Impact of Long Run Exposure to Television on Homicides: Some Evidence from Brazil

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Abstract

This paper focuses on the link between television coverage and violent crime, in particular, homicides in Brazil, a country where crime has grown dramatically in recent decades. Using Census data for the period 1980-2000, the paper finds that people living in areas covered by television signal have significantly lower rates of homicides. The effect is strongest for men of lower socioeconomic status.

Key words: Television, Homicides, Crime, Brazil, Media, Latin America
JEL Classification Code: O1

Word count: 6,492

1. Introduction

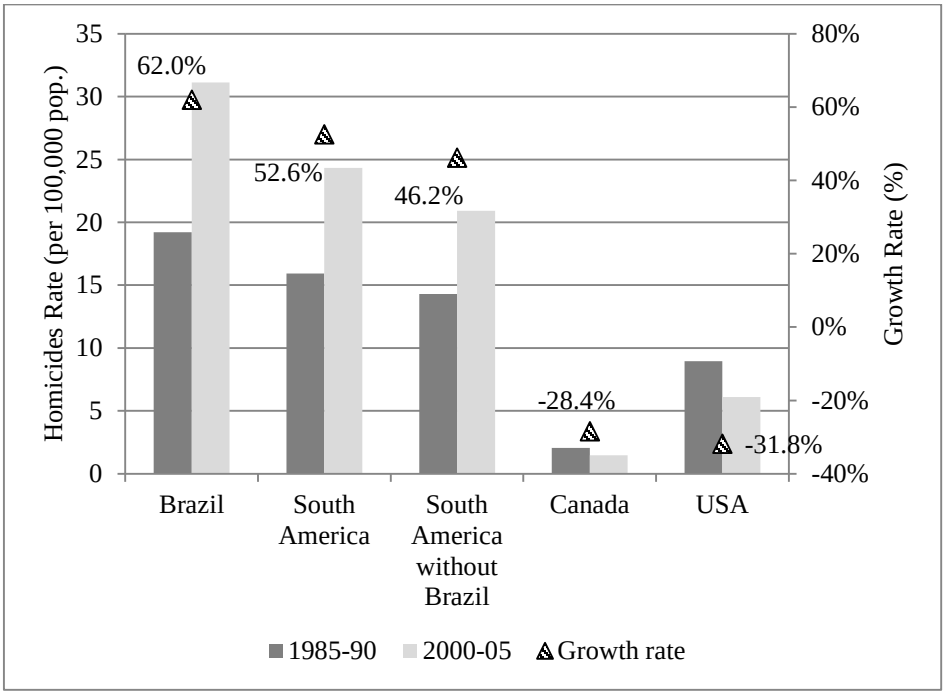
The main purpose of this paper is to study the link between media exposure and criminal behaviour. We aim to evaluate whether access to television is significantly linked to violent crime and in particular, homicides in the case of Brazil. On the one hand, and like in many other developing countries, Brazil has experienced a vast growth in television viewership to the point that current television coverage has spread to the majority of the population (Kottak, 1990). Furthermore, recent research shows that values and attitudes transmitted by Brazilian television have contributed to give a sense of belonging to people who are away from home (Faria, & Potter, 1999), and has played an important role in influencing behavioural and attitudinal patterns in the population has induced a reorientation of beliefs and norms as a way to feel integrated with the more modern and urban southern Brazilian region (La Pastina, 2004; Pace, 1993; La Ferrara, Chong, & Duryea, 2012; Chong & La Ferrara, 2009).

On the other hand, violent crime in Brazil appears to be endemic[1]. The continuous increase of crime levels in Latin America in the past two decades has situated the region among the most violent in the world (Ayres, 1998). According to data from the Pan American Health Organization, the homicide rate in the region rose over 46 per cent from the period 1985-1990 to 2000-2005; while in particular, Brazil experienced an homicide average rate (per 100,000 population) of 19.2 for the 1985-1990 period and 31.1 for the period 2000-2005; experiencing a growth of 62 per cent (See Figure 1)[2].

Finding a statistically significant link between television exposure and violent crime has proven difficult. In terms of potential short run impact, Dahl and DellaVigna (2009)

assess the link of violent movies on assaults in the field, by exploiting the variation in the violence

Figure 1: Average Homicides (per 100,000 population) and GDP Growth Rates (%)



Authors' calculations. Countries included in South America averages: Argentina, Chile, Paraguay, Uruguay, Colombia, Peru, Ecuador, Venezuela and Brazil. The average for the second period for Canada does not include the homicide rate for the years 2004 and 2005. Source: Health Indicators Database, 2009. Pan American Health Organization (PAHO)

of blockbuster movies from 1995 to 2004. They find that violence in movies significantly reduces violent crime in the evening of the same day of exposure and also it reduces violent crime during the night hours following exposure. This may be due to the fact that exposure to movie lowers crime temporarily even after the end of the movie through psychological effect, such as, catharsis, arousal, and the like. However, Phillips (1983) finds that U.S. homicide rates increased by 12.46 per cent immediately after heavyweight championship prize fights for the period 1973-1978, suggesting that experiencing the fight through the mass media stimulated fatal and aggressive behaviour. More related,

Phillips (1982) addresses the link between violent and fictional television stories with deaths and fatal accidents in the United States in 1977 and finds that soap opera suicide stories trigger imitative suicides and single vehicle accidents within the following week after the soap opera suicide story was aired.

Similar to short run links, long run impact has not been thoroughly studied, despite the fact that there are theories that explain how learning processes may contribute to long term effects. For instance, one such theory is related to observational learning and imitation, which refer to the likelihood, that an individual may acquire an observed behaviour in a realistic context, especially when the individual identifies with the model performing the behaviour (Bandura, 1977).

Similarly, another such possible link is priming, which has to do with the activation of related ideas in a person's memory when experiencing some stimulus. This effect turns into a long term effect, called automation process, when repeated priming and use of an aggressive behavioural scheme leads to chronic and automatic access to long lasting aggressive scripts and schemas, increasing the likelihood of interpreting any social encounters in an aggressive way (Anderson, & Huesmann, 2003). Another long term effect of media violence on aggressiveness is the process called desensitization or emotional habituation. This process reduces individual negative emotional reactions to violence as the individual increases the level of exposure to media violence. This gradual process of violence approval might result in a greater stimulation of violent behaviour (Huesmann, Rowell, Titus, Podolski, & Eron, 2003). Among the studies that examine the effect of television violence on aggressive behaviour over time, all of them report long term effects, with follow up surveys implemented after a long time, ranging from a 3 year

period (Milavsky, Kessler, Stipp, & Rubens, 1982) to 10 years (Lefkowitz, Eron, Walder, & Huesmann, 1977), 15 years (Huesmann et al., 2003) and 17 years (Johnson, Cohen, Smailes, Kasen, & Brook, 2002). The main result is that watching violence on television during early childhood or adolescence is associated with risk for subsequent aggressive acts against others, suggesting a delayed effect of media violence on aggressive behaviour[3].

Interestingly, in the case of developing countries empirical evidence on the impact of mass media on crime is practically non-existent despite the fact that television viewership is also massive and violent crime in many such countries runs rampant. The existing research on developing countries focuses on the influence of mass media on risk taking behaviours and on reorienting family decisions. There is some work that links television viewing to youth engagement in risky behaviours (Altman et al., 1996; Centerwall, 1992) where provision of cultural behavioural models are the mechanisms through which mass media operates (Klein et al., 1993). Also, in the case of Brazil, Chong and La Ferrara (2009) find that the share of women who are divorced increases significantly after television signals becomes available, with a stronger impact in relatively smaller areas. Similarly, La Ferrara et al. (2012) find that women with television exposure have lower fertility; with a stronger impact for women of lower socioeconomic status and for women in the central and late phases of their fertility cycle[4].

In order to test for evidence of a possible long term relationship between media exposure and crime variables in Brazil we apply an identification strategy that is analogous to that of Chong and La Ferrara (2009). We exploit the variation on the time of entry of the three most important broadcasting networks across municipal regions over

a 20 year period. In fact, we cover the universe of Brazilian municipal areas and use Census data for the years 1980, 1991 and 2000, which allow us to look at the long run impact of television on violent crime[5]. Whereas the identification strategy is similar to Chong and La Ferrara (2009), in this paper we do not focus on the role of Rede Globo only, but on all the TV broadcasting companies that existed by the end of the 1970s in the country.

There are two potential sources of endogeneity in the timing of the introduction of television to the Brazilian market. The first refers to a possible prioritization made by the Brazilian Ministry of Telecommunications in awarding licenses. Chong and La Ferrara (2009) and La Ferrara, et al. (2012) show that in Brazil the selective criteria were mostly followed by clientelistic and political purposes with no obvious clear link to divorce or fertility rates, respectively. It is reasonable to believe that a possible link with violent crime patterns and in particular, homicides, was even less obvious. This is reinforced by the fact that the bulk of politically related license awarding was done at a period in which both overall violent crime and crime differences among localities was very low (Ayres, 1998; Buvinic, Morrison, & Shifter, 1999). This fact helps mitigate the concern that television entry might have been driven by pre-existing crime trends. A second concern is related to the possibility of a potential selection problem on the entry of television, which implies that there could be an unobserved determinant that influences both television presence and homicides rates. Notice, however, that while networks might have chosen to begin broadcasting in the bigger cities or in order of the income power of the markets' total population, as it would yield higher profits from advertising, at least in the Latin American case there does not appear to be a link between cities with rapid

population growth and higher rates of victimization (Gaviria, & Pages, 2002). While it is practically impossible to uncover potential unobservables that may have had an impact on both television entrance and crime rates, our claim is that the former, though not random, was uncorrelated with pre-existing differences in crime trends across areas. We proceed to test for this possibility by analysing whether there are significant pre-existing differences in the homicide rate between areas with and without coverage and find a statistically insignificant correlation between years of coverage and the homicide rate on our first year of analysis[6]. After controlling for time varying characteristics, and area and time fixed effects, we empirically assess the potential selection on our variables of interest in two ways. First, we estimate the probability of television coverage using as main control a lag for the homicide rate. Second, we conduct a series of placebo regressions to determine if future television entry predicts current crime. Results suggest that crime trends are not a significant predictor for coverage, thus supporting our main assumption and giving more confidence that our coefficients are not spurious.

The present paper is organised as follows. The next section describes the introduction of television in Brazil. Section 3 describes the data and the empirical approach. Section 4 shows our findings including robustness tests. Finally, Section 5 concludes with brief remarks.

2. Expansion of Television[7]

Television has played a central role for the functioning and reproduction of contemporary Brazilian society and has played a strategic role in the process of articulating, diffusing, and institutionalizing new behavioural and attitudinal patterns in the country (Faria, & Potter, 1999). In the span of three decades, exposure to television

messages rose from zero to become universal in urban areas and to almost half in rural households. One of the crucial reasons for television's influence in the country is the strength of its oral tradition. In the early 1990s, after more than 30 years of expansion of basic schooling, adult literacy reached 80 per cent, only. People with less than four years of schooling account for 43 per cent of the economically active population in the urban areas, and nearly 80 per cent in the rural areas (Faria, & Potter 1999; Chong, & La Ferrara, 2009). Another characteristic of the country that contributes to the impact of television is the high rate of geographical, occupational, and social mobility, as nearly one third of the population live in a place different from the one in which they were born. In this context, television helps give a sense of belonging (Faria, & Potter, 1999). Television in Brazil has played a strategic role in the process of articulating, diffusing and institutionalising new behavioural and attitudinal patterns (Faria, & Potter, 1999).

By the early seventies, Brazil was living under a dictatorship that saw the need of providing a strong identity in order to achieve cultural integration in the country. As part of this objective, the government introduced a telecommunications policy with the aim achieving television broadcasting to the whole country (Ortega, Solsona, & Tsaliki, 2000). During the military regime of General Joao Baptista Figueredo (1978-1985), the concessions of television networks, and in particular those related to Rede Globo, followed a clientelistic, political, and ideological criteria. The dictator had the absolute power to give the licenses for radio and television stations. Although this law was changed to make the Congress the one in charge of approving the licenses, the clientelistic criteria was not abandoned at all (Lima, 2001). The relevance of the role of the media for the military regime was central. As several authors have stated, the military

regime had an ‘obsession’ with the national integration, for which the media was the one in charge of the cultural, political and economic integration. During that period the association between the government and Rede Globo was clear (Miguel, 2001). The government of President Jose Sarney (1985-1990), the first elected government after the fall of the military dictatorship, provides a good example of how the clientelistic provision of licenses kept going. On 1989, there was a constitutional amendment to enlarge the government term from four to five years. During the five years of his mandate, the government gave a total of 1080 licenses for TV stations, most of them were given to members of the Brazilian political elite. Between 1987 and 1988, for example, the government gave 168 licenses for TV and radio stations to companies associated to 91 congressmen, from which 88 voted in favour of the constitutional amendment to prolong the government of Sarney for one more year (Costa, & Brener, 1997). About the same situation happened again during the first mandate of president Fernando Henrique Cardoso (1995-1998), when the Congress was about to vote another constitutional amendment, which intended to approve re-election. From the 1848 licenses given to set up retransmission stations, 268 were given to firms associated to the firms linked to 87 congressmen (Lima, & Caparelli, 2004). In fact, there is a very concentrated ownership of the media in Brazil. About 90 per cent of the media is ultimately controlled by 15 families or groups which also hold a great amount of regional economic and political power. Particularly, the TV concessions are controlled by a limited number of groups. An important reason why Rede Globo was the chosen partner of the government has to do with the fact that the network had a long standing cooperation agreement with Time-Life during the sixties (Chong, & La Ferrara, 2009). According to this agreement,

Time was supposed to give administrative assistance, helping develop business administration practices, programming schemes, financial methodologies, personnel training, and several aspects related with commercial television. More importantly, the support also included marketing strategies which at the time were unheard of in a country such as Brazil. The military government apparently assessed that, in part, Rede Globo matched best with their integration objectives especially given the fact that by the early seventies the marketing know-how had already been assimilated (Dos Santos, & Capparelli, 2005). Today, Rede Globo is the fourth largest commercial network in the world. In addition, Brazil is one of the largest television exporters within Latin America and around the world, and the main product they export are soap operas (Chong, & La Ferrara, 2009).

On the other hand, Sistema Brasileiro de Televisão (SBT) first aired in 1981 and historically has been considered the second largest commercial network in the country, although it has lost some market share lately. This company has typically broadcast programs and soap operas imported from Mexico and the United States, which have been generally not perceived as realistic representations of Brazilian society. It is popular belief that compared to the toned-down Brazilian soap operas, Mexican soaps are considered tacky and exaggerated. Still, Mexican soap operas have been one of the most recognizable features on SBT, mostly during the early 1990s when they reached their peak in the country. The rest of SBT's programming has found its inspiration in sitcoms and dramas imported from the United States. Somewhat more recently, this network has also been active in broadcasting sporting events, in particular, the Olympics and the

Soccer World Cup. To this day, SBT television coverage includes most of the Brazilian households.

Another Brazilian network is Rede Record which is the oldest television network in the country; it first broadcasted television signals in1953. It originally aired shows, sports, journalism, comedies and plays. The peak of Record's ratings was in the 1965–1967 period, when it became well known for its musical programs. During the subsequent years, Record did not manage to keep the ratings up and began to lose ground. The creation of Sistema Brasileiro de Televisão marked the deepening of Record's decline. During the 1980s, Record suffered from very low ratings and a lack of compelling programming. It is currently owned by an evangelical group; in terms of ratings, the company has improved somewhat more recently but it has not been able to regain the status of previous decades. Finally, another relevant network is TV Bandeirantes which was founded in 1967. Along with Rede Globo, TV Bandeirantes was the first Brazilian television network to fully broadcast in colour, and during the early seventies it increased its geographical reach to a national level from its São Paulo origins.

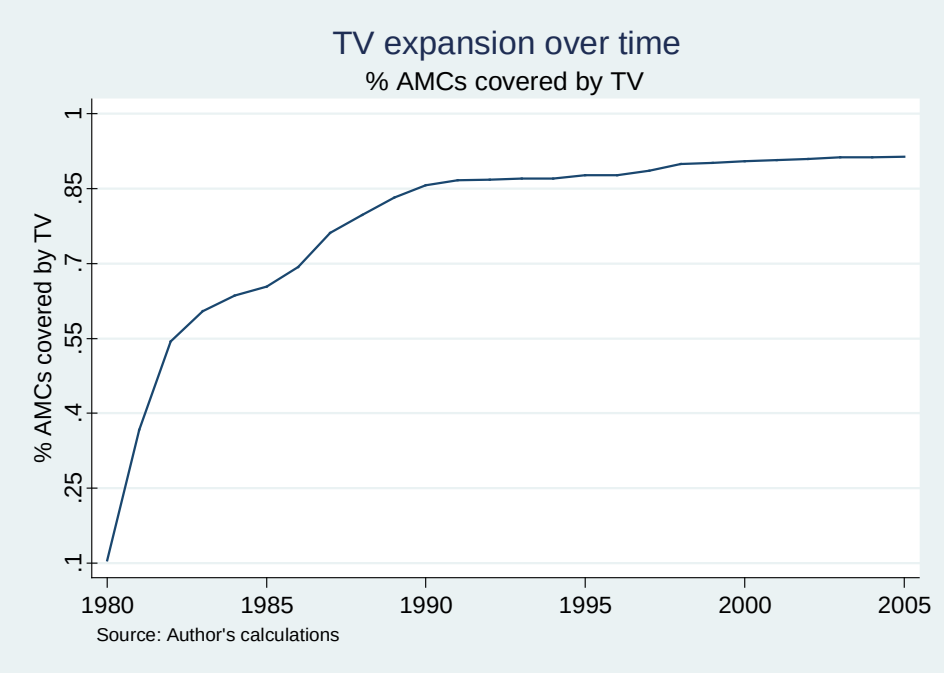
To this day, the ratings of Rede Globo, while have eroded in recent years, are still the highest at the national level, at about 50 per cent. The corresponding ratings of SBT reach about 25 per cent, whereas those of Bandeirantes and Record are at about 10 per cent (Dos Santos, 2004)[8].

3. Data and Empirical approach

In order to identify the effects of television exposure on homicides, we exploit information on the timing of entry of television networks into different areas of the country. As a first step, when correlating the television expansion and homicides in

Brazil we find a suggestive negative trend that becomes accentuated when television was first introduced. This relationship is further confirmed when we examine it at the aggregate level, that is, over time and across 3,659 Minimally Comparable Areas (AMCs) in Brazil. Using Census data for the period 1980-2000 we find that, after controlling for time varying covariates and for time invariant area characteristics, AMCs reached by television signal had significantly lower rates of violent crime as measured by the number of homicides per 1000 people. These results appear not to be driven by selection in television entry, that is, after controlling for area fixed effects, television coverage is uncorrelated both with previous violent crime levels and with lagged changes in crime.

We consider different data sources at the AMCs level as it is the smallest spatial area unit of analysis provided by the Brazilian Statistical Institute. For our dependent variable, we use the average rate of deaths occasioned by others per 1000 inhabitants in each AMC using data provided by the Brazilian Ministry of Health[9]. In addition, the homicides construct does not take into account if victims were killed by the same person. Despite those limitations, we get a disaggregation of these homicide statistics by gender and



cohort.

Figure 2

Our key independent variable is a dummy that captures whether an area receives the television signal in a given year, and is constructed from information on the location and radial reach of television broadcasting and retransmitting stations in every year for all the corresponding television companies. Our main variable of interest in this analysis is referred to the number of years each area has had coverage of any particular network; namely, Rede Globo, SBT, and Bandeirantes/Record. Since we have information on the year and the location (latitude, longitude, as well as its radial reach in kilometres) where each broadcasting or retransmitting station was installed, we are allowed to identify the first year each municipality was reached by the signal of any particular antenna and started receiving the signal, deriving from that, the years of coverage of any particular network for each AMC corresponding to each municipality.

We run regressions using as main explanatory variable the maximum years of coverage of any of the three networks considered in our analysis, as well as the years of coverage for each network independently. Also, as robustness check, we run regressions using a dummy variable that equals 1 if the year had any network coverage within its radius and zero otherwise. Here we used the variable coverage with one year lag with respect to the year of the census available in order to guarantee enough time of exposure to the network signal. The information on the broadcasting and retransmitting station as well as its signal radius of operation was provided by Rede Globo.

We also include additional covariates at the AMC level that are constructed using the information from three rounds of the Brazilian Census: 1980, 1991 and 2000[10]. The variables are the following: Average years of education of the household head; a proxy for average wealth that is constructed through principal component analysis from durables ownership and access to basic services (electricity, sanitation, and so forth)[11]; share of catholic households; share of rural households and the percentage of AMCs' population related to Brazil's. A detailed description of the variables included in our analysis is provided in the Appendix. Table 1 contains descriptive statistics of all the variables used in this paper. Table 2 presents the correlation matrix between all the outcomes and all explanatory variables used in our estimations, with the corresponding *p*-values above each coefficient.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Homicides / 1000 inhabitants	10968	0.363	0.405	0	4.247
Female Homicides / 1000 inhabitants	10968	0.042	0.0647	0	1.009
Male Homicides/ 1000 inhabitants	10968	0.321	0.3738	0	3.982
Homicides 15-34 / 1000 inhabitants	10968	0.197	0.2555	0	2.510
Homicides 35-64 / 1000 inhabitants	10968	0.133	0.155	0	1.683
Years of television coverage	10968	8.024	7.845	0	27
Years of Globo coverage	10968	7.718	7.805	0	27
Years of SBT coverage	10968	1.410	4.197	0	23
Years of BAN-REC coverage	10968	1.460	4.338	0	24
Television coverage	10968	0.626	0.4839	0	1
Globo coverage	10968	0.609	0.488	0	1
SBT coverage	10968	0.138	0.3448	0	1
BAN coverage	10968	0.129	0.3361	0	1
Education of head	10968	3.679	2.375	0.2569	14.66
Wealth	10968	-0.0003	2.059	-6.142	6.727
Catholic	10968	0.883	0.0972	0.1728	1
Population	10968	0.027	0.1610	0.0004	8.109
Rural	10968	0.437	0.234	0	1

Sample years: 1980, 1991, 2000. Source: Brazilian Census, before the Census the respective AMC

Table 2: Pairwise Correlations

	Homic.	Female Homic.	Male Homic.	Homic. From 15-34	Homic. From 35-64	Years of TV coverage	Years of Globo coverage	Years of SBT coverage	Years of BAN coverage	Education of head	Wealth	Catholic	Pobla
Female Homic.	0.547 (0.000)												
Male Homic.	0.9891 (0.000)	0.4195 (0.000)											
Homic. From 15-34	0.9386 (0.000)	0.4817 (0.000)	0.9345 (0.000)										
Homic. From 35-64	0.8543 (0.000)	0.4771 (0.000)	0.8436 (0.000)	0.6572 (0.000)									
Years of TV	0.1213 (0.000)	0.0921 (0.000)	0.1161 (0.000)	0.1231 (0.000)	0.0952 (0.000)								
Years of Globo	0.1189 (0.000)	0.09 (0.000)	0.1138 (0.000)	0.119 (0.000)	0.0955 (0.000)	0.9778 (0.000)							
Years of SBT	0.0412 (0.000)	0.0352 (0.000)	0.0387 (0.000)	0.044 (0.000)	0.0299 (0.002)	0.3642 (0.000)	0.2842 (0.000)						
Years of BAN	0.0388 (0.000)	0.0439 (0.000)	0.0347 (0.000)	0.0357 (0.000)	0.0399 (0.000)	0.3792 (0.000)	0.3517 (0.000)	0.2971 (0.000)					
Education of head	0.0391 (0.000)	0.0386 (0.000)	0.0362 (0.000)	0.0699 (0.000)	-0.0099 (0.302)	0.2256 (0.000)	0.2294 (0.000)	0.0898 (0.000)	0.1756 (0.000)				
Wealth	0.082 (0.000)	0.1068 (0.000)	0.0707 (0.000)	0.1107 (0.000)	0.0277 (0.004)	0.1381 (0.000)	0.1515 (0.000)	0.0193 (0.043)	0.1913 (0.000)	0.3631 (0.000)			
Catholic	-0.3346 (0.000)	-0.1996 (0.000)	-0.3287 (0.000)	-0.3424 (0.000)	-0.2537 (0.000)	-0.4345 (0.000)	-0.4232 (0.000)	-0.2007 (0.000)	-0.203 (0.000)	-0.2656 (0.000)	-0.2854 (0.000)		
Pobla	0.1712 (0.000)	0.0649 (0.000)	0.1746 (0.000)	0.2035 (0.000)	0.0891 (0.000)	0.018 (0.059)	0.0186 (0.051)	0.0195 (0.041)	0.0303 (0.002)	0.1156 (0.000)	0.1383 (0.000)	-0.1172 (0.000)	
Rural	-0.2393 (0.000)	-0.1835 (0.000)	-0.228 (0.000)	-0.2766 (0.000)	-0.1382 (0.000)	-0.3251 (0.000)	-0.3201 (0.000)	-0.116 (0.000)	-0.1946 (0.000)	-0.3294 (0.000)	-0.6489 (0.000)	0.4381 (0.000)	-0.1617 (0.000)

Pairwise correlation coefficients are reported. Significance levels of each correlation coefficient are displayed in parenthesis.

Our empirical specification combines aggregate data at the AMC level over three periods covering Census years 1980, 1991 and 2000 with information on the timing of penetration for different television networks in Brazil. We aim to determine how certain variables affect the incidence on homicides as proxy of violent crime, focusing on the impact of novelas. Since our main dependent variable used in this paper is continuous, we estimate regressions based on ordinary least squares. Empirically, we test the following benchmark specification:

$$Homicides_{jt} = \beta Coverage_{jt} + \gamma X_{jt} + \mu_j + \lambda_t + \varepsilon_{jt} \qquad (1)$$

where Homicides is the average rate of deaths occasioned by others per 100,000 inhabitants in area j at time t; Coverage is a continuous variable that accounts for the maximum years of coverage at time t of any of the three commercial networks considered (Globo, Bandeirantes or SBT) in area j. Additionally, X_{jt} is a set of time-varying controls at the AMC level that includes the average years of education of the household head, a proxy for average wealth, the share of catholic households, the share of rural households, and the percentage in total population; $\mu_j$and λ_t are, respectively, area and year fixed effects; and ε_{jt} is the error term. Note that by adding area fixed effects we control for time invariant unobserved characteristics that might affect violence and may also be correlated with the time of television networks entry. The year fixed effects help to capture the secular trend in violence that is common to all areas. In addition, for robustness purposes, we estimate the same benchmark specification explained above using a dummy variable that equals 1 if area j received the signal of any network one year before the year of the census. Finally, we also assess the potential selection on our variables of interest.

4. Results

Table 3 presents our first set of results using aggregate data at the AMC level for the Census years 1980, 1991 and 2000. The first three columns of the table show the results considering as dependent variable the average rate of homicides per 100,000 inhabitants in each AMC, while the other columns display the results disaggregating the homicide rate by gender and cohort. Our OLS regressions include fixed effects at the AMC level to control for differences in time invariant unobservables across locations, time dummies to control for time trends, and standard errors clustering by AMC.

As it is shown, there is a negative and statistically significant relationship between the years of coverage and the homicide average. In fact, the coefficient implies that one more year of access to television network is associated with a reduction in the homicide average of 0.002 per 1000 inhabitants. This result is significant at 10 per cent when including standard errors clustered at the AMC level. This negative relationship might be attributed to extended-incapacitation, as watching TV or listening to radio may reduce the situational opportunities to incur into violent activities (Dahl, & DellaVigna, 2009). Also, considering the particular content of the commercial novelas in Brazil, this relationship might be revealing a positive connection between the progressive and empowering values that are projected in these types of Brazilian novelas and the incidence on violent crimes. Intuitively, being a region with wealthier households and with a higher rate of catholic population reduces the incidence of violence within the respective location. Figure 3 further illustrates our results above. It reports the coefficients from a regression of homicides on dummies for cumulative years of coverage using our benchmark

specification, in Table 3 column 1. As the figure shows, the longer the access to television the more negative the impact on homicides.

Table 3: Television and Homicides
(Homicides per 1000 inhabitants)

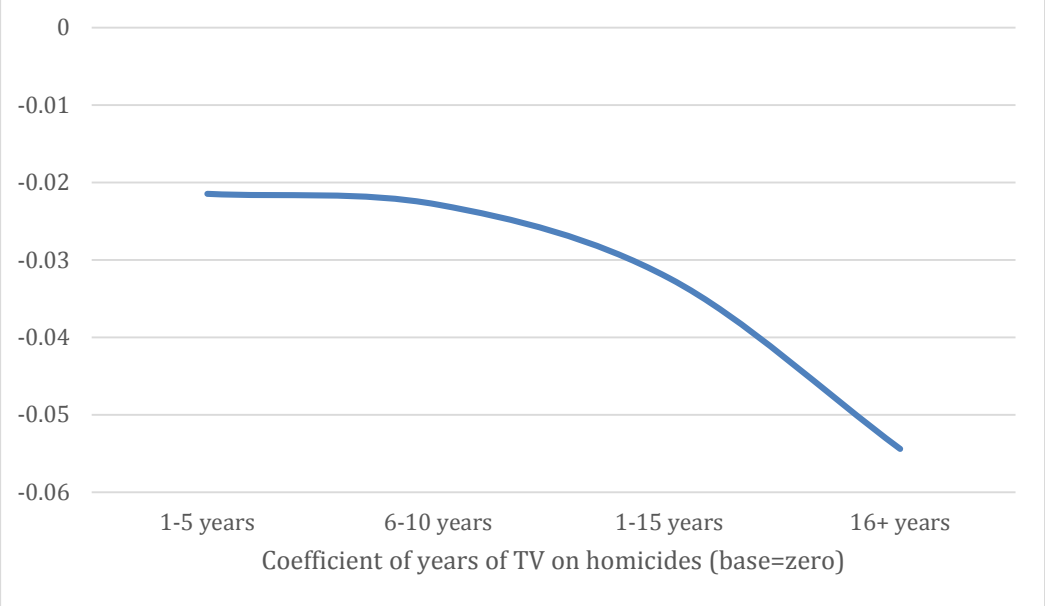
	Average Homicides (1)	Female Homicides (2)	Male Homicides (3)	Age 15-34 Homicides (4)	Age 35-64 Homicides (5)
Years of coverage	-0.0022*	-0.0001	-0.0021*	-0.0021***	-0.0001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Education of head	-0.0024	-0.0001**	-0.0010	0.0001	-0.0011**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Wealth indicator	-0.0316***	-0.0025	-0.0288***	-0.0188***	-0.0101***
	(0.007)	(0.002)	(0.007)	(0.005)	(0.003)
Catholic	-0.4638***	0.0031	-0.4694***	-0.4537***	-0.0231
	(0.121)	(0.024)	(0.112)	(0.080)	(0.051)
Population	0.2182	0.0012	0.2174	0.2062	0.0571
	(0.482)	(0.025)	(0.458)	(0.357)	(0.096)
Rural	-0.0043	-0.0268*	0.0232	0.0142	-0.0195
	(0.071)	(0.014)	(0.065)	(0.048)	(0.030)
Unemployment	0.0443	0.0439	0.0329	0.0337	0.0283
	(0.083)	(0.084)	(0.073)	(0.069)	(0.044)
Constant	0.743***	0.048**	0.697***	0.572***	0.152***
	(0.117)	(0.024)	(0.107)	(0.076)	(0.049)
Clusters AMC level	Yes	Yes	Yes	Yes	Yes
Fixed Effects AMC level	Yes	Yes	Yes	Yes	Yes
Time Effects Census	Yes	Yes	Yes	Yes	Yes
Observations	10968	10968	10968	10968	10968
R-squared	0.7503	0.4326	0.7545	0.7295	0.6459

*** p<0.01, ** p<0.05, * p<0.1. Coefficients are reported using Ordinary Least Squares. Standard errors are in parentheses.

Table 4 runs the same benchmark specification of column 3 from Table 3 with the difference that here we estimate the regressions for the specific type of coverage: Red Globo, SBT and Bandeirantes. The first six columns estimate the coefficients considering separate regressions for each type of coverage. This is because there is a significant correlation between the years of coverage for the different networks (between 28 and 35 per cent). So, if we include different explanatory variables for each network in one regression it becomes more difficult to determine which explanatory variable is actually

producing the effect on our outcome. The consequences with nonlinearly independent explanatory variables is that, despite not violating OLS assumptions, it increases the standard errors; being harder to reject the null hypothesis. However, we still run our regressions for each type of network in one aggregate regression (columns 7 and 8), and even so, we find significant results for Rede Globo and Bandeirantes. The effect of years of coverage with SBT network does not appear to be significant. Perhaps this might be related to the specific content of SBT novelas which are not so representative of Brazilian reality. This assertion, however, cannot be fully confirmed and escapes the aim of our research.

Figure 3: Homicides and TV Expansion in Brazil



This figure reports the coefficients from a regression of homicides on dummies for cumulative years of coverage using our benchmark specification in Table 3.

Table 4:
Television and Violent Crime, by Network
(Average Homicides per 1000 inhabitants)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Years coverage Globo	-0.0022*	-0.0022**					-0.0022	-0.0021*
	(0.001)	(0.001)					(0.001)	(0.001)
Years coverage SBT			-0.0001	-0.0008			0.0009	-0.0009
			(0.001)	(0.001)			(0.001)	(0.001)
Years coverage BAN-REC					-0.0022*	-0.0023**	-0.0022	-0.0023*
					(0.001)	(0.001)	(0.001)	(0.001)
Education of head		-0.0011		-0.0021**		-0.0021		-0.0013
		(0.001)		(0.001)		(0.001)		(0.001)
Wealth indicator		-0.0315***		-0.0315***		-0.0322***		-0.0324***
		(0.007)		(0.008)		(0.007)		(0.008)
Catholic		-0.4643***		-0.4571***		-0.4598***		-0.4649***
		(0.121)		(0.121)		(0.121)		(0.121)
Population		0.2151		0.2332		0.2296		0.2197
		(0.481)		(0.485)		(0.487)		(0.483)
Rural		-0.0037		-0.0087		-0.0019		0.0034
		(0.071)		(0.071)		(0.071)		(0.072)
Unemployment		0.0431		0.0534		0.0576		0.0531
		(0.039)		(0.039)		(0.039)		(0.042)
Constant	0.3115***	0.7425***	0.3103***	0.7417***	0.3104***	0.7368***	0.3105***	0.7391***
	(0.004)	(0.117)	(0.004)	(0.117)	(0.004)	(0.117)	(0.004)	(0.117)
Clusters AMC level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects AMC level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects Census	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10968	10968	10968	10968	10968	10968	10968	10968
R-squared	0.7473	0.7502	0.7461	0.7504	0.7474	0.7503	0.7472	0.7508

*** p<0.01, ** p<0.05, * p<0.1. Coefficients are reported using Ordinary Least Squares. Standard errors are in parentheses.

As an exercise for robustness check, in Appendix 1 and Appendix 2 we test the same regressions as Table 1 and 2, but employing a different variable for television exposure, namely, a dummy that takes the value 1 if the AMC received the network coverage one year before the census year, and zero otherwise. Here we used the variable coverage with one year lag so as to guarantee an enough time of exposure to the network signal. Our main hypothesis about the relationship between television coverage and crime remains very similar.

One still relevant concern is whether television coverage is correlated with pre-existing crime trends, which would introduce a selection problem on our variable of interest. Appendix 3 and Appendix 4 partially address this potential problem. Appendix 3 shows estimates from an OLS regression where the dependent variable is the years of coverage, and the main explanatory variables are the average rate of homicides per 1000 inhabitants and the change in the average rate of homicides between t and t-1. These estimations also include area and year fixed effects, as well as clustering at the AMC level. As we can see from the table, we find no significant correlation between changes in violent crime and the years of coverage of any of the networks considered; suggesting that violent crime trend is not a significant predictor of commercial network presence. Appendix 4 performs a falsification test, constructing a placebo treatment based on the timing of the networks entry. We perform analogous regressions to the ones we performed in Table 3, but instead of only looking at the effects of contemporary coverage on current behaviour, we also look at the effects of future entry. Our dependent variable is again the average rate of homicides per 1000 inhabitants, and our main variables of interest are years of coverage in time t and in time t+1. The coefficient on years of

coverage at t+1 effectively captures the effect of future entry for areas that are not covered by the signal in t. Our hypothesis for this 'placebo' experiment is that violent crime in places that do not receive signal should not be affected by the fact that the signal may become available in the future. The results of Table 6 show that when not considering clustering the coefficient on future presence of television signal is positive and significant, while when considering standard errors clustered at the AMC level, the coefficient becomes insignificant.

5. Concluding remarks

This paper focuses on the link between television coverage and violent crime, namely, homicides in Brazil, a country where crime has grown dramatically in recent decades. Using Census data for the period 1980-2000, the paper finds that people living in areas covered by television signal have significantly lower rates of homicides. The effect is strongest for men of lower socioeconomic status. Future research should focus on whether content may account for the differences that we found when focusing on specific TV networks.

Appendix 1: Television and Homicides
(per 1000 inhabitants)

	Average Homicides	Female Homicides	Male Homicides	Age 15-34 Homicides	Age 35-64 Homicides
	(3)	(4)	(5)	(6)	(7)
Dummy if coverage 1 year before Census	-0.0316**	-0.0052	-0.0267*	-0.0267***	-0.0023
	(0.015)	(0.003)	(0.014)	(0.010)	(0.007)
Education of head	-0.0028*	-0.0017**	-0.0024	-0.0001	-0.0018**
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
Wealth indicator	-0.0306***	-0.0024	-0.0277***	-0.0177***	-0.0108***
	(0.007)	(0.002)	(0.007)	(0.005)	(0.003)
Catholic	-0.4525***	0.0054	-0.4608***	-0.4437***	-0.0227
	(0.121)	(0.024)	(0.111)	(0.080)	(0.051)
Population	0.2285	0.0024	0.2257	0.2163	0.0573
	(0.481)	(0.025)	(0.457)	(0.357)	(0.095)
Rural	-0.0100	-0.0278*	0.0175	0.0074	-0.0196
	(0.071)	(0.014)	(0.065)	(0.048)	(0.030)
Unemployment	0.0821	0.0644	0.0755	0.0336	0.0246
	(0.074)	(0.085)	(0.069)	(0.043)	(0.035)
Constant	0.7418***	0.0487**	0.6948***	0.5697***	0.1525***
	(0.116)	(0.024)	(0.107)	(0.076)	(0.049)
Clusters at AMC level	Yes	Yes	Yes	Yes	Yes
Fixed Effects AMC level	Yes	Yes	Yes	Yes	Yes
Time Effects Census	Yes	Yes	Yes	Yes	Yes
Observations	10968	10968	10968	10968	10968
R-squared	0.7501	0.4334	0.7546	0.7294	0.6455

*** p<0.01, ** p<0.05, * p<0.1. Coefficients are reported using Ordinary Least Squares. Standard errors are in parentheses.

Appendix 2: Television and Homicides by Network
(Average Homicides per 1000 inhabitants)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dummy if covered by Globo (1 year before the Census)	-0.0377**	-0.0345**					-0.0388**	-0.0348**
	(0.015)	(0.015)					(0.015)	(0.015)
Dummy if covered by SBT (1 year before the Census)			0.0248*	0.0110			0.0307**	0.0176
			(0.013)	(0.013)			(0.013)	(0.013)
Dummy if covered by BAN-REC (1 year before the Census)					-0.0081	-0.0156	-0.0184	-0.0214
					(0.015)	(0.015)	(0.015)	(0.016)
Education of head		-0.0027**		-0.0025		-0.0026		-0.0026
		(0.001)		(0.001)		(0.001)		(0.001)
Wealth indicator		-0.0297***		-0.0306***		-0.0318***		-0.0307***
		(0.007)		(0.007)		(0.007)		(0.007)
Catholic		-0.4536***		-0.4574***		-0.4594***		-0.4553***
		(0.121)		(0.121)		(0.121)		(0.121)
Population		0.2256		0.2256		0.2313		0.2207
		(0.479)		(0.485)		(0.488)		(0.481)
Rural		-0.0082		-0.0116		-0.0068		-0.0077
		(0.071)		(0.071)		(0.071)		(0.071)
Unemployment	0.0363	0.0429	0.0328	0.0635	0.0393	0.0533	0.0339	0.0436
	(0.044)	(0.046)	(0.039)	(0.036)	(0.046)	(0.053)	(0.053)	(0.046)
Constant	0.3141***	0.7413***	0.3101***	0.7406***	0.3106***	0.7393***	0.3143***	0.7406***
	(0.005)	(0.116)	(0.004)	(0.117)	(0.004)	(0.117)	(0.005)	(0.116)
Clusters at the AMC level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects at AMC level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects Census	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10968	10968	10968	10968	10968	10968	10968	10968
R-squared	0.7474	0.7503	0.7476	0.7503	0.7463	0.7507	0.7474	0.7504

*** p<0.01, ** p<0.05, * p<0.1. Coefficients are reported using Ordinary Least Squares. Standard errors are in parentheses.

Appendix 3: Testing for Selection on TV Coverage

	Years of coverage			
	(1)	(2)	(3)	(4)
Average Homicides	-0.3035	-0.1672		
	(0.218)	(0.212)		
DAverage Homic (first difference)			-0.0498	-0.0596
			(0.135)	(0.134)
Education of head	0.0888***	-0.3492*	-0.3512*	-0.3525*
	(0.025)	(0.193)	(0.193)	(0.193)
Wealth indicator	-0.3929***	-0.4793***	-0.3267***	-0.4733***
	(0.105)	(0.152)	(0.109)	(0.152)
Catholic	-4.8021***	-2.9677	-0.2383	-2.8895
	(1.426)	(2.083)	(1.291)	(2.089)
Rural	1.6083	0.0690	0.2243	0.0582
	(1.017)	(1.498)	(0.976)	(1.498)
Population	-3.9259*	-1.8473	-3.9754	-1.9379
	(2.128)	(3.400)	(2.868)	(3.450)
Married	9.8104***	5.4454**	1.6563	5.4878**
	(1.416)	(2.173)	(1.634)	(2.176)
Unemployment	0.0045	0.0032	0.0395	0.0028
	(0.005)	(0.0056)	(0.005)	(0.006)
DEducation of head		0.0156		0.0156
		(0.016)		(0.016)
DWealth Indicator		0.1634		0.1594
		(0.106)		(0.106)
DCatholic		2.1763		2.1277
		(1.631)		(1.635)
DRural		-0.0205		-0.0170
		(1.039)		(1.039)
DPobla		3.0113		3.0317
		(5.042)		(5.086)
DMarried		-3.4753***		-3.5076***
		(1.275)		(1.274)
Constant	-1.4543	17.3996***	16.8576***	17.2619***
	(1.518)	(2.140)	(1.605)	(2.151)
Clusters AMC level	Yes	Yes	Yes	Yes
Fixed Effects AMC level	Yes	Yes	Yes	Yes
Time Effects Census	Yes	Yes	Yes	Yes
Observations	10968	7312	7312	7312
R-squared	0.8893	0.9606	0.9606	0.9603

*** p<0.01, ** p<0.05, * p<0.1. Coefficients are reported using Ordinary Least Squares. Standard errors are in parentheses.

Appendix 4: Placebo Regressions

Dependent variable: Average Homicides per 1000 inhabitants

	(3)	(4)
Years of coverage in t	-0.0225*	-0.0226*
	(0.013)	(0.013)
Years of coverage in t+1	0.0203	0.0203
	(0.013)	(0.013)
Education of head		-0.0016
		(0.001)
Wealth Indicator		-0.0319***
		(0.007)
Catholic		-0.4668***
		(0.121)
Population		0.2172
		(0.485)
Rural		0.0001
		(0.071)
Unemployment		0.0393
		(0.063)
Constant	0.3034***	0.7357***
	(0.006)	(0.117)
Clusters at the AMC level	Yes	Yes
Fixed Effects AMC level	Yes	Yes
Time Effects Census	Yes	Yes
Observations	10968	10968
R-squared	0.7474	0.7504

*** p<0.01, ** p<0.05, * p<0.1. Coefficients are reported using Ordinary Least Squares. Standard errors in parentheses.

Appendix 5: Description of Variables

Variable	Definition
Homicides/ 1000 inhabitants	Average rate of deaths occasioned by others, per 1000 inhabitants in each AMC (1980-1985, 1991-1996, and 2000-2005). Source: Ministry of Health from Brazil.
Homicides by gender / 1000 inhabitants	Female or male deaths occasioned by others, per 1000 inhabitants in each AMC (1980-1985, 1991-1996, and 2000-2005). Source: Ministry of Health from Brazil.
Homicides by cohort / 1000 inhabitants	People from different cohorts, whose death was caused by others per 1000 inhabitants in each AMC (1980-1985, 1991-1996, and 2000-2005). The cohorts considered are: 5-14, 15-34, 35-64. Source: Ministry of Health from Brazil.
Unemployment	Rate of formal unemployment at the AMC level. Source: Brazilian household surveys.
Years of TV coverage	Maximum number of years each area has had coverage of any particular network, namely, Rede Globo, Bandeirantes and SBT at the year of the census
Years of Globo coverage	Number of years each area has had signal from Globo at the year of the census
Years of SBT coverage	Number of years each area has had signal from SBT at the year of the census
Years of BAN-REC coverage	Number of years each area has had signal from Bandeirantes or Record at the year of the census
TV coverage	Dummy equal to 1 if the AMC is within the signal radius of a Globo, SBT or BAN broadcasting or retransmitting station in 1979, 1990, and 1999 (coverage status of 1 year before the census)
Globo coverage	Dummy equal to 1 if the AMC is within the signal radius of a Globo broadcasting or retransmitting station in 1979, 1990, and 1999.
SBT coverage	Dummy equal to 1 if the AMC is within the signal radius of a SBT broadcasting or retransmitting station in 1979, 1990, and 1999.
BAN--REC coverage	Dummy equal to 1 if the AMC is within the signal radius of a Bandeirantes or Record broadcasting or retransmitting station in 1979, 1990, and 1999.
Education of head	Average years of education of the household head.
Wealth	A proxy for average wealth
Catholic	Share of catholic households
Percentage in total population	Percentage of AMC's population related to Brazil's one.

*Ministry of Health: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/extbr.def

Endnotes

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[1] Studies at the city and state level estimate the direct costs of crime, which range from 3 to 5 per cent of GDP per year, while cross country studies suggest that a 10 per cent decrease in Brazil's homicide rate may raise per capita income around 0.2 to 0.8 percent in 5 years (World Bank, 2006).

[2] Buvinic, et al., (1999) identify mechanisms through which violence patterns may affect economic development. They divide the costs violence into direct costs, which include all the goods and services; non-monetary effects; multiplier effects, social multiplier effects.

[3] There is evidence that suggests that identification with aggressive television characters might activate later aggression (Huesmann et al., 1984). There is also some laboratory evidence that links violence to youths' aggressive behavior, thoughts, and even physically aggressive behavior (Anderson, 2003; Bandura, et al. 1963; Bushman, & Huesmann, 2001; Comstock, 1980; Huesmann, et al., 1997). However, it has been strongly argued that laboratory settings are unable to translate results into in the field because of their artificiality (Dahl and DellaVigna, 2007; Paluck and Levy, 2009; Phillips 1983).

[4] There is a recent another strand of literature that analyze other social and economic outcomes affected by television exposure as well. For instance, Gentzkow and Shapiro (2008) find that the introduction of television in U.S. cities did not have adverse effects on educational achievement. Jensen and Oster (2007) find that introduction of cable television is positively associated with increases in female autonomy and school enrollment and decreases in fertility and reported son preference. Olken (2006) finds that the more time spent watching television, the lower the levels of participation in organizations and trust. Paluck and Levy (2009) find that media programs may become instruments of development policy. Finally, Besley and Burgess, 2002; DellaVigna and Kaplan, 2007; Stromberg, 2004 and others have studied the role of the media on voters' behavior.

[5] By 1980 only a 36 per cent of the total municipal regions (AMCs) had coverage of any of the three networks considered. Please, see Figure 2.

[6] The correlation coefficient is 0.15 with a significance level of 0.37.

[7] This section draws from La Ferrara, et al (2012)

[8] There are two minor broadcasting companies in Brazil, Rede TV and TV Cultura with ratings of about 4 percent each as well as other regional companies (Dos Santos, 2004).

[9] Unfortunately, due to data availability we are unable to include other serious offenses such as violent robbery or kidnapping, but only homicides.

[10] We are not able to include the 1970 census wave because the information on homicides was only available for 1980 onward.

[11] Variables included in the analysis are: share of households with access to piped water from the public system, share of households with sanitation, share of households with electricity, share of

households owning a radio, share of households owning a refrigerator, share of households owning a car. We do not consider ownership of a television set, as this is likely endogenous to the availability of network signal.

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