, we measure aggregate crime perception (from here onwards simply crime perception) as the inclusive disjunction of the 14 crime perception categories. Thus, crime perception is equal to 1 if a person believes that she can a be victim of at least one of the 14 crimes in the next 12 months. For crime victimization we follow the same procedure.

This way of measuring crime perception represents an improvement over a common problem found in other studies. Usually, there is a concern that the public may include other factors like terrorism, "*litter on the streets, broken windows or a general lack of respect*" (Duffy et al., 2008, p. 28) into their definition of crime. Our measure of aggregate crime perception (and also of victimization) is based on 14 direct questions regarding different crimes. Compared to other studies that define crime perception as either (1) the placing of crime in a ranking of the country's problems (Mastrorocco and Minale, 2018)—which makes this particular measure dependent on variables affecting other elements of the ranking—or as (2) the answer to questions similar to "*how secure do you feel as compared to 12 months ago?*" (Ramírez-Álvarez, 2017) or "*do you think crime has increased?*"—which imply a comparison with past personal estimates of crime perception—we call our variable a more concrete and less noisier measure of absolute crime perception. In a regression setting, it can be modeled as the expected victimization rate, which leads to a quite natural interpretation of the parameters.[14]

3.2 Province-level news data

To measure the coverage of crime news, we use a novel dataset compiled by "iMedia". "iMedia" is a Peruvian private firm specialized on tracking and monitoring news and performing data analysis. As part of their regular activities they compile and store all types of news from national and local news suppliers in different media formats such as newspapers and TV. For the period 2013-2017, we requested them to compile all crime-related news using a list of validated keywords for the following crime categories based on the crimes surveyed

[14]The ENAPRES database also contains typical socioeconomic factors such as sex, civil status, age, and so on.

by INEI: theft, threat, fraud, extortion, abuse, sexual offence and kidnapping.[15] The resulting database contains all the registered crime news in the Peruvian written press tracked by iMedia, which includes not only daily newspapers, but also weeklies and magazines, and it is rather exhaustive of the Peruvian written press. In fact, according to own calculations our dataset contains 90% of the most read newspapers of the 16 main cities of Peru, averaging between the coverage rates of the 5 years of iMedia data (2013-2017).[16] Last but not least, the data contains several attributes of interest such as the issuing newspaper, the type of crime, the text included in the news, and the area in cm^2 it covered. In what follows we explain how we classify news as positively or negatively-toned and how we link them to provinces.

A. Sentiment Analysis

Not all crime-related news tell bad stories. Some news can be crime-related and still transmit a positive message, such as improvements in the security level by informing the disbanding of a criminal gang, the conviction of a murderer, or by factually describing decreasing criminality rates. We name this type of news as *positive* crime news, as opposed to typical *negative* crime news. Acknowledging that crime news can also have a positive sentiment is critical for a proper and cleaner decomposition of the effect of crime coverage. Although one is used to think about crime news as generally transmitting a negative message—with headlines mainly referring to thefts and particular murders coming up to mind—crime-related news could also introduce feelings of relief and security. These positively-toned news should not increase crime perception, at least. Thus, grouping all crime-related news and assuming they all increase crime perception would lead to an underestimation of the real effect of negative crime news. Moreover, one would not be able to respond to an empirically-relevant question: do *positive* crime news actually decrease crime perception? This question is also relevant from a policy point of view: the perception gap could be explained if the impact of negative news is larger than that of positive news, even more so if negative news are over-provided. Performing this distinction between positively and negatively-toned news and separating their effects is, as far as we know, a novelty of this paper.

To determine the news' text polarity, we use a sentiment dictionary, which classifies words

[15] We used a keyword-based selection algorithm. This algorithm used a list of keywords that are in Spanish and that are particular to each crime category. This information is available upon request.

[16] These cities concentrate more than 80% of the urban population.

as being positively, neutrally or negatively toned. We generate it by compiling different dictionaries for text analysis in Spanish (Perez-Rosas et al., 2012; Molina-González et al., 2013; Sidorov et al., 2012; Urizar and Roncal, 2013), and other sources. In addition, we also include crime-specific keywords derived from the queries we used to get the initial data set.[17] The main idea of this algorithm is to count the total number of positively, negatively, and neutrally toned words. This counting does not include the stopwords in the text, as is usual in text analysis. Then, we classify each news to the sentiment with the maximal word count. For example, if a piece of news has 5 positively toned words, 18 negatively-toned ones and 2 neutral ones, it will be classified as negatively toned. Appendix B describes and gives further technical detail on this algorithm. As a visual example of the outputs of our algorithm, Appendix Figures 1 and 2 show news that were classified as negative and positive, respectively.

B. Spatial Entities Extraction

Similarly, one can think that people tend to give more weight to news from crimes occurring near to where they live, work or visit, when forming their expectation on the likelihood of being crime victims. This consideration draws upon the discussion on possible differential effects of local and non-local crime news found in the literature. Liska and Baccaglini (1990) find evidence that fear of crime is increased only by local homicide stories, as opposed to stories from other cities. Moreover, they find that the latter make people feel safer by comparison. To be consistent with these observations, we perform a spatial entities extraction procedure to identify the location of the crime reported in each news. Grouping all news might bias our results. Performing this procedure to diminish potential bias has also been previously untried, as far as we know.

For every piece of news in the database, we verify whether its text featured any of the names of any region, province or district in the country.[18] Afterwards, for every news with at least one spatial entity identified, we choose the smallest geographical entity listed. This first filtering is then subject to an ambiguity calculation process and double verification to address issues such as confounding spatial entities' names with street addresses, people's names or other spatial entities' names. Appendix C gives further methodological detail on the spatial

[17] The final list of keywords for both positive and negative sentiments is available upon request.
[18] Peru has three administrative spatial divisions: regions, provinces and districts.

entities extraction procedure and steps. After performing this procedure, we are able to allocate each positive and negative crime news to a unique province-month pair (for instance, the province of Canta in December, 2015). We then build a monthly panel of news content at the province level, with information on the total number of crime news in in each province-month, as well as total negative and positive crime news, separately. Importantly, we record the average area in cm^2 covered by crime news occurring in each province-month.

For a better understanding of the data, the resulting descriptive statistics are displayed in Table 1. First, note that the number of yearly crime news has more than doubled since 2013. However, the number of newspapers tracked by iMedia is mostly increasing through time. Thus, a better measure of the degree of media focus on crime is given by the average number of crime news published in each newspaper. This number has gone from 198 in 2013 crime news per newspaper up to 405 in 2017. Even though the number of crime news per media source is increasing in time, the average area covered is heterogeneous through the period of analysis. The most common type of crime reported in the news is theft. Furthermore, since 2014 crime news are always most reported in the cover page. As expected, the majority of crime news were negatively-toned and most of the reported crimes occurred in Peru's capital, Lima.

Table 1: Crime news dataset descriptive statistics

	Year				
	2013	2014	2015	2016	2017
Number of news	24,316	32,071	49,934	68,753	64,826
Number of media sources	125	156	160	166	160
News per media source	195	206	312	414	405
Crime mode	Theft	Theft	Theft	Theft	Theft
Page mode	Third page	First page	First page	First page	First page
Avg. area in cm^2	336.31	266.83	282.29	208.06	287.28
Date mode	2013-03-26	2014-09-03	2015-09-03	2016-06-01	2017-10-26
Sentiment mode	Negative	Negative	Negative	Negative	Negative
Region mode	Lima	Lima	Lima	Lima	Lima
Province mode	Lima	Lima	Lima	Lima	Lima

3.3 Homicides data

Finally, we would want to control for some measure of real risk factors at the province-month level that might correlate with news coverage. The National Register of Crime and Misconduct Complaints in police agencies provides such information, as it contains all death

complaints reported in police agencies at the province-month-level. With this information, we build a monthly time series with the number of violent deaths associated to intentional criminal offences and reported in each province. These include not only intentional homicides, but also serious injuries followed by death and aggravated theft with subsequent death.

4 Identification Strategy

4.1 Area coverage shocks

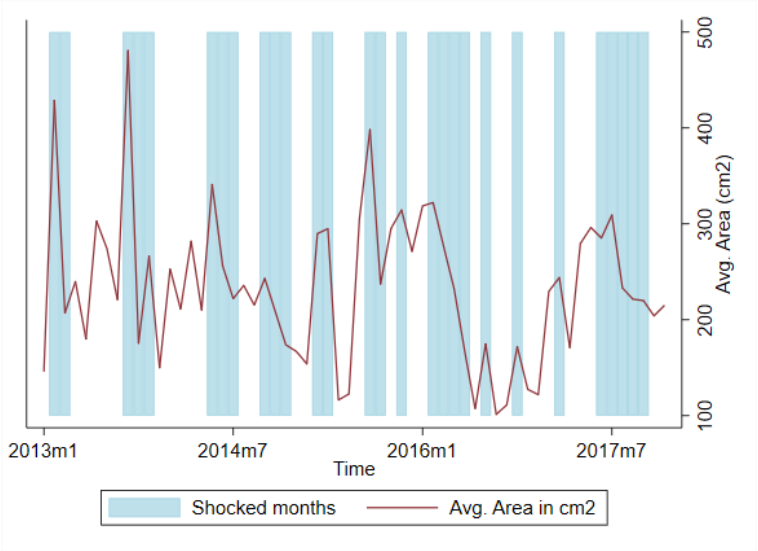
We use the following simple definition as the criteria to leverage *short-term deviations from trend* in the monthly average area (in cm^2) devoted to crime-related news for each province.[19] A province p is defined as treated in month t if it experiences a crime news *coverage shock* at such moment t. As we are using newspapers, a *coverage shock* is said to happen on month t in province p if the sum of the average areas of crime news from crimes that happened in province p on the current and previous month is larger than that of the next two months, conditional on at least one crime news from that province happening on that four-month time span. Formally:

$$Coverage\ shock_{p,t} = \begin{cases} 1 & \text{if } Avg.Area_{p,t-1} + Avg.Area_{p,t} > Avg.Area_{p,t+1} \\ & +Avg.Area_{p,t+2} \text{ and } \sum_{s=t-1}^{t+2} Avg.Area_{p,s} > 0 \\ 0 & \text{if } Avg.Area_{p,t-1} + Avg.Area_{p,t} \leq Avg.Area_{p,t+1} \\ & +Avg.Area_{p,t+2} \text{ and } \sum_{s=t-1}^{t+2} Avg.Area_{p,s} > 0 \\ . & \text{if} \sum_{s=t-1}^{t+2} Avg.Area_{p,s} = 0 \end{cases} \tag{1}$$

With this definition, we compare province-months experiencing a short-term spike in the average size of news during the two most recent months relative to the next two ones, with province-months that experience such spikes just after the month of analysis. These constitute our treatment and control groups, respectively. We apply this definition to the province-months throughout the entire period of analysis, so that all province-months are labeled either as treated or non-treated, whenever there is at least one crime news in the four-months window. We compute separate measures of *coverage shocks* for both negative and positive

[19] Our definition for a *coverage shock* is based on the one used by Marshall (2018) to identify homicide shocks at the municipality level.

Figure 3: Average area of negative crime news in Cañete and shocked months (highlighted), 2013-2017



crime news. By way of example consider Figure 3, which shows the monthly time series of the average area from negative crime news in the province of Cañete. As one can see, shocked months (shaded with light blue) are those where there is a relative spike in the series or are immediately preceded by one. Thus, for the case of this province, the light blue months will conform the treatment group and the white months will constitute the control group. Notice how this definition effectively retrieves peaks in the average area series.

It is important to remark that we define our *coverage shocks* based on the *average* area devoted to tell crimes from each province in each month, not the *total* area nor the number of crime news. This has a series of advantages. First, we alleviate the problem of the changing composition of the newspapers database. We know that there is an increase in the number of tracked newspapers in the "iMedia" data, which could explain part of the increase in the number of crime news. Thus, by centering our attention in the average area of the news, we attempt to detach our treatment from the absolute number of crime news. Second, we know that some newspapers tend to report crime news more heavily due to editorial discretion. By focusing on average area *deviations*, our definition of *coverage shock* also seeks to address this possible source of concern. We aim to capture months in which crimes with particularly high media resonance happened, as these are expected to merit a larger area in the newspaper. We expect these highly covered crimes to have a great impact on crime perception that is almost

exclusively channeled by the media, in a context where almost 80% of the population reads newspapers. Moreover, we argue that these salient crimes are more likely to create short-term deviations in the average area of crime-related news. Consistent with our claim that these type of news are arguably random in their occurrence, we find that within provinces the proportion of times the average area for negative crime news increased was fairly similar to the proportion of times it decreased (42% vs 41%). We find comparable results when assessing the likelihood that average area for positive crime-related news increases (32%) or decreases (30%).

4.2 Empirical Specification

We propose the following baseline linear probability model:

$$\begin{aligned} Crime\ perception_{i,p,t} = \beta_0 &+ \beta_1 Coverage\ shock^{neg}_{p,t} + \beta_2 Coverage\ shock^{pos}_{p,t} \\ &+ \beta_3 Crime\ news^{neg}_{p,t} + \beta_4 Crime\ news^{pos}_{p,t} + \beta_5 Violent\ deaths_{p,t} \\ &+ \gamma_y + \gamma_p + \varepsilon_{i,p,t} \end{aligned} \tag{2}$$

where i indexes individuals, p provinces, t months and y years. *Crime perception*$_{i,p,t}$ measures aggregate crime perception as previously defined. It is an indicator that takes the value of 1 if individuals think that they will become a crime victim in the following 12 months. Next, *Coverage shock*$^{neg}_{p,t}$ is defined as explained above and, broadly speaking, distinguishes between province-months where negative crime news had a short-term spike in their area. An equivalent definition applies for *Coverage shock*$^{pos}_{p,t}$, but using positive crime news time series instead. On average, individuals in shocked province-months in the two previous months experience negative crime news that are 55 and 72 cm^2 larger and positive crime news about 99 and 118 cm^2 larger than in their respective control groups. The coefficients associated to both *coverage shocks* (β_1 and β_2) are our parameters of interest and may be interpreted as the causal effect of experiencing a spike in the size of negative or positive crime news on the perceived probability of becoming a crime victim. We would expect that $\beta_1 > 0$, as larger negative news from crimes in one's province are theorized to increase crime perception. More uncertainty remains on the sign of coefficient β_2. However, one can expect that positive crime news could, at least temporarily, induce a sense of peace on newspapers' readers, thus

reducing aggregate crime perception ($\beta_2 < 0$).

To identify our parameters of interests it is key to: (1) control for the total number of positive and negative crime news occurring in a certain province-month ($Crime\ news^s_{pt}$) and (2) control for the number of monthly violent deaths in each province ($Violent\ Deaths_{p,t}$), as these should serve as proxies for local crime rates and real risk factors. By including them, we compare province-months where newspapers assigned a larger area to crime news, rather than comparing factually more dangerous province-months with less dangerous ones. This is possible because both the number of crime news and violent deaths are much more likely to track the actual number of crimes and other province-month-specific unobservable factors that are likely to correlate with crime perception.

We also include year and province fixed effects (γ_y and γ_p, respectively) to control for unobserved time-invariant factors at the province level and cross-sectional-invariant factors at the year level affecting crime perceptions. Hence, we exploit within-province variation in *coverage shocks* to identify our parameters of interest.

4.3 Potential issues with identification

4.3.1 Self-selection of readers

Individuals may self-select or not into reading newspapers depending on their content and as a reaction to *coverage shocks*. This is not an issue in our specification as our treatment variable is defined in a wider sense. In particular, we are not estimating the effect of *coverage shocks* comparing just among readers, rather we are including both readers and non-readers as our treatment variable is defined at the province-level. In other words, we are estimating an intention-to-treat effect (ITT).

Moreover, although one might think that changes in readers' perception make up all of the observed effect, one cannot discard the possibility that the treatment is also affecting non-readers. This could happen by up to two channels. First, newspaper readers can tell their acquaintances what they have read, particularly if their perception of crime changed as a result of reading such newspapers. Second, as in several places in the world, newspapers in Peru are sold in newsstands that hold newspapers' covers at sight of the pedestrians. Photos and large headlines (both more area-increasing relative to text) are more likely to be spotted by people walking by, intentionally or not, regardless if they end up buying the newspapers. These

transmission channels, including news readership itself, would be captured by our estimation. As we are interested in the ITT effect of crime news coverage on the population this does not represent a problem for the consistency of our estimates.[20]

4.3.2 Crime perception leading crime coverage

There could be a potential problem if there is a simultaneous relationship between the coverage of crime news and crime perception at the province-level. Given the controls we are already including in our main specification, this would imply that newspapers strategically manipulate the *size* of their crime-related news according to changes in crime perception. For example, newspapers could supply larger crime news when people are getting increasingly fearful. We argue this is unlikely for several reasons. First of all, news area devoted to crime depends on several other factors that are not related to crime perception and that might reduce the flexibility to continually manipulate news size to track crime perception. For example, other daily relevant news related to politics, the economy, or even sports might demand area changes that restrict the newspapers ability to permanently make a strategical assessment of news size. Second, it is also unlikely that this type of behavior can be sustained for 196 provinces and that the newspapers possess exact information on monthly changes in fear of crime. Empirical evidence also supports these ideas. For example, evidence from the UK reveals that stories about crime are usually leading—not following—changes in feelings of insecurity (Duffy et al., 2008). To give further confidence on the validity of these dynamics for the case of Peru, we performed a Granger causality test (Granger, 1969) exploiting within provinces variation in crime perception and news area. In general, we fail to reject the null hypothesis that lagged values of crime perception have zero explanatory power on the average area of crime news, after controlling for past realizations of such variable.[21] This gives further strength to the argument that there is no feedback relationship between the two variables.

[20] As stated above, individuals may self-select into reading newspapers and this could explain part of the effect. However, underpinning this mechanism is not our objective.

[21] We performed a Granger (1969) causality test with province fixed effect for both positive and negative crime news area. We used crime perception as the explanatory variable. We regress three specifications for each news sentiment: with only one lag, with two, and three. We fail to reject the null hypothesis for all three specifications of the negative area. For the equation with positive area, we only reject the null hypothesis in the specification with two lags. However, with three lags, the null hypothesis was not rejected again.

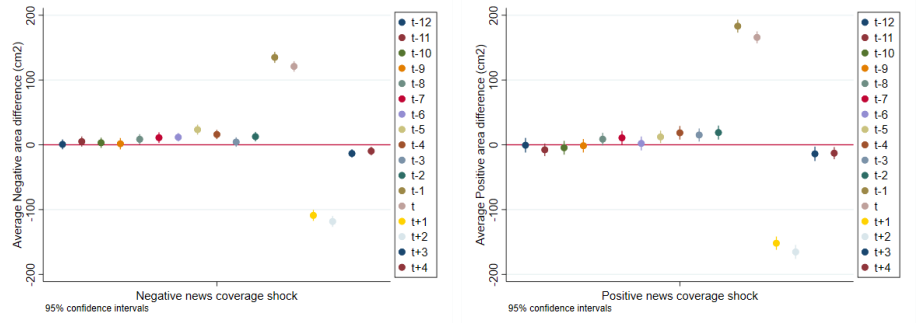
4.3.3 Attenuation bias

To define whether a province was shocked or not, we use the news' size in cm^2 as our main input. However, some of the areas reported in our data were measured with error. Some news feature impossibly high areas (around 764,000 cm^2). To alleviate this concern we dropped from the computation of our *coverage shocks* all news featuring an area higher than 1,800 cm^2, which is the size of the largest Peruvian newspaper.[22] Even though this should greatly reduce attenuation bias, some wrongly measured areas below the 1,800 cm^2 threshold may still remain. Thus, our results represent lower-bound estimates of the true population parameters.

4.3.4 Balance checks

We claim that our measures of *coverage shocks* are exogenous conditional on covariates. To further validate our claim, we verify whether there were systematic differences in the pre-trends (i.e. before the occurrence of a *coverage shock*) between treated and non-treated province-months in terms of news coverage. As stated, the treatment group is composed by all province-months that were subject to a *coverage shock*. Provinces that were not shocked belong to the control group. Inspecting Figure 4, which displays the average area difference between treated and non-treated provinces across each month before and after the shock, one can see that treated and non-treated provinces are similar in terms of news coverage before the occurrence of the coverage shock. There are some area imbalances before the shock, but these are small in absolute terms and also small relative to the size of the upcoming area jump.

Figure 4: Difference in news average area between treatment and control groups around the treatment month



[22] We drop those news from any further calculations or descriptive statistics regarding area in cm^2.

To address the concern that these unbalances may bias our results, we create up to five different constrained versions of our measures of *coverage shocks*, each one with a more stringent pre-trend balance requirement for the average area. We constrain our measures of *coverage shocks* by dropping all observations coming from a month t that showed unbalance between treated and non-treated provinces in months s, for $s < t-1$. To exemplify how this procedure works, lets pick a month, say January 2015. For January 2015 (t), we can compare treated and non-treated provinces in terms of their average area (recall that we know which provinces were treated in January 2015, and which were not). This difference should be positive and large. The mean difference for December 2014 ($t-1$) should also be significant. Then, we can compare the average area in November 2014 ($t-2$) between those provinces that were treated and not treated in January 2015 (t). If treated and non-treated provinces are not equal (i.e. we reject the null hypothesis that the difference is zero), we drop all observations coming from January 2015, since we erroneously assigned them as treated (i.e. shocked) and non-treated. Recall that what we are trying to do is to capture short-term deviations from the general trend (or cycle) of crime coverage in terms of area. If we find that there is an unbalance in a month previous to a shocked period, then we are not capturing such short-term deviations. We repeat this process for every month in the period of analysis.

To avoid an arbitrary cut in the number of months in which pre-trends balance was required, we evaluate up to six different measures: the first without any constraint, the second one requiring only 1-month of pre-trend balance (the penultimate month before the *coverage shock*), the third one requiring 2-months of pre-trend balance (months $t-2$ and $t-3$ without statistically significant differences in crime news area) and so on. We apply this procedure to our two measures of positive and negative *coverage shocks*. Although this should lead to a possible bias reduction, imposing these constraints sometimes entails large sample cuts.

In the Appendix Section D we further validate our empirical strategy by analyzing how unconstrained and constrained *coverage shocks* are distributed among months and provinces. We also explore how the distribution of crime news area is characterized months before the treatment. We conclude that the average probability of occurrence of unconstrained positive and negative shocks are fairly centered around 0.5. Regarding constrained shocks, they are

not as evenly distributed as their unconstrained counterparts.[23] Similarly, we show that the probability of being subject to a news *coverage shock* either negative or positive is around 0.5 for most provinces. For the constrained shocks, results are similar, although a few provinces are subject to different probabilities of *coverage shocks* occurrence.[24] Finally, we show that the distributions of crime news area are similar across several months before the treatment.

5 Main Results

5.1 Average Effects

In this section, we present the average effects of crime news *coverage shocks* on crime perception that result from estimating Equation (2). We show the results using the unconstrained and constrained *coverage shocks*. We do this as a direct robustness check (as the sample size changes across columns), but also to observe how the effect of something progressively more akin to a short-term shock evolves. The first column of Table 2 shows the coefficients for unconstrained negative and positive shocks. The second column shows the coefficients of these shocks, but when we require 1-month pre-trend balance. The third column requires two months of pre-trend balance, the fourth column three, the fifth one four, and the sixth one five.[25]

Regarding the effect of a negative news *coverage shock*, we find robust evidence for a statistically significant positive effect on crime perception, mostly at the 1% level, for all six versions of treatment (see Table 2). Using the 1 month-balance *coverage shock* as our benchmark specification (Column 2), increasing the size of reported negative news leads to an increase of crime perception of 1.4 percentage points. Although the average rate of crime perception in Peru is around 80% in our sample, the estimated effect is far from negligible. On average, negative crime news are about 53 cm^2 larger during two months in shocked province-months. This represents a 25% increase in negative news size relative to non-shocked province-months. To put this effect in perspective with a simple back-of-the-envelope calculation, an

[23] To address this issue we include year-month fixed effects in the Robustness Section.

[24] We are already including province fixed effects which should take care of these small differences.

[25] All the regressions were estimated using individual weights (expansion factors) provided by the ENAPRES survey. Standard errors are clustered at the province level to account for within-province error correlation. This is necessary because our treatment variables (*coverage shocks*) are defined at the province-level and the observations are individuals (Abadie et al., 2017).

increase of 53 cm^2 on the area devoted to each crime news during two months is associated with around 336,000 Peruvians changing their minds on them being potential crime victims in the following year. This is a seemingly large and relevant impact, considering that it is only the size of the news that is changing and not its number nor the underlying criminality rates or trends.

Table 2: Effect of crime news coverage shocks on crime perception

	(1)	(2)	(3)	(4)	(5)	(6)
Negative area shock$_t$	0.0052*	0.014***	0.022***	0.022***	0.023***	0.018***
	(0.0029)	(0.0035)	(0.0040)	(0.0041)	(0.0087)	(0.0064)
Positive area shock$_t$	-0.0062*	-0.011**	-0.0067*	-0.0048	-0.0025	0.0058
	(0.0032)	(0.0052)	(0.0036)	(0.0035)	(0.0065)	(0.0061)
Observations	310890	177456	98964	93723	60006	54686
Months balance	0	1	2	3	4	5

Standard errors clustered at the province-level are in parentheses. Significance stars: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The assessment of the positive news *coverage shock* is less clear, as no significant effects are found beyond the second month of pre-trend balance requirement. However, this could be due to the smaller magnitude of the parameter. If anything, positive *coverage shocks* are linked with a decrease in crime perception. Once again, using Column 2 as our benchmark, larger newspapers' area devoted to crime news leads to a reduction in crime perception of 1.1 pp. This result serves as a validation of our sentiment analysis procedure, but, most importantly, proves that the media can also play a key role on closing the persistent perception gap. In our sample, province-months that experience a positive news shock have 117 cm^2 larger positive crime news. This is a 47% size increase relative to non-shocked province-months. It implies that an increase of 117 cm^2 on the average area devoted to positive crime news is associated with about 264,000 Peruvians changing their minds and declaring to feel safe for the year.

How do these two effects stand in relation to each other? The difference of the effect per cm^2 of negative and positive *coverage shocks* is significant at the 1% level. In fact, the calculated average effect per cm^2 of negative news would be almost three times larger than the calculated effect of positive news, signaling a potential and important asymmetry on the revision of people's expectations depending on the nature of the news received. This implies

that it takes almost three times more newspaper space of positive crime news to undo the increased crime perception of a given negative *coverage shock*. This finding is also relevant as it could explain how, even under "accurate" (using the term somewhat loosely) crime coverage by the press, people's perception can go astray, as negative news are weighted more heavily in the construction of one's beliefs. Thus, it is not only the case that negative crime news might be over reported (in number and size), but that their effect is also larger.

This result is consistent with individuals exhibiting *confirmatory bias* (Lord et al., 1979) (Rabin and Schrag, 1999). Under this framework, agents disregard or misinterpret new information that does not support their previous beliefs. Thus, if a majority of the population has a high subjective probability of becoming a crime victim, confirmatory bias will reinforce the impact of negative news, as they confirm one's previous position. Nonetheless, the bias will also reduce the effect of positive crime news, due to the the opposite reason. Persistence of false beliefs, even after receiving an infinite amount of information, is another important consequence of confirmatory bias (Rabin and Schrag, 1999), which could also help explain the documented growth of the perception gap. Finally, this impact asymmetry is also consistent with some form of negativity bias, operating through simple negative potency (Rozin and Royzman, 2001). This happens when a negative event (crime news) is more salient and potent than a positive event with the same objective magnitude (area in cm^2).

5.2 Robustness Checks

Table 3 shows several robustness checks for our results and, as it can be generally seen, our main point estimates for the effect of both negative and positive crime news coverage tend to perform well in varying specifications. Their sign and, most notably magnitude remains rather unchanged. Column 1 shows the benchmark specification with the initial 1.4 pp positive effect of negative news coverage on crime perception and the corresponding relieving effect of 1.1 pp of positive crime news coverage. Column 2 includes the lagged values of both *coverage shocks* to address the possibility of omitted variable bias, as our definition of *coverage shock* could lead to treatment autocorrelation. Then, a current-period treatment effect could be partially reflecting a persistent effect from a past shock. In this case, the inclusion of past shocks as controls should, if anything, reduce the absolute value of our estimates. However, as can be seen in Column 2, our coefficient for the negative *coverage shock* is robust to this inclusion

Table 3: Robustness - Effect of crime news coverage shocks on crime perception - with 1-month balance shocks

	Baseline	(1) + Shocks$_{t-1}$	(1) + News$_{t-1}$	(1) + Province time-trends	(1) + Month-Year FE	(1) − Violent Deaths$_t$	(6) − News$_t$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Negative area shock$_t$	0.014***	0.020***	0.015***	0.013***	0.016***	0.013***	0.012***
	(0.0035)	(0.0062)	(0.0039)	(0.0036)	(0.0055)	(0.0032)	(0.0031)
Positive area shock$_t$	-0.011**	-0.017	-0.011**	-0.0076*	-0.013***	-0.011**	-0.011**
	(0.0052)	(0.012)	(0.0053)	(0.0044)	(0.0049)	(0.0049)	(0.0044)
Negative area shock$_{t-1}$		0.000091					
		(0.0046)					
Positive area shock$_{t-1}$		-0.00091					
		(0.0062)					
Observations	177456	99113	177456	177456	177456	177456	177456
Months balance	1	1	1	1	1	1	1
Control: #news$_t$	Yes	Yes	Yes	Yes	Yes	Yes	
Control: #news$_{t-1}$			Yes				
Control: violent deaths$_t$	Yes	Yes	Yes	Yes	Yes		
Province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes		Yes	Yes
Month-Year fixed effects					Yes		
Province time-trend				Yes			

	Only Year-FE	Only Province-FE	Treatment Only	Socio-economic Controls	News Content Controls	News Value Controls	TV-related Controls
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Negative area shock$_t$	0.015***	0.019***	0.021***	0.015***	0.014***	0.014***	0.014***
	(0.0035)	(0.0056)	(0.0055)	(0.0041)	(0.0040)	(0.0033)	(0.0035)
Positive area shock$_t$	-0.0031	-0.0086**	-0.0011	-0.0092*	-0.012**	-0.010**	-0.011**
	(0.0052)	(0.0038)	(0.0047)	(0.0047)	(0.0052)	(0.0048)	(0.0053)
Observations	177456	177456	177456	177442	170021	177456	177456
Months balance	1	1	1	1	1	1	1
Control: #news$_t$				Yes	Yes	Yes	Yes
Control: violent deaths$_t$				Yes	Yes	Yes	Yes
Province fixed effects		Yes		Yes	Yes	Yes	Yes
Year fixed effects	Yes			Yes	Yes	Yes	Yes
Control: Socioeconomic variables				Yes			
Control: Content shares$_{t,t-1}$					Yes		
Control: News value$_{t,t-1}$						Yes	
Control: TV$_{t,t-1}$							Yes

Standard errors clustered at the province-level are in parentheses. Significance stars: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

and the effect of the positive *coverage shock* increases in absolute value, although it barely loses significance. Furthermore, the lagged values of the *coverage shocks* have a very close to zero effect on the next period's crime perception. These two results reflect a very short-lived effect of news coverage, although relevant in size. Similarly, in Column 3, we control for the lagged number of crime news, whose areas are also part of the definition of a contemporaneous *coverage shock*. Results remain unchanged.

To avoid confounding the treatment with periods of overall increasing crime perception, we include province-specific linear time trends in Column 4. For a stronger test, we include month-year fixed effects in Column 5. Results do not change much. In Columns 6-10, we begin to remove covariates from our main equation. In Column 6, we do not control for the number of violent deaths and in Column 7, we additionally stop controlling for the number of crime news. After this, point estimates for both *coverage shocks* remain almost the same, although the effect of negative news is slightly smaller. In Columns 8, 9 and 10 we remove province, year and both province and year fixed effects, respectively. In the three specifications the effect of negative news coverage is larger. Moreover, the effect of positive news coverage loses significance when province fixed effects are removed. Finally, Column 11 includes socioeconomic control variables at the individual and household level. These include the traditional socioeconomic variables, such as sex, age and living conditions, but also variables such as being a crime victim, owning a TV or having access to internet.[26]

One possible concern regarding our identification strategy is that our definition of *coverage shock* might confound content-neutral size changes with content-varying ones. What do we mean by this? As one can imagine pieces of news from some types of crime like life threats or abuses usually merit a larger size per article than regular theft. In fact, average area is mostly heterogeneous among the different crime types in our news data. To exemplify, the average difference in size between theft and threat news is of around 88 cm^2. If such content changes where actually driving the *coverage shocks*, our estimates' interpretation would not be, strictly speaking, reflecting the effect of changes in news size only, but would also compound the effect of changes in the reported content or the reported crime category. Although we would still be capturing the influence of media this is not our main interest. In order to test the validity of our interpretation, we compute measures of the shares of each type of crime

[26] Appendix Table 1 lists the entirety of covariates used.

news from the total number of crime news at the province-month level and include them in the main specification. As can be seen in Column 12, our main point estimates remain almost unchanged.

On a similar note, other features could also be covarying with *area coverage shocks*. For example, *coverage shocks* could be reflecting not only regular changes in the size of the news but also in the position of the news within the newspaper. It is not the same to place the news in the front pages than in other pages. Naturally, space in the front pages is more expensive and is more salient than space in other pages. To explore if our *coverage shocks* are covarying with placement of the news within newspapers and saliency in general, we control for the monetary value of each piece of negatively and positively-toned news in t and $t-1$.[27] Our results remain unchanged. Also, coefficients of these additional variables are not significant individually, but have the expected signs: a higher average value of negative crime news is associated with increased crime perception and the opposite holds true for positive crime news

So far we have only considered the effect of newspapers on crime perception without including other important sources of mass communication like TV, for example. It could be argued that highly covered crimes are likely to receive widespread attention by not only the newspapers but also TV. Thus, we would be overestimating the effect of newspapers by actually estimating the effect of an overall increase of crime news coverage by different media. To address the possibility of this omitted variable bias, we control for the number of both positive and negative crime-related aired news from each province tracked by iMedia, as well as for their average duration in seconds.[28] As can be seen in Column 14, our estimates remain practically unchanged to the inclusion of a second measure of total criminality (number of TV news) and to another coverage decision and relevance assessment (seconds on air), both in t and $t-1$.

[27] This data was also tracked by iMedia and is computed as the price per cm^2 of the page of the newspaper where it was published.

[28] iMedia not only tracked the area of newspapers, but also had data on number of news aired in the TV and their average duration.

5.3 Heterogeneous Effects

5.3.1 Victims and non-victims

Although we find significant and robust average effects, there is potential for differential impacts among the population. We find evidence for heterogeneous effects among people who had been victim of a crime in the last 12 months and those who had not. Testing this can be particularly insightful as ex-ante it is unclear whether previous victims are more or less sensitive to crime news. It could be the case that a past crime victim is more perceptive of crime overall and thus also more sensitive or alert to crime news. However, it is also possible to theorize that non-crime victims are more unaware of crime and when first exposed to information about it a disproportionate reaction might follow. Our findings support the second hypothesis (see Column 1 in Table 4). For our preferred specification, the observed effect of negative coverage is in the region of 1.8 pp for non-victims and around 0.6 pp for crime victims. In fact, the interaction coefficient is statistically significant. Regarding *positive coverage shocks*, although the interaction term is non-significant, being a crime victim also attenuates their impact. These findings support the substitution thesis from the fear of crime literature, which predicts that exposure to media representations of crime has a stronger effect on those without direct experience of crime. This would happen because crime reported on the media becomes a substitute for direct real-world experience (Gunter, 1987; Weitzer and Kubrin, 2004).[29]

Additionally, being a crime victim is associated with a 12 pp increase in average crime perception. One the one hand, one can think of a situation where victims tend to be on average more fearful of being a victim again in the near future, but are simultaneously less sensitive to negative crime news coverage. On the other hand, those who have not been a crime victim in the last 12 months are those who are actually affected by crime news coverage. In the case of Peru, this second group is the majority of the surveyed population. This also has implications at the aggregate level: in countries where criminality rates are descending, people will become more sensitive to news, as the media becomes their primary source of information on crime.[30]

[29] Our results are similar if we consider either the unconstrained definition of our treatment variables or other constrained definitions. Results are available upon request.

[30] This conclusion may be relevant for countries as the US, were crime rates greatly fell during the 90s.

Table 4: Heterogeneous effect of crime news coverage shocks on crime perception

	(1)	(2)	(3)
Negative area shock$_t$	0.018***	0.020***	0.019***
	(0.0047)	(0.0074)	(0.0036)
Positive area shock$_t$	-0.011*	-0.012**	-0.013**
	(0.0061)	(0.0055)	(0.0058)
Victim any crime	0.12***		
	(0.0063)		
Victim × neg. shock	-0.012***		
	(0.0043)		
Victim × pos. shock	0.0022		
	(0.0052)		
Woman		-0.010	
		(0.0071)	
Woman × neg. shock		-0.011	
		(0.010)	
Woman × pos. shock		0.0012	
		(0.0031)	
Mountains × neg. shock			-0.024***
			(0.0083)
Mountains × pos. shock			0.0069
			(0.0084)
Jungle × neg. shock			-0.014
			(0.014)
Jungle × pos. shock			0.0022
			(0.011)
Observations	177454	177456	177456
Months balance	1	1	1

Standard errors clustered at the province-level are in parentheses.
Significance stars: *** p <0.01, ** p <0.05, * p <0.1

5.3.2 Men and women

The distinction between men and women in the literature on crime perception is addressed by authors like Braakmann (2012) and Hale (1996) and it is related to considerations about vulnerability and fear. Ex-ante it would be logical to think that women would be more sensitive to changes in crime news coverage, given Peru's record as a country with high femicide rates and overall higher female vulnerability. However, women are less exposed to newspapers as their readership is lower on average in Peru. Introducing heterogeneity in the effect of *coverage shocks* by sex does not result in significant differences in the treatment effect for negative and positive crime news' coverage in our preferred specification (see Column 2 in Table 4), although we do find that women, if anything, are less sensitive to *negative coverage shocks* as the interaction coefficient offsets almost the entirety of the treatment effect on men.[31]

5.3.3 Natural Regions

Third, we find that there is heterogeneity in the effect across the main natural regions of Peru, typically coast, mountains and jungle.[32] We observe that most of the overall effect of a negative news shock was concentrated in the coast, whereas in the case of the mountains the interaction coefficient offsets the entire treatment effect. Focusing in our benchmark specification (Column 3 in Table 4), the effect of both negative and positive crime news coverage is only statistically significant for the coast provinces, but not for the jungle nor the mountains.[33] This finding is consistent with the fact that people from coastal cities are more avid newspapers readers than their counterparts in other regions, according to CPI (2017).[34]

[31] Our results are similar if we consider either the unconstrained definition of our treatment variables or other constrained definitions. Results are available upon request.

[32] We classified the regions as follows: Tumbes, Piura, Lambayeque, La Libertad, Áncash, Lima, Callao, Ica, Arequipa, Moquegua, Tacna belong to the coast; Cajamarca, Huánuco, Pasco, Junín, Huancavelica, Ayacucho, Apurímac, Cusco and Puno belong to the mountains and Amazonas, San Martín, Loreto, Ucayali and Madre de Dios belong to the jungle.

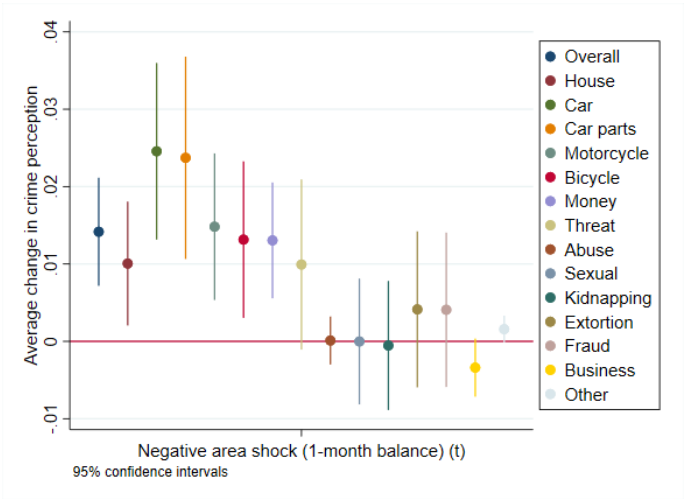
[33] Our results are similar if we consider either the unconstrained definition of our treatment variables or other constrained definitions. Results are available upon request.

[34] To further explore how the effect of *coverage shocks* interact with readership habits, we compute province-level newspaper reading rates using other data sources. In particular, we leveraged on the 2004-2012 waves of the National Household Survey (ENAHO for its Spanish acronym) which is traditionally used to measure poverty and contains information about consumption at the household level. With it, we could know whether or not the household consumed newspapers, books or magazines. In this way, in unreported regressions we find that if anything, the effect of *coverage shocks* is larger in provinces were readership is above the median.

5.3.4 Type of crimes

So far we already have established that crime perception is in fact sensitive to crime news coverage. Thus, one can ask: which specific crimes see their perception increased? To answer this question, we exploit the variables used to build the aggregate measure of crime perception and use them separately to identify the effect of the *coverage shocks* on crime-specific perceptions. Figure 5 shows the results for the negative *coverage shock* and reveals that the overall increase in crime perception is mostly driven by three types of crimes. First, the fear of house theft; second the fear of burglary of other important properties (auto, autoparts, motorcycle and bicycle theft) and; third, the fear of money, wallet or cellphone theft, which is usually associated with the common violent street crime or pickpocketing. However, there is no significant evidence for crime news coverage to be increasing fear to other potentially more violent crimes like threats, abuse, sexual offences, kidnapping, extortion and fraud. Somewhat strangely, we observe that negative crime news coverage has a negative effect on business theft crime perception.[35]

Figure 5: Effect of negative crime news coverage shocks on different crime-specific perceptions



[35] We do not report the heterogeneous effects of *positive coverage shocks* by types of crime as they were considerably noisy, although we do find that street crime was more responsive.

6 Consequences of Crime Perception

In this section of our study we explore some of the consequences of aggravating the perceived crime and subsequently increasing the perception gap, as a result of crime news coverage. There are at least four ways how this perception gap could be welfare-reducing: (i) increases in fear and corresponding health problems, (ii) habit changes, (iii) irreversible investments, and (iv) deterioration of institutions' reputation. We are going to focus on (ii) to (iv), although a deep engagement with these issues is left as an avenue for future research.

6.1 Habit Changes

Individuals may react to a higher crime perception by changing their habits inefficiently affecting both time and money allocations, which may further restrict mobility, labor decisions and even housing choices (Hamermesh, 1999; Ellen and O'Regan, 2010). To explore how individuals change their habits in response to crime perceptions we exploit some survey questions from the ENAPRES that were only available in 2017. Broadly speaking, in this survey individuals were asked (i) whether they have changed any habit in response to their perceived crime rates, and if the answer was positive (ii) since what year they are behaving differently. They were asked for different habits in particular, such as (i) avoidance of certain individual actions (e.g. go out at night, take a walk, use their cellphone in the streets, arrive home late, ask for a taxi in the street, and carry too much cash), (ii) household-level responses (e.g. not leaving the house alone, adding latches, adding locks, having a watch dog, setting a burglar bar door, setting bars in the windows), and (iii) neighborhood-level responses (e.g. setting video surveillance systems, hiring a private watchman, setting a system of community alarms, setting a system of access control, organizing a neighbor security council).

Given that this data is only available for 2017, we do not have a meaningful variation across months and years, so it is not feasible to exploit our identification strategy. However, we believe that a descriptive analysis would be telling and may serve to show the extent to which people adjust their behavior due to crime perceptions, which we already have established is affected by crime news coverage. In Figure 6 we reconstruct a time-series of the individuals' answer using the fact that they report since what year they are behaving differently due to their perceived crime. Panel A report the time-series for individual-level reactions, Panel

B for household-level responses, and Panel C for neighborhood-level responses. As can be seen, a large share of individuals has adjusted their habit in almost every category, and this adjustment has been increasing in time. This is consistent with the fact that according to Figure 2, in this same period the crime perception gap was increasing too. We believe that all this suggests that a mismatch between crime perception and crime victimization rates may have relevant consequences on welfare.

6.2 Trust in Government Institutions

People might hold someone accountable for changes in perceived criminality. Which Government institution is more likely to receive blame for increased crime? Does some institution receive any credit at all when people feel safer? These questions are based on the aforementioned role of crime perceptions on trust in institutions and overall social capital. To investigate how people distribute accountability after perceived increases in crime, we estimate our main specification but using four different dependent variables. These measure confidence in the National Police, the Judiciary Power, the district municipality and the Public Prosecutor in a discrete scale from 1 to 3.[36] The survey question was: "*Regarding citizen security: How much trust does the j-th institution inspire you?*", so we are using a variable that aims to directly measure the perceived ability of these institutions to fight crime.

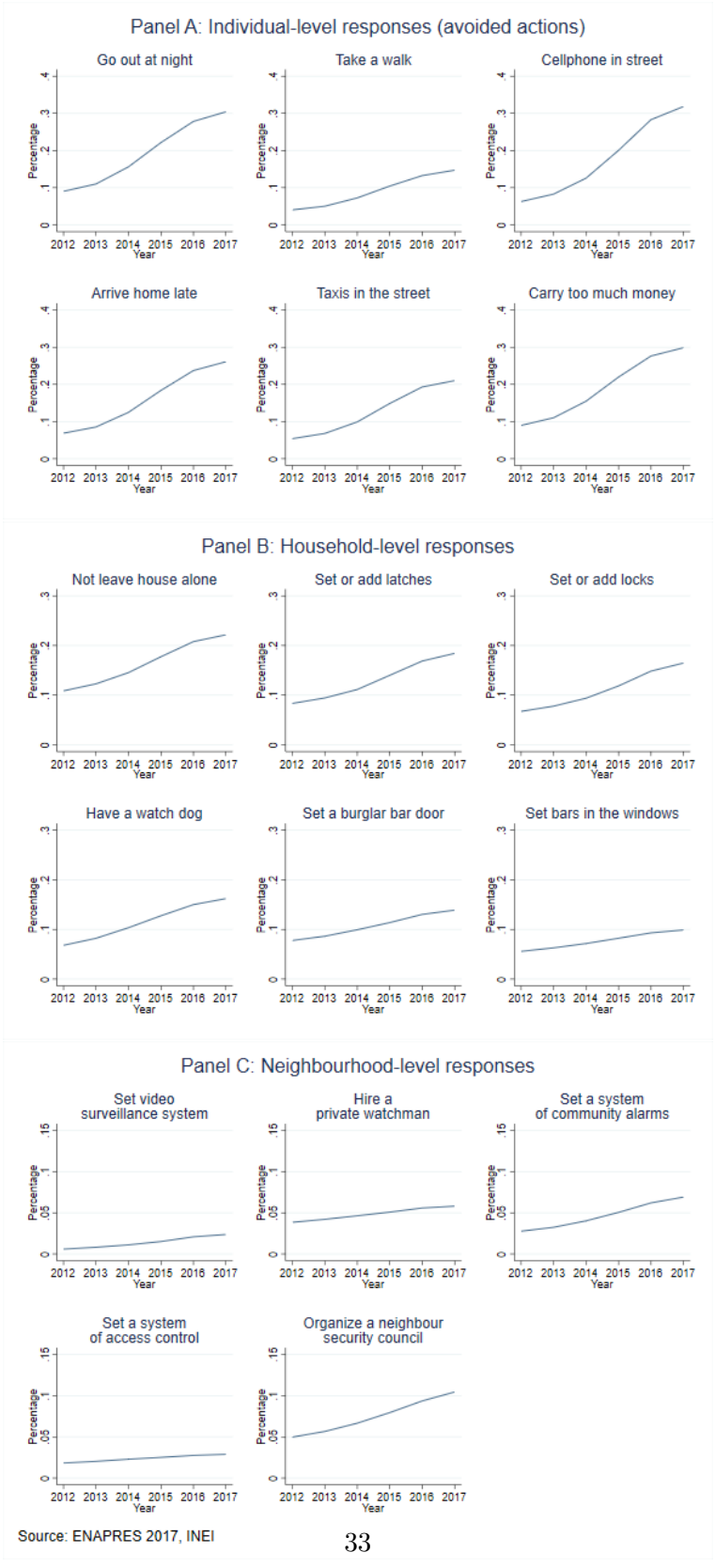
Results for our preferred specification are reported in Panel A of Table 5. We can see that in general, people assign guilt to both national governmental institutions such as the Judiciary Power, the Public Prosecutor and the National Police,[37] and local institutions such as the district municipality, although the latter seems to receive more blame as the coefficient on *negative coverage shocks* is larger than in other cases. Interestingly, people give less credit to the institutions presented here as a response to good news.[38] These results are relevant for

[36] We used the ENAPRES. For the year 2013, the survey question was in a scale from 1-4. That year was adapted for comparability with the following 4 years.

[37] Although the Police is officially a national institution, people may think of them as a local institution. According to Article 197 in Peru's Political Constitution (1993), province and district municipalities offer citizen security services in cooperation with the Peruvian National Police (PNP). Thus, the service is jointly provided by local governments and the national government, through the PNP. The Organic Law of Municipalities (Ley N° 27972, Ley Orgánica de Municipalidades) further regulates the provision of citizen security by municipalities as a local public service. Province municipalities must establish a system of citizen security, with participation of the civil society and the PNP and must regulate the provision of surveillance services. District municipalities must then organize and provide such services where they believe convenient. It is then coherent that the reputation of both municipalities and the PNP are harmed by negative crime news at a local level.

[38] Furthermore, in unreported results we show that non-victims do not punish the Justice System institutions

Figure 6: Habit changes due to crime perception, since 2012 up to 2017



Source: ENAPRES 2017, INEI

two reasons. First, they suggest an asymmetric treatment from the public between institutions, as some are more susceptible than others to the the press, but also asymmetric within institutions, as some can only be negatively affected by news and other in both directions. Second, these results represent a further dimension on the possible impact of crime news coverage: it does not only affect people's fear of crime, welfare and behavior, but also their trust on the Government's institutions, which may impose greater costs to society (Corbacho et al., 2015).[39]

Finally, to further explore the effects of crime news *coverage shocks* in the trust citizens have in their country's institutions, we study the impact of news shocks on police task-specific ratings. Police's performance was evaluated on four indicators: (i) attend promptly when a crime occurs, (ii) maintaining security and public tranquility, (iii) informing the community on crime prevention and (iv) treating everyone without any distinction. The survey question was "*How do you qualify the performance of the National Police in relation to duty j?*" and the answer was in a scale from 1 to 4.[40] We run our preferred specification. Results are shown in Panel B of Table 5. Once again, we find asymmetry and negativity bias, as the decrease in the police qualification is always significant at the 1% level after negative news, but not significantly affected by positive news.

6.3 Other outcomes

We briefly explored the effect of *coverage shocks* on several other outcomes such as electoral votes using data from national and local elections, and consumption of goods related to crime using data from the 2013-2017 waves of the National Household Survey (ENAHO). We did

(i.e. the Judiciary Power and the Public Prosecutor) as much as those that were already victims, even though non-victims' perceived crime rates are more reactive to crime news coverage as shown in section 5.3.1. In section 5.3.1 we argue that the fact that non-victims are more reactive to crime news coverage in terms of their perceived crime rates supports the substitution thesis from the fear of crime literature, which predicts that exposure to media representations of crime has a stronger effect on those without direct experience of crime. We believe that the fact that now victims rather than non-victims punish public institutions is consistent with this thesis too. Victims had a higher crime perception already as their real world experience served as a substitute for information about crime rates. Hence, when on top of that we add crime *coverage shocks* it makes sense that they will be more prone to punish public institutions more harshly.

[39] An important caveat is that our results are less robust than before when considering either the unconstrained *coverage shocks* or other definitions for the constrained *coverage shocks*, although they remain somewhat similar. These results are not reported in the paper but are available upon request.

[40] These survey questions were available in the ENAPRES.

Table 5: Effect of crime news coverage shocks on confidence in institutions and police ratings (standardized)

	Panel A: Confidence in institutions			
	Police	Judic.	Munic.	Prosec.
	(1)	(2)	(3)	(4)
Negative area shock$_t$	-0.018***	-0.019***	-0.032***	-0.011
	(0.0055)	(0.0060)	(0.0060)	(0.0073)
Positive area shock$_t$	0.00041	0.0094*	0.0091*	0.0099**
	(0.0062)	(0.0048)	(0.0051)	(0.0048)
Observations	175754	167282	174677	166367
Months balance	1	1	1	1
	Panel B: Police ratings			
	Speed	Secur.	Info.	Equal
	(5)	(6)	(7)	(8)
Negative area shock$_t$	-0.036***	-0.037***	-0.029***	-0.029***
	(0.0071)	(0.0067)	(0.0070)	(0.0095)
Positive area shock$_t$	-0.0016	-0.00054	0.0024	-0.0010
	(0.0063)	(0.0065)	(0.0064)	(0.0088)
Observations	177903	177902	177901	177901
Months balance	1	1	1	1

Standard errors clustered at the province-level are in parentheses. Significance stars: *** p <0.01, ** p <0.05, * p <0.1

not find evidence suggesting that *coverage shocks* had an impact on these outcomes.[41][42] This could be explained by the fact that, perhaps, the effect of a single crime news shock in terms of area covered by newspapers might not be strong enough by itself to cause an important change in these outcomes. However, being continuously exposed to several shocks and to the

[41] Appendix Table 2 shows the result on electoral outcomes relying on electoral data from district-level elections in 2014. We consider the share of votes given to the incumbent party, the share of blank votes, the share of null votes, the share of blank plus null votes, the turnout, and the probability that a national party is elected rather than a local party. We control for the lagged dependent variable, that is, the electoral outcome in the district elections of 2010. We compare electoral outcomes in districts belonging to a province that experienced a *coverage shock* a month before the election against districts belonging to a province that experienced no shock. Note that in contrast to our main regressions where we rely on variation from month to month, here we just have available one month as elections were carried out in October of 2014. Then, it is not strange that we find almost no statistically significant difference.

[42] Appendix Table 3 shows the result on expenditures. We rely on data from the National Household Survey (ENAHO) which is usually employed to measure poverty. We consider the effect on the extensive margin in the consumption of four goods and services whose demand could be affected by crime news coverage (i.e. either they spend a positive amount on these or they do not): (i) public transport for 14-year old children or younger as households might consider safer private alternatives, (ii) private guardians (i.e. persons that remain at the front of people's homes), (iii) "Serenazgo" (i.e. private patrols at the neighborhood level), and (iv) recreation and entertainment as households may reduce consumption in these goods so as to avoid crime. We find that households are more likely to spend in the service of "Serenazgo" after being exposed to a *negative coverage shock*. Somewhat puzzling, we find that households exposed to *positive coverage shocks* have a higher likelihood of spending in private guardians.

media in general during an extended period of time may have larger effects as it is suggested by the aforementioned changes in habits that were found in the raw data. This result is not strange to the literature as Ramírez-Álvarez (2017) also found that individuals were somewhat unresponsive to crime perceptions, although this is at stakes with results from Mastrorocco and Minale (2018) who found certain impacts on voting behavior.

7 Concluding Remarks

We started by observing a seemingly conflicting result: decreasing criminality rates coupled with increasing crime perception in several countries across the globe. Our main hypothesis was that news media could be held in part accountable for the widening perception gap and resulting unwarranted fear of crime. We centered our attention on crime news coverage in Peruvian newspapers between 2013 and 2017, understanding coverage as the area in cm^2 each piece of news occupied. In order to establish a causal relation between these two variables, we compute province-level crime news *coverage shocks*, which represent short-term deviations from trend in the area devoted to crime news. These are arguably exogenous after (i) controlling for relevant covariates on real criminality, (ii) discarding other potential issues, (iii) verifying balance between provinces and (iv) performing several robustness checks. To identify the relevant population parameters, we split news according to their sentiment and to their geographical location.

Under this framework, we find that changes in the size of negatively-toned crime news may increase crime perception, whereas changes in the size of the positively-toned crime news may have the opposite effect. Thus, media is revealed to be very powerful as it can, for very little cost, shift crime perception in both directions. In this regard, we also find that the calculated average effect per cm^2 of negative news would be almost three times larger than the calculated effect of positive news, signaling a potential and important asymmetry on the revision of people's expectations depending on the nature of the news received. This may explain why perceived crime rates tend to remain high even if true criminality rates are decreasing. Altogether, the media exerts a stronger influence on non-crime victims and men, and mostly increases the perception of regular street-crime and property theft. Finally, we also delve into some of the possible consequences of increasing crime perception and find some

evidence that it may be welfare-reducing, although results are less conclusive.

Our results leave some other research questions open for further analysis. First, this paper does not shed light on whether there is an optimal level of perception gap and what it would be. Clearly, some perception of criminality is needed, as it could lead to efficient crime avoidance behavior, but widening misperceptions are almost surely not positive. Second, one can speculate that the crime perception literature is finding a total impact of media, that accounts for both the number of news and its size, by not differentiating between these two. An identification strategy with exogenous variability for both the number of news and their size would be required to disentangle such effects. Third, this paper brings evidence for the existence of the perception gap in Peru as a case-study. A valid question would then be why are some citizens less affected to crime news coverage in some countries and not in others? Consumption patterns, preferences for different media outlets, lifestyle and education are some variables that could explain differing sensitivities to news media. Finally, further study could be done on why political institutions are affected differently by the media. Putting partisan media targeting aside, governmental institutions could use from more knowledge on the reasons for their relative vulnerability to both negative and positive crime news.

As closing comments, even though all our conclusions are drawn from the study of newspapers in Peru, we believe that they serve as a general proof of the persuasive power of media, that is applicable to several countries in the world. The main transmission mechanism (news size), is also not limited to written press only and can be adapted to other media outlets like radio, TV and the internet, using other metrics like seconds on air, for example.

A straightforward policy recommendation that arises from these findings is the need for a more responsible and conscious crime news reporting that ponders over (i) the effects of editorial choices like size and the use of images, and (ii) the asymmetric impact of positive and negative crime news. Arguably, countries with a large perception gap could do better with a finer balance between positive and negative crime news. In a context of decreasing criminality, an accurate and objective representation of the country's crime situation might not lead to a justified decrease in crime perception if negative and positive news are not reported with an appropriate coverage balance.

References

Abadie, A., Athey, S., Imbens, G. W., and Wooldridge, J. (2017). When should you adjust standard errors for clustering? NBER Working Paper 24003, National Bureau of Economic Research.

Adena, M., Enikolopov, R., Petrova, M., Santarosa, V., and Zhuravskaya, E. (2015). Radio and the Rise of the Nazis in Prewar Germany. *The Quarterly Journal of Economics*, 130(4):1885–1939.

Ardanaz, M., Corbacho, A., and Ruiz-Vega, M. (2014). Mind the Gap: Bridging the Perception and Reality of Crime Rates with Information. IDB Working Papers Series 6595, Inter-American Development Bank.

Arellano Marketing (2017). Estudio nacional del consumidor peruano: informe final.

Arias, E., Larreguy, H. A., Marshall, J., and Querubin, P. (2018). Does the Content and Mode of Delivery of Information Matter for Electoral Accountability? Evidence from a Field Experiment in Mexico. Working Paper.

Braakmann, N. (2012). How do individuals deal with victimization and victimization risk? Longitudinal evidence from Mexico. *Journal of Economic Behavior & Organization*, 84(1):335–344.

Bureau of Justice Statistics (2016). Criminal Victimization, 2015. "https://www.bjs.gov/content/pub/pdf/cv15.pdf".

Caldeira, T. P. (2000). *City of walls: crime, segregation, and citizenship in São Paulo*. Univ of California Press.

Callanan, V. J. (2012). Media consumption, perceptions of crime risk and fear of crime: Examining race/ethnic differences. *Sociological Perspectives*, 55(1):93–115.

CERLALC (2012). Comportamiento lector y hábitos de lectura. "http://www.observatoriopoliticasculturales.cl/OPC/wp-content/uploads/2013/03/Comportamiento-Lector-y-H%C3%A1bitos-Lectores-%E2%80%93-CERLALC.pdf".

Chiricos, T., Eschholz, S., and Gertz, M. (1997). Crime, news and fear of crime: Toward an identification of audience effects. *Social Problems*, 44(3):342–357.

Chiricos, T., Padgett, K., and Gertz, M. (2000). Fear, tv news, and the reality of crime. *Criminology*, 38(3):755–786.

Chong, A., León-Ciliotta, G., Roza, V., Valdivia, M., and Vega, G. (2019). Urbanization patterns, information diffusion, and female voting in rural paraguay. *American Journal of Political Science*, 63(2):323–341.

Corbacho, A., Philipp, J., and Ruiz-Vega, M. (2015). Crime and Erosion of Trust: Evidence for Latin America. *World Development*, 70(C):400–415.

CPI (2017). Estudio de lectoría de diarios en Lima y 15 principales ciudades - 2016. "https://cpi.pe/images/upload/paginaweb/archivo/23/LectoriaDiarios_2016.pdf".

Custers, K. and den Bulck, J. V. (2011). Mediators of the association between television viewing and fear of crime: Perceived personal risk and perceived ability to cope. *Poetics*, 39(2):107–124.

DellaVigna, S. and Kaplan, E. (2007). The Fox News effect: Media bias and voting. *The Quarterly Journal of Economics*, 122(3):1187–1234.

Ditton, J., Chadee, D., Farrall, S., Gilchrist, E., and Bannister, J. (2004). From imitation to intimidation: A note on the curious and changing relationship between the media, crime and fear of crime. *British Journal of Criminology*, 44(4):595–610.

DuBow, F., McCabe, E., and Kaplan, G. (1979). *Reactions to crime: a critical review of the literature: executive summary*. Department of Justice, Law Enforcement Assistance Administration, National Institute of Law Enforcement and Criminal Justice Washington, DC.

Duffy, B., Wake, R., Burrows, T., and Bremner, P. (2008). Closing the gaps – crime and public perceptions. *International Review of Law, Computers & Technology*, 22(1-2):17–44.

Dustmann, C. and Fasani, F. (2016). The Effect of Local Area Crime on Mental Health. *Economic Journal*, 126(593):978–1017.

Ellen, I. G. and O'Regan, K. (2010). Crime and urban flight revisited: The effect of the 1990s drop in crime on cities. *Journal of Urban Economics*, 68(3):247–259.

Enikolopov, R., Petrova, M., and Zhuravskaya, E. (2011). Media and political persuasion: Evidence from Russia. *American Economic Review*, 101(7):3253–85.

Eschholz, S., Chiricos, T., and Gertz, M. (2003). Television and fear of crime: Program types, audience traits, and the mediating effect of perceived neighborhood racial composition. *Social Problems*, 50(3):395–415.

Fattah, E. A. and Sacco, V. F. (2012). *Crime and Victimization of the Elderly*. Springer Science & Business Media.

Fernández-Baca, J. (2014). Estudio de la estructura del mercado de la prensa escrita en el Perú. Documento de discusión. Universidad del Pacífico – Centro de Investigaciones.

Ferraz, C. and Finan, F. (2008). Exposing corrupt politicians: the effects of Brazil's publicly released audits on electoral outcomes. *The Quarterly Journal of Economics*, 123(2):703–745.

Gallup (2019). Crime. "https://news.gallup.com/poll/1603/crime.aspx".

Gerbner, G., Gross, L., Morgan, M., and Signorielli, N. (1980). The "mainstreaming" of america: Violence profile no. 11. *Journal of Communication*, 30(3):10–29.

Grabe, M. E. and Drew, D. G. (2007). Crime cultivation: Comparisons across media genres and channels. *Journal of Broadcasting & Electronic Media*, 51(1):147–171.

Granger, C. W. J. (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. *Econometrica*, 37(3):424–438.

Green, G. (2002). Fear of crime and health in residential tower blocks: A case study in liverpool, UK. *The European Journal of Public Health*, 12(1):10–15.

Gross, K. and Aday, S. (2003). The scary world in your living room and neighborhood: Using local broadcast news, neighborhood crime rates, and personal experience to test agenda setting and cultivation. *Journal of Communication*, 53(3):411–426.

Guite, H., Clark, C., and Ackrill, G. (2006). The impact of the physical and urban environment on mental well-being. *Public Health*, 120(12):1117–1126.

Gunter, B. (1987). *Television and the Fear of Crime*. John Libbey.

Hale, C. (1996). Fear of crime: A review of the literature. *International review of Victimology*, 4(2):79–150.

Hamermesh, D. S. (1999). Crime and the Timing of Work. *Journal of Urban Economics*, 45(2):311–330.

Heath, L. (1984). Impact of newspaper crime reports on fear of crime: Multimethodological investigation. *Journal of Personality and Social Psychology*, 47(2):263–276.

Hirsch, P. M. (1980). The "scary world" of the nonviewer and other anomalies. *Communication Research*, 7(4):403–456.

Holbert, R. L., Shah, D. V., and Kwak, N. (2004). Fear, authority, and justice: Crime-related TV viewing and endorsements of capital punishment and gun ownership. *Journalism & Mass Communication Quarterly*, 81(2):343–363.

Horváth, R. (2013). Does trust promote growth? *Journal of Comparative economics*, 41(3):777–788.

INEI (2018). Perú - Encuesta Nacional de Programas Presupuestales 2017.

Jackson, J. and Gouseti, I. (2014). Fear of Crime and the Psychology of Risk. In *Encyclopedia of criminology and criminal justice*, pages 1594–1603. Springer.

Kruger, D. J., Reischl, T. M., and Gee, G. C. (2007). Neighborhood social conditions mediate the association between physical deterioration and mental health. *American Journal of Community Psychology*, 40(3-4):261–271.

Larreguy, H. A., Marshall, J., and Snyder Jr., J. M. (2018). Publicizing Malfeasance: How Local Media Facilitates Electoral Sanctioning of Mayors in Mexico. Working Paper.

Liska, A. E. and Baccaglini, W. (1990). Feeling safe by comparison: Crime in the newspapers. *Social problems*, 37(3):360–374.

Lord, C. G., Ross, L., and Lepper, M. R. (1979). Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology*, 37(11):2098–2109.

Marshall, J. (2018). Political information cycles: When do voters sanction incumbent parties for high homicide rates? Working paper.

Martin, G. J. and Yurukoglu, A. (2017). Bias in cable news: Persuasion and polarization. *American Economic Review*, 107(9):2565–99.

Mastrorocco, N. and Minale, L. (2018). News media and crime perceptions: Evidence from a natural experiment. *Journal of Public Economics*, 165(C):230–255.

McGinn, A. P., Evenson, K. R., Herring, A. H., Huston, S. L., and Rodriguez, D. A. (2008). The association of perceived and objectively measured crime with physical activity: a cross-sectional analysis. *Journal of physical activity and health*, 5(1):117–131.

Mineo, L. (2014). El Diario Más Vendido en el Mundo de Habla Hispana se Hace en Perú. *ReVista: Harvard Review of Latin America*.

Molina-González, M. D., Martínez-Cámara, E., Martín-Valdivia, M.-T., and Perea-Ortega, J. M. (2013). Semantic orientation for polarity classification in Spanish reviews. *Expert Systems with Applications*, 40(18):7250–7257.

Office for National Statistics (2011). Crime and Justice: Social Trends 41. "https://webarchive.nationalarchives.gov.uk/20151014074225/http://www.ons.gov.uk/ons/rel/social-trends-rd/social-trends/social-trends-41/social-trends-41---crime-and-justice.pdf".

Oviedo, E. and Rodríguez, A. (1999). Santiago, una ciudad con temor. *Revista panamericana de salud pública*, 5:278–285.

Pearson, A. L. and Breetzke, G. D. (2013). The association between the fear of crime, and mental and physical wellbeing in new zealand. *Social Indicators Research*, 119(1):281–294.

Perez-Rosas, V., Banea, C., and Mihalcea, R. (2012). Learning Sentiment Lexicons in Spanish. In *LREC*, volume 12, page 73.

Potter, W. J. (1986). Perceived reality and the cultivation hypothesis. *Journal of Broadcasting & Electronic Media*, 30(2):159–174.

Rabin, M. and Schrag, J. L. (1999). First impressions matter: A model of confirmatory bias. *The Quarterly Journal of Economics*, 114(1):37–82.

Ramírez-Álvarez, A. A. (2017). Media and crime perceptions: Evidence from Mexico. Serie documentos de trabajo del Centro de Estudios Económicos 2017-06, El Colegio de México, Centro de Estudios Económicos.

Romer, D., Jamieson, K. H., and Aday, S. (2003). Television News and the Cultivation of Fear of Crime. *Journal of Communication*, 53(1):88–104.

Ross, C. E. and Mirowsky, J. (2001). Neighborhood disadvantage, disorder, and health. *Journal of health and social behavior*, pages 258–276.

Rozin, P. and Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, 5(4):296–320.

Schwarz, N., Bless, H., Strack, F., Klumpp, G., Rittenauer-Schatka, H., and Simons, A. (1991). Ease of retrieval as information: Another look at the availability heuristic. *Journal of Personality and Social Psychology*, 61(2):195–202.

Sidorov, G., Miranda-Jiménez, S., Viveros-Jiménez, F., Gelbukh, A., Castro-Sánchez, N., Velásquez, F., Díaz-Rangel, I., Suárez-Guerra, S., Trevino, A., and Gordon, J. (2012). Empirical study of machine learning based approach for opinion mining in tweets. In *Mexican International Conference on Artificial Intelligence*, pages 1–14. Springer.

Singer, A. J., Chouhy, C., Lehmann, P. S., Stevens, J. N., and Gertz, M. (2019). Economic anxieties, fear of crime, and punitive attitudes in latin america. *Punishment & Society*, 22(2):181–206.

Slovic, P., Finucane, M. L., Peters, E., and MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis: An International Journal*, 24(2):311–322.

Snyder Jr., J. M. and Strömberg, D. (2010). Press coverage and political accountability. *Journal of Political Economy*, 118(2):355–408.

Spenkuch, J. L. and Toniatti, D. (2016). Political advertising and election outcomes. Working Paper.

Stafford, M., Chandola, T., and Marmot, M. (2007). Association between fear of crime and mental health and physical functioning. *American Journal of Public Health*, 97(11):2076–2081.

Tavits, M. (2006). Making democracy work more? Exploring the linkage between social capital and government performance. *Political Research Quarterly*, 59(2):211–225.

The Organic Law of Municipalities (2005). Ley N 27972.

Tversky, A. and Kahneman, D. (1973). Availability: A Heuristic for Judging Frequency and Probability. *Cognitive Psychology*, 5(2):207–232.

Urizar, X. S. and Roncal, I. S. V. (2013). Elhuyar at TASS 2013. In *Proceedings of the Workshop on Sentiment Analysis at SEPLN (TASS 2013)*, pages 143–150.

Velásquez, D., Medina, S., Yamada, G., Lavado, P., Núñez, M., Alatrista, H., and Morzan, J. (2018). I read the news today, oh boy: The effect of crime news coverage on crime perception and trust. Technical report, IZA Discussion Papers.

Weaver, J. and Wakshlag, J. (1986). Perceived vulnerability to crime, criminal victimization experience, and television viewing. *Journal of Broadcasting & Electronic Media*, 30(2):141–158.

Weitzer, R. and Kubrin, C. E. (2004). Breaking news: How local TV news and real-world conditions affect fear of crime. *Justice Quarterly*, 21(3):497–520.

Whitley, R. and Prince, M. (2005). Fear of crime, mobility and mental health in inner-city london, UK. *Social Science & Medicine*, 61(8):1678–1688.

Yanagizawa-Drott, D. (2014). Propaganda and Conflict: Evidence from the Rwandan Genocide. *The Quarterly Journal of Economics*, 129(4):1947–1994.

Appendices

A Tables and Figures

Table 1: Socioeconomic controls used for Column 11 in Table 3

	Variable name	**Type**	**Description**
1	*Victim*	dummy	Victim of any crime in the last 12 months
2	*Victim 2*	dummy	Victim of any crime or crime attempt in the last 12 months
3	*Woman*	dummy	Is a woman
4	*Age*	continuous	Age in years
5	*Mountains*	dummy	Lives in a region located in the mountains
6	*Jungle*	dummy	Lives in a region located in the jungle
7	*Members*	continuous	Number of household inhabitants
8	*Water*	dummy	Household has water supplied by truck, tank, well, river or canal
9	*House*	dummy	House has inadequate physical characteristics
10	*Overcrowded*	dummy	Inhabitants per room in the dwelling is more than 3.4
11	*Toilet*	dummy	House has no toilet, or no type of hygienic service
12	*TV*	dummy	Household has color TV
13	*Internet*	dummy	Household has internet
14	*Cable TV*	dummy	Household has cable-TV
15	*Cellphone*	dummy	Household has cellphone with internet service

Table 2: Effect of crime news coverage shocks on district electoral outcomes.

Vars. in levels	Incumbent Votes (%) (1)	Blank Votes (%) (2)	Null Votes (%) (3)	Blank + Null Votes (%) (4)	Turnout (%) (5)	National Party (6)
Negative area shock$_{t-1}$	0.0100	-0.00049	-0.0018	-0.0021	0.0020	0.034
	(0.012)	(0.0023)	(0.0036)	(0.0040)	(0.0022)	(0.050)
Positive area shock$_{t-1}$	-0.0077	-0.00084	0.00029	0.000022	0.0039*	-0.016
	(0.012)	(0.0024)	(0.0036)	(0.0041)	(0.0021)	(0.049)
Lagged dependent variable	Yes	Yes	Yes	Yes	Yes	Yes
Observations	782	1283	1283	1283	1283	1135

Standard errors clustered at the province-level are in parentheses. Significance stars: *** p <0.01, ** p <0.05, * p <0.1

Table 3: Effect of crime news coverage shocks on the probability a household consumes:

	Public transport (1)	Private guardian (2)	"Serenazgo" (3)	Entertainment (4)
Negative area shock$_t$	0.00071	0.00049	0.0030*	0.010
	(0.0024)	(0.00072)	(0.0017)	(0.0061)
Positive area shock$_t$	0.00017	0.0026***	0.0010	0.0077
	(0.0020)	(0.00069)	(0.0010)	(0.0049)
Observations	47816	47902	47902	47677
Months balance	1	1	1	1

Standard errors clustered at the province-level are in parentheses. Significance stars: *** p <0.01, ** p <0.05, * p <0.1

Figure 1: Example of a negatively-toned crime news
The negatively-toned piece of news has the following headline: "*Land tenants from community report vandals' threats*". Its header says: "*Again, there would be problems because of land dispute*".
Source: Correo - Piura, 31st of December, 2017

Nuevamente habrían problemas por litigio de tierras.

Posesionarios de comunidad denuncian amenazas de vándalos

Tras el desalojo a varios posesionarios de terrenos de la Comunidad Campesina de Castilla, estos denunciaron ayer en la comisaría de El Indio las amenazas que vendrían recibiendo por parte de un grupo de delincuentes que se encuentran apostados en la zona.

Uno de los denunciantes en diálogo con Correo manifestó que tienen información que los vándalos "sembrarán" armas a los comuneros con la finalidad que la policía durante una intervención que realizarán en los predios judicializados los intervenga y detenga.

"Tenemos miedo, nos han dicho que la Policía coludida con estos delincuentes nos pondrán armas de fuego y droga para hacernos pasar como delincuentes cuando no lo somos. Eso es injusto fuimos a la comisaría y no nos querían aceptar la denuncia, nosotros no somos ningunos delincuentes", refirió el denunciante.

Figure 2: Example of a positively-toned crime news
The positively-toned piece of news has the following headline: "*They detain Ramón Linares after request due to embezzlement of public funds*".
Source: El Mercurio - Cajamarca, 1st of December, 2017

Detienen a Ramón Linares por requisitoria de peculado

En la víspera, luego de ser detenido por la Policía Nacional del Perú de Contumazá, Flavio Ramón Linares Verástegui, director de "El Centinela", fue conducido a Cajamarca y se encuentra en poder de la policía judicial, para luego ser llevado a Bagua.
"El Tonco", venía siendo requisitoriado a nivel nacional desde el 28 de agosto del presente año por la sala penal de Bagua (Amazonas) por el delito de Peculado, producto de actos de corrupción cometidos cuando era Subprefecto. En el momento de su detención se identificó con un documento que no le pertenecía (usurpación de identidad) pero luego en el local de la comisaría se identificó como tal.
Según se sabe, que Linares Verástegui es profesor de

educación física en la I.E. San Isidro de Tembladera, había llegado a Contumazá para afrontar una denuncia ante la UGEL por parte de una docente del lugar y al promediar las seis de la tarde fue detenido.
Según el Código Penal en su Artículo 387: Peculado doloso y culposo. El funcionario o servidor público que se apropia o utiliza en cualquier forma, o consiente que un tercero se apropie o utilice caudales o efectos públicos, cuya percepción, administración o custodia le estén confiados por razón de su cargo, será reprimido con pena privativa de libertad no menor de cuatro ni mayor de ocho años. Cuando el valor de lo apropiado o utilizado sobrepase diez unidades impositivas tributarias, será reprimido con pena privativa de libertad no menor de ocho ni mayor de doce años. Si los caudales o efectos, independientemente de su valor, estuvieran destinados a fines asistenciales o a programas de apoyo social, la pena privativa de libertad será no menor de ocho ni mayor de doce años.

B Sentiment Analysis

This section defines the sentiment analysis procedure with detail. As explained, we use it to determine the polarity of each piece of news: negative, positive or neutral. First, we detail the data pre-processing that allows the analysis techniques to work optimally. For the news dataset, the process went as follows: (i) accents and special characters elimination through the appropriate encoding handling, (ii) line breaks removal, (iii) punctuation marks and extra spaces are removed, (iv) repeated letters are reduced and (v) stopwords are removed. The algorithm in Figure 3 depicts the repeated process used to evaluate all pieces of news in the database.

Figure 3: Algorithm for news sentiment analysis

```
news_dataset ←news texts from News dataset
keywords ←domain-specific keywords
positive ←list of positive words
negative ←list of negative words
positive_count ←0
negative_count ←0
neutral_count ←0
foreach news in news_dataset do
    tokens ←news white space split
    foreach token in tokens do
        if token is in positive then
            positive_count ←positive_count + 1 ;
        else if token in negative or keywords then
            negative_count ←negative_count + 1;
        else
            neutral_count ←neutral_count + 1 ;
        end
    end
    sentiment ←max(positive_count, negative_count, neutral_count) ;
    return sentiment
end
```

Furthermore, considering n as the list of news texts, p as the list of positive sentiment keywords, *neg* as the combination of negative sentiment keywords and domain-specific keywords, and *neu* as all other words different from p and *neg*, the algorithm can be summarized with the equations below:

$$
\begin{aligned}
positive_{count}(n_i) = &\quad \sum_0^j count(p_{ij}) \\
negative_{count}(n_i) = &\quad \sum_0^j count(neg_{ij}) \\
neutral_{count}(n_i) = &\quad \sum_0^j count(neu_{ij})
\end{aligned}
$$

where p_{ij} symbolizes the positive word j in news i, neg_{ij} symbolizes the negative word j in news i, and neu_{ij} symbolizes the neutral word j in news i. Each piece of news was classified to the sentiment for which it had the highest count. Crime news classified as neutral were not used for our analysis, as they were relatively scarce (about 1% of total crime news according to the algorithm) and of less interest than those classified as positive or negative.

C Spatial Entities Extraction

This section explains the extraction procedure with detail. As mentioned, it was used to determine the geographical location of each piece of news. First, the UBIGEO Id database for the different possible combinations of administrative spatial sub-divisions in Peru was used. The fields that compose it are explained in the Table 4. The importance of this dataset relies on the dictionaries constructed from it: a dictionary per spatial unit containing their unique elements (e.g all the unique regions, provinces or districts), and a homonyms dictionary (spatial entities with the same name, but referring to different places or locations). This dataset was also subject to a pre-processing, that basically consisted on accents and special characters removal, through the appropriate encoding handling.

Table 4: UBIGEO dataset description

Variable	**Description**
UBIGEO Id	Id corresponding to a combination of spatial administrative subdivisions, given by INEI.
District	Third-level spatial administrative subdivision in Peru.
Province	Second-level spatial administrative subdivision in Peru.
Region	First-level spatial administrative subdivision in Peru.

C.1 Initial Spatial Entities Extraction

In this stage, the initial extraction of spatial entities in the news is carried out. For each spatial entity in the regions' dictionary, we verify whether it appears in the news description

or not. If the entity is found in a given description, it is added to a list of found regions. This process is then executed in the same way for provinces and districts. Then, empty lists are removed (regions, provinces or districts lists). Finally, the entity list of the smallest geographic unit is chosen.

C.2 Ambiguity Calculation

In this stage, the ambiguity (represented by a Boolean Value) of the spatial entities extraction is computed. First, we verify the entities list size. If it is greater than one (i.e., there is more than one district name in the text, for example), then it receives a Boolean Value of one, as it would be unclear which one was the actual crime location. Then, if the entities list size is not greater than one, we check whether the spatial entity has a homonym or not. If it does have an homonym, it is given a Boolean Value of one. All other cases are assigned a Boolean Value of zero.

C.3 Double Verification

The double verification process comprises four main activities:

- We verify that the entity does not refers to an address (e.g., streets, avenues, boulevards, intersections). For this, we have a dictionary of the different types of addresses, as well as their variations and abbreviations. We verify four words before and after the spatial entity to see if any of the type of addresses appears. In case of finding an address, it is georeferenced through the Google Maps API, from where the corresponding district can be obtained.

- We check if the spatial entity, in the context of the news, is not a surname or a first name. Towards this aim, we look if the word immediately before is capitalized or not. If so, it is considered to be a name.

- We analyze if the full name of the geographical entity is extracted. The search algorithm may extract only a part of the full name of the spatial entity, since that specific part matches the searched text. For example, let's compare the region or province San Martín with the district San Martín de Porres. The algorithm may have found and selected San Martín as the geographic entity (since this part satisfies the search), when in reality the

text refers to San Martín de Porres. In that sense, it is necessary to do this verification step.

- The different variations of the spatial entity's name are standardized, compared and fixed.

C.4 Valid News Filtering

In this subsection we remove news which will not add valuable data for our analysis. Specifically, news without any spatial data (either district, provincial or regional) are filtered out as they are not analyzable.

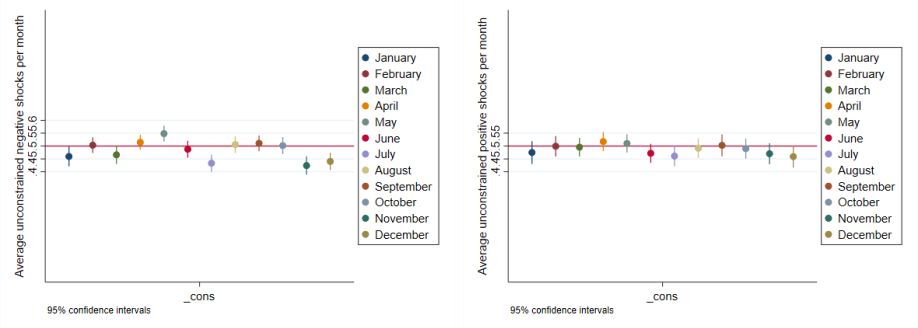
C.5 Computation of Upper Spatial Granularity and Georeferentiation

In this subsection, we compute the upper spatial granularity and georeference the news. This is means that, starting from the smallest spatial unit available, the information for the larger units is completed through queries to the UBIGEO dataset. For example, given that we know the district of location, we can reconstruct the data on its corresponding province and region. Then, spatial entities are georeferenced through the Google Maps API. This allows us to get the latitude and longitude associated with each news item.

D Balance checks (continued)

We can further validate our empirical strategy by analyzing how *coverage shocks* are distributed among months. Ideally, we would want to observe a seemingly random assignment of the number of shocks, so as to avoid confounding possibly month-specific effects on crime perception with treatment effect. As can be observed in Figure 4, both the average probability of occurrence of positive and negative shocks are fairly centered around 0.5 with seemingly random deviations around it. Regarding constrained shocks, they are not as evenly distributed as their unconstrained counterparts. However, this potential problem is addressed in the Robustness subsection, with the inclusion of month-year fixed effects to the final specification.

Figure 4: Shocks' distribution among months



A similar analysis can be performed for the distribution of area across provinces. Although the sample size is very small for each province individually ($n < 60$), for the large majority of provinces, one cannot reject the hypothesis that the unconditional probability of being subject to a news *coverage shock* (either positive or negative) is 0.5, as good as a coin toss. Regarding the constrained versions of the shock a few more provinces get a significantly different from 0.5 probability of receiving treatment, as some province-month combinations were eliminated due to pre-trend imbalance.

A last concern is that maybe shocked provinces, even though similar to non-shocked provinces in terms of average news' area, could be different in terms of other moments. The following graphs show that this is not the case, since the distributions of the average crime news area are similar across several months before the treatment. (see Figure 5). This holds similarly for the constrained versions of the treatment.

Figure 5: Distribution of news' average areas among treated and non-treated province-months for negative news (left panel) and positive news (right panel)