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- ▶ **Information and Crime Perceptions: Evidence from a Natural Experiment**
- ▶ Nicola Mastrococco and Luigi Minale

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Information and Crime Perceptions: Evidence from a Natural Experiment¹

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Abstract

This paper investigates the influence of media on the beliefs and perceptions individuals hold, with a focus on crime perceptions. We study the case of Italy, where the majority of television channels have been under the influence of the former Prime Minister Silvio Berlusconi for more than a decade. First, we document that these channels systematically over represent crime news compared to others. We then test if individuals revise their perceptions about crime when exposure to news programs broadcast by a specific group of partisan channels is reduced. In order to identify the causal effect we exploit a natural experiment in the Italian television market where the staggered introduction of the digital TV signal led to a drastic drop in the viewing shares of the channels above. Combining unique data on each channel's crime news coverage and prime-time viewing shares, we find that reduced exposure to crime-related news decreased concerns about crime, an effect that is mainly driven by older individuals who, on average, watch more television and use alternative sources of information (such as Internet, radio and newspapers) less frequently. Finally, we show that this change in crime perceptions is likely to have important implications for voting behaviour.

Keywords: information; mass media; persuasion; crime perceptions.

JEL Classification: D72, D83, K42, L82

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1. Introduction

A recent body of empirical literature suggests that media have a significant impact on political and public policy outcomes (see, among others: Della Vigna and Kaplan, 2007; Gerber et al., 2009; Enikolopov et al., 2011; Della Vigna et al., 2012; Barone et al., 2014). Yet, little is known about the mechanisms through which media concretely manage to influence collective decisions and policies. In this paper we explore one possible channel: influencing individuals' *beliefs* and *perceptions* about topics that are salient in the political debate. Understanding the role of information provided by the media on the formation of beliefs and attitudes is relevant for outcomes that go well beyond voting. Indeed, as Della Vigna and Gentzkow (2010) argue, the efficiency of democratic and economic systems ultimately depends on the accuracy of individual beliefs. One potential threat to the accuracy of belief steams from the fact that, although people base their beliefs partly on direct observation, a large share of information is provided by intermediaries - such as television, newspapers, or Internet - who might themselves have some interest in the behaviour of the receivers. In this case the communication is defined as persuasive⁴ (Della Vigna and Gentzkow, 2010) and its effect on the receiver is uncertain. In this paper we focus on a particular type of, potentially persuasive, communication: the one provided by news media. More precisely, we investigate the influence of *news media* on beliefs and perceptions individuals hold, and we focus on *perceptions about crime*.

We do so in the context of Italy, a country where, for over a decade, a relevant share of traditional analogue TV channels has been under the influence of Berlusconi in his dual role of media tycoon and Prime Minister⁵. We study if and to what extent individuals revise their

⁴ Della Vigna and Gentzkow (2010) provide a theoretical definition of *persuasive communication* and present an extensive review of the empirical literature on the subject.

⁵ Three channels – Rai1, Rai2 and Rai3 - constituted the bulk of the Italian public broadcasting system, which has a long tradition of alignment with the parties in government (Larcinese, 2005). Other three channels – Rete4, Canale5 and Italia1 – were privately owned by Berlusconi through his media conglomerate Mediaset.

perceptions once their exposure to news provided by this group of channels is reduced. Estimating the causal effect of the exposure to specific media on individuals' perceptions poses difficult identification issues, as people self-select into TV channels according to their news content (Durante & Knight, 2012)⁶. To tackle endogeneity we exploit a natural experiment: the staggered introduction of digital TV in Italy. Between 2008 and 2012, Italy has gradually shifted from analogue to digital TV transmission: on specific dates, which varied by region, the analogue signal was switched off and substituted with the digital one. Around the digital switch dates the number of nationally available free TV channels increased from 7 to more than 50 within days. Such a supply shock was accompanied by a drastic drop in the viewing shares of the six main traditional analogue channels (Rai and Mediaset) from 82% in June 2008 to 60% in June 2012⁷, mostly in favour of the newly available digital channels. We exploit the exogenous shift in viewing shares described above to study if and to what extent individuals revise their perceptions about crime when exposure to potentially biased news is reduced.

We focus on perceptions about crime for a number of reasons. First, not only have crime perceptions been proven to be relevant for several economic outcomes⁸, but also crime is at the top of people's concerns in many countries, and thus often at the centre of the political debate⁹. Second, and most importantly, thanks to unique data on the number of crime news broadcast in daily news programs, we are able to document how a specific group of traditional channels systematically over report crime news compared to other channels.

Durante and Knight (2012) provide evidence of the bias in favour of the Berlusconi's coalition (centre-right) while he was Prime Minister on five out of six of the above TV channels.

⁶ One of many sources of bias is generated by the fact that individuals, for example, tend to choose those sources of information that reinforce their pre-existing beliefs. One rare example of attempt to directly test the effect of the type of media individuals are exposed to on their beliefs and attitudes is provided by Gentzkow and Shapiro (2004).

⁷ Source: AUDITEL data. <http://www.auditel.it>

⁸ Crime perceptions and victimization have been proven to be relevant for outcomes such as house prices (Buonanno and Montolio, 2013) mental health (Dustmann and Fasani, 2014) and daily routines and behaviours (Braakman, 2014; Becker and Rubinstein, 2011).

⁹ As **Appendix Figure A1** shows, people rank consistently crime among the first five (out of 15) most important perceived problems in a number of European countries. Source: Eurobarometer.

Finally, it exists a puzzling mismatch between individual perceptions and actual data when it comes to crime rates. **Figure 1** provides evidence of such mismatch for Italy where despite a decreasing (or if anything stable) trend in actual crime rates over the period 2004 to 2012 (left panel) about 80% of respondents believe that crime is on the rise (right panel)¹⁰. These figures seem to reveal an information problem potentially deriving from the fact that people, by having little observational experience about crime, might tend to collect a relevant share of information about it through indirect and secondary sources. Thus the providers of such information (i.e. the media) are likely to play an important role in the formation of crime perceptions.

To identify the reduced-form effect of the expansion in the number of available channels on crime perceptions we exploit a specific feature of the digital introduction: the fact that the deadlines at which the signal switched from analogue to digital varied across regions, and did so for exogenous infrastructural reasons. In this way we recover an intention to treatment (ITT) parameter and find that the increase in the number of available TV channels - and the consequent lower exposure to news broadcast by partisan ones - led individuals to revise their perceptions about crime downward. The effect is mainly driven by individuals from older cohorts. For example, among those aged above 65, we estimate that the introduction of the digital TV caused the probability of mentioning crime as among the three priority problems in the country to drop by 5.2 percentage points, or about 8 percent with respect to the average value. To rationalise the differential effect across age groups we show that, on average, older individuals watch more TV and use alternative sources of information less frequently - i.e. internet, radio and newspapers – than their younger counterparts. They were therefore likely to be more exposed to the potential bias before, to place higher weight on information coming from television and to respond more to changes in its content.

¹⁰ The gap between actual crime rates and people's perceptions is a feature common to other countries as well. Indeed, while crime levels have been decreasing in many western countries during the last decade (see for example "The curious case of falling crime" in *The Economist*, July 20th, 2013) a surprisingly large share of the population believes that crime is actually increasing. Dustmann and Fasani (2014) provide similar evidence for the UK.

We then estimate more precisely the change in the exposure to crime news induced by the digital reform. To do so, we combine unique data on: a) the monthly amount of crime-related news reported by each TV channel during prime-time news programs; and b) the region-specific monthly viewing shares of each TV channel during prime-time news programs. We use the switch to digital signals to predict exogenous changes in the exposure to crime news induced by the policy, and estimate the effect on crime perceptions through a two-step method. We find that the digital reform induced a reduction in exposure to crime news of about 12 percent of the average value and that a 1 standard deviation decrease in exposure to crime news is associated with a 9.2 percent decrease in people's concern about crime, among those aged above 65. In this case we recover a local average treatment effect (LATE) driven by those individuals who actually "changed" channel because of the digital reform.

In the last part of the paper we try to assess whether the change in crime perceptions induced by the lower exposure to crime news might be relevant for voting behaviour. Using data from an electoral survey collected just before the introduction of digital TV, we predict that the reduction in crime concern caused by the digital reform might have induced about 3% of those aged above 65 who voted for the centre-right coalition to change their vote. Since individuals aged above 65 represent about 1 out of 4 of Italian voters (and usually show higher turnout rate), the effect we detect is likely to be relevant for electoral outcomes.

This paper contributes to the growing literature on persuasive communication in economics, and in particular to the group of studies that focus on the effect of (biased) news media on political outcomes.¹¹ A number of papers within this literature provide empirical evidence that (biased) media influence voting outcomes. Della Vigna and Kaplan (2007) find that the introduction of Fox News has led to a significant increase in the share of votes for the

¹¹ See Pratt and Stromberg (2011) for an exhaustive review of the literature on media and electoral outcomes. A number of studies have also looked at the effect of persuasive communication in other context such as: advertisement (Simester et al., 2007); non-profits organisations (Landry et al., 2006); communication directed at investors by firms or financial analysts (Engelberg and Parsons, 2009) and non-informative communication provided by leaders (Bassi and Rasul, 2014).

Republican Party in the U.S. 2000 election. Enikopolov et al. (2011) adopts a similar empirical strategy to show that Russian voters with access to an independent TV channel were less likely to vote for Putin during the 1999 national election. Finally, Barone et. al (2014) measure the impact of media bias in favour of Berlusconi on his electoral support. Similarly to us, they exploit the introduction of the digital signal and, looking at the northern region of Piedmont, show how the availability of new digital channels caused a drop in Berlusconi's voting shares in the 2010 regional elections¹². Our study differs from the papers above because, while most of the existing literature convincingly estimates some reduced-form effect of media on voting, we shed light on one of the possible mechanisms through which such effect might take place: the manipulation of individuals' perceptions with respect to politically salient topics. In fact, the paper is one of the first in producing causal evidence of the impact of information provided by potentially motivated agents (partisan media) on the beliefs and perceptions individuals hold. Moreover, by using unique data on TV viewing shares and news content of the different channels we are able to do better than just estimating an intention to treatment effect, thus improving upon some of the existing studies in the literature.

Our paper also contributes to a broader literature interested in the effect of media (mainly television) on beliefs, attitudes and behaviours. In particular our paper is close to those studies that look at how media affect perceptions and beliefs through their content (see, among the others Gentzkow and Shapiro (2004); La Ferrara et al. (2011); Della Vigna et al.

¹² Barone et al (2014) exploit the fact that about half of Piedmont region introduced the digital TV signal before 2010 regional elections, and compare voting outcomes across municipalities within such region. They find that after more than ten years of exposure to biased television, voters have not completely filtered out the bias. Another recent working paper investigates the effect of Berlusconi's TV on voting behaviour, yet from a different perspective. Durante et al. (2013) analyse the long-term impact of early exposure to Berlusconi's commercial TV (Mediaset) and find that municipalities with a longer history of exposure to it did show greater electoral support for Berlusconi's party. They argue that this effect could not be explained by exposure to partisan news bias (since, prior to 1985, news programs were not broadcast on Mediaset channels) but instead by the decline in social capital and the diffusion of a culture of individualism promoted by Berlusconi's TV.

(2014); Yanagizawa (2014); Olken (2009); and Jensen and Oster (2009)¹³. We add to this literature by providing a new field of evidence about the impact of media on perceptions, and we are the first to study the influence on crime perceptions.

The rest of the chapter is organized as follows: section 2.2 presents the institutional background on Italian television market and the intensity in crime news reporting on traditional channels; section 2.3 discusses our identification strategy and presents the natural experiment; section 2.4 introduces the data and the estimating equations; section 2.5, 2.6 and 2.7 present different sets of results; section 2.8 concludes.

2. Background

2.1. The Italian TV market

Up until 2007 - the year before the switch from analogue to digital TV signal transmission started - Italy presented a particularly concentrated television market, with only seven national channels freely available to viewers through the analogue signal. Three channels – Rai1, Rai2 and Rai3 - constituted the bulk of the Italian public broadcasting system, which has a long tradition of alignment with the parties in government (Larcinese, 2005)¹⁴. Other three channels – Rete4, Canale5 and Italia1 – were privately owned by Berlusconi through his media conglomerate Mediaset. Finally, there was a seventh channel - LA7 - which is private and can be considered independent from political influences¹⁵. Until the digital

¹³ Gentzkow and Shapiro (2004) study the effect of media use and Anti-American sentiment in the Muslim world; La Ferrara et al. (2011) the role of soap operas in reducing fertility in Brazil; Della Vigna et al. (2014) and Yanagizawa (2014) the effect of propaganda channeled through the radio on violence, respectively in Serbia and Rwanda; Olken (2009) the effect of television on trust in Indonesia; and finally Jensen and Oster (2009) the effect of cable TV and women's status in rural India.

¹⁴ Larcinese (2005) well explains the historical background. Initially there were two main public channels and just in a second moment a third one was added. This created the so call “*lottizzazione*” for which the two main channels went to the government coalition (which at the time was a coalition formed by *Democrazia Cristiana* and *Partito Socialista*) and the third one went to the communist opposition.

¹⁵ LA7, previously called TeleMontecarlo, was owned since 1999 by Telecom Italia Media Spa, a telecommunication company specialized in television production and broadcasting, advertising and other multimedia activities.

reform the Italian TV market has been a de-facto duopoly with the six main traditional channels, those referring to either Rai or Mediaset, holding about 85% of total daily viewing shares. Silvio Berlusconi, in his double role of media tycoon and Prime Minister, was in the position to influence five out of seven national channels while in government, between 2001 and 2006 and between 2008 and 2011¹⁶. Durante and Knight (2012) provide evidence of the bias in favour of the Berlusconi's centre-right coalition while he was Prime Minister on five out of seven of the above TV channels. As Larcinese (2005) points out “....*for having the owner of a vast broadcasting corporation as the leader of one of the electoral coalitions, Italy is probably a unique example in having such extreme selective exposure to television news*¹⁷”. Such a concentrated television market, together with the link between an important share of TV channels with a single political party makes the introduction of digital TV a unique experiment for studying the effects of a change in the news content individuals are exposed to.

2.2. Crime news reporting on Italian television

In this section we study the intensity of crime news reporting in Italian TV channels and in particular in the six main traditional channels (Rai + Mediaset) in comparison with others. News programs in Italy (*telegiornali*) are usually broadcast between 6:00 and 8:30PM, the time slot labelled as prime-time. They last 30 minutes and contain between 10 and 15 news items. We have data on the number of crime news items (stories) broadcast by each TV channel per month.

In **Figure 2** we compare the monthly averages of crime related news broadcast during prime-time news programs by the six main traditional channels with the same statistic for the only independent TV channel nationally transmitted through the analogue signal (LA7) for

¹⁶ Durante and Knight (2012) find evidence of bias toward the centre-right coalition in Berlusconi privately owned channels. When it comes to the three public channels, Rai 1 and Rai 2 exhibit bias toward the centre-right while that coalition is at the government, whereas Rai 3 is generally closer to the opposition.

¹⁷ Larcinese (2005), p.4

the years from 2007 to 2013. The difference in crime reporting intensity between the two groups is striking, with the Rai and Mediaset channels reporting a number of crime related news which is on average double that reported by the independent channel LA7. One could argue that LA7 might be underreporting crime news rather than Rai and Mediaset channels over reporting them. Because LA7 has no links with any political parties we expect it to have little incentive to under or over-report crime news. Nevertheless, we address such concern by comparing the monthly averages of crime related news broadcast by the main Italian public channel (RAI 1) with that of the main TV channels in a selected number of European countries. Such data are available for Spain (TVE), the UK (BBC), France (France 2) and Germany (ARD) from year 2010 onward and are presented in **Figure 3**. The main public Italian channel (RAI 1) broadcast an average of 73 crime related news per month during the period 2010 to 2013. The number is larger for a factor that ranges between 1.7 (Spain) to 18 (Germany) with respect to the same metric in the other European countries considered. As **Figure 3** shows, such a large difference in the amount of attention dedicated to crime by news programs on specific Italian channels is not justified by existing differences in crime rates (measured as murder rate) across countries.

We exploit such regularity in the broadcast of crime news together with the shift in viewing shares induced by the introduction of the digital TV signal to study the effect of a reduction in the exposure to crime news on crime perceptions. In the last section of the paper, while assessing the potential implications for voting, we will discuss to what extent it is plausible to consider the high amount of crime news reported in partisan channels as a rational strategy to gain electoral payoff.

3. Identification: The Digital Reform as a Natural Experiment

3.1. The Digital Reform

In 2008 Italy began introducing terrestrial digital TV. On specific deadline dates, which varied by region, the analogue signal was substituted by the digital one. Terrestrial digital TV technology enhances transmission efficiency and allowed Italian households to receive more than 50 new digital channels previously not available through the analogue signal¹⁸. Terrestrial digital TV has a low set-up cost (lower than cable or satellite TV) as it uses existing analogue infrastructures. In order to receive the newly available digital channels people needed a specific *decoder* (similar to a modem). The price of such decoders was 50 euros, and its cost was 100% subsidized by the government through vouchers. The switch over was initiated in 2006 by the centre-left government as per a compulsory European Union Directive (2007/65/EC). Indeed many other European countries have gone through the same technological change, and switched-over from analogue to digital TV signal during the last decade. What is peculiar in the Italian case is that the deadlines to switch off differed across regions, allowing us to analyse the effect of the policy using a difference-in-difference type of strategy. Identification relies on the exogeneity of such switch-off deadlines, after conditioning on region fixed effects, time fixed effects and time varying region characteristics.

Area-specific deadlines were based on similarity of 1950s infrastructures and could not be manipulated by local politicians or interest groups once set¹⁹. Italy was divided into sixteen areas, to each of which a precise date for the switch off of the analogue signal was assigned. The switch over for the entire country was completed over 4 years from November 2008 to June 2012 (**Appendix Figure A2**). To test the orthogonality of switch-off deadlines to

¹⁸ E-media Institute, DGTVi

¹⁹ Please refer [here](#) for the EU directive legislation summary and [here](#) for the official Italian Law on the introduction of digital television

regional characteristics we perform a balancing test and compare two groups of regions: *early* switchers (those that passed to digital before or at December 2009) and *late* switchers (those that passed to digital from January 2010 onwards). **Table 1** shows that *late* and *early* switcher regions are similar in dimensions such as unemployment and employment rates, GDP per capita, share of tertiary educated, of immigrant residents and of internet users, persons cited for crimes and murder rates per 100,000 people, suggesting that area-specific deadlines seem to be largely idiosyncratic to the purpose of our analysis.

3.2. The induced change in TV viewing shares and in exposure to biased news

Treatment induced by the digital reform. The switch from analogue to digital TV signal caused an unprecedented increase in the offer of channels. Such increase was accompanied by a drastic drop in the viewing shares of the six traditional channels (Rai + Mediaset) mainly in favor of the newly available digital ones. The viewing shares during prime-time (the period between 6:00 and 8:30 pm when most news programs are aired) of the six main traditional channels went down from about 82% in June 2008 to 60% in June 2012²⁰. At the same time, viewing shares of the new digital channels jumped from 2% to 17% (see **Figure 4**). Because the two platforms are characterized by different intensities of crime news reporting, such shift generates arguably exogenous variation in exposure to crime news. As shown above, the six main traditional channels broadcast higher number of crime related news than that broadcast by independent Italian TV channel and by most important channels in main European countries. On top of that, as we will show below, even among the six traditional channels, those characterized by higher crime news reporting intensity are those that lost relatively more viewing shares because of the Digital Reform.

Ultimately, for those who reacted to the introduction of digital TV by “changing” channel from traditional analogue channels to the new digital ones, we can think of two alternative

²⁰ We focus on prime-time, as we are interested in capturing the time of the day when most news programs are aired but, as we will show later, the drop in the viewing shares of traditional channels shares is homogeneous across all time slots during the day.

possibilities. The first is to switch from news programs on traditional channels to news programs on digital ones. In this case people would now be exposed to a different (it could be lower or higher) amount of crime news. The second possibility is to switch from news programs on traditional channels to full-entertainment programs on digital ones. In this case, people would not receive any information about crime through that specific channel anymore and the exposure to potentially biased news is reduced. Data about the content of new digital channels indicate that the latter case is indeed most common. **Figure 5** plots the increase in the viewing share of new digital channels, split into those that broadcast some news programs (News Channels) and those that are full-entertainment (Other Channels). About 95% of the viewing shares of new digital channels are of channels that do not broadcast news at all²¹. As **Figure 6** shows the most common programs broadcast by digital channels are TV-shows, movies and programs for kids, and to a lower extent sport programs, educational/history programs and life-style programs.

Importantly for our analysis, as we show in detail in the Appendix, the switch to digital signal did not induce any change in the total amount of time spent by people watching television (see **Appendix Table A1**). Thus, people did not watch more or less television in response to the digital reform; instead they simply switched from some channels to others. We therefore can conduct our analysis without worrying about possible substitution effects between TV watching time and other alternative activities being possibly contaminating the results.

In the next paragraphs we will show how the shift in viewing shares is clearly triggered by the new technology introduction and takes place precisely in correspondence of the region-specific switch-off deadlines, thus providing evidence of its exogeneity.

²¹ Such data confirm the descriptive evidence presented by Barone et al. (2014) who also show that the vast majority of people watching digital TV channels in Italy sort themselves into full-entertainment programs.

Descriptive evidence. In order to further support the effectiveness of our identification strategy, we would like to observe jumps in the region-specific shares of the six main traditional and new digital channels in correspondence with the region-specific switch-off deadlines. **Figure 7** plots the evolution of prime-time viewing shares, for respectively the six main traditional and new digital channels, in selected regions around switch-off dates. The plotted regions are Campania (switch-off deadline December 2009), Lombardy (switch-off deadline October 2010), Umbria (switch-off deadline November 2011) and Sicily (switch-off deadline June 2012). For all of them it is possible to observe a large and sudden increase (decrease) in the viewing shares of new digital channels (traditional analogue channels) in precise correspondence with the deadlines to switch off the analogue signal (indicated by the vertical dashed lines). To better show the variation we exploit in our empirical exercise, **Figure 8** plots the evolution of the prime-time viewing shares of new digital channels in two pairs of neighbouring regions that switched off the analogue signal at different times. In Panel A we compare Campania with Calabria (in the south) while in panel B Emilia Romagna with Tuscany (in the center-north). Focusing on Panel A, the trend in digital channels viewing shares is remarkably similar before November 2009, when none of the two regions had switched off yet, and after May 2012, when both regions have already switched to the digital signal. In between switch-off deadlines (indicated by the dashed vertical lines) individuals who happened to live in either of the two neighbouring regions have been exposed to a different mix of TV channels. We exploit precisely such differential exposure, which we argue is as good as random.

Evidence from regression analysis. In order to provide a more systematic evidence of the effect of the digital introduction on TV watching behaviour we make use of unique data on TV viewing shares collected for each channel at the month by region level and estimate the TV viewing share during prime-time for various groups of channels (labelled as c) in region r and month t as a function of the introduction of digital signal as follows:

$$Share_{rt}^c = \gamma_0 + \gamma_1 Digital_Switch_{rt} + \gamma_r + \lambda_t + u_{rt} \quad (1)$$

We group channels into four groups: main traditional channels (RAI + Mediaset), New Digital Channels, Satellite Channels and Residual Channels²². In equation (1) above *Digital_Switch_{rt}* is an indicator for the region having switched to digital signal in month *t* or before, while γ_r and λ_t are region and time fixed effects respectively. Panel A of **Table 2** reports estimates from equation (1) for the group of main traditional channels. The switch-over induces a decrease in the viewing shares of these channels between 8.1 and 8.7 percentage points, depending on the specification. This corresponds to more than a 10% decrease on the baseline value. In Panel B, C and D we look at viewing shares of New Digital, Satellite, and Residual Channels respectively. The switch-over is associated with an increase in the viewing shares of New Digital channels that ranges between 6.2 and 7.2 percentage points depending on the specification, while, as expected, has only a tiny positive effect on the viewing shares of Satellite and Residual Channels. In the table we deal in different ways with the potential confounding effect due to time trends by including linear time trends (column 1), year fixed effects (column 2), month*year fixed effects (column 3) and month*year plus region-specific linear trends (column 4). The switch to digital signal is very powerful in predicting values of TV viewing shares with an F-stat equal to 89.9 and 110.8 in our most restrictive specification (column 4) for respectively viewing shares of main traditional and new digital channels.

Viewing shares during slots other than prime-time. Although most of the news programs are aired during prime-time (between 6:00 and 8:30pm), some news are also broadcast during other time of the day, for example at lunch-time: between 12:00 and 15:00. One concern is that people might watch fewer news programs on traditional analogue channels during prime-time, but more of them during other times of the day. Such substitution across

²² Satellite Channels are pay-per-view ones to which terrestrial digital TV does not automatically provide access. The forth group, Residual Channels, include other digital and satellite channels whose viewing shares are not recorded individually, as well as some minor local channels.

time-slots could potentially offset the decrease in crime news exposure measured during prime-time. It is therefore important to test whether TV viewing shares during other times of the day responded to the switch-over in the same way as they did during prime-time. **Appendix Table A2** presents estimates where we replicate, for all other time-slots available and for the entire day, the same exercise as in **Table 2**. Reassuringly, the effect of the switch-over on the viewing shares of traditional analogue channels (negative effect) and on new digital ones (positive effect) goes in the same direction in all and every time slot and estimates for all of them are very similar to those we found for prime-time.

4. Data and Estimating Equation

4.1. Data

To conduct our empirical analysis we draw on various sources of data.

Individual perceptions of crime. Our primary data source is the Multipurpose Household Survey, collected yearly by the Italian National Statistical Agency (ISTAT). One of its several modules gathers information about individual and household daily life²³. The survey is carried out yearly (around March) and is a repeated-cross section representative at the regional level of the entire Italian population. In addition to the usual demographic, labour market, and education information, the survey asks a set of questions about the use of TV, Internet and radio, as well as about beliefs and perceptions regarding a number of issues. From this survey, we employ two measures of perceptions about crime. The first is the answer to the question that asks “*What do you think are the priority problems of the country?*”. Respondents can choose three topics from the following list of ten: unemployment, crime, tax evasion, environment/pollution, public debt, inefficiency of health sector, inefficiency of school sector, inefficiency of judicial sector, immigration, poverty,

²³ The module is called Aspects of Daily Life. <http://siqua.istat.it/SIQual/visualizza.do?id=0058000>

others. Individuals are free to mention fewer than, but no more than three topics. We construct an indicator variable for the individuals reporting crime as one of the three priority problems in Italy and we call it *Crime_Concern*. This variable captures individuals' concern about crime, or, in other words, the level of salience of crime as a priority problem to be tackled at the national level. In our estimating sample 57% of individuals report crime as being among the three priority problems in Italy, making crime the second most reported problem after unemployment (mentioned by 72% of individuals) throughout the entire period. The average of *Crime_Concern* by sub-group of population, alongside other descriptive statistics for our main estimating sample, is reported in **Appendix Table A3**. The share of people particularly concerned about crime is higher among those aged above 65 than among those aged 65 or less, and is equal to 62 and 55 percent respectively. The survey contains a second measure of crime perception, which derives from the question “*What level of crime risk does your area of residence present?*”. Respondents can choose from four categories that range from “absent” to “very high”. We therefore construct a categorical variable that goes from 1 to 4 and is increasing in the perceived level of crime in the area of residence and call it *Crime_Risk_Local*. This variable is less suited to our purpose as a) it refers only to the local area while we are interested in attitudes toward crime at the national level, and b) it is reported only at the household level. However, the question, unlike the previous one, has also been asked in year 2011 and 2012.

TV viewing shares. To measure the shift in audience shares induced by the digital reform we gathered unique data about monthly, region-specific, viewing shares for each TV channel available from year 2007 until 2013. The data have been extracted from the official Auditel²⁴ dataset. Auditel is an independent third party agency responsible for television audience measurement in Italy. Viewing shares data are based on a sample of about 5200 households and 14000 individuals that is representative at the regional level of the entire Italian

²⁴ <http://www.auditel.it>

population²⁵. We have information about viewing shares for five different time slots during the day: slot1, from 07:00 to 11:59; slot2, from 12:00 to 14:59; slot3, from 15:00 to 17:59; slot4 (prime-time) from 18:00 to 21:30 and slot5, from 20:31 to 23:59.

Crime related TV news items. To measure the number of crime news items reported by each TV channel we use data on primetime newscasts collected by the “Pavia Observatory”. The Pavia Observatory is an independent research institute specializing in media analysis that works in collaboration with the University of Pavia. We obtained data on the monthly number of crime-related news items broadcast during prime-time news programs for each one of the main traditional TV channels and some others, from 2007 until 2013.

Crime committed and other control variables. Data about the number of crime committed in each region by month and type of crime have been provided by the Italian Home Office Ministry. Crimes are split into the following categories: violent and drug related crimes, property crimes, and other types of crimes. A number of regional level time varying characteristics, such as employment and unemployment rate, GDP per capita, share of tertiary educated, and age structure, are provided by the Italian National Institute of Statistics (ISTAT).

4.2. Estimating Equation

In this section we present our empirical strategy to estimate the reduced-form effect of the increase in the number of available TV channels on individual perceptions about crime. In order to identify the intention to treatment effect (ITT), i.e. the effect of the switch-over from analogue to digital TV signal and the subsequent increase in number of available channels, we exploit region specific idiosyncratic deadlines to switch and implement a difference-in-

²⁵ More information on Auditel procedure is available at <http://www.auditel.it/come-lavora/>. Auditel has selected a sample of 20000 households. Every year they conduct a face to face interview with each of them to check the type of technology they use (Satellite, DG, DVD, etc) and they install the so called *people meter*. The *meter* is based on the advanced technology Unitam / CTS (content tracking system) and collects data everyday on the number of TV minutes watching per all the existing channels.

difference design that compares crime perceptions of individuals within the same region, before and after the switch to digital signal occurred. More formally, we estimate various versions of the following linear probability model:

$$Crime_Concern_{irt} = \alpha_0 + \alpha_1 Crime_{rt} + \alpha_2 Digital_Switch_{rt} + \mathbf{X}'_{irt} \delta + \mathbf{Z}'_{rt} \gamma_r + \lambda_t + \varepsilon_{irt} \quad (2)$$

where i indexes individuals, r regions and t time periods. The variable $Crime_Concern_{irt}$ is an indicator for the individual mentioning crime among the three priority problems in the country. $Digital_Switch_{rt}$ is a dummy that equals 1 if region r experienced the switch-off to digital signal at time (year) t or before. The switch-off might occur at any point in time during the year previous to the annual household survey collected in March. Indeed, switching to digital TV just one month before the survey is likely to induce different treatment than switching 11 months before it, as the share of time between two surveys during which individuals have access to more TV channels differs. In order to take such heterogeneity in (intention to) treatment intensity into account we also consider an alternative measure for $Digital_Switch$, which is the fraction of months (over the 12 previous to each annual survey) after the switch-off occurred. The coefficient of interest is α_2 , which captures the impact of the increase in available TV channels on individual crime perceptions. For our purpose it is crucial to control for region-specific crime rates that are likely to be an important determinant of crime perceptions. $Crime_{rt}$ is the (log) crime rate, defined as number of crimes over 10'000 population, in region r during the calendar year previous to the collection of year t survey. The coefficient on crime rates is of interest on its own as it will tell us whether, and to what extent, crime perceptions respond to actual crime rates. Vector \mathbf{X}'_{irt} denotes a set of individual and household level characteristics including gender, age, age squared, marital status, education, set of dummies of occupational status, family size, family structure, and major source of household income. Vector \mathbf{Z}'_{rt} includes a series of region time-varying covariates that might affect crime perception directly or

indirectly, such as unemployment rate, GDP per capita, share of population with tertiary education, and share of immigrants. The γ_r are region fixed effects meant to capture any unobserved time-invariant characteristics that affect crime perceptions and may also be correlated with the timing of the switch-over to digital TV. The λ_t are year fixed effects meant to allow for very flexible trend in crime perception common to all regions. Finally, ε_{irt} is an idiosyncratic error term. Our identifying assumption is that, conditional on region and year fixed effects and on the time-varying controls, the timing of the switch-over to digital TV is orthogonal to the error term. We will attempt to test the plausibility of this assumption in the remainder of the paper. Finally, throughout the empirical analysis, we cluster standard errors at the region level to allow for an arbitrary correlation of residuals within regions.

After having estimated the reduced-form effect of the digital TV introduction on crime perceptions, we will attempt to get a more precise estimate of the relationship between exposure to crime news and crime perceptions. To do so we will make use of unique data on TV news content and measure the effect of the switch-over on the exposure of individuals to crime news.

5. The Effect of the Digital Reform on Crime Perceptions

5.1. Estimates

Overall effect. Here we discuss results from the estimation of the reduced form effect of the switch-over to digital TV on individual crime perceptions. **Table 3** summarizes the results from our estimation of equation (2): a linear probability model of *Crime_Concern* on a post switch-over indicator *Digital_Switch* and controls. *Crime_Concern* is an indicator for the individual reporting crime as being among the three priority problems in the country at the moment of the survey. The coefficient on *Digital_Switch*, an indicator taking value 1 if the

region has switched-off in period t or before, captures the effect of the increase in the number of available TV channels on crime perceptions. When we look at the effect on the overall population (column 1) we find a negative coefficient, suggesting that the Digital Reform induced a lower concern about crime. The coefficient is not statistically significant though. However, we do not expect all groups of the population to a) be exposed in the same way to the pre-existing bias, and b) to respond in the same way to the partial removal of it. Indeed, individuals of different cohorts are likely to gather information from different combinations of media; for example, older individuals are likely to rely more on television and less on new technologies such as internet, as we will show in more detail later.

Heterogeneity of the effect across age groups. We therefore turn and study the heterogeneous effect of the Digital Reform for five different age groups of the population (results reported in column 2). We do so by interacting *Digital_Switch* with a set of five age group indicators. While estimates for individuals below age 41 are equal to zero, they are negative for older individuals. Estimates get larger as we move from younger to older groups and are significantly different from zero at conventional levels for the group formed by individuals above age 65. These results suggest that elderly individuals' crime perceptions respond more to the decreased exposure to potentially biased news programs broadcast by the six main traditional TV channels. We will investigate the possible reasons for this result in the reminder of this section.

New specification: accounting for the length of treatment. From column 3 onward we employ a more precise version of *Digital_Switch*: the share of months the region has spent under the new digital regime during the year previous to the survey. Such specification takes into account the length of the (intention to) treatment we are interested in. Our estimates (all negative) get larger, and are now significant also for the second oldest group of individuals, those aged 52-65. The fact that when we account for the intensity of the treatment estimates are larger suggests that in our empirical analysis we are not likely to be picking up just some

spurious correlation between year of switch-off and changes in crime perceptions. We consider this specification more appropriate to the purpose of our analysis and will use it from this point forward.

Robustness of estimates and magnitude of the effect. The coefficients are very stable across specifications, suggesting that the introduction of digital TV is not correlated with any individual characteristic (included from column 4) or region time-varying characteristics (included from column 5). In Column 5 and 6 we also add region-specific crime rates that, very importantly, do not affect the estimates on the *Digital_Switch*. It is interesting to note that crime perceptions respond to actual crime rates, but only to specific crime categories; column 6 shows that people become more concerned about crime only when violent and drug related crimes increase, while property crimes and other crimes do not seem to affect individual concerns in any significant way. In our most complete specification the increase in TV channels, or better, having access for the entire pre-survey year to an increased number of TV channels, is associated with a statistically significant decrease in crime concern for individuals aged above 51. The effect estimated is economically relevant: if we focus on the older group of individuals, those aged above 65, the digital reform is associated with a decrease in the probability of reporting crime as one of three priority problems of 5.2 percentage points, corresponding to about 8.4 percent change with respect to the average probability for that specific age group (equal to 0.62). These results are consistent with the increase in the number of channels available - and the induced lower exposure to partisan ones over-reporting crime news - leading individuals to revise their crime perceptions downward.

Estimates of the group-specific *Digital_Switch* coefficients from the most complete specification (column 6) together with 90% confidence intervals are also plotted in **Figure 9**. The figure shows clearly how the effect of the reform gets larger as we move from left to right of the age distribution. In **Figure 10** we also report estimates from regressions of the

type in column 6 but estimated separately for males and females. Among females the effect is negative and statistically significant for those aged above 40 and gets more precisely estimated as age increases. The effect is negative and significant for males above age 65. As for interpreting the coefficients, for females aged above 65 the switch-off is associated with a decrease in the probability of reporting crime as priority problem of 3 percentage points, which represents a decrease of about 5 percent with respect to the average probability for that specific group of individuals. Similarly the effect of the switch-off on males above age 65 corresponds to a decrease of about 6.5 percent on their average probability²⁶.

5.2. Interpreting heterogeneous effects across age groups

TV watching time. The increase in the number of available TV channels, and the induced lower exposure to partisan ones over-reporting crime news, led to a decrease in the share of people who consider crime as a priority problem, particularly among older cohorts. Why do elderly people revise their perceptions more than other groups? One possible reason is that elderly individuals were more exposed to potentially biased traditional channels before the introduction of digital TV. **Figure 11** shows the average daily TV watching time for individuals in our estimating sample, by gender and along the distribution of age. TV watching time is lowest for individuals between 25 and 45, when people are in the middle of their labour market participation. Then it starts increasing around age 40-50, in correspondence with the age group from which the reduced-form coefficients become negative and increasingly significant. Females tend to watch more TV than males, and this is true at almost every age. On average, individuals aged 65 watch TV for almost 3.5 hours per day, while individuals aged 35 do so for little more than 2 hours. By watching more television elderly individuals were more likely to be exposed to news programs in partisan channels before the introduction of the digital signal and this could be a reason why they revised their perceptions to a higher extent. The stronger response for the group of elderly

²⁶ Average probability of reporting crime as a major problem is 0.62 and 0.61 for female and males respectively above age 65.

individuals confirms findings from previous studies (for example Barone et al., 2014) that while looking at the effect of media on voting also found a stronger effects in town with higher share of elderly individuals.

Differential access to other sources of information. Television is not the only source of information people use; indeed we expect the access to other media to matter as well. Let us suppose that individuals collect information about the level and the salience of crime from two main different sources: direct observation and indirect channels, such as television, Internet, newspapers and the radio. We can think of individuals using a simple Bayes rule to update their perceptions once a new piece of information is received, and to do so according to the weight they attribute to the source of such information. If many sources of information are available each one will have little weight and contribute only marginally to the update of perceptions. Hence, we can expect the weight attached to information coming from television to be higher for individuals who have only limited access to other sources. To explore this hypothesis we examine data available for our estimating sample about the use of Internet, radio and newspapers. Individuals aged above 65 use information sources other than TV much less frequently in comparison with individuals aged below 65 (**Figure 12**). More precisely, 94% of those aged above 65 have never used the Internet, 50% do not read any newspaper, and 63% never listen to the radio. On the contrary, among individuals below age 65 such shares are much lower: 39% have never used the Internet, 36% do not read any newspaper, and 29% never listen to the radio. Thus, older individuals appear to have a much less diverse set of sources from which they gather indirect information and the prominence of one single source could reveal why in their case changes in the content of television are more strongly reflected into changes in perceptions.

Effect on concerns about other topics. If elderly individuals are less concerned about crime after the introduction of digital TV, we might be interested in knowing what problems

have substituted crime as priorities in their opinion²⁷. We therefore look at the effect of the digital introduction on the likelihood of mentioning any of the other problems suggested by the question “*What do you think are the 3 priority problems of the country?*”, and there are nine of them apart from crime. The **Appendix Table A4** reports estimates for individuals aged above 65 of the effect of the switch-over for each of the other topics plus crime. In the table, problems are ranked from left to right from the most (unemployment) to the least mentioned (inefficiency of education system). The lower concern about crime seems to be compensated for by higher concern about most of the other problems, such as poverty, tax evasion, inefficiency of health sector, inefficiency of judicial system and public debt. However, estimates are statistically significant at conventional level only for inefficiency of health sector and judicial system though. The introduction of digital TV is also associated with lower concern about unemployment, but standard errors are quite large.

5.3. Further robustness checks

Effect of switch-over on unemployment and crime. The first robustness check we perform is to test if, in correspondence with the switch-off deadlines, regions have experienced changes in economic outcomes that are themselves relevant for crime perceptions. We test such hypothesis by estimating, in a similar fashion as above, the effect of the Digital Reform on unemployment and crime rates. The unit of observation is the region*year. Estimates suggest (**Appendix Table A5**) that the Digital Reform is not statistically significantly associated with any change in unemployment or crime rates at the regional level, regardless of whether we use a specification with an indicator for Digital_Switch (columns 1 and 3) or the share of months (columns 2 and 4). In the case of unemployment share estimates even change signs when adopting the share of months as explanatory variable.

²⁷ Our outcome variable is a relative measure of concern as people are asked to report the three priority problems. Given such relative nature we are not able to test whether the increase in TV channels, and the consequent lower exposure to Berlusconi-influenced news programs, induced a lower general concern about every problem.

Effect of switch-over on individuals not watching TV. Some individuals in our sample do not watch TV at all. We should expect not to find any effect of the introduction of digital TV on them. As a robustness check we thus estimate the same reduced-form regressions presented in Table 3 on the sample of those individuals who report not to watch TV at all, i.e. about 5% of the total. This exercise is only valid under the assumption that these people did not pass from not watching TV to watching it (and vice versa) in response to the digital TV introduction. The **Appendix Table A6** reports results from such exercise, estimates on *Digital_Switch* are small and never significant (for any of the five age groups) across all the four specifications.

Timing of the switch-over effect: perceptions about local level crime. We now run a placebo test to check if we can detect any effect of the switch to digital signal before it actually occurred. To do so we employ the second measure of crime perceptions included in our dataset that refers to the level of crime risk in the area of residence. The questionnaire asks to rate the risk of crime in the local area of residence on a scale from 1 to 4 (highest level of crime) and we use answers to such question to construct a measure of perception of the level of crime in the local area called *Crime_Risk_Local*. Such variable is only reported at the household level but is available until year 2012 enabling us to look at the effect of the increase in the number of TV channels available also 1, 2 and 3 years after the switch-off. Exploiting the fact that different regions switched from analogic to digital TV transmission at different points in time between 2008 and 2012 we are able to run a regression with both lags and leads of the switch-off year indicator. The estimated leads and lags running from two years prior to two years after the switch-off are plotted in **Appendix Figure A3**. Estimates show no effect of the switch-off before it actually occurred and such result is reassuring. They start to become negative right after the switch-off, and keep decreasing with time (becoming statistically significant two years after it). This might be an indication of individuals adjusting their viewing behavior gradually. Furthermore, it could be that perceptions about the level of local crime might take longer to adjust. Perhaps because

individuals put larger weight on direct information when forming their perceptions about the crime level in the local area, while relying more on secondary sources of information, such as television, when forming perceptions at the national level.

Strategic editorial response to the change in market shares. The interpretation of our results would be hindered if the amount of crime news items broadcast by Berlusconi-influenced media changed with the introduction of digital television. This would be the case if the editors of news programs responded to the change in the television market's structure by strategically increasing or decreasing the amount of crime stories reported. To explore such possibility we plot (**Appendix Figure A4**) the average number of crime news reported on channels directly owned by Berlusconi against the viewing shares of new digital channels, from 2007 until the end of 2012. Despite the significant increase in digital channels viewing shares (dashed blue line), the amount of crime news reported in Berlusconi's channels (red line) fluctuates around an average of about 100, and does not show any clear trend during the period. In particular, the number of crime news reported does not seem to change in any systematic way in correspondence with the various waves when the digital signal is introduced (indicated in the figure by the grey shaded areas).

6. Assessing the Effect of Crime News Exposure on Perceptions

Our reduced-form estimates indicate that (older) individuals tend to revise their concern about crime downward once they less exposed to news programs in partisan TV channels that are likely to over report crime news. In this section we try to measure to what extent such reduced-form effect can be linked to the change in crime news exposure induced by it. In other words, we now attempt to answer to the question about what happens to people's concern about crime when we vary the amount of crime news they are exposed to. As discussed earlier, in our setting the decrease (increase) in exposure to crime news comes also together with the decrease (increase) in exposure to other types of news, and with an

increase (decrease) in exposure to full-entertainment contents. Therefore our measure of exposure to crime news will naturally capture those additional elements as well.

6.1. Measuring *crime news exposure*

The first step toward estimating the effect of the amount of crime news on crime perceptions is to construct a measure of individual *exposure to crime news*. To do so, we combine unique data on: a) region-specific monthly viewing shares of each TV channel during prime-time news programs; and b) the monthly amount of crime-related news items reported by each TV channel during prime-time news programs. With these two pieces of information we construct the following region*time specific measure of *exposure to crime news*:

$$\sum_{c=1}^C CrimeNews_t^c * Share_{rt}^c$$

where $CrimeNews_t^c$ represents the number of crime news items reported during prime-time news programs on channel c during period t ; while $Share_{rt}^c$ is the prime-time viewing share of channel c in region r during period t . The measure, that we call *Crime_News_Exposure*, is the summation, over all TV channels, of the number of crime news items broadcast during the period t weighted by the region-specific viewing share in the region r during the period t . This weighted average delivers us the actual number of crime news items the average individual who lives in region r is exposed to at each point in time (during each month or year). Between two months, the exposure to crime news of individuals living in a specific region can vary either because the average amount of crime news broadcast changes or because of some reallocation of viewing shares between TV channels characterised by different crime news reporting intensity takes place.

6.2 Estimating changes in *crime news exposure* induced by Digital Reform

We now estimate the effect of the Digital Reform on individuals' *exposure to crime news* and we do so by estimating the following first-stage equation:

$$(\sum_{c=1}^C CrimeNews_t^c * Share_{rt}^c) = \gamma_0 + \gamma_1 Digital_Switch_{rt} + \mathbf{Z}_{rt}'\theta + \gamma_r + \lambda_t + v_{rt} \quad (3)$$

Where t can be either month or year and *Digital_Switch* is an indicator for the regions having switched to digital at time t or before²⁸. While we always include region fixed effects, from columns 1 to 4 we account for possible confounding factors due to the time dimension in different ways. More precisely, in column 1 we only include a linear time trend; in columns 2 year fixed effects; in column 3 year*month fixed effects to allow for maximum flexibility in the (common) time trend; finally, in column 4, we estimate our tighter specification where we include both year*month fixed effects and region-specific linear time trends. In our context TV news programs are broadcast nationally, so any change over time in the amount of crime news reported is absorbed by time fixed effects. Instead, the variation in *Crime_News_Exposure* that is generated by the digital switch has to do with the reallocation of viewing shares away from traditional analogue channels and in favour of those with fewer or no crime news. In fact it is important to underline that if we look within the six main traditional channels, we can observe (**Figure 13**) how channels characterized by higher crime news reporting intensity are those that lost most viewing shares during the period of digital TV introduction. Thus, because of this differential effect of the Digital Reform on viewing shares of different traditional channels, even the group of individuals who keep watching those traditional channels is, after the reform, on average exposed to lower crime news intensity. Estimates (reported in **Table 4**) suggest that the digital introduction induced a decrease in the exposure of individuals to crime news. The coefficients on the *Digital_Switch* indicator are always negative, remarkably stable across

²⁸ In this part of the analysis we use the dummy measure of the digital switch rather than the fraction of months after the switch-off occurred.

specifications, and very powerful in predicting changes in *Crime_News_Exposure*. They are all significant at the 1% level and the F-statistic associated with *Digital_Switch* always scores above 35 in our most complete specifications, from column 4 onward. In column 5 we exclude from the analysis the residual TV channels, which we cannot label as either digital, or satellite; while in column 6 we estimate the equation collapsing the data into a yearly dataset. Estimates are in both cases very similar to those in the main specification. According to these results in column 3 the switch to the digital TV caused a reduction in the exposure to crime news equal to 8.4 crime news items per month. This number corresponds to about 12% of the average amount of crime news individuals are exposed to during a month, thus suggesting a sizable effect.

6.3 Quantifying the effect of *crime news exposure* on crime perceptions

We then move on and use the predicted values of *Crime_News_Exposure* to get a better measure of the effect of the digital reform on crime perceptions. We do so by estimating the following second-stage equation:

$$Crime_Concern_{irt} = \beta_0 + \beta_1 Crime_{rt} + \beta_2 (\sum_{c=1}^C \widehat{CrimeNews}_t^c * Share_{rt}^c) + \mathbf{X}'_{irt} \beta_3 + \mathbf{Z}'_{rt} \beta_4 + \eta_r + \kappa_t + u_{irt} \quad (4)$$

where the variable *Crime_Concern_{irt}* is the same as the one used in equation (2) and described above. $\sum_{c=1}^C \widehat{CrimeNews}_t^c * Share_{rt}^c$ is our measure of *Crime_News_Exposure*. Vectors \mathbf{X}'_{irt} and \mathbf{Z}'_{rt} are the same as in equation (2). As usual robust standard errors are clustered at the regional level in all regressions.

In our first stage the change in *Crime_News_Exposure* is driven by the compliers, i.e. those individuals who decide to change channel in response to the digital reform. We identify a local average treatment effect (LATE) for those individuals who changed their viewing habits because of the digital introduction. In particular, because we observe *Crime_News_Exposure* at a higher than individual level, the estimates delivered by our

model are a mixture of a zero effect for individuals in treated regions who did not change channel and a possibly non-zero effect for those who did change channel.

OLS estimates as well as IV ones of equation (4) are reported in **Table 5**. These are year level regressions where the exposure variable is calculated as the average monthly number of crime news broadcast during the year before each survey. Both OLS and IV estimates on *Exposure* are positive. OLS are just slightly larger than IV ones. This is due a first stage almost perfectly predicting *Crime_News_Exposure*. In fact, once we account for region and time fixed effects, almost the entire variation in the exposure to crime news is explained by the shift in viewing shares across TV channels induced by the digital TV introduction.

When we allow the effect to vary across age groups our IV estimates (column 6) indicate that, similarly to the reduced-form case, the effect gets stronger (more negative) with age, and estimates are significant for individuals aged above 65. According to these estimates a one standard deviation decrease in the exposure to crime news (equivalent to 13 fewer news items per month) is associated with a 5.7 percentage point decrease in the probability of reporting crime as priority problem for individuals aged above 65. That is about a 9.2 percent drop with respect to their average likelihood of being concerned about crime of 0.62. These results suggest that, over and above actual crime levels (crime rates is included as control in all specifications), people do respond to changes in the number of crime news they are exposed to in the intuitive way. That is, they are more concerned about crime when TV broadcasts higher number of crime news, regardless of the actual amount of crime.

7. Crime Perceptions and Voting Behaviour

In this section we want to analyse the potential implications that the change in perceptions induced by the introduction of digital TV might have for voting behaviour.

Issue bias and agenda setting. To do so we need to discuss whether reporting a particularly high number of crime news might be a rational strategy for TV channels under the influence of Berlusconi with the objective to increase people's concern about crime and eventually gain electoral advantage (increase voting for the centre-right coalition). Such strategy, called issue selection or agenda setting within the political economy literature (Larcinese, Puglisi and Snyder, 2011), is realised when media choose which type of information to report (for example crime events) in order to influence the perception of citizens about which issues are relevant and to what extent. Indeed, quoting Larcinese et al. (2011) "editors and journalists have a large degree of freedom in deciding what is newsworthy and what is not, and these choices influence the perception of citizens about which issues are relevant and to what extent". If this applies, a coalition that can influence or partially control the media might be incentivised to make a particular topic a salient one in the electorate's mind if the topic is perceived by the electorate as an area of specific expertise of the coalition. When, in other words, the coalition is said to "own" that specific topic. In the USA, for example, the majority of people believe that the Republican Party is better suited at dealing with national security issues while the Democratic Party is better at dealing with health care and social issues (Larcinese et al. 2011).

To gather evidence on whether crime is an issue "owned" by the centre-right coalition in Italy we use data from the Italian National Election Study Survey (ITANES), a survey similar in content to the American National Election Study Survey in the US and representative of the entire Italian population. It turns out that to the question "What coalition would be better able to face the problem: crime?", 51% of the respondents report the centre-right coalition, only 20% the centre-left and the remaining 29% say that is indifferent. These numbers suggest that making the topic crime a salient one in the electorate's mind might be a rational strategy for the Italian centre-right coalition, which indeed has often based its past electoral campaigns around issues such as crime and security.

During the period of digital TV introduction no national elections took place. Yet, we can look at the 2008 national election and use survey data to: a) study the relationship between crime concern and the probability of voting for the centre-right coalition; and b) use those estimates to, under some assumptions, predict the potential effect of the lower exposure to partisan TV channels on the likelihood to vote for the centre-right coalition.

We employ data from the post-2008 election wave of the Italian National Election Study Survey (ITANES) introduced above. Apart from the usual socio-demographic characteristics, the survey asks which party the person voted for in the 2008 national elections as well as the perceived most important problem in the country at the time of the elections. We regress an indicator for the individual reporting having voted for the centre-right coalition (*CR_Vote*) on a dummy equal one if the person reports *crime* as the most important problem in the country (*Crime_Concern*). **Table 6** reports linear probability estimates from such regression. Individuals who consider crime as the most important problem are almost 25 percentage point more likely to vote for the centre-right coalition than those who do not think so. These results are in line with the evidence shown above that the majority of Italian citizens believe that the centre-right coalition has a competitive advantage, over the centre-left one, in tackling crime. Estimates of the coefficient are stable to the inclusion of individual characteristics and region fixed effects. Although we cannot give causal interpretation to these results, they do point in the direction of a relationship in the Italian context between having crime as a major concern and the likelihood of voting for the centre-right coalition.

Predicting changes in voting behaviour. We use these estimates to run an illustrative exercise of the potential effect of the change in crime concern induced by the lower exposure to partisan channels on the probability of voting for the centre-right coalition. We focus on individuals aged above 65, the population group for which we found stronger effect of the Digital Reform. The estimated coefficient of the effect of the switch-off on crime concern

was -0.052 (**Table 3**, column 6). Let us suppose a decrease of the same magnitude for the variable *Crime_Concern* from the regression above. Using the estimated relationship between considering crime as most important problem in the country (*Crime_Concern*) and the propensity to vote for the centre-right Berlusconi's coalition (*CR_Vote*) we obtain that the induced change in the latter likelihood would be equal to 1.3 percentage points, or 2.83 percent with respect to the average probability of centre-right vote (0.46). According to these numbers about 3% of 2008 national election centre-right voters aged above 65 could have been induced to change their vote by the decrease in crime concern caused by digital TV introduction. Individuals aged above 65 represent about one out of four of the Italian population entitled to vote and they have on average higher turnout rates than younger individuals. For such reasons we argue that the change in crime perceptions induced by the decreased exposure to partisan channels linked to Berlusconi might have relevant effects on voting outcomes.

8. Concluding Remarks

People base a good part of their behaviours on beliefs and perceptions. Thus, studying the role played by media in the formation of such beliefs and perceptions is particularly relevant for our understanding of individual and collective behaviours. In this paper we investigate the influence of news media, and in particular partisan ones, on crime perceptions and voting behaviour. To do so, we exploit a natural experiment in the Italian television market where the staggered introduction of the digital TV signal across regions led to a drastic drop in the viewing shares of partisan channels and, as a consequence, to a lower exposure to potentially biased news about crime.

We find that the lower exposure to partisan news channels led individuals to revise their perceptions about crime as one of the priority problem in Italy downward. The effect is mainly driven by individuals from older cohorts. Older individuals watch more TV and use

alternative sources of information less frequently - i.e. internet, radio and newspapers – than their younger counterparts. They were therefore likely to be more exposed to the potential bias before the digital introduction and to place a higher weight on information coming from television. We then attempt to estimate the effect of exposure to crime news on crime perceptions. To do so, we combine unique data on: a) region-specific monthly viewing shares of each TV channel during prime-time news programs; and b) the monthly amount of crime-related news reported by each TV channel during prime-time news programs. After using the switch to digital signals to predict exogenous changes in the exposure to crime news we attempt to estimate the effect on crime perceptions through a two-step method. Findings suggest that the digital reform induced a reduction in exposure to crime news of about 12 percent of the average value and that a 1 standard deviation decrease in exposure to crime news is associated with a 9.2 percent decrease in crime concern, among those aged above 65. Finally, we assess whether the change in crime perceptions induced by the lower exposure to partisan channels might be relevant for voting behaviour. Using data from an electoral survey collected just before the introduction of digital TV, we predict that the reduction in crime concern caused by the digital reform might induce about 3% of those aged above 65 who voted for the centre-right coalition to change their vote.

This paper contributes to the literature on persuasive communication in economics by providing causal evidence of the impact of information provided by motivated agents (partisan media) on the beliefs and perceptions individuals hold. Further, using unique data on TV viewing shares we identify both an intention to treatment effect of the increase in the number of TV channels and a local average treatment effect driven by those individuals who actually “change” channel in response to the increase in their number. Finally, we contribute to the growing literature that looks at the effect of (biased) news media on political outcomes by shedding light on one of the possible mechanisms through which media manage to influence voting decision and policies: the manipulation of individuals’ perceptions with respect to politically salient topics. We provide evidence of this phenomenon by studying the

Italian case where a specific group of media tends to over-report crime news. As a consequence, individuals' perceptions of crime as a priority problem might be distorted, and indeed we find that people consistently over-estimate crime rates. We show that once the exposure to such news programs is reduced, the level of crime concern decreases, and does it in particular for those individuals, the elderly, who are likely to base a larger amount of their beliefs on information coming from television. Since new digital channels are mostly full-entertainment, our results suggest that, in this specific case, people's beliefs might have become more accurate once exposed to a lower amount of information. Finally it is worth noticing that individuals aged above age 52, for which we find a significant effect, make up about 30 percent of Italian voting population. Hence, for an office-seeking politician, being able to influence their beliefs about politically salient issues might have relevant implications in terms of voting outcomes.

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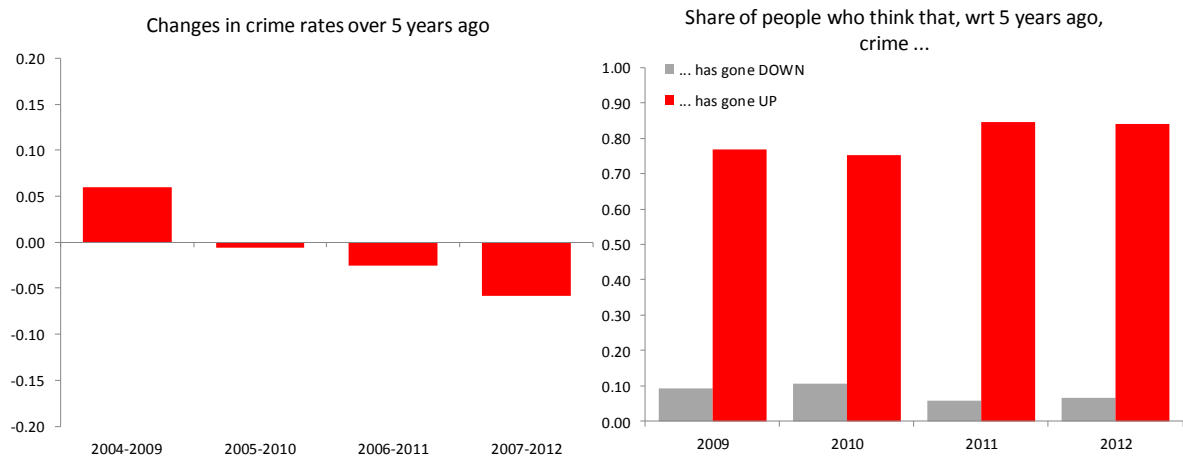
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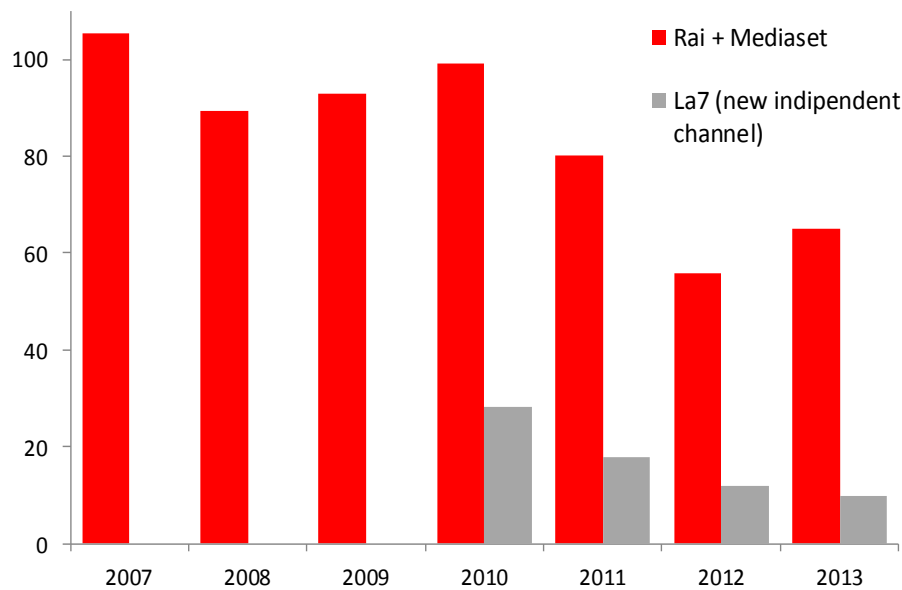
FIGURES

Figure 1. Actual crime vs crime perceptions in Italy: 2004-2012



Note. The left panel of the figure reports changes in crime rates between 2004 and 2012. Source: Authors' elaboration on Italian Home Office Data. The right panel reports the share of people by answer to the question "Do you think that, with respect to five years ago, crime has gone up/gone down/ stayed the same/ do not know" from 2009 to 2012. The shares referring to the answers "stayed the same" and "do not know" are not reported. Source: Eurostat (left panel) and UNIPOLIS Foundation (right panel).

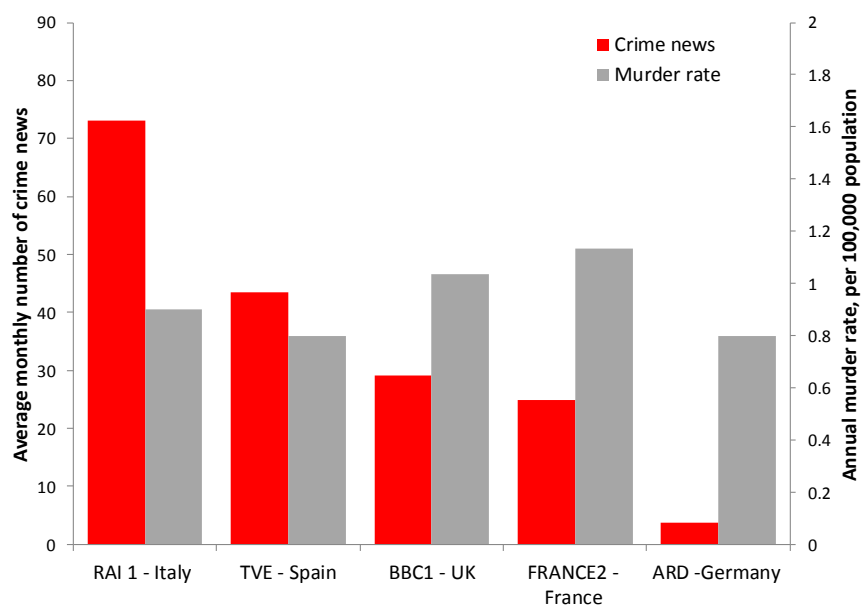
Figure 2. – Intensity of crime news reporting: Main Traditional Channels (Rai + Mediaset) vs New Independent Channel (La7)



Note. The graph shows the average monthly number of crime news broadcast during prime-time news programs respectively by main traditional channels (Rai + Mediaset) and the new independent channel (La7). Data for LA7 channel are available only from year 2010 onwards.

Source: Authors' elaboration from Pavia Observatory data.

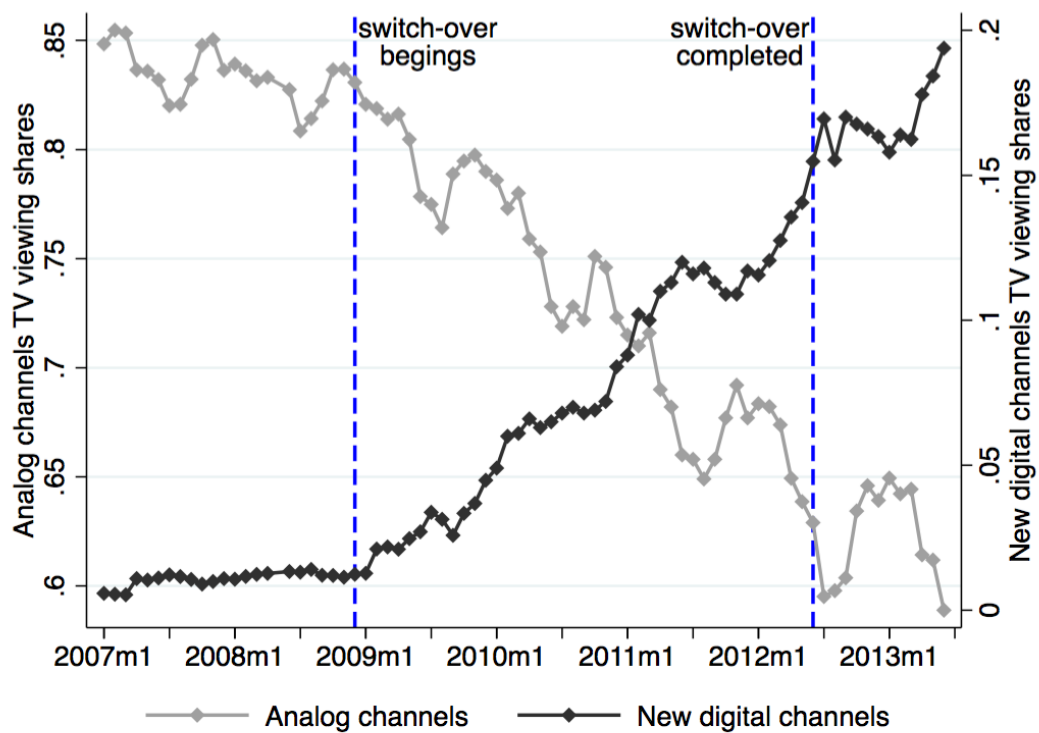
Figure 3. – Intensity of crime news reporting and murder rates: selected countries



Note. The graph compares the average monthly number of crime news broadcast during prime-time news programs by the main public TV channel with the annual murder rate in a selected number of European countries.

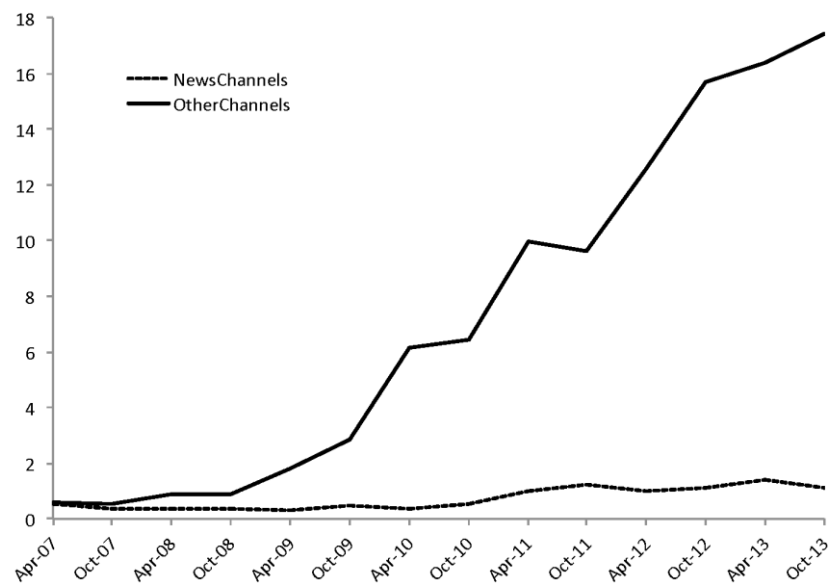
Sources: Pavia Observatory (crime news data) and Eurostat (murder rates). Years: 2010-2012.

Figure 4. - Viewing shares during prime-time (18:00-20:30): Main traditional analogue channels (Rai + Mediaset) vs new digital channels



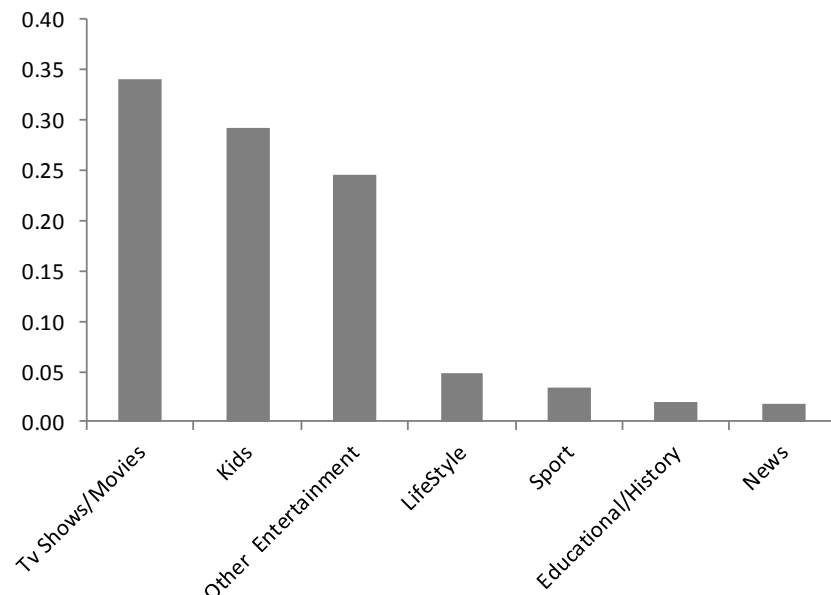
Note. The figure plots monthly TV viewing shares during prime-time for main traditional analogue channels (Rai and Mediaset) and new digital channels between 2007 and 2013. Source: authors' elaboration on AUDITEL data.

Figure 5. - Viewing shares: new digital channels also broadcasting news programs vs full-entertainment digital channels



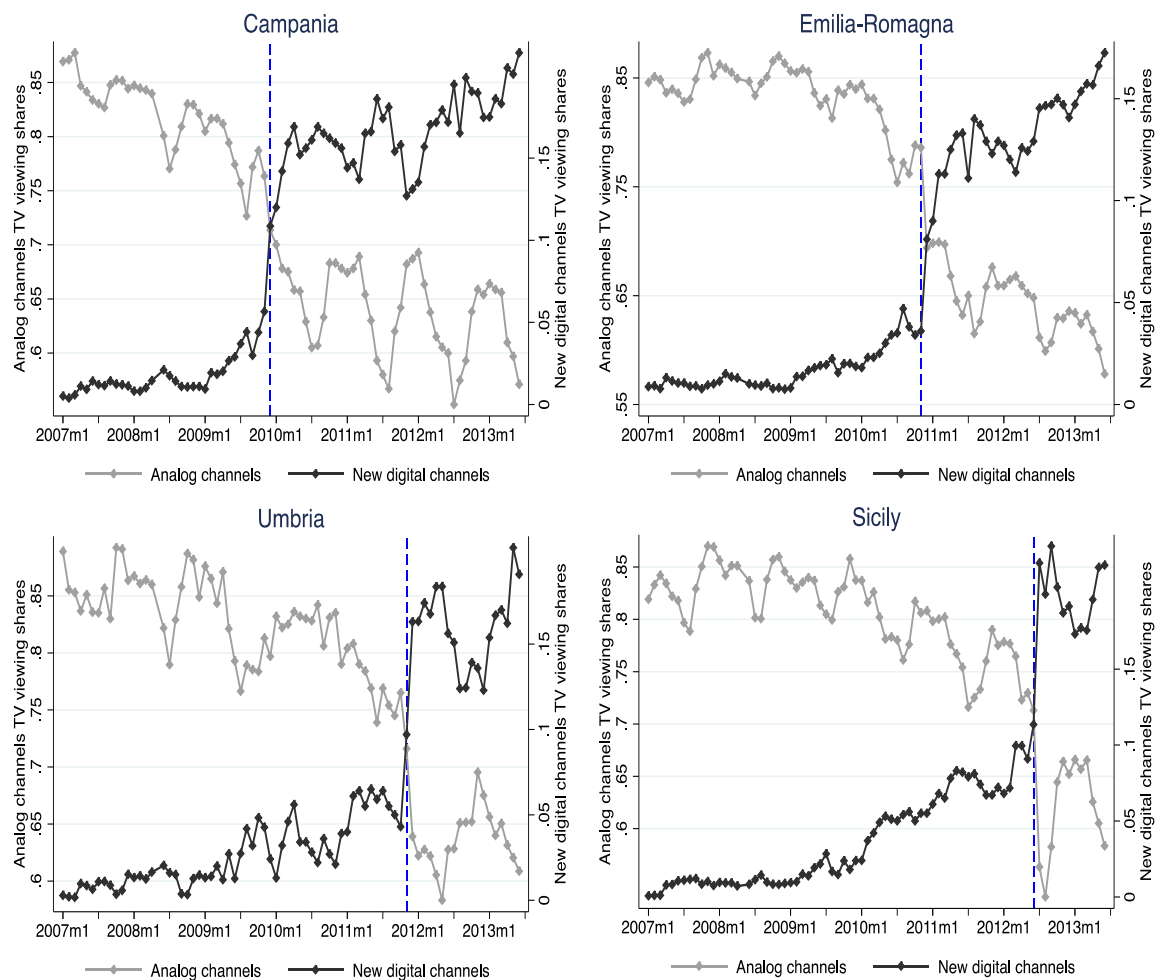
Note. The figure shows the evolution of viewing shares (prime-time) for new digital channels split into channels also broadcasting news programs (news digital) and full-entertainment (other digital channels). Source: authors' elaboration on AUDITEL data.

Figure 6. – Content of new digital channels: composition of total viewing shares



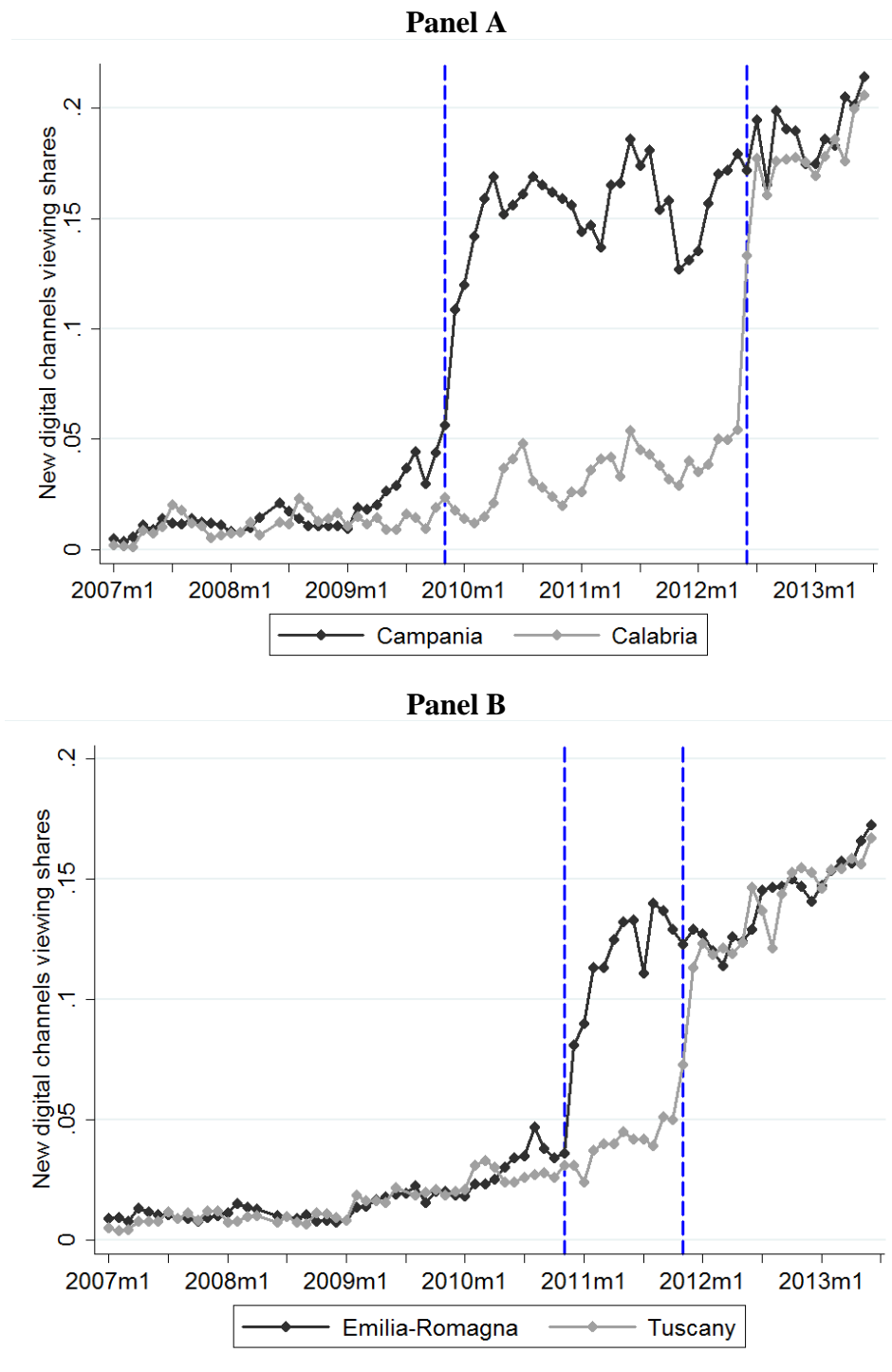
Note. The figure reports the total viewing of new digital channels divided by type of channel, for year 2010. The interpretation of the y axis scale is that, for example, almost 35% of the entire digital viewing share during year 2010 refers to digital channels broadcasting TV shows or movies.

Figure 7. - Viewing shares (prime-time) around switch-over to digital signal deadlines in selected regions



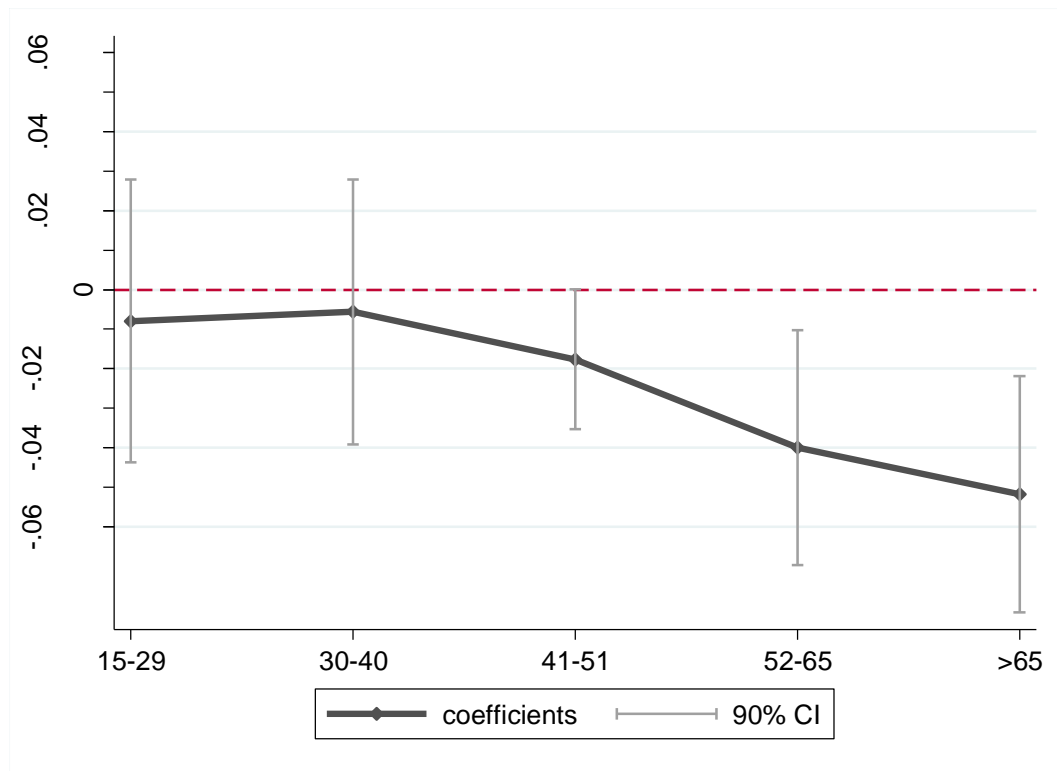
Note. The figure reports the evolution of monthly viewing shares (prime-time) before and after the switch-over to digital TV signal in 4 selected regions. The light grey lines indicate viewing shares of main traditional analogue channels while the dark grey ones indicate those of new digital channels. The dashed vertical lines indicate switch-off dates for each specific region. Source: authors' elaboration on AUDITEL data.

Figure 8. - Discontinuity in digital channels viewing shares (prime-time) around switch-over to digital signal deadlines: selected pairs of neighboring regions



Note. The figures show the evolution of monthly TV viewing shares (prime-time) of new digital channels in 2 pairs of neighboring regions, before, during, and after the switch to digital signal. The dashed vertical lines indicate switch-off dates. In particular in Panel A the first line corresponds to the deadline in region Campania (12/2009) while the second to the deadline in region Calabria (06/2012). In Panel B the first line corresponds to the deadline in region Emilia-Romagna (11/2010) while the second to the deadline in region Tuscany (11/2011). Source: authors' elaboration on AUDITEL data.

Figure 9. - Reduced-form effect of the Digital Reform on crime perceptions: heterogeneity across age groups

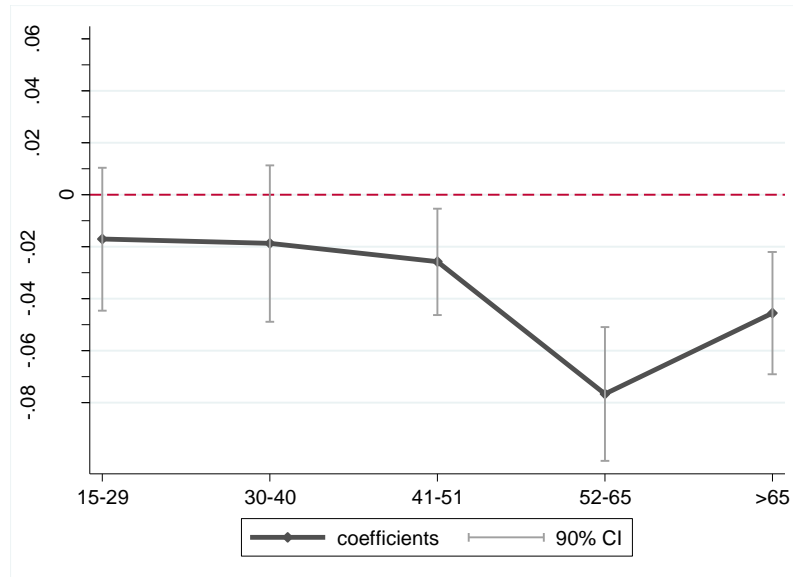


Note. The figure plots estimates and 90% confidence intervals by age groups from a LPM regression of *Crime_Concern* on a post digital switch variable (*Digital_Switch*) and controls. *Crime_Concern* is an indicator for the individual reporting crime as one of the 3 priority problems in Italy. *Digital_Switch* equals the number of months (as fraction of the 12 before each survey) elapsed since region *r* experienced the switch to digital signal. The specification is the same used in column 6 of Table 3. Individual and family controls include: gender, age, education, set of dummies of occupational status, family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regressions include year and region fixed effects.

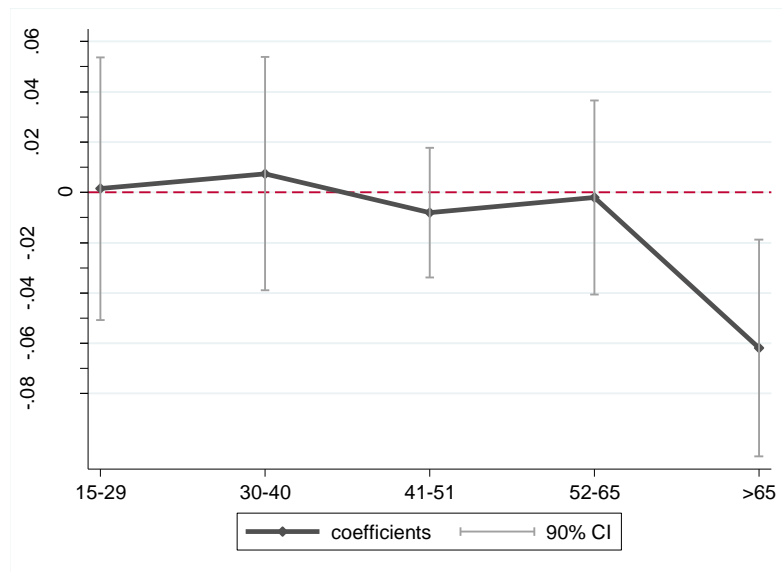
90% confidence intervals based on robust standard errors clustered by region are reported.

Figure 10. - Reduced-form effect of the Digital Reform on crime perceptions: heterogeneity by gender and age groups

Panel A: Females



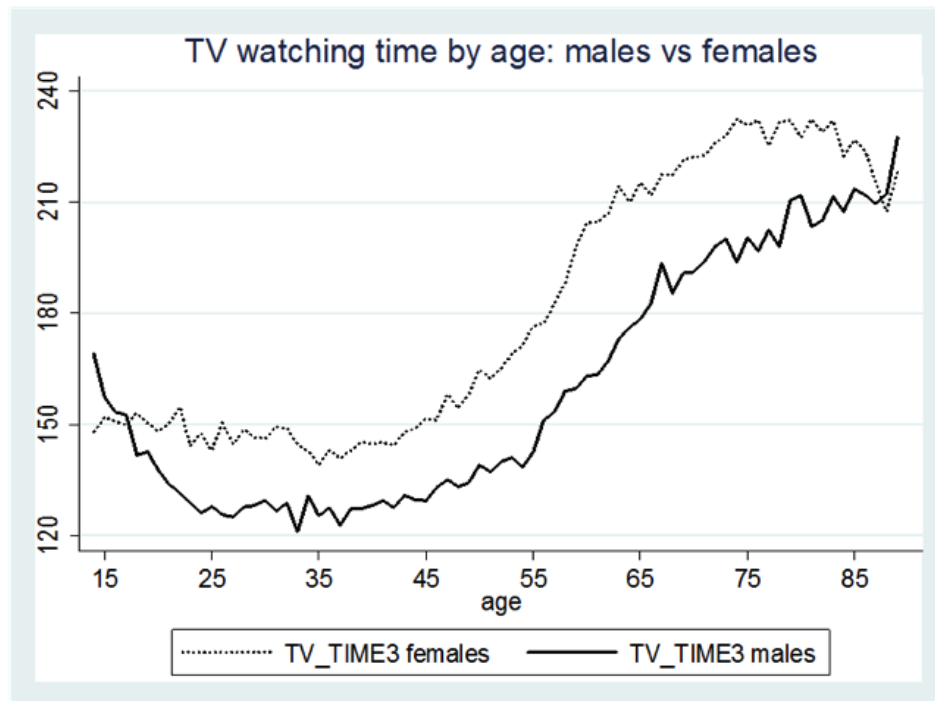
Panel B: Males



Note. The figure plots estimates and 90% confidence intervals by gender and age groups from a LPM regression of *Crime_Concern* on a post switch-over variable (*Digital_Switch*) and controls. *Crime_Concern* is an indicator for the individual reporting crime as one of the 3 priority problems in Italy. *Digital_Switch* equals the number of months (as fraction of the 12 before each survey) elapsed since region *r* experienced the switch to digital signal. The controls included are the same as those in column 6 of Table 3. In particular, individual and family controls include: age, education, set of dummies of occupational status, family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regressions include year and region fixed effects.

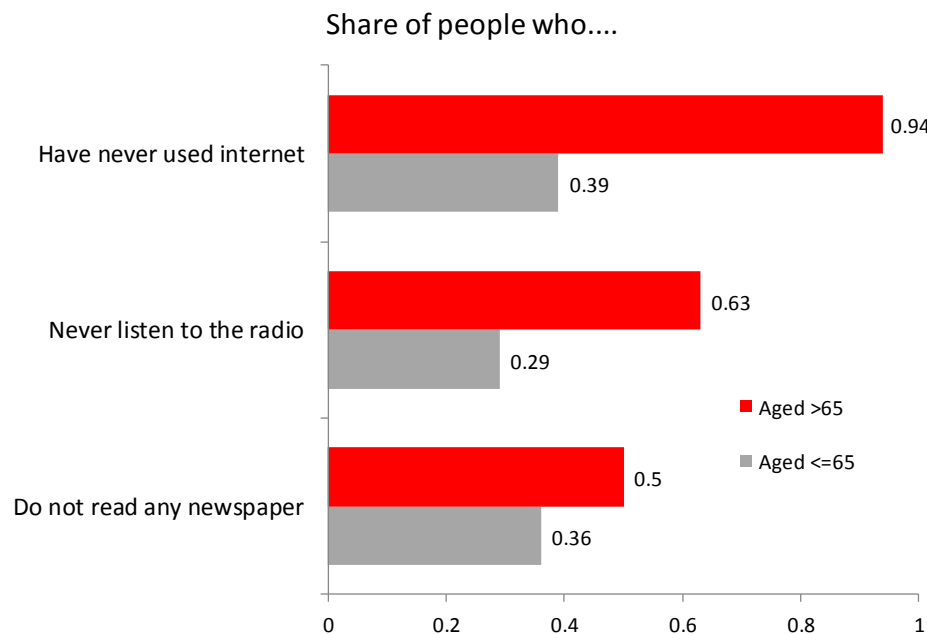
90% confidence intervals based on robust standard errors clustered by region are reported.

Figure 11. - Average daily TV watching time: by gender and age



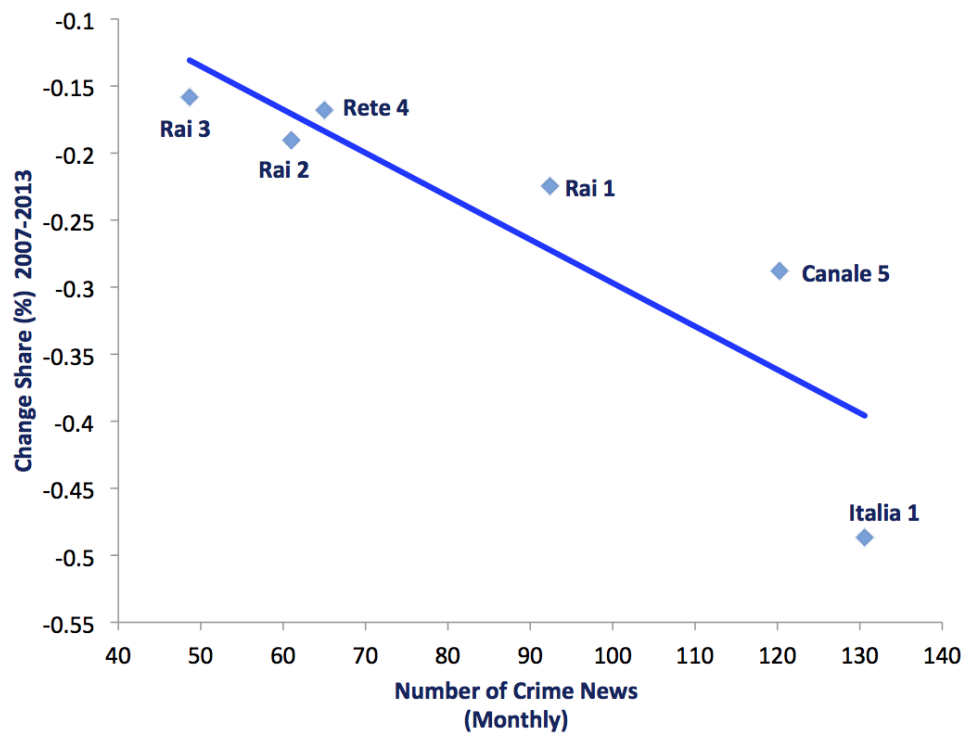
Note. The figure plots average (reported) daily TV watching time (in minutes) for males and females along the age distribution. The estimates are obtained by pooling various waves of the Multipurpose Household Survey (ISTAT).

Figure 12. - Use of alternative sources of information



Note. Source: authors' elaboration on data from the Multipurpose Household Survey (ISTAT).

Figure 13. – Crime news reporting intensity and viewing share drop during Digital Reform



Note. The figure plots monthly average number of crime news against the change in TV viewing shares (both between 2007-2013) for each of the six main traditional channels.
Source: authors' elaboration on AUDITEL data.

TABLES

Table 1. - Balancing test: *early* vs *late* switcher regions

	<i>Early Switchers</i>	<i>Late Switchers</i>	Difference	p-value
Unemployment rate	0.063	0.064	-0.002	0.923
Employment rate	0.636	0.629	0.008	0.866
Share of tertiary educated	0.084	0.085	-0.001	0.121
Share of immigrant residents	0.039	0.042	-0.004	0.756
Share of internet users	0.388	0.355	0.033	0.213
GDP per capita (euros)	25,900	23,976	1924	0.550
Population density (people by square km)	186.3	182.9	-3.4	0.950
Persons cited for crimes (per 100,000 people)	1,149	1,137	-13	0.933
Murder rate (per 100,000 people)	1.010	0.881	0.129	0.546

Note. The table reports means of various characteristics for two groups of regions: those that switched to digital before or at December 2009 (*early switchers*) and those that switched to digital from January 2010 onwards (*late switchers*). Column 4 reports the p-values for tests of the difference between means in the two groups.

Table 2. - Effect of the Digital Reform on TV viewing shares

	(1)	(2)	(3)	(4)
Panel A: Traditional Channels				
Digital Switch	-0.087*** (0.010)	-0.086*** (0.010)	-0.085*** (0.010)	-0.081*** (0.008)
F-stat: Digital Switch	79.25	74.09	73.42	89.93
Panel B: New Digital Channels				
Digital Switch	0.072*** (0.007)	0.067*** (0.006)	0.064*** (0.007)	0.065*** (0.006)
F-stat: Digital Switch	103.4	116.5	94.45	110.8
Panel C: Satellite Channels				
Digital Switch	0.007 (0.004)	0.009** (0.004)	0.009* (0.005)	0.007 (0.005)
F-stat: Digital Switch	2.732	4.559	3.473	2.370
Panel D: Other Channels				
Digital Switch	0.012*** (0.004)	0.012*** (0.004)	0.014*** (0.004)	0.012** (0.004)
F-stat: Digital Switch	8.728	9.352	11.83	7.513
Region fixed effects	X	X	X	X
Linear time trend	X			
Year fixed effects		X		
Month*Year fixed effects			X	X
Region-specific linear trends				X
Observations	1,519	1,519	1,519	1,519

Note. The table reports estimates from regressions of TV viewing shares (during prime-time) on *Digital_Switch*. The level of observation is the viewing share by channel*month*region. *Digital_Switch* equals one if the region *r* experienced the switch-over to digital signal at time (month) *t* or before. Each panel reports estimates of the TV viewing shares (prime-time) of a different group of channels. Rai and Mediaset channels are indicated as Traditional Channels.

Robust standard errors clustered at the region level are reported in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3. - Reduced-form effect of the Digital Reform on crime perceptions

	Digital: Indicator of switch-off occurred		Digital: Share of months after switch-off			
	(1)	(2)	(3)	(4)	(5)	(6)
DigitalSwitch	-0.014 (0.010)					
DigitalSwitch * Aged 15-29		-0.000 (0.015)	-0.006 (0.020)	-0.008 (0.020)	-0.008 (0.018)	-0.008 (0.022)
DigitalSwitch * Aged 30-40		0.001 (0.015)	-0.006 (0.021)	-0.005 (0.020)	-0.005 (0.022)	-0.006 (0.020)
DigitalSwitch * Aged 41-51		-0.009 (0.009)	-0.015 (0.014)	-0.016 (0.013)	-0.016 (0.011)	-0.018 (0.011)
DigitalSwitch * Aged 52-65		-0.025 (0.017)	-0.040* (0.022)	-0.039* (0.022)	-0.039* (0.020)	-0.040** (0.018)
DigitalSwitch * Aged >65		-0.035*** (0.012)	-0.050*** (0.012)	-0.051*** (0.011)	-0.050*** (0.011)	-0.052** (0.018)
Crime rate: all					0.097 (0.091)	
Crime rate: violent & drug						0.205** (0.075)
Crime rate: property						0.035 (0.081)
Crime rate: other						-0.025 (0.057)
Individual & family controls				X	X	X
Region time-varying controls					X	X
Region fixed effects	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X
Observations	139,165	139,165	139,165	139,165	139,165	139,165

Note. The table reports estimates of the reduced-form effect of the introduction of digital TV on perceptions about crime. Estimates are from a linear probability model of *Crime_Concern* on a post switch-over variable (*Digital_Switch*). *Crime_Concern* is an indicator for the individual reporting crime as one of the 3 priority problems in Italy. In order to take into account the effective time passed since the region has switched to the digital signal we employ two alternative versions of the variable *Digital_Switch*. The first, which we employ in column 1 and 2, is a dummy that equals one if the region *r* experienced the switch-over to digital signal at time *t* or before. The second, which we employ from column 3 onwards, is the number of months (as fraction of the 12 before each survey) elapsed since region *r* experienced the switch to digital signal. Crime rates are calculated as logs of crimes per 10'000 individuals. Individual and family controls include: gender, age, education, set of dummies of occupational status, family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regressions include year and region fixed effects. Robust standard errors are clustered by region and reported in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4. - First-stage estimates: effect of Digital Reform on crime news exposure

					No residual channels	Yearly data
	(1)	(2)	(3)	(4)	(5)	(6)
Digital Switch	-15.895*** (4.515)	-8.306*** (1.632)	-8.436*** (1.388)	-8.130*** (1.172)	-7.783*** (1.083)	-8.154*** (1.319)
F-stat: Digital Switch	12.39	25.92	36.92	48.16	51.64	38.23
Region fixed effects	X	X	X	X	X	X
Linear time trend	X					
Year fixed effects		X				X
Month*Year fixed effects			X	X	X	
Region-specific lin. trends				X	X	X
Observations	1,406	1,406	1,406	1,406	1,406	133

Note. The table reports estimates of the effect of the switch to digital signal on the exposure to crime news. Estimates are from regressions of *Crime_News_Exposure* on a post switch-over indicator *Digital_Switch*. The unit of observation is the TV viewing share by TV channel, month and region. *Crime_News_Exposure* is the summation, over all TV channels, of the number of crime news items broadcast during period t weighted by the region-specific viewing share in the region r during period t. *Digital_Switch* is a dummy that equals one if the region r experienced the switch-over to digital signal at month t or before. F-stats of the excluded instrument are reported.

Robust standard errors are clustered by region and reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. - OLS and IV estimates of the effect of crime news exposure on crime perceptions

	OLS (1)	OLS (2)	OLS (3)	IV (4)	IV (5)	IV (6)
Exposure	0.0028** (0.0013)	0.0028* (0.0015)		0.0025 (0.0019)	0.0022 (0.0017)	
Exposure * Aged 15-29			0.0014 (0.0015)			0.0013 (0.0024)
Exposure * Aged 30-40			0.0018 (0.0013)			0.0011 (0.0020)
Exposure * Aged 41-51			0.0024* (0.0014)			0.0021 (0.0019)
Exposure * Aged 52-65			0.0033** (0.0015)			0.0035 (0.0026)
Exposure * Aged >65			0.0041** (0.0015)			0.0044** (0.0019)
F-stat (excluded instr.)				29.80	29.29	18.76
Individual & family controls		X	X		X	X
Region time-varying controls		X	X		X	X
Region fixed-effects	X	X	X	X	X	X
Year fixed-effects	X	X	X	X	X	X
Observations	139,165	139,165	139,165	139,165	139,165	139,165

Note. The table reports OLS and IV estimates of regressions of *Crime_Concern* on *Crime_News_Exposure* (simply *Exposure* in the table). *Crime_Concern* is an indicator for the individual reporting crime as one of the 3 priority problems in Italy. *Crime_News_Exposure* is the summation, over all TV channels, of the number of crime news items broadcast during period *t* weighted by the region-specific viewing share in the region *r* during period *t*. Regressions are estimated on yearly data. In column 4, 5 and 6 we employ the switch to digital signal as an instrument for *Crime_News_Exposure*. In column 6 the digital switch is interacted with each of the age group dummies. F-stats of the excluded instrument are reported in columns 4, 5 and 6. Crime rates are calculated as logs of crimes per 10'000 individuals. Individual and family controls include: gender, age, education, set of dummies of occupational status, family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regressions include year and region fixed effects. Robust standard errors are clustered by region and reported in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6. - Concern about crime and likelihood of voting for the centre-right coalition

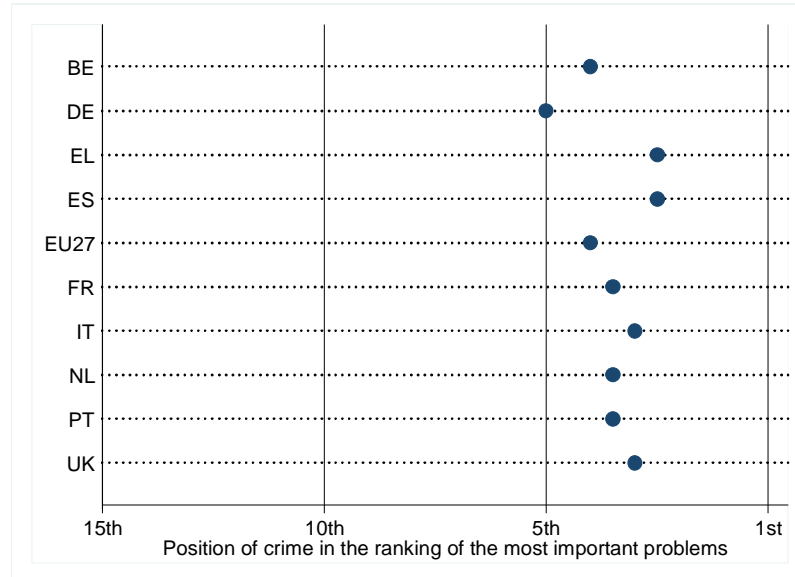
	Voted for the centre-right coalition		
	(1)	(2)	(3)
Crime Concern	0.249*** (0.028)	0.248*** (0.030)	0.246*** (0.029)
Individual controls		X	X
Region fixed effects			X
Observations	1,652	1,637	1,637
R-squared	0.030	0.071	0.098

Note. The table reports estimates from a linear probability model of an indicator for the individual having voted for the centre-right coalition in 2008 election on a dummy for reporting crime as most important problem in the country at the moment of the elections. Individual controls include: age, male dummy, level of education, dummy for married and a set of dummies of occupational status. Sample: ITANES Survey (2008)

Robust standard errors are clustered by region and reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.

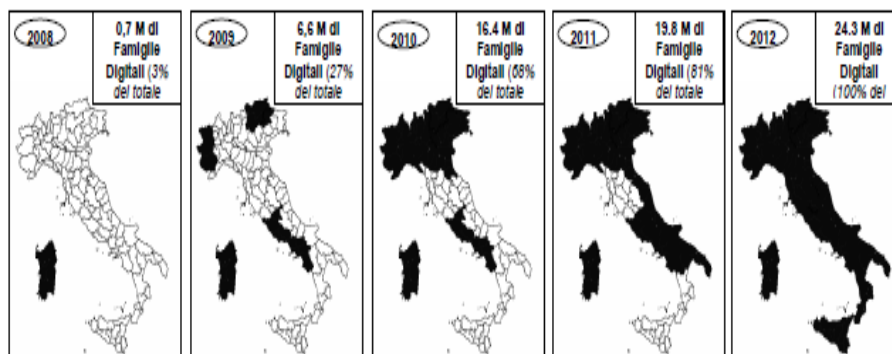
Appendix Figures

Figure A1. - Concern about crime in selected European countries (2008-2010)



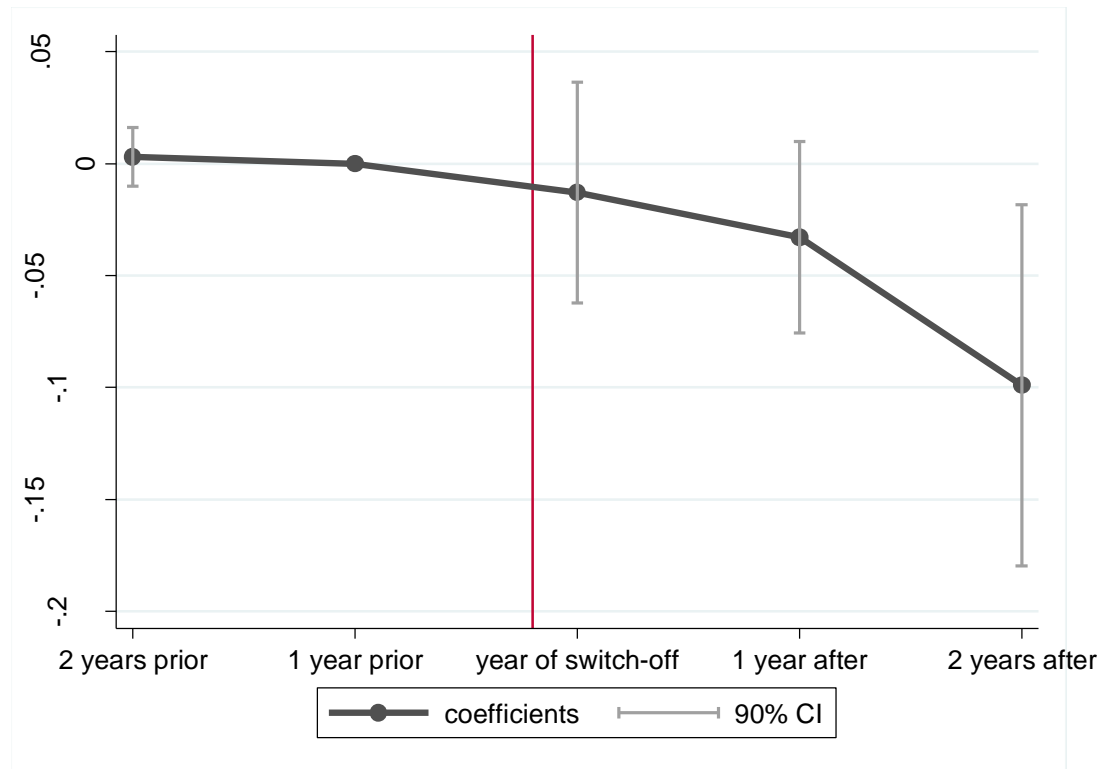
Note. This figure presents how crime is ranked, from 1st to 15th, among a list of major problems in selected European countries. The ranking goes from 15th, indicating the least mentioned topic, to 1st, indicating the most mentioned topic. Sources: Authors elaboration from the 2008 and 2010 waves (pooled) of the Eurobarometer Survey.

Figure A2. - Timing switch-over Italian Regions



Note. Sources: Italian Ministry of Communication.

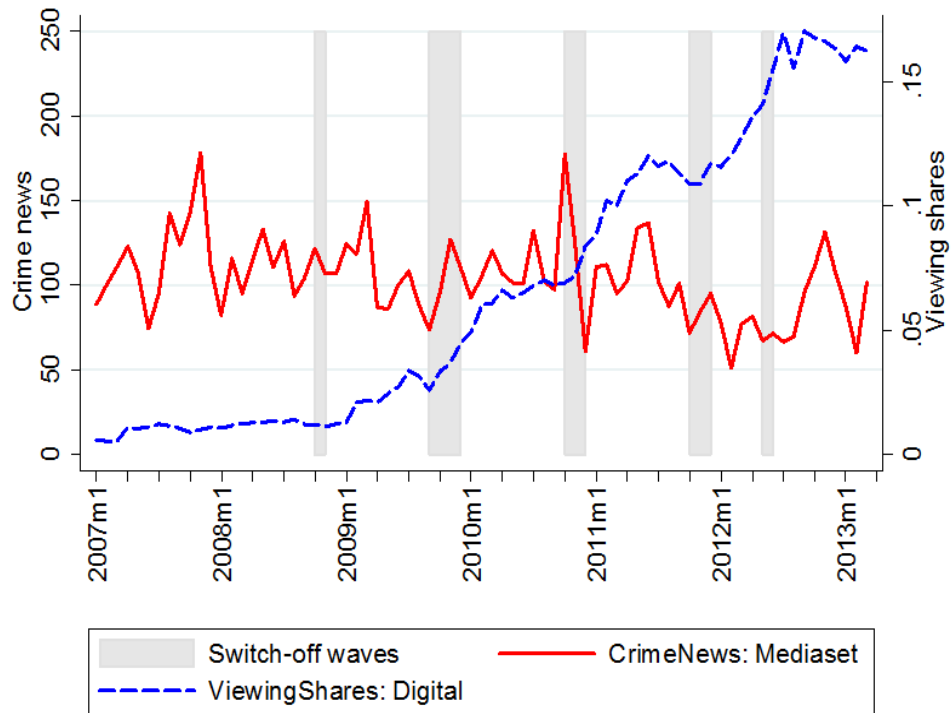
Figure A3 - Timing of change in perceptions of local area crime after the switch-over to digital TV signal.



Note. The figure plots estimated coefficients and 90% confidence intervals from regression of the perception of crime level in the local area (*Crime_Risk_Local*) on a set of dummies from $t-2$ to $t+2$, where $t=0$ is the year when the switch-over to digital signal has occurred. The outcome variable ranges from 1 (crime absent) to 4 (crime level very high) and is collected at the household level. Family controls include: family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regression include year and region fixed effects.

90% confidence intervals based on robust standard errors clustered by region are reported.

Figure A4. - Crime news reporting in Berlusconi-owned channels and viewing shares of new digital channels



Note. The figure plots the average number of crime news (per month) on TV channels owned by Berlusconi (Mediaset) against the viewing shares (prime-time) of new digital channels, from 2007 to 2013. The grey shaded areas indicate different waves of switch from analogue to digital signal.
Source: authors' elaboration on AUDITEL data and Pavia Observatory data.

Appendix Tables

Table A1. - Effect of Digital Reform on total TV watching time

	Do watch TV		Average viewing time per day	
	(1)	(2)	(3)	(4)
DigitalSwitch * Aged 15-29	-0.007 (0.005)	-0.008 (0.005)	2.672 (2.801)	1.532 (2.790)
DigitalSwitch * Aged 30-40	-0.013 (0.010)	-0.012 (0.009)	1.105 (2.623)	-0.117 (2.195)
DigitalSwitch * Aged 41-51	-0.003 (0.007)	-0.002 (0.008)	-2.073 (2.982)	-3.138 (2.635)
DigitalSwitch * Aged 52-65	-0.005* (0.003)	-0.003 (0.002)	-3.881 (3.028)	-0.647 (2.487)
DigitalSwitch * Aged >65	0.001 (0.004)	0.002 (0.004)	-1.296 (4.591)	0.146 (4.891)
Individual and family controls		X		X
Region time-varying controls		X		X
Region fixed effects	X	X	X	X
Year fixed effects	X	X	X	X
Observations	140,349	140,349	114,103	114,103

Note. The table investigates whether the switch to digital signal induced any change in the total amount of time people spend watching TV by regressing two measures of TV watching behavior on a post switch-over variable. *DigitalSwitch* is the number of months (as fraction of the 12 before each survey) elapsed since region *r* experienced the switch to digital signal. Column 1 and 2 report estimates from regressions where the outcome is an indicator for the individual watching at least some TV (columns 1 and 2), while columns 3 and 4 report estimates where the outcome is the average daily TV viewing time for those who watch at least some TV. Individual and family controls include: age, education, set of dummies of occupational status, family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regressions include year and region fixed effects.

Estimates show no evidence of individuals from any of the age groups varying their total TV watching time after the introduction of the digital signal.

Robust standard errors are clustered by region and reported in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A2. - Effect of Digital Reform on TV viewing shares: all time-slots

Time slot:	18:00-20:30 Prime-time news (1)	All day (2)	12:00-14:59 Lunch-time news (3)	7:00-11:59 (4)	15:00-17:59 (5)	20:31-23:59 (6)
<i>Panel A: Traditional Channels</i>						
Digital_Switch	-0.085*** (0.010)	-0.085*** (0.010)	-0.064*** (0.010)	-0.120*** (0.019)	-0.103*** (0.014)	-0.078*** (0.010)
F-stat: Digital Switch	73.42	68.97	43.92	41.06	52.13	62.04
<i>Panel B: New Digital Channels</i>						
Digital_Switch	0.064*** (0.007)	0.068*** (0.005)	0.057*** (0.005)	0.094*** (0.010)	0.086*** (0.006)	0.062*** (0.006)
F-stat: Digital Switch	94.45	154.1	140.5	90.33	179.1	110.3
<i>Panel C: Satellite Channels</i>						
Digital_Switch	0.009* (0.005)	0.010* (0.006)	0.010* (0.005)	0.009 (0.008)	0.009 (0.008)	0.009 (0.008)
F-stat: Digital Switch	3.473	3.177	3.613	1.406	1.401	1.222
<i>Panel D: Other Channels</i>						
Digital_Switch	0.014*** (0.004)	0.013*** (0.004)	0.006 (0.004)	0.025** (0.010)	0.020*** (0.006)	0.011** (0.004)
F-stat: Digital Switch	11.83	9.460	1.677	6.504	10.77	7.251
Month*year fixed effects	X	X	X	X	X	X
Region fixed effects	X	X	X	X	X	X
Observations	1,519	1,519	1,519	1,519	1,519	1,519

Note. The table reports estimates from regressions of TV viewing shares on *Digital_Switch* for different time slots during the day. The level of observation is the viewing share by channel*month*region. *Digital_Switch* equals one if the region *r* experienced the switch-over to digital signal at time (month) *t* or before. In each panel the TV viewing shares of a different group of channel is adopted as outcome variable. Month-by-year and region fixed effects are included in all regressions, as in column 3 of Table 2. Rai and Mediaset channels are indicated as Traditional channels.

Robust standard errors clustered at the region level are reported in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A3. - Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Obs
Individuals					
Male	0.48	0.50	0	1	139,165
Age	49	19	15	95	139,165
Married	0.60	0.49	0	1	139,165
Tertiary education or more	0.10	0.30	0	1	139,165
Employed dummy	0.43	0.49	0	1	139,165
Retired dummy	0.22	0.41	0	1	139,165
Dummy for not watching TV at all	0.05	0.21	0	1	139,165
Average daily TV watching time (minutes)	165	114	0	930	136,382
Family size	2.98	1.30	1	12	139,165
<i>Crime_Concern</i> : dummy for reporting crime as one of 3 main problems in the country	0.57	0.49	0	1	139,165
Individuals aged <= 65	0.55				
Individuals aged > 65	0.62				
Females	0.57				
Males	0.56				
<i>Crime_Risk_Local</i> : perception of crime level in the local area	2.01	0.90	1	4	201,923

Note. Descriptive statistics of the main estimating sample from the Multipurpose Household Survey (ISTAT) for the years 2007 to 2010. The variable *Crime_Risk_Local* is available also for the years 2011 and 2012.

Table A4. - Effect of Digital Reform on concern about other topics

	Unemployment	Crime	Poverty	Tax evasion	Inefficiency of health sector	Immigration	Environment / Pollution	Inefficiency of judicial system	Public debt	Inefficiency of education sector	Others
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Effect of digital on aged >65	-0.063 (0.075)	-0.050*** (0.011)	0.031 (0.022)	0.018 (0.013)	0.028* (0.017)	0.003 (0.018)	-0.001 (0.026)	0.031* (0.018)	0.011 (0.022)	-0.010 (0.006)	-0.001 (0.007)
Individual & family controls	X	X	X	X	X	X	X	X	X	X	X
Region time-varying controls	X	X	X	X	X	X	X	X	X	X	X
Region fixed effects	X	X	X	X	X	X	X	X	X	X	X
Year fixed effects	X	X	X	X	X	X	X	X	X	X	X
Mean of outcome	0.72	0.57	0.3	0.22	0.22	0.21	0.16	0.15	0.14	0.07	0.02
Observations	139,165	139,165	139,165	139,165	139,165	139,165	139,165	139,165	139,165	139,165	139,165

Note. The table investigates the effect of the switch to digital signal on the likelihood for individuals aged above 65 of mentioning each of the other problem suggested by the question “*What do you think are the 3 priority problems of the country?*”. Suggested problems are ordered from left to right from the most to the least mentioned. The independent variable is the number of months (as fraction of the 12 before each survey) elapsed since region r experienced the switch to digital signal. Individual and family controls include: gender, age, education, set of dummies of occupational status, family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regressions include year and region fixed effects.

Robust standard errors are clustered by region and reported in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A5. – Effect of Digital Reform on crime and unemployment

	Unemployment share (*100)		log (Crime rate)	
	(1)	(2)	(3)	(4)
Digital Switch (indicator)	-0.245 (0.340)		-0.019 (0.016)	
Digital Switch (fraction)		0.118 (0.302)		-0.022 (0.018)
Region fixed effects	X	X	X	X
Year fixed effects	X	X	X	X
Observations	114	114	114	114

Note. The table investigates whether the timing of the switch to digital signal is associated with any changes in economic variables that might themselves explain crime perceptions. We regress the unemployment rate (multiplied by 100) and the crime rate in a specific region and year on *Digital_Switch*. Crime rates are calculate as logs of crimes per 10'000 individuals. We use two versions of the variable *Digital_Switch*: a dummy that equals one if the region *r* experienced the switch-over to digital signal at year *t* or before (columns 1 and 3); and the number of months, in the calendar year to which the outcomes refers, elapsed since region *r* experienced the switch to digital signal. Observations are at the region by (calendar) year level. The regressions include year and region fixed effects.

Robust standard errors are clustered by region and reported in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A6. - Effect of Digital Reform on individuals who do not watch TV

	(1)	(2)	(3)	(4)
DigitalSwth * Aged 15-29	-0.011 (0.082)	-0.006 (0.081)	-0.006 (0.081)	0.006 (0.071)
DigitalSwth * Aged 30-40	-0.011 (0.039)	-0.014 (0.038)	-0.014 (0.038)	-0.000 (0.032)
DigitalSwth * Aged 41-51	-0.052 (0.056)	-0.057 (0.052)	-0.057 (0.053)	-0.039 (0.042)
DigitalSwth * Aged 52-65	-0.018 (0.042)	-0.016 (0.040)	-0.016 (0.041)	-0.003 (0.034)
DigitalSwth * Aged >65	-0.061 (0.088)	-0.071 (0.087)	-0.071 (0.088)	-0.061 (0.080)
Individual & family controls		X	X	X
Region time-varying controls			X	X
Region & year fixed effects	X	X	X	X
Observations	5,822	5,822	5,822	5,822

Note. The table investigates the effect of the Digital Reform on those individuals who do not watch TV. It reports estimates from a linear probability model of an indicator for the individual reporting crime as one of the 3 main problems in Italy (*Crime_Concern*) on a post switch-over dummy. The sample includes individuals who report to never watch television. Individual and family controls include: age, education, set of dummies of occupational status, family size, family structure, major source of household income. Region time-varying controls include: unemployment rate, crime rate, GDP per capita, share of immigrants, share of population with tertiary education. The regressions include year and region fixed effects.

Robust standard errors are clustered by region and reported in brackets. *** p<0.01, ** p<0.05, * p<0.1.