Propaganda and Conflict

Theory and Evidence from the Rwandan Genocide

David Yanagizawa-Drott

CID Working Paper No. 257 August 2012

© Copyright 2012 Yanagizawa-Drott, David, and the President and Fellows of Harvard College



Working Papers

Center for International Development at Harvard University

Propaganda and Conflict:

Theory and Evidence from the Rwandan Genocide

David Yanagizawa-Drott* Harvard University

August 2012

Abstract

This paper investigates the role of mass media in times of conflict and state-sponsored violence. A model of collective violence is presented where mass media has the potential to increase participation in conflict by facilitating coordination, in addition to any direct effect on behavior due to content. Guided by the insights of the model, the paper uses a unique nation-wide village-level dataset from the Rwandan Genocide to estimate the impact of radio broadcasts that called for the extermination of the Tutsi minority, and are commonly believed to have played a significant role in fueling the violence. The results show that the broadcasts increased participation in the killings. They indicate that approximately 10 percent, or an estimated 51,000 perpetrators, of the participation in the violence during the Rwandan Genocide can be attributed to the effects of the radio. Violence that inherently requires more coordination, such as militia and army violence, was also more affected by the broadcasts. Together with a set of results presented in the paper, the evidence indicates that mass media can in part affect conflict by functioning as a coordination device.

JEL codes: D7, N4

Keywords: Conflict, Genocide, Media Effects

^{*}Harvard Kennedy School. email: david yanagizawa-drott@harvard.edu. I thank Robert H. Bates, Tim Besley, Raquel Fernandez, Ethan Kaplan, Asim Khwaja, Masavuki Kudamatsu, Rocco Macchiavello, Nancy Qian, Rohini Pande, Torsten Persson, David Stromberg, and Jakob Svensson for their comments, and participants at Harvard; Stanford SIEPR; LSE; Dartmouth; U Pompeu Fabra; Warwick; U Namur, Center for Global Development; EUDN Oxford; ESEWM, CIFAR, and BREAD 2011. I would also like to thank Giovanni Zambotti for ArcGIS assistance, and Annalise Blum and Aletheia Donald for excellent research assistance. All mistakes are my own.

1 Introduction

"The radio encouraged people to participate because it said 'the enemy is the Tutsi'. If the radio had not declared things, people would not have gone into the attacks."

-Rwandan Genocide perpetrator, interviewed by Straus (2007)

As many as 22 million noncombatants have been killed in nearly fifty genocides and politicides since 1945 (Harff, 2003). Nearly all of these state-sponsored mass murders occurred during or shortly after regular civil wars or revolutions. One of their key features is that the violence is of a predominantly collective nature, meaning that the killing is carried out by individuals organized collectively in groups such as militias, communal police, death squads, and the army. Therefore, in order to explain the mechanisms of state-sponsored mass murders, it is necessary to identify the factors that motivate civilians to participate in group violence in times of conflict. To this end. influential theories of collective behavior propose that strategic complementarities, where the act of violence is more attractive the higher the fraction of the population engaged in violent activity, can play a crucial role (Schelling, 1978; Granovetter, 1978).² The implication is that large-scale violence can erupt when individuals are able to coordinate their actions so that participation surpasses some critical level. However, despite a large body of empirical literature on the determinants of conflict at the country-level (e.g., Collier and Hoeffler, 1998, 2004; Fearon and Laitin, 2003; Miguel et al, 2004; Besley and Persson, 2011) and a small but growing literature on determinants at the micro-level (e.g., Verwimp, 2005; Dube and Vargas, 2008), there is little evidence identifying the factors that cause individuals to participate in state-sponsored mass murders, or demonstrating whether strategic complementarities matter for collective violence, and if so, what factors faciliate coordination.³

This paper approaches these issues by investigating whether and how mass media affects conflict. The research questions are partly motivated by the fact that elites of autocratic states have repeatedly used mass media, which they often control, with the intention of influencing citizen behavior in times of conflict. That is, history presents us with recurrent episodes of mass media being used for

¹State-sponsored mass murders - genocides and politicides - are considered distinctly different phenomena from civil war and revolutions, primarily because of the intent of state authorities to destroy certain groups in society, but also because the violence is large scale and one-sided. Nevertheless, multiple definitions exist (e.g., Harff and Gurr 1988; Krain, 1997; Harff, 2003).

²There could be many underlying reasons for strategic complementarities. For example, to operate a functional militia group a minimum number of members is necessary. A number of complementary phenomena observed in social psychology have the same consequences, e.g., herd mentality, bandwagon effects, groupthink, peer pressure, and social conformity.

³For a review of conflict literature, see Blattman and Miguel (2010).

propaganda purposes.⁴ Joseph Goebbels, propaganda minister of Nazi Germany, called radio "the most important instrument of mass influence that exists anywhere" and considered it an essential tool in achieving the political ambitions of the Third Reich (Welch, 1993). Furthermore, theory by Glaeser (2005) suggests that ethnic or religious hatred can be affected when powerful elites broadcast messages targeting minority groups. Complementary motivation and partial support for this proposition comes from cross-country evidence showing that when persecution or elimination of certain groups in society is encouraged by the official ideology of the elite in power, the likelihood of a conflict transitioning into mass murder is significantly higher (Harff, 2003). However, it has not yet been established to what extent mass media encouraging harm against a certain societal group can cause violence against that group.⁵ The main goal of this paper is to provide evidence to this end, and to shed light on the mechanisms whereby violence is facilitated by mass media.

To analyze how mass media can affect conflict, the paper first sets up a simple model of participation in group violence. It considers a situation where individuals belonging to the majority group face the choice of whether to participate in a collective attack against the minority group. The government's de facto policy on punishment (or reward) for such violence is uncertain, which is frequently the case in times of conflict, and citizens can receive information about the policy through mass media. Two forms of local violence are analyzed: collective violence, where strategic complementarities are present; and individual violence, where the benefit of violence does not depend on whether others are violent.⁶ The key insight is that when mass media broadcast a public signal that violence against the minority group is state-sponsored, this can affect participation in violence via two channels. First, through a direct information effect, where individuals who have access to mass media are more likely to become perpetrators because their beliefs about the government's policy change. Second, through an indirect coordination effect, where strategic complementarities lead some individuals to join the violence because mass media induces other individuals to join. The latter effect implies that mass media lead to positive spillovers in the case of collective violence, and can shift the composition of violence to comprising a higher share of violence that inherently

⁴ A definition of propaganda is "ideas, facts, or allegations spread deliberately to further one's cause or to damage an opposing cause." (Source: Merriam-Webster Online Dictionary). Early studies of how propaganda has been used were done by Lee (1945) and Lasswell (1971).

⁵Evidence shows that mass media can have *unintended* effects on ethnic animosity (Della Vigna et al., 2011) and violence (Monten and Iyengar, 2008) in times of conflict. Beginning with Lazarfeld et al. (1944), there has developed a large empirical literature examining how mass media affects political behavior in times of peace. For two recent reviews of the media effect literature, see DellaVigna and Gentzkow (2010), and Prat and Stromberg (2011).

⁶By incorporating strategic complementarities, the model deviates from the contest model - the workhorse model of conflict literature - that assumes away collective action issues within groups (e.g., Haavelmo, 1954; Hirshleifer, 1988). The model uses the global games framework (Carlsson and van Damme, 1993; Morris and Shin, 1998), which enables a unique equilibrium and the derivation of testable predictions. This paper follows Granovetter (1978) and Tilly (2008) in that collective violence by definition requires more coordination than individual violence.

requires more coordination, such as militia and army violence.⁷

The paper investigates these issues by estimating the effects of propaganda disseminated via radio before and during the 1994 genocide in Rwanda. The Rwandan Genocide was a nation-wide extermination campaign led by the country's government and members of the Hutu political elite against the Tutsi ethnic minority, which resulted in 500,000-1,000,000 civilian deaths and reduced the country's Tutsi population by approximately 75 percent. There was large-scale participation in the killings by members of the ethnic Hutu majority (des Forges, 1999; Straus, 2004; Verwimp, 2006). The violence varied in the degree of organization and coordination, ranging from largely uncoordinated individual violence to more collective forms of violence perpetrated by militia groups and the army. Controlled and supported by key members of the government, the "hate radio" station Radio Television Libre des Mille Collines (hereafter RTLM) led propaganda efforts through broadcasts calling for the extermination of the Tutsi ethnic group. RTLM is commonly believed to have played a significant role in fuelling the violence (BBC, 2003; ICTR, 2003; Dallaire, 2007).

The paper uses a unique nation-wide village-level dataset from Rwanda to examine the effects of access to RTLM broadcasts on participation in the violence. To measure access to the broadcasts, it uses information on RTLM transmitters to produce a dataset on radio coverage at a high spatial resolution. This enables us to estimate what portion of a given village (administrative sector) had sufficient reception to listen to the radio during the genocide. To identify causal effects, the empirical strategy exploits arguably exogenous variation generated by Rwanda's highly varying topography. Specifically, it uses *local* variation in radio reception arising from hills in the line-of-sight between radio transmitters and villages. Due to the country's topography, this variation in reception is practically random and, therefore, arguably uncorrelated with other determinants of violence. An additional advantage of Rwanda's highly varying topography is that spatial spillovers can be estimated by exploiting variation in radio reception across neighboring villages.

To measure participation in the violence, the paper uses data on the number of persons prosecuted for violent crimes committed during the genocide in each village (510,000 in total). ¹⁰ The prosecution data contains two distinct legal crime categories that capture the degree to which the

⁷The idea that mass media can facilitate coordination when actions are strategic complements is not new. Chwe (2001) formalized this idea and applied it to the advertising of consumer products with network externalities. Also, the coordination effect in this paper gives rise to a "social multiplier", since aggregate coefficients of exposure to mass media will be greater than individual coefficients (Becker and Murphy, 2000; Glaeser et al., 2003).

⁸ A significant number of moderate Hutus were also killed. For discussions on the death tolls, see des Forges (1999), Verpoorten (2005), as well as Davenport and Stam's analysis at www.genodynamics.com.

⁹The paper is not the first to use of this method of examining media effects in the social sciences. Olken (2009) was the first to use a similar (but not identical) approach in his study of the effects of mass media on social capital in Indonesia

¹⁰Since prosecutions are here a proxy for participation, there is a measurement error in the dependent variable. However, this is unlikely to bias the point estimates upward (see the data section for a discussion).

violence was collective. The first crime category is prosecutions for highly organized and *collective* forms of violence, which applies to members and accomplices of organizations such as militia groups, communal police, the gendarmerie, and the army (77,000 in total). The second category is prosecutions for less organized and coordinated *individual* violence, such as homicide or attempted homicide, where violence is carried out by a perpetrator who is not a part, or accomplice of, any of the organized groups in the first category (432,000 in number).¹¹ The two sets of legal data therefore allow us to investigate how RTLM affected different forms of violence.

The main results show that the broadcasts were responsible for an increase in violence during the genocide. The estimates suggest that a one standard deviation increase in radio coverage in a village increased total participation in violence in by 12-13 percent. A counterfactual estimate of the aggregate effects suggests that 10 percent (approximately 51,000 prosecuted persons) of the total participation in the genocide was caused by RTLM propaganda. Furthermore, the station is estimated to have had a larger aggregate effect on collective violence, compared to individual violence. Approximately 6.5 percent (28,000 persons) of the individual violence and 29 percent (22,000 persons) of the collective violence can be attributed to the broadcasts. The paper therefore provides evidence that conflict in general, and state-sponsored mass murder in particular, can be affected by propaganda disseminated through mass media.

The results also shed light on the mechanisms through which violence was fueled by the broadcasts. First, the estimates show that once a critical mass of the village had access to the broadcasts, the composition of violence changed to a larger share of collective violence, consistent with coordination effects. Second, there are positive cross-village spillovers for collective, but not individual, violence. The estimates show that, conditional on radio coverage in the village, prosecutions are significantly higher when a larger share of the population in neighboring villages has radio coverage. The spillover effects altered the composition of violence, as a larger share of village violence was collective when neighboring villages had access to the broadcasts. The two sets of results are consistent with the idea that "hate radio" broadcasts enabled improved coordination of militia groups and other forms of collective violence.¹²

The spillover effects on organized violence are quantitatively important, as it is estimated they caused 21.3 percent of the collective violence (16,000 persons). This implies that a majority of

¹¹Of course, one cannot rule out that homicides can also be subject to some degree of strategic complementarity - for example, due to some perpetrators' desire to conform or submit to peer pressure. As argued by Tilly (2008), however, collective violence by organizations such as militia groups can be viewed as fundamentally requiring more central coordination (in addition to any desire to conform or submit to peer pressure).

¹²This result is consistent with what some offenders themselves report. Based on interviews with perpetrators, Scott Straus (2007) concluded that RTLM catalyzed some "key agents of violence". Straus' subjects reported that "radio coordinated elites, signaled that authorities wanted the population to fight the enemy, and reinforced local mobilization for violence".

the effects on collective violence can be attributed to cross-village externalities. Interpreted within the framework of the model, a majority of the effects of the station on collective forms of violence were thus due to social interactions, or coordination effects, rather than the persuasive power of the content or inflammatory messages contained in the broadcasts.

As mentioned above, this paper primarily contributes to the large literature on the determinants of conflict by providing evidence that mass media can play an important role therein. It also contributes to the literature in economics that investigates the causes of the Rwandan Genocide (Andre and Platteau, 1998; Verwimp, 2005, 2006; Verpoorten, 2005) and the role of RTLM (Straus, 2007). Furthermore, it adds to the literature on the effects of mass media. A small theoretical branch in this literature deals with how self-interested elites use mass media to stay in power or achieve political goals (Besley and Prat, 2006; Glaeser, 2005; Edmond, 2008). While much of the large empirical media effects literature, which started with Lazarfeld et al. (1944), has suffered from endogeneity problems, recent research using more suitable methods for causal inference has found important effects on ethnic animosity (DellaVigna et al., 2011), political knowledge and beliefs (Gentzkow and Shapiro, 2004; Snyder and Stromberg, 2008), voting behavior (Gentzkow, 2006; Della Vigna and Kaplan, 2007; Chiang and Knight, 2008; Enikolopov et al., 2011; Gerber et al., 2009); and social capital (Paluck, 2009; Olken, 2009). This paper adds to the literature in this field by presenting evidence showing that mass media can move individuals to engage in the most violent and destructive behavior: the attacking and killing of fellow citizens.

The rest of the paper is structured as follows: Section 2 provides background information on the genocide and RTLM; section 3 presents the model; section 4 presents the data; section 5 explains the empirical strategy; section 6 presents the results and robustness tests; and section 7 concludes the paper.

2 Background

This section provides a brief historical background of pre-existing political tensions in the period leading up to the genocide, as well as the structure and content of RTLM broadcasts.

There are two large ethnic groups in Rwanda: the Hutu majority, and the Tutsi minority (the latter constituting approximately 10 percent of the population in 1991). Historically, the Tutsi minority had been the ruling elite; however, when the country gained independence from Belgium in 1962, Rwanda became a Hutu dominated one-party state. Following independence, several episodes of violence between the two ethnic groups led to hundreds of thousands of ethnic Tutsis fleeing to neighboring countries (Prunier, 1995). A period of relative stability followed, but in 1973

violent conflict resumed as ethnic clashes between Hutus and Tutsis in Burundi spilled across the border into Rwanda.

In October 1990, a Tutsi-led rebel army invaded northern Rwanda from Uganda. The rebels, who called themselves the Rwandan Patriotic Front (RPF), represented Tutsi refugees that had fled during earlier clashes, and demanded an end to the ethnically unbalanced policies Rwanda had been practicing. After a period of negotiations and unrest, a peace agreement was finally signed in Arusha in August 1993. With scarce resources and a weak mandate, the United Nations' peacekeeping forces were dispatched to facilitate the installation of a transitional government. After bouts of violence, unrest, and delays in the implementation of transitional measures, the Hutu president Habyarimana was assassinated when his jet was shot down on April 6 1994. Within days, extremist factions within Hutu-dominated political parties managed to take over key government positions. An ethnic cleansing campaign spread throughout the country shortly thereafter.

Broadly speaking, violence occurred in two forms. One was of a highly organized and coordinated kind, in which branches of government took an active role in the killings (from presidential guards to the regular army and the national gendarmes; and via the civil administration down to the mobilization and supply of resources to militia groups) (Prunier, 1995). Yet much of the collective violence was done by the *Interahamwe* militia, which had originally been the youth wing of the ruling political party (National Revolutionay Movement for Development, MRND), and the *Impuzamugambi* militia, which was the paramilitary wing of the extremist party Coalition for the Defence of the Republic (CDR). Together, the two groups and their paramilitary wings made up a coalition that became known as Hutu Power. Militia members participating in the organized and collective violence would erect roadblocks, distribute weapons, and systematically organize and carry out killings of Tutsis.

In addition to collective violence, there was also large-scale participation by civilians staging attacks which were much less organized and coordinated. In contrast to members of militia groups, civilians seldom had access to firearms, instead using mainly machetes and clubs (Straus, 2004; Verwimp, 2005).

The genocide ended in late July 1994 when the Tutsi RPF rebels defeated the Rwandan army and militia groups. By that point, at least 500,000 Tutsis had been killed (des Forges, 1999).

¹³The rebel army, numbering about four thousand well-trained troops, mainly consisted of second-generation Rwandan refugees. They had gained military experience from Uganda's National Resistance Army which seized power in 1986.

2.1 Media and RTLM

Prior to the start of the genocide, Rwanda had two national radio stations, RTLM and Radio Rwanda. RTLM began broadcasting in July 1993, using two transmitters. One 100 Watt transmitter was placed in the capital, Kigali, and another 1000 Watt transmitter was placed on Mount Muhe, one of the country's highest mountains. Although the government-owned Radio Rwanda had been broadcasting some propaganda before the genocide, it was RTLM that broadcast the most extreme and inflammatory messages.

RTLM was set up by members of Hutu Power. Until his assassination, President Habyarimana had been one its strongest backers (Des Forges, 2007). One of the station's founders, Ferdinand Nahimana, was also the director of the Rwanda Bureau of Information and Broadcasting (ORIN-FOR), the agency responsible for regulating mass media. Thus, a connection between the station and top government officials had evidently been established even before April 6 1994. After that date, when key members of Hutu Power took over, the station essentially became the voice of the new government. The broadcasts continued throughout the genocide, and did not abate until RPF rebels seized power in mid-July 1994.

The radio station called for the extermination of the Tutsi ethnic group and claimed that preemptive violence against it was a response necessary for "self-defense" (ICTR, 2003; Frohardt and Temin, 2007). In her content analysis of taped RTLM broadcasts, Kimani (2007) reports that the most common inflammatory statements consisted of reports of Tutsi RPF rebel atrocities (33%); allegations that Tutsis in the region were involved in the war or a conspiracy (24%); and allegations that the RPF wanted power and control over the Hutus (16%). Key government officials appeared on air, including Prime Minister Jean Kambanda. The language used in broadcasts was dehumanizing, as Tutsis would often be referred to as *inyenzi*, or cockroaches. After April 6 1994, messages from the radio station made it clear that the government had no intention of protecting the Tutsi minority from attacks, and that Hutus engaged in killings would not be held accountable. Instead, the propagated message was that the radio station as well as government officials encouraged the killing of Tutsis.¹⁵

Alternative print media did exist. The number of independent newspapers at the time of the

¹⁴Nahimana also played an active role in determining the content of RTLM broadcasts, writing editorials and giving journalists texts to read (ICTR, 2003).

¹⁵The fact that the station was popular and that there was demand for its broadcasts suggests that citizens viewed the broadcasts as contributing important information. For example, Des Forges described the high demand for RTLM as follows: "people listened to the radio all the time, and people who didn't have radios went to someone else's house to listen to the radio. I remember one witness describing how in part of Rwanda, it was difficult to receive RTLM, and so he had to climb up on the roof of his house in order to get a clear signal, and he would stand up there on the roof of his house with his radio to his ear listening to it." Interview with Alison des Forges, available (January 30 2011) at <www.carleton.ca/jmc/mediagenocide>

genocide, including political opposition publications, was between 30 and 60 (Alexis and Mpambara, 2003; Higiro, 2007). However, the circulation and readership of these newspapers in rural areas was limited due to relatively low literacy rates. Consequently, radio was the sole source of news for most people (des Forges, 1999).

It is commonly believed that RTLM broadcasts fueled the violence in Rwanda (BBC, 2003). In their verdict against the station's founders, the International Criminal Tribunal for Rwanda stated that organized and coordinated violence by militia groups had been affected by the broadcasts: "The International Criminal Tribunal for Rwanda stated that organized and coordinated violence by militia groups had been affected by the broadcasts: "The International Criminal Tribunal for Rwanda stated that organized and other militia listened to RTLM and acted on the information that was broadcast by RTLM. RTLM actively encouraged them to kill, relentlessly sending the message that the Tutsi were the enemy and had to be eliminated once and for all." (ICTR, 2003). Beyond qualitative and anecdotal evidence, however, it is still unclear how much of the violence was, in fact, caused by propaganda.

3 A Simple Model of Propaganda and Violence

To analyze how mass media can affect conflict, the paper first sets up a simple model of participation in collective violence. Albeit relatively simple, the model sheds light on some channels through which exposure to propaganda can translate into increased violence. Its main purpose is to derive a set of testable predictions that will be applied to the data in subsequent sections of the paper.

The model considers a situation in which there are two groups. Individuals in the majority group face the choice of participating in an attack against the minority group; the government's de facto policy on punishment (or reward) for such violence is uncertain; and some citizens receive information about the policy through mass media. The model is micro-founded, focuses on local violence, and allows for strategic complementarities in the organization of violence. The model will focus on two distinct types of violence: collective violence, where strategic complementarities play a role, and individual violence, where the payoff of conflict does not depend on whether others participate in the attack. By explaining macro (group) behavior based on individual decision-making, the model will deviate from typical conflict models that analyze group-level optimization while assuming away coordination issues within groups. ¹⁶

The model employs the static global game structure developed by Carlsson and van Damme (1993) and Morris and Shin (1998, 2005), which enables a unique equilibrium and the derivation of testable predictions.

¹⁶By incorporating strategic complementarities, the model deviates from the contest model - the workhorse model of conflict studies - which assumes away collective action issues within groups (e.g., Haavelmo, 1954; Hirshleifer, 1988).

3.1 Basic setup

Consider an area with a continuum of citizens. In principle, the area could be a country, region, or a village (in this section, we use the term village). Each citizen is a member of one of two ethnic groups, ethnic majority group H and ethnic minority group T. The population size of group H is normalized to 1, and the size of group T in each village is δ . The analysis focuses on the discrete decision by group H members to participate in an attack against minority group T in the village. In order to keep things simple, strategic behavior by minority group members is not studied. Instead, we assume that an exogeneous fraction δ of the minority group defends themselves in case of an attack, so that the size of the defending group is $\bar{t} = \delta t$. In what follows, we exclusively focus on the behavior of group H members.

Let the payoffs be

$$u = \begin{cases} \pi + \theta + \alpha \frac{h}{t} & \text{if the member participates in the attack} \\ 0 & \text{if the member does not participate in the attack} \end{cases}$$

The payoff from participating in the attack has an exogenous private benefit π . This could reflect the monetary value of resources (e.g., land or other property) that is taken from group T citizens in an attack, independently of the number of participants in the attack. Violence against minority citizens is potentially illegal and associated with punishment by the government. The parameter θ captures the punishment cost when the government can verify that an individual has participated in a violent attack. In democracies, we would expect a large negative value to reflect the strong protection of civil rights.¹⁸ The stronger the protection, the more negative θ will be. By contrast, a positive value of θ would reflect that violence is heavily state-sponsored.¹⁹ The de facto subsidy can come in many forms, such as through the provision of firearms, equipment, or training.

Importantly, we allow the payoff from participation in violence to depend on the total number of participants in the attack, relative to how many individuals defend themselves, $\frac{h}{t}$. That is, we allow strategic complementarities in violence, $\alpha \geq 0.20$ There are multiple reasons for α to

¹⁷In standard conflict models, the analysis takes place at the group level where coordination within groups is assumed away. For a framework of how relative sizes of ethnic groups affect conflict, see Esteban and Ray (2008).

¹⁸ In the spirit of Becker's (1968) model of crime and punishment, θ may be broken down into two factors consisting of the product of the probability of being caught by the government, and the punishment conditional on being caught. Disentangling the two factors empirically is not feasible, given the data in this paper, and we therefore lump them together

¹⁹Note that this is equivalent to punishment for *not* participating in the violence. This was, for example, very common during the Rwandan Genocide. Hutus who did not want to participate in the killings often had to pay fines to officials and organizers (Hatzfeld, 2003). Soldiers and police would also threaten to punish Hutus who wanted only to pillage and not to harm the Tutsis (Des Forges, 1999).

²⁰One could also, in principle, allow for strategic substitutes such that members are less willing to participate if others are participating. It is worth noting that the empirical results that will follow are largely inconsistent with

be strictly positive. For example, a positive α could reflect that it requires a certain number of individuals to make a militia group functional. There could be safety in numbers if attacking in numbers decreases the likelihood of one being injured or killed.²¹ To get a convenient formalization of these potential factors, we let the payoff structure be linear in $\frac{h}{t}$.

We are interested in the equilibrium number of ethnic majority members participating in the violence, h, and how this can be affected by broadcasting propaganda. To focus on the interesting aspects of such broadcasts, we simplify by assuming that the private value of π is zero.²²

3.2 Information and beliefs

In situations of ethnic conflict and civil unrest, political factions compete for power. This is often associated with uncertainty regarding the government's policy. In this context, the extent to which citizens will be punished or rewarded for participating in ethnic violence is often unclear. We formalize this by assuming that there is incomplete information about θ . In this section, we describe how members form their beliefs about θ .

In line with the literature on global games, members do not observe θ but receive information about its value, and thus form beliefs. We make the standard assumption that members have a diffuse prior distribution of θ on the real line. Each member i observes an independent private signal $x_i = \theta + \varepsilon_i$, where ε_i is independently and normally distributed with mean zero and variance σ_x^2 . We can consider x_i as all of the independent private information that a certain member has acquired from different sources.

Now, suppose there is a mass media outlet that broadcasts information about the government's policy position. Given the empirical setting in this paper, let the outlet be a radio station. The station broadcasts a signal p about the value of θ . A fraction r of the village population receives the signal p. For simplicity, we do not consider strategic behavior on behalf of whoever sends out the signal. Instead, agents correctly view the signal p as informative about an underlying policy, θ . The signal has the structure $p = \theta + b$. To keep the analysis simple, we assume that p is exogenous, unobservable, and distributed normally with mean zero and variance $\sigma_p^{2.23}$

strategic substitutes (derivations and predictions not shown, but are available upon request).

²¹ Additional reasons for a positive α could be different sources of interpersonal phenomena documented in social psychology and sociology. These include a desire to conform, peer pressure, and group think.

²²This is not an important assumption, but it simplifies the math. It can easily be relaxed without changing any of the results, since a positive value of π would simply lead to a larger baseline aggregate violence h in the absence of propaganda.

 $^{^{23}}$ The key assumption about p is that σ_p^2 is finite, so that the broadcasts are informative. The zero mean is not a binding assumption, since one can easily add a known constant to shift the distribution. If the radio signal is biased on average, individuals will adjust for this when they form beliefs about θ . Treating the signal as exogenous and without manipulation may be unrealistic. For a model with endogenous information manipulation in a civil war context, see Edmond (2009).

Key to the model is that p is a public signal among members with access to the broadcasts, i.e., there is common knowledge about the radio signal among ethnic majority group members with means of accessing a radio. Therefore, a member with radio access will not only use the signal to update his own belief about θ , but will also know that a fraction r of the other village members listen to the radio and receive signal p, and everybody with radio knows that everybody else with radio knows this, and so on. Individuals without radio access do not receive the public signal. In order to focus on the choices of majority members who receive the radio broadcasts, and to keep the analysis tractable, we make the simplifying assumption that members without radio are unaware of others receiving the radio signal.

Individuals use Bayes' rule to update their beliefs about the government's policy. For members without radio, the posterior distribution for member i who receives private signal x_i is normally distributed with mean $\bar{\theta}_i^N = x_i$ and variance σ_x^2 . For members with radio, the posterior expectation of θ given public information alone is normal with mean $\bar{\theta}_i^R = \left(\sigma_x^2 p + \sigma_y^2 x_i\right) / \left(\sigma_p^2 + \sigma_x^2\right)$.²⁴

3.3 Equilibrium

We are interested in the equilibrium level of participation in violent behavior, h. Consider a strategy where each member follows a simple switching rule

$$a(\bar{\theta}_i^j) = \begin{cases} \text{participate} & \text{if} \quad \bar{\theta}_i^j \ge \kappa^j \\ \text{do not participate} & \text{if} \quad \bar{\theta}_i^j < \kappa^j \end{cases}$$

where j=N labels the strategy for members without radio and j=R for members with radio. That is, members participate if their beliefs about the government's punshment cost (reward) is sufficiently low (high), i.e., $\bar{\theta}_i^j$ is above some threshold κ^j . Following Morris and Shin (1998, 2005), this strategy is unique under some regularity conditions (see the online appendix for the regularity conditions and the derivation of the equilibrium). Therefore, there is a unique equilibrium cutoff for members with radio (κ^R) and those without radio (κ^N) , defined by the expectation of government policy that makes an individual indifferent regarding the choice of attacking the ethnic minority group or not doing so.

For an individual with radio access, the threshold κ^R depends on how many members of the ethnic majority group also have access to the broadcast, $\kappa^R(r)$. When r is low, an individual gathers that not many others have received p. When r is high, however, the individual knows that most members have also received p. This can dramatically change the individual's expectations

²⁴The posterior variance is $\frac{\sigma_x^2 \sigma_p^2}{\sigma_x^2 + \sigma_p^2}$.

regarding how others will behave, and can change his own willingness to participate. Therefore, the fraction of the population with radio coverage, r, is a key variable for the equilibrium participation in violence.

3.4 Predictions

Having pinned down the equilibrium thresholds, κ^N and κ^R , we can derive the equilibrium participation, h. See the appendix for the derivation. Given a government policy θ and some signal p, we can calculate the participation rate among those unable to receive the broadcasts (the share with beliefs $\bar{\theta}_i^N \geq \kappa^N$), and the participation rate among the population receiving the broadcasts (the share with beliefs $\bar{\theta}_i^R \geq \kappa^R$). The weighted average gives us the participation rate as a function of the population exposed to the propaganda. We are now ready to state the main results.

Lemma 1 When the propaganda transmits the signal that violence against the minority group is state-sponsored (i.e., the cost θ is sufficiently low), participation in violence increases in the population with access to the media broadcasts (If $p > \tilde{p} \equiv -\frac{\alpha}{2\tilde{t}}$, then $\partial h/\partial r > 0$).

Proof: see the appendix. The logic behind Lemma 1 is relatively intuitive. Let propaganda be defined as a signal that the government encourages violence against the minority, $p > \tilde{p}$. Since this is informative, people receiving the propaganda update their beliefs about the government. When the updated belief increases the expected value of participation for the average member, which is the case when $p > \tilde{p}$, this will in turn increase the likelihood that an individual will participate.²⁵

Collective and Individual Violence

In principle, different forms of violence can be defined along the continuum of strategic complementarities, α . To focus on the key distinction, however, assume that there are two forms: collective, where strategic complementarities are present $(\alpha > 0)$; and individual, where the benefit of violence does not depend on whether others are violent $(\alpha = 0)$. The total violence h can therefore be broken down into two parts, where the population share for each type of violence is h_v , and where $v \in \{c, i\}$. Further, assume that the pool of eligible recruits for the two forms of violence are separable: γ share of the population are eligible recruits for collective violence, and $1 - \gamma$ can potentially join the individual violence. The motivation for this separability is that individuals who are marginal recruits for collective violence, e.g. by paramilitary organizations and the army, in

²⁵Note that this result implies that an average p will not necessarily increase violence. However, the result is equivalent to an alternative model where where the private signal x_i reflects heterogenous priors, θ is drawn randomly, and p is symmetrically distributed around θ . Since mass media is not manipulated, what the broadcasts do is simply provide information that the government exercises a repressive policy against the minority group.

practice are often physically capable young men, whereas women and older men are typically not eligible, willing, or marginal. Separability also simplifies the analysis.

Proposition 1 If the condition in Lemma 1 is satisfied, then there are increasing scale effects for collective violence (h_c) , but not individual violence (h_i) : $\partial^2 h_c/\partial r^2 \geq 0$, $\partial^2 h_i/\partial r^2 = 0$, $\partial h_i/\partial r = \bar{c} \geq 0$.

Proof: see the appendix. The intuition behind Proposition 1 is as follows. When there are no strategic complementarities, the individual decision to participate does not depend on the total number of participants. In this case, propaganda broadcasts only affect participation through beliefs about the government's policy. As the population with access to the broadcasts increases, the first (non-strategic) effect implies that more members will hold beliefs about the government's policy above the participation threshold. This effect on beliefs increases participation. As the fraction holding positive expectations of the value of conflict is constant within the population exposed to the propaganda, the effects are linear in the population exposed. This is the direct information effect.

Under strategic complements, there is an additional mechanism in play. Strategic complements imply that individuals are more willing to join the collective violence (e.g. a joint attack by a militia group) when many others also join. As more individuals are exposed to the propaganda, the direct information effect implies that a larger number are likely to participate in the violence. Expecting a higher participation rate, each individual exposed to the propaganda is consequently more willing to also participate (since the participation threshold is now lower). Therefore, propaganda can lead to an indirect coordination effect that stimulates participation in collective violence. The implication is that propaganda can cause some individuals to participate in collective violence, but not individual violence, simply because their peers are expected to participate (and will do so in equilibrium). Because of these social interactions, mass media lead to positive spillover effects across individuals in the village. Since the marginal effect is increasing in the share of the population exposed, the indirect effect gives rise to a non-linear, increasing scale effect in the case of collective violence. 26 If complements in violence are strong (α is positive and large), the coordination effect is a potentially important mechanism whereby propaganda affects behavior.

To see how propaganda can lead to information and coordination effects, Figure 1 plots the predicted effect under parameterized versions of the model where the condition in Lemma 1 is ful-

²⁶In the model, the scale effect arises because of coordination. It is worth noting that the scale effects can arise under a broader class of models with complements and peer effects when there exists no coordination problem. This possibility is important to keep in mind when interpreting the empirical results. For a discussion of scale effects in other contexts, see Glaeser et al.'s paper on the "social multiplier" (2005).

filled. To highlight the coordination effect, the parameter values are first set such that average prior beliefs (i.e., without receiving p) about the punishment costs (θ) are high, so that the information effect of radio coverage is negligible. The effect on individual violence is therefore practically zero (dashed black line). By contrast, ceteris paribus, collective violence can increase substantially once a critical mass has access to the broadcast. This is simply due to some individuals joining because they believe others will join - i.e. the coordination effect. Furthermore, since the cost of individual violence can differ from that of collective violence, the grey dashed line shows how individual violence is affected when θ is low, ceteris paribus. In this case, baseline violence in the absence of mass media is higher and violence increases in the size of the population exposed to the propaganda.²⁷ This effect, however, is linear. Since collective violence is non-linear, the example demonstrates that the *composition* of violence can be affected, as share of the violence that is collective can increase substantially when a critical mass has access to the broadcasts, even if baseline individual violence is higher in the absence of mass media.

From Theory to Empirics

In the sections below, we use data from Rwandan villages to estimate how propaganda disseminated by RTLM affected violence against the Tutsi minority during the genocide. The above results provide the main hypotheses to be tested. According to Lemma 1, as the share of the population exposed to RTLM propaganda, which arguably provided a signal that the Hutu elite in power supported the persecution of Tutsis, increases, participation in violence against Tutsis is predicted to increase. Proposition 1 also provides a test of coordination effects under strategic complements. If propaganda facilitates coordination of collective violence among Hutu citizens, we should expect non-linear effects in the share of the village population exposed.

The data (see below) is at the village level. A priori, to test for scale effects, it is unclear whether the village is the appropriate unit of analysis. In fact, as the median village area in the dataset is only 10.6 square kilometers, social interaction between individuals living in different villages is highly likely.²⁸ In this case, coordination effects due to radio might not only arise within villages (in fact, one might expect that within-village coordination in part could more easily be achieved through other means), but also across villages. Coordination effects will then lead to cross-village spatial spillovers, if the strategic complementarities exists across individuals living in different, but nearby, villages. Furthermore, in the presence of positive cross-village spillovers, the

²⁷The strategic complementarity parameter for collective violence is $\alpha = 0.05$. The other parameter values are: $\pi = 0$, p = 0.5, $\theta = -0.5$ for high cost, and $\theta = -0.1$ for low cost, and the variances of private information ($\sigma_x = 0.05$) and public information ($\sigma_p = 0.15$) are set such that the conditions for a unique equilibrium are satisfied.

²⁸The village is officially called an "administrative sector." The median population is 4,338.

true aggregate effect of propaganda on violence would be underestimated. Assessing whether such externalities exist, and their magnitudes, is therefore important, and the empirical strategy will include specifications investigating spillover effects across villages.

4 Data

Several sources of data are combined to construct a village-level dataset. The final dataset consists of 1065 villages.

Violence

To measure participation in the violence, we use a nation-wide village-level dataset on persons prosecuted for violent crimes committed during the Rwandan genocide. The data is taken from the government agency National Service of Gacaca Jurisdictions. The prosecution data for each village comes from local so-called *Gacaca* courts. This court system was set up in 2001 to process the hundreds of thousands of individuals accused of crimes committed during the genocide. There are two violent crime categories:

Category 1 includes prosecutions for those accused of having carried out more organized and coordinated attacks, legally defined as planners, organizers, instigators, supervisors of the genocide; and leaders at the national, provincial or district level, within political parties, the army, religious denominations and militia.

At the village level, this category typically implies crimes committed by local militia members such as the Interahamwe and Impuzamugambi. Since this category captures violence that is inherently more collective in nature, category 1 crimes will henceforth be referred to as *collective violence*.

Category 2 prosecutions concern acts of individual violence committed by ordinary citizens who were not members or accomplices of militia, the army, or other groups that carried out coordinated attacks. They are legally defined as authors, coauthors and accomplices of deliberate homicides or of serious attacks that caused someone's death; persons who - with the intention of killing - caused injuries or committed other serious acts of violence without actually causing death; and persons who committed criminal acts or became accomplices of serious attacks without the intention of causing death.

Since this category captures violence that is less collective in nature, henceforth category 2 crimes will be referred to as *individual violence*.²⁹

²⁹For the complete law specifying what consistutes category 1 and 2 crimes, see the National Service of Gacaca Ju-

The data specifies the number of prosecuted persons for each village in Rwanda. In total, approximately 77,000 persons were prosecuted for collective violence and 433,000 persons for individual violence. Since prosecution and participation are not identical, the number of persons prosecuted for violence is used as a proxy for the number of persons who participated in the violence. Henceforth, the number of participants and the number of those prosecuted will be used interchangeably. Figure 3 shows a map with total prosecutions across villages. Figure 4 shows the share of total violence that is collective (category 1 prosecutions divided by the sum of category 1 and 2 prosecutions) across villages. The map shows that there is substantial variation across the county.³⁰

Since we do not observe actual participation but rather prosecutions, we are likely to have some measurement errors in the dependent variable. That is, in some villages more individuals were prosecuted relative to the number of individuals that actually committed a given crime, and vice versa; however, this will not lead to biased estimates unless the measurement error is correlated with the variation in radio coverage. In case the measurement error is correlated with radio coverage, the sign of the bias will depend on the sign of the correlation. One worry is that due to the alleged impact that RTLM had on Tutsi deaths, there were fewer Tutsis to act as witnesses after the genocide. This may decrease the likelihood that someone who committed a given crime was actually later prosecuted. In this case, the correlation would be negative, leading to an underestimation of the true effects.

RTLM Reception

This paper uses village-level data on predicted radio coverage. The variable is constructed in several steps. First, it uses data on Radio RTLM transmitter locations and technical specifications, provided by the government agency Rwanda Bureau of Information and Broadcasting (OR-INFOR).³¹ Our data predicts radio coverage across the country using engineer-developed digital topographic maps and radio propagation software. The software (ArcGIS) uses an algorithm called ITM/Longley-Rice, which is typically used by radio and TV engineers to assess the signal strength of broadcasts.

The software uses a digital topographic map of Rwanda, provided by the Shuttle Radar To-

risdictions: http://www.inkiko-gacaca.gov.rw/En/EnLaw.htm. See Tilly (2008) for a conceptual discussion regarding the distinction between collective violence and individual violence.

³⁰White areas on the map indicate an absence of data. This is either due to the presence of national parks and Lake Kivu, or because of difficulties in matching village names across datasets (see below).

³¹The transmitter specifications include latitude, longitude, altitude of antenna base, antenna height, transmission power, frequency, and polarization. For the Mount Muhe antenna, ORINFOR did not provide data on its exact GPS position. However, since the height above sea level for the antenna was provided, its position on the mountain was possible to pin down with high precision.

pography Mission (SRTM), and lets the software run the ITM/Longley-Rice algorithm to predict signal strength across the country. Due to the high resolution of the topographic data, the software can predict radio coverage with high precision. The software predicts signal strength at 90 meter cell resolution, and indicates whether each cell has sufficient signal strength reception.

Using the digitized map of village boundaries, we can calculate the fraction of a given village that had RTLM radio coverage. This is the main independent variable. Figure 2 shows a map of the radio coverage variable. As the measure uses predicted radio coverage rather than actual radio coverage, there could be some random measurement errors in the data (although this is unlikely to be significant, given the 90 meter resolution of the topographic data). In that case, one could observe an attenuation bias and an underestimation of the true effects.³² As there is no available dataset on Radio RTLM listening rates, the paper will estimate the reduced form effect of RTLM radio coverage on participation in the violence.³³

Additional Data

Population and ethnic data was retrieved from the Rwanda 1991 population census provided by IPUMS International and GenoDynamics. The GenoDynamics data is used for the population in each village, but it does not contain any data on ethnicity. The data was matched to village names within communes. Unfortunately, the matching is imperfect, as many villages either have different names in different data sources, or use alternate spelling. It is also not uncommon for two or more villages within a commune to have identical names, which prevents successful matching. Due to these data-matching issues, the final dataset contains 1065 villages out of the total 1513 in the country. As most of these issues are idiosyncratic, the main implication is likely lower precision in the estimates than otherwise would have been the case.

The 1991 census from IPUMS International reports the number of Tutsi and Hutu households in a given commune. The ethnicity of a household is defined by the ethnicity of the household head. To measure ethnic minority size, the number of Tutsi households is divided by the number of Hutu households in the commune.³⁴

Before and during the genocide, newspapers served as alternative information sources for house-

³²The propagation model creates missing data problems for a small section of villages near the border in the north and northeast of the country. Since the predicted radio signal was incorrect for those villages, they were dropped from the sample. This is unlikely to affect the estimations and conclusions, as only a small fraction of the violence (1.9% of all prosecutions) took place in these villages. In fact, all the main results are robust to the inclusion of these villages.

³³The average radio ownership rate within the commune in the sample is 34%, taken from the 1991 Census. Radio ownership data is not available at the village level.

³⁴There is no village identifier available in the IPUMS data. There are 128 communes in the sample.

holds. In the years preceding the genocide, the independent press quickly expanded, simultaneously with a growth in multi-party politics and the legalization of opposition parties in June 1991. The number of independent newspapers that did not align with government parties was between 30 and 60 during this period (Alexis and Mpambara, 2003; Higiro, 2005). Arguably, a necessary requirement for access to newspapers is literacy and basic primary education. In addition, Des Forges (1999) reports that, in practice, not only the literate would read the newspapers, but those who knew how to read were accustomed to reading newspapers out loud to others.³⁵ To test for whether propaganda affects violence differently depending on literacy and primary education, we construct literacy rates and primary education levels using the IPUMS data. As an additional control variable for wealth, the fraction of households that has a cement floor (i.e., not a dirt floor) is used as a proxy.

Finally, a set of spatial variables is also included. The SRTM topography data and ArcGIS software maps allow us to calculate the village mean altitude, the village variance in altitude, distance to the border, and population density. Using data from Africover, we can also measure the village centroid distance to the nearest major town and the distance to the nearest major road.

The summary statistics are presented in Table 1.

5 Empirical strategy

Identifying the causal effects of radio coverage on violence requires variation in radio coverage to be uncorrelated with all other determinants of violence. In the model, radio coverage is exogenous, while in reality the placement of the two RTLM transmitters was not random. One 100 Watt transmitter was placed in the capital Kigali. The other transmitter (1000 Watt) was placed on Mount Muhe in the northwestern part of the country.³⁶ The main endogeneity concern is that the transmitters could have been placed in areas more prone to conflict. The simple correlation between radio coverage and participation would then violate the identifying assumption.

The following identification strategy addresses the problem in steps.³⁷ Nicknamed "The Land of the Thousand Hills," Rwanda is a very hilly country without any large, continuously flat regions.

³⁵The model assumes that independent information is unbiased on average. However, since the newspapers in Rwanda were typically aligned with political parties, each newspaper most likely supplied biased information. This does not necessarily mean that the newspapers were biased on average. In fact, Mullainathan and Shleifer (2005) argue that, given sufficient political divisions, the information will on average be unbiased.

³⁶The tallest mountain in Rwanda, Mount Karisimbi, is on the border with the DR Congo and Uganda. Mount Muhe is the second tallest mountain in the country, but also the tallest that is well within the its borders. There is strong reason to believe that the placement of the transmitters was driven by the desire to maximize the number of listoners.

³⁷The strategy was pioneered by Olken (2009). The approach in this paper is similar but not identical to that of Olken.

Appendix figure 1 shows a map with its topography. As is clear from the figure, there are hilltops and valleys nearly everywhere in the country. The main strategy of this paper is to exploit *local* variation in radio coverage due to hills lying in the line-of-sight between radio transmitters and villages.

Radio propagation follows the laws of physics for electromagnetic propagation. Given transmitter height and power, the two main determinants of the signal strength are distance to the transmitter, and whether the receiver is in the line-of-sight of the transmitter.³⁸ In free space, the power density of the radio signal decreases in the square distance from the transmitter. Since the transmitter may have been placed strategically, the distance to the transmitter is most likely correlated with other determinants of violence.³⁹ We therefore control for a second-order polynomial in the distance to the transmitter.⁴⁰ This will leave variation in signal strength caused by variation in the line-of-sight between the transmitter and the receiver.

Whether the receiver is in the line-of-sight of the transmitter will depend on two factors: the topography of where the receiver is located (the higher the altitude of the receiver, the higher the likelihood of its being in the line-of-sight) and the topography of the area between the transmitter and the receiver. Since the topography of a village may be correlated with the other unobservable determinants of participation in conflict, it should be controlled for. Specifically, we include second-order polynomials in the mean altitude of the village and the altitude variance. This will leave variation in the radio coverage due to the topography between the transmitter and the receiver.

Since the two RTLM transmitters may have been strategically placed in parts of the country with a certain kind of topography, the remaining variation (after controlling for the distance to the transmitter and the topography of the village) may still be correlated with determinants of violence. Therefore, in order to control for broad regional differences in topography, we include commune fixed effects.⁴¹ The variation in radio coverage exploited for identification is thus a highly local variation across villages within communes. This variation is arguably uncorrelated with other determinants of conflict, as radio coverage is determined by whether a hilltop randomly happens

³⁸If the electromagnetic signal encounters sharp-edged objects, there can also be some diffraction. The exact formula, and the Longley-Rice model, can be found at http://flattop.its.bldrdoc.gov/itm.html (Available Dec 30 2012).

³⁹The bias is likely to be negative for at least two reasons. First, radio coverage was better in the northern part of the country. As the Tutsi RPF rebels advanced from the north to stop the genocide, violence against Tutsis was greater in the South. Second, there were fewer Tutsis in the north to begin with, so practically fewer could be attacked and killed.

⁴⁰The second-order polynomial in the distance to the transmitter alone explains 44 percent of the variation in radio coverage. We use second-order polynomials to address the possibility of non-linear relationships. The results are not sensitive to this, as simple linear terms give very similar results.

⁴¹Commune fixed effects alone explain 82 percent of the variation in village mean altitude, and 72 percent of the variation in radio coverage.

to be in the line-of-sight between the transmitter and the village.

To see this, appendix figure 2 graphically illustrates the topography and radio coverage variation within four communes in the northern part of the country. The radio signal in these communes comes from the Mount Muhe transmitter located approximately 30 km west outside the figure. The figures show that within each commune, villages that happen to be situated to the east of the hilltops have low radio coverage, while villages that happen to be situated to the west of the hilltops have high radio coverage. This is because the signal comes in from the west, and the hilltops are in the line-of-sight of the transmitter. This arguably provides a credible identification strategy, as there is no plausible reason why other determinants of participation in violent behavior should be different across the eastern and western sides of the hilltops.⁴²

Exogeneity check

If the identification strategy is valid and radio coverage is as good as randomly assigned, there should be no correlation between the variation in radio coverage and the other determinants of participation in violence. To assess this, we test the validity of the exogeneity assumption by using available observable village characteristics from different data sources. The regression specification is

$$y_{ci} = \beta r_{ci} + X'_{ci}\pi + \gamma_c + \varepsilon_{ci} , \qquad (1)$$

where y_{ci} is a characteristic of village i in commune c; r_{ci} is the radio coverage of village i in commune c; X'_{ci} is the vector of village i controls and γ_c is the commune fixed effects.

The vector of standard village controls are second-order polynomials in the distance to the nearest transmitter, the average altitude in a village and the variance in altitude within a village. If the exogeneity assumption is correct, we expect $\beta = 0$.

Table 2 shows the results. None of the village characteristics are significant, which lends credibility to the identification strategy. In the main regressions, results will be presented both with and without village characteristics. In general, the results are similar with and without the inclusion of these covariates.

5.1 Specifications

This section presents the main econometric specifications used to test how the RTLM broadcasts affected collective and individual violence.

⁴²In this example, the variation comes from the east-west relationship to the hilltops. In other communes it will, of course, function in other directions. In table 2 we also show that the slope of the village is uncorrelated with radio coverage.

Main Effects

To test whether RTLM affected participation in the genocide, the following regression is first estimated

$$\log(h_{vci}) = \beta_v r_{ci} + X'_{ci} \pi + \gamma_c + \varepsilon_{ci} , \qquad (2)$$

where h_{vci} is the number of persons prosecuted for violence type v in village i in commune c; r_{ci} is the RTLM radio coverage of village i in commune c; X_{ci} is the vector of village i controls; and γ_c is the commune fixed effects.⁴³ We will run separate regressions where h_{vci} is collective violence, individual violence, or total violence (sum of collective and individual). The vectors of baseline covariates to control for radio propagation determinants are latitude, longitude, and second-order polynomials in the distance to the nearest transmitter, the mean altitude in the village, and the variance in altitude within the village. We use second-order polynomials to control for potential non-linear relationships in distance and altitude. In additional specifications, we also add controls for the slope of the village (north, east, and south dummy variables) at the centroid, and logs of population, population density, distance to the nearest major town, distance to the nearest major road, and distance to the border. Since equation 2 only includes radio coverage of village i, β_v captures the direct (within-village) effect of radio coverage on violence type v. If RTLM increased participation in the killings, we would expect $\beta_v > 0$.

To account for spatial autocorrelation, Conley (1999) standard errors that adjust for spatial dependence are used.⁴⁴

To investigate whether scale effects within villages lead to more collective forms of violence, a more flexible specification is estimated using five dummy variables that indicate increments of r_{ci} (zero radio coverage is the omitted category). If mass media facilitate coordination when there are strategic complementarities, we would expect non-linear, increasing scale effects within villages for collective violence, but not for individual violence. Since this mechanism would affect the composition of violence, regressions with the share of collective violence (number of prosecutions for collective violence, divided by the sum of prosecutions for collective and individual violence) as the dependent variable are also included.

Spatial Spillover Effects

The broadcasting of propaganda in a village may not only affect violence in that village, but also

⁴³Of the 1065 villages in the sample, 20 villages had no prosecuted persons. Since the outcome variable is logged, and the log is undefined at zero, we add one prosecution to all observations in the data. The results are robust to dropping the villages with zero prosecutions.

⁴⁴The spatial dependence cannot be unlimited. We use a distance cut-off of 50 km. This implies that we assume the errors are uncorrelated across villages at least 50 kilometers apart. The results are also robust to higher cut-offs, e.g. a 100 km cut-off, and to using clustered standard errors at the district level (see appendix).

in nearbly villages through spatial spillovers. According to the model, positive spillovers can arise when there are strategic complementarities in violence and mass media facilitate coordination. To test this, the following specification is estimated

$$\log(h_{vci}) = \lambda_{vd}\bar{r}_{dci} + \bar{X}'_{dci}\phi_d + \gamma_c + \varepsilon_{ci} , \qquad (3)$$

where \bar{r}_{dci} is the population-weighted average of radio coverage in other villages within distance d from village i in commune c; and \bar{X}'_{dci} is the population-weighted average of covariates X' of villages within distance d from village i. Since \bar{r}_{dci} is population-weighted, it captures the share of the population in neighboring villages that have radio coverage. Weighting by population is reasonable since spatial spillovers are theoretically predicted to arise from scale effects in the population (and not geographic areas) exposed to broadcasts. The distance d is either within ten kilometers, or between 10 and 20 kilometers from village i. In principle, spatial externalities can, of course, work beyond 20 kilometers. For example, broadcasts increase violence in one village, which increases violence in neighboring villages, which, in turn, affects the violence levels in their respective neighboring villages, and so on. To the extent that such spillovers exist beyond 20 kilometers, the estimated equation will yield a lower bound on the total propaganda effects. However, a priori it seems unlikely that spillovers over such distances are present. We also test for this directly by including variables beyond 20 kilometers. If strategic complementarities in collective violence span across individuals living in nearby villages (within distance d), mass media can facilitate cross-village coordination of violence, which would lead to $\lambda_{vd} > 0$.

The parameters will be estimated separately for collective and individual violence. If collective violence requires more coordination than individual violence, strategic complementarities are stronger and λ_{vd} would be more positive for collective violence. To assess the degree to which the broadcasts affect the share of the violence that is collective, additional regressions, where the dependent variable is the number of persons prosecuted for collective violence divided by the total number of prosecutions, will be estimated.

In addition, if radio facilitates coordination of violence across villages, leading to violence that is more collective in nature, then the direct effect of radio reception in a village will be higher if other villages are also exposed to the broadcasts.

⁴⁵The village distances are measured from centroid to centroid.

⁴⁶For parameters in regression models with spatial spillovers to be identified, the spatial dependence needs to be bounded. For a classic work on spatial econometrics, see Anselin (1988). For a more recent overview of spatial econometric models and their respective limitations, see Elhorst (2010).

⁴⁷The results are also robust to the inclusion of variables extending beyond 20 km (results not shown).

To test this, the following specification is estimated

$$y_{ci} = \beta r_{ci} + \lambda_d \bar{r}_{dci} + \theta \left(r_{ci} * \bar{r}_{dci} \right) + \bar{X}'_{dci} \phi_d + \gamma_c + \varepsilon_{ci} , \qquad (4)$$

where y_{ci} is the share of violence that is collective. When the marginal effect of radio reception in a village is higher when neighboring villages also receive the radio, then $\theta > 0$.

Finally, additional specifications test for heterogeneous effects depending on the size of the ethnic minority and the level of basic education in a given village.

6 Results

Table 3 presents the effects of RTLM radio coverage in a village. Columns 1-3 show the effects on total violence. The regression in column 1 uses commune fixed effects, column 2 adds the propagation controls, and column 3 includes additional covariates. The estimated effects of RTLM reception are statistically significant (at the five percent level) and quantitatively important. The estimated coefficients in columns 1-3 imply that full radio coverage increased the number of persons prosecuted for any type of violence by approximately 62-69 percent (.484 - .526 log points), compared to persons in areas with no radio coverage. A more relevant comparison arises when we scale the coefficient by the variation in radio coverage in the sample. The estimates in the columns suggest that a one standard deviation increase in radio coverage increased participation in all forms of violence by 12-13 percent.

Columns 4-6 present the results on collective violence. The estimates are significant at the five and one percent levels and imply that a one standard deviation increase in radio coverage increased participation in collective violence by 13-14 percent. RTLM broadcasts were also shown to have increased individual violence. The estimates (significant at the ten percent level) imply that a one standard deviation increase in the share of the village with radio reception increased individual violence by 10-11 percent. Compared to the effects on collective violence, the estimates suggest that individual violence was less affected by the broadcasts. However, the effects are not statistically discernible from one another.

Thus, the results show that RTLM broadcasts increased participation in violence during the genocide. According to the model, under complementarities in violence, the supply of propaganda will exhibit scale effects for collective violence (see figure 1). To investigate this possibility, figure 5 graphically illustrates results using a more flexible specification with dummy variables (for coefficients and standard errors, see appendix table 1). For collective violence (figure 5A), there is evidence suggesting scale effects within villages: for increases in radio coverage at low levels,

the overall pattern indicates that there is no increase in participation, but once a critical level is reached, there is a sharp increase in violence. This is in contrast to individual violence, for which there is no pattern indicating increasing scale effects within villages. Figure 5B shows the estimated coefficients when the outcome is the share of collective violence. There is no increase in the share of collective violence for low levels of radio coverage - the coefficients are close to zero up until the 80 percent mark, but when a sufficiently large share of the village has radio reception, the composition of violence is more collective (significant at the five percent level).

Interpreted within the theoretical framework, these scale effects arise as the broadcast facilitates coordination, in addition to the direct information effect due to content. As suggested by figure 1, when a large share of the population within a village has access to the broadcasts, mass media can also function as a coordinating device. The sharp increase in the share of violence that is collective then arises as it is only at the high levels that potential militia members (the main type of organized group violence in villages) in the Hutu population expect other potential militia members within the same village to show up and participate in attacks against Tutsis.⁴⁸

As discussed above, the same mechanism can arise also *across* villages, if strategic complementarities matter beyond village borders. This hypothesis is investigated next.

6.1 Spillover Effects

Table 4 presents the estimates of equation 3. For collective violence, column 1 shows that cross-village spillovers within 10 km are statistically significant and substantially important. The point estimate (2.18) implies that a one standard deviation increase in the share of the population in nearby villages with radio reception (0.18) increases participation in collective violence by 47.6 percent. The spillover effects are spatially limited, as there is no evidence of radio coverage mattering in villages more than 10 kilometers away. The specification in column 2 includes the direct effect of radio coverage in the village. The estimates on the spillover coefficient are very similiar, suggesting that the spillover effects are not simply arising from spatial autocorrelation in radio coverage.

Furthermore, comparing the direct effect in column 2 to the spillover effect, the magnitude of the spillover coefficient is four times the direct effect coefficient (2.04 versus 0.505); however, the two coefficients are not directly comparable, given that a marginal increase in the two variables uses different population scales. The average village population in the sample is 4850. The population in nearby villages within 10 kilometers is, on average 96,600. Therefore, if we compare a marginal increase in radio coverage within a village to the marginal increase in the population-weighted radio

⁴⁸Unsurprisingly, since the overwhelming fraction of total prosecution cases is for individual crimes, we find little evidence of scale effects when summing collective and individual violence.

coverage in villages within 10 kilometers, the results imply that the population exposed is approximately 20 times larger in the latter case. Thus, it is not surprising that the spillover coefficient is larger than the direct effect coefficient. If we scale the spillover effect by the relative average population, the spillover effect implies that the marginal effect of an increase in the *population* having access to the broadcasts in nearby villages (within 10 kilometers) is approximately 1/5 of an increase in the share of the population within a given village.

By contrast, columns 4-6 show that there is no evidence of positive spillovers for individual violence.⁴⁹ Similar to the within-village results, the spillover effects therefore affected the composition of violence. To estimate this directly, columns 10 and 11 show that the share of collective violence increases when nearby villages have radio coverage.

What can explain the spillover effects? Interpreted within the model, positive spillovers across individuals that have access to the broadcasts are the result of improved coordination. One explanation for the underlying mechanism of the spillover effect is therefore that there are complementarities in collective violence that span beyond village boundaries. When violence in other nearby villages increases due to the broadcasts, potential militia members in a given village correctly expect other potential militia members in nearby villages to show up and participate in attacks against Tutsis. Because the willingness to participate in collective attacks is higher when others participate, the result in an increase the share of the violence that is collective.

Yet spillover effects may arise for other reasons, too. An alternative interpretation is that the cross-village externalities in columns 1-2 and 10-11 are due to information spillovers, as people in neighboring villages may share information they have heard on the radio, or because they visit one another's homes.⁵⁰ This seems less likely, however, since there are no spillover effects for individual violence. There is no obvious reason why this information would only spread to individuals who are part of, or potential recruits of, militia groups and other organized groups. Moreover, if the cross-village effects are due to such information spillovers, radio coverage should be substitutes across nearby villages. That is, if radio reception was already strong in a given village, there would be no role for the spread of information about the content of the broadcasts to nearby villages that also have radio access, since this would merely constitute repeating the same information. Rational individuals would therefore not double-count the information. If the indirect effects are due to information spillovers, the interaction effect of the two radio coverage variables should be negative,

⁴⁹Since prosecutions for individual violence consititute 85 percent of total violence, it not surprising that there are no spillover effects on total violence (columns 7 and 8).

 $^{^{50}}$ Of course, both mechanisms could be in play. In this case, the sign of the interaction coefficient reflects which mechanism dominates.

but the interaction coefficient in columns 3 and 12 shows that the interaction coefficients between radio coverage are positive and large (although imprecisely estimated), rather than negative.⁵¹ This is exactly what we would expect when there are strategic complementarities in collective violence, since the marginal effect of propaganda is higher when other individuals also receive the same broadcasts.

In addition, the coordination mechanism is consistent with what perpetrators themselves report. From interviews with perpetrators, Scott Straus (2007) concludes that RTLM catalyzed some "key agents of violence" and that perpetrators had reported that "radio coordinated elites, signaled that authorities wanted the population to fight the enemy, and reinforced local mobilization for violence." ⁵²

6.2 Heterogeneous Effects

To further investigate under what conditions propaganda leads to increased violence against an ethnic minority, as was the case in Rwanda, we allow the effects to depend on the relative size of the ethnic groups in a commune. This test is also partly motivated by the simple idea that propaganda may be more effective in persuading people to participate in the attacks when the minority is small and less capable of defending itself, since conflict is less costly for the majority in this case.

Table 5 presents estimates for the effects in villages with a relatively small Tutsi minority (below the median commune level) and for villages where the Tutsi minority is relatively large (above the median commune level).⁵³ When control variables are included, the propaganda effects are insignificant and close to zero if the ethnic minority is relatively large. When the ethnic minority is relatively small, however, the estimates are large and significant. They imply that a one standard deviation increase in radio coverage increased participation in collective violence by 20 percent (column 4), and participation in individual violence by 16 percent (column 6). The results therefore indicate that propaganda is more effective in inducing violence when the ethnic minority under attack is relatively small.

To further investigate the conditions under which propaganda in the form broadcasted by RTLM may translate into ethnic violence, we estimate heterogeneous effects depending on the education levels of the Hutu population. This is partly motivated by the fact that the only alternative

 $^{^{51}}$ Large standard errors are not surprising given that the variation in radio coverage across nearby villages is naturally limited.

⁵²In addition, in Jean Hatzfeld's (2003) interviews with convicted militiamen who gave personal accounts of how village violence was organized and carried out, the killers' descriptions are consistent with strategic complementarities in militia violence across nearby villages.

⁵³The median is a 7.7 percent Tutsi population. The maximum minority size is 44 percent.

media sources in the country were newspapers, and literacy is a necessary requirement for reading newspapers. Since education is correlated with wealth (which may have a direct effect, especially since wealthy households are more likely to own radios), all regressions include interaction effects between radio coverage and a wealth measure. The wealth measure is the percentage of Hutu households with a cement floor in the commune. The data comes from the 1991 census.

The results suggest that literacy and primary education have the ability to mitigate adverse propaganda effects. The results in table 6 show that the effect of broadcasts on violence decreases with literacy rates and primary education levels among Hutu households. The estimates are significant at conventional levels.⁵⁴

6.3 Aggregate Effects

In order to assess the effect of RTLM broadcasts on aggregate participation in genocidal violence, this section performs simple counterfactual calculations estimating what the scale of the genocide would have been in the absence of the broadcasts. Table 7 presents the results.

The actual number of persons prosecuted for collective violence is approximately 77,000, and for individual violence approximately 433,000. As the results in table 4 show that spillover across villages were important for participation in collective violence, we construct two counterfactual aggregate measures of collective violence using the estimated equation 3.⁵⁵ First, we estimate a counterfactual allowing for both direct effects and spillovers. The difference between the actual and the counterfactual number of prosecutions gives us the total effect of RTLM broadcasts. Second, we estimate a counterfactual assuming only direct effects while ignoring cross-village spillovers (i.e., restricting the spillover parameter in equation 3 to be zero). Comparing the two counterfactuals will then allow us to estimate the contribution of cross-village spillovers.

To do this, for collective violence we use the estimated regression 5 of table 4. Since the coefficient of radio coverage within 10-20 kilometers is small and insignificant, we simply let it be zero. To account for uncertainty in the estimated regression parameters, we first draw each coefficient (one for the direct effect and one for the spillover effect within 10 km) from a normal distribution with mean equal to the estimated coefficient and standard deviation equal to the standard error. For each observation, we then calculate the counterfactual number of prosecutions. The total number of prosecutions in the sample is then summed. Since the sample does not contain the universe of villages, we rescale the counterfactual number estimated in the sample by the fraction

⁵⁴Since primary education and literacy are not randomly assigned, one should worry about omitted interactions that would lead to biased estimates. The interaction effects in table 6 should, therefore, be interpreted with caution.

of actual prosecutions in the sample. This gives us the counterfactual number of prosecutions in the country as a whole. This procedure is then repeated 500 times, using a random draw of coefficients each time. For individual violence, as we find no evidence of cross-village spillovers, we follow the same procedure as for collective violence, with the difference that the estimated equation 2 is used instead (estimated coefficient and standard error come from column 9 of table 3).

Table 7 presents the means and standard deviations of the estimated counterfactuals and appendix figure 4 illustrates the distributions graphically. Focusing on the mean, the estimates imply that 9.9 percent (approximately 51,000 persons) of the total participation in genocidal violence was caused by the propaganda. Looking at the two forms of violence separately, we see that 6.5 percent of individual violence was caused by the broadcasts, while for collective violence the effects are substantially larger. The estimates suggest that 29.0 percent (approximately 22,000 persons) of the aggregate collective violence was caused by RTLM broadcasts. The evidence also shows that spillovers were important, as only 7.7 percent of the collective violence is estimated to be due to direct effects. 22.3 percent of the collective violence can, therefore, be attributed to spillover effects. If we are willing to interpret this as evidence of coordination effects, the results indicate that the radio station was important in coordinating violence perpetrated by the militia and the army.

Conservative estimates suggest that at least 500,000 people were killed in the genocide (Des Forges, 1999). However, since there is no reliable nation-wide data on deaths available at the village level, one limitation of the data is that it does not allow for direct estimates of how many deaths the broadcasts caused. Additional assumptions are therefore needed to assess the causes of deaths. Under the additional assumption that the number of deaths was proportional to the total number of prosecution cases, the estimated effects suggest that RTLM caused approximately 50,000 Tutsi deaths. Due to the lack of data on deaths, however, the degree of uncertainty about this number is high and the estimate should be interpreted with caution.

6.4 Robustness

To ensure that the results are not disproportionately affected by data from one particular region, we exclude each one of the 26 districts, one-by-one, and re-run the main regressions in tables 3 and 4. Appendix figure 3 shows the distribution of the estimated coefficients. There is no evidence that the results were disproportionately affected by data from any particular district. Finally, appendix table 2 shows that the results are robust to using district-clustered standard errors.⁵⁶

⁵⁶The results are also robust to clustering at the commune level.

7 Concluding Remarks

This paper provides evidence that, at least under certain conditions, mass media can affect conflict. The evidence in this paper highlights some of these conditions. First, propaganda encouraging violence against an ethnic minority appears to be more capable of inducing participation in violence when the minority is relatively small and defenseless. Also, mass media aimed at stimulating violence may be more effective when the targeted audience lacks basic education. Of course, additional fundamental factors, beyond the scope of this paper's investigation, are likely to be just as important; these include pre-existing ethnic animosity and a history of civil war.

Furthermore, the empirical results show that the scale of propaganda appears to be important for more organized and coordinated forms of collective violence. Propaganda is found to be most likely to produce adverse effects when a large share of the population is exposed to it. As suggested by the proposed framework in this paper, such effects may arise because there are strategic complementarities in violence that require higher degrees of organization and coordination.

Together, these factors jointly caused RTLM broadcasts to increase levels of violence during the Rwandan Genocide. The counterfactual estimates suggest that approximately 10 percent of the participation in the genocidal violence was due to the radio station's broadcasts, and that almost one-third of the violence by militias, communal police, gendarmerie and other organizations was caused by the same station.

The results are also relevant for policy regarding restrictions on mass media, especially in cases of state-sponsored mass murders. The 1994 Rwandan Genocide is one such example. Romeo Dallaire, the United Nations Force Commander for the peacekeeping intervention, urged the international community to jam RTLM signals, but his call went unheeded. One argument against such a measure was that it would result in a violation of Rwanda's state sovereignty. Another argument in favor of allowing the media to operate without restrictions is consensus on the fundamental human right to free speech and a free press. This argument was put forward at the time, and lawyers from the U.S. State Department concluded that the U.S. should not interrupt RTLM broadcasts partly for this reason (Des Forges, 2007). The U.S. Department of Defense had also estimated that jamming the station would be costly - about \$8500 USD per hour. The results presented in this paper show that allowing the station to broadcast the propaganda had a direct human cost in terms of increased violence. In addition, the violence may also have had long-term consequences for human capital formation (Akresh and de Walque, 2009), economic development, and political stability. In future ethnic conflicts where there is evidence of state-sponsored violence, it might, therefore, be advisable that this possibility be taken into account.

Finally, although this paper provides evidence on some of the conditions under which mass

media is likely to affect violence, only so much can be inferred from one case study. Future research ought to identify the broader contexts in which the involvement of mass media has the power to stimulate conflict and war.

References

- [1] Akresh, R and de Walque, D. (2009), "Armed Conflict and Schooling: Evidence from the 1994 Rwandan Genocide," *IZA Discussion Paper 3516*.
- [2] Alexis, M and Mpambara, I. (2003), "IMS Assessment Mission Report: The Rwanda Media Experience from the Genocide," Copenhagen: International Media Support.
- [3] Andre, C. and Platteau, J.P., (1998), "Land Relations Under Unbearable Stress: Rwanda Caught in the Malthusian Trap." Journal of Economic Behavior Organization, 34(1):1-47.
- [4] Anselin, L. (1988), Spatial Econometrics: Methods and Models. Dordrecht: Kluwer Academic Publishers.
- [5] BBC (2003), "The Impact of Hate Media in Rwanda," BBC article, news.bbc.co.uk/2/hi/africa/3257748.stm
- [6] Becker G. (1968), "Crime and punishment: An Economic Approach." Journal of Political Economy, 76(2):169-217.
- [7] Becker, G. and Murphy, K. (2000), Social Economics. Cambridge: Harvard University Press.
- [8] Besley, T. and Persson, T. (2011), "The Logic of Political Violence." *The Quarterly Journal of Economics*, 126(3):1411-1445.
- [9] Besley, T and Prat, A. (2006), "Handcuffs for the Grabbing Hand? Media Capture and Government Accountability." *American Economic Review*, 96(3):720-36.
- [10] Bethany, L and Gleditsch, N P. (2005), "Monitoring Trends in Global Combat: A New Dataset of Battle Deaths," European Journal of Population 21(2–3):145–66.
- [11] Blattman, C and Miguel, E. (2009), "Civil War," Journal of Economic Literature, 48(1): 3-57.
- [12] Carlsson, H and van Damme, E. (1993), "Global Games and Equilibrium Selection," *Econometrica*, vol. 61(5):989-1018.
- [13] Chalk, F. and Jonassohn, K. (1990), The History and Sociology of Genocide: Analyses and Case Studies. New Haven, CT: Yale University Press.
- [14] Chiang, C and Knight, B. (2011), "Media Bias and Influence: Evidence from Newspaper Endorsements," *Review of Economic Studies*, 78(3):795-820.
- [15] Childs, H L. (1972), Propaganda and Dictatorship: A Collection of Papers. New York: Arno Press.
- [16] Chwe, M. (2001), Rational Ritual: Culture, Coordination and Common Knowledge. Princeton, NJ: Princeton University Press
- [17] Chretien, J, Dupaquier, J, Kabanda, M, Ngarambe, J and Reporters Sans Frontieres. (1995), Rwanda: Les Medias du Genocide [Rwanda: The media of the genocide]. Paris: Karthala.
- [18] Collier, P and Hoeffler, A. (1998), "On Economic Causes of Civil War," Oxford Economic Papers, 50(4):563-73.
- [19] Collier, P and Hoeffler, A. (2004), "Greed and Grievance in Civil War," Oxford Economic Papers, 56(4):563-95.
- [20] Conley T G. (1999), "GMM Estimation with cross sectional Dependence," *Journal of Econometrics*, 92(1):1-45.

- [21] Dallaire, R. (2007), "The Media Dichotomy." In Thompson, Allan, (Ed.) The Media and the Rwandan Genocide. London: Pluto Press.
- [22] Della Vigna, S and Kaplan, E. (2007), "The Fox News Effect: Media Bias and Voting," Quarterly Journal of Economics, 122(3):187-234.
- [23] Della Vigna, S and Gentzkow, M. (2010), "Persuasion: Empirical Evidence," *Annual Review of Economics*, 2:643-69.
- [24] DellaVigna, S, Ruben E, Vera M, Maria P and Ekaterina Z. (2011), "Unintended media effects in a conflict environment: Serbian radio and Croatian nationalism", NBER Working Paper, 16989.
- [25] Des Forges, A. (1999), Leave None to Tell the Story: Genocide in Rwanda. Human Rights Watch and the International Federation of Human Rights Leagues, New York, NY, USA. www.hrw.org/legacy/reports/1999/rwanda/
- [26] Des Forges, A. (2007), "Call to Genocide: Radio in Rwanda, 1994." In Thompson, Allan, (Ed.) The Media and the Rwandan Genocide. London: Pluto Press.
- [27] Dube, O and Vargas J. (2007), "Commodity Price Shocks and Civil Conflict: Evidence From Colombia", Unpublished Working Paper, Harvard University and UCLA.
- [28] Edmond, C. (2008), "Information Manipulation, Coordination and Regime Change," Stern School of Business, N.Y.U. Working Paper EC-07-26.
- [29] Elhorst, J P. (2010), "Applied Spatial Econometrics: Raising the Bar," Spatial Economic Analysis, 5:1,9-28.
- [30] Enikolopov, R, Petrova, M, and Zhuravskaya, E. (2011) "Media and Political Persuasion: Evidence from Russia", *American Economic Review*, forthcoming.
- [31] Esteban, J and Ray, D. (2008) "Polarization, Fractionalization and Conflict", *Journal of Peace Research*, 45(2): 163-182.
- [32] Fearon, J D. and Laitin D D. (2003) "Ethnicity, Insurgency and Civil War", American Political Science Review, 97(1):75-90
- [33] Frohardt, M and Temin, J. (2007), "The Use and Abuse of Media in Vulnerable Societies." In Thompson, A, (Ed.) *The Media and the Rwandan Genocide*. London: Pluto Press.
- [34] Gentzkow, M and Shapiro, J. (2004), "Media, Education and Anti-americanism in the Muslim World," *The Journal of Economic Perspectives*, 18(3):117-33.
- [35] Gentzkow, M. (2006), "Television and Voter Turnout," Quarterly Journal of Economics, 121(3):931-972.
- [36] Gerber A, Karlan, D and Bergan, D. (2009), "Does the Media Matter? A Field Experiment Measuring the Effect of Newspapers on Voting Behavior and Political Opinions," *American Economic Journal: Applied Economics*, 1(2):35-52.
- [37] Glaeser, E. (2005), "The Political Economy of Hatred," Quarterly Journal of Economics, 120(1):45-86.
- [38] Glaeser, E., Sacerdote, B.I., Scheinkman, J. (2003), "The Social Multiplier," Journal of the European Economic Association, 1(2-3):345-353.

- [39] Granovetter, M. (1978), "Threshold Models of Collective Behavior," American Journal of Sociology, 83(1):1420-1443.
- [40] Harff, B. (2003), "No lessons learned from the Holocaust? Assessing risks of genocide and political mass murder since 1955," American Political Science Review, 97(1):57-73.
- [41] Harff, B and Gurr, T. (1988), "Toward Empirical Theory of Genocides and Politicides: Identification and Measurement of Cases Since 1945," *International Studies Quarterly*, 32(3):359-371.
- [42] Haavelmo, T. (1954), A Study in the Theory of Economic Evolution, Amsterdam: North-Holland.
- [43] Hatzfeld, J. (2003), Machete Season: The Killers in Rwanda Speak., New York: Farrar, Straus and Giroux.
- [44] Higiro, J V. (2007), "Rwandan Private Print Media on the Eve of the Genocide." In Thompson, Allan, (Ed.) *The Media and the Rwandan Genocide*. London: Pluto Press.
- [45] Hirshleifer, J. (1989), "Conflict and Rent-Seeking Success Functions: Ratio vs. Difference Models of Relative Success," *Public Choice*, 63(2).
- [46] International Criminal Tribunal for Rwanda, ICTR (2003), Case No. ICTR-99-52-T Judgement. http://www.ictr.org/ENGLISH/cases/Barayagwiza/judgement/Summary-Media.pdf
- [47] Kimani, M. (2007), "RTLM: the Medium that Became a Tool for Mass Murder." In Thompson, Allan, (Ed.) The Media and the Rwandan Genocide. London: Pluto Press.
- [48] Krain, M. (1997), "State-Sponsored Mass Murder," Journal of Conflict Resolution, 41(3):331-360.
- [49] Lazarsfeld P F, Berelson, B, Gaudet, H. (1944), The People's Choice: How the voter makes up his mind in a presidential campaign. New York: Columbia University Press.
- [50] Lasswell, H D. (1971), Propaganda Technique in World War I, Cambridge, MA: MIT Press.
- [51] Lee, A.M. (1945), "The analysis of propaganda: a clinical summary," American Journal of Sociology, 51 (2): 126-135.
- [52] Monten, J and Iyengar, R. (2005), "Is there an "Emboldenment" Effect? Evidence from the Insurgency in Iraq", NBER Working Paper.
- [53] McLean-Hilker, L. (2010), "The Role of Education in Driving Conflict and Building Peace The Case of Rwanda," EFA Global Monitoring Report 2011, The Hidden Crisis: Armed Conflict and Education. UNESCO.
- [54] Miguel, T., Satyanathm, S., and E. Sergenti. (2004), "Economic Shocks and Civil Conflict: An Instrumental Variables Approach," *Journal of Political Economy*, 112(4): 725-753.
- [55] Morris, S and Shin, H S. (1998), "Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks," *American Economic Review*, 88(3):587-97.
- [56] Morris, S and Shin, H S. (2005), "Notes on Strategic Substitutes and Complements in Global Games", Princeton University. Unpublished paper.
- [57] Mullainathan, S and Shleifer, A. (2005), "The Market for News," American Economic Review, 95(4): 1031–53.
- [58] Olken, B. (2009), "Do Television and Radio Destroy Social Capital? Evidence from Indonesian Villages," *American Economic Journal: Applied Economics*, 1(4):1-33.

- [59] Paluck, E L. (2009), "Reducing Intergroup Prejudice and Conflict Using the Media: A Field Experiment in Rwanda," *Journal of Personality and Social Psychology*, 96 (March): 574-587
- [60] Prat, A and Strömberg, D. (2005), "Commercial Television and Voter Information,", CEPR Discussion Papers 4989.
- [61] Prat, A and Strömberg, D. (2011), "The Political Economy of Mass Media,", CEPR Discussion Papers No. DP8246.
- [62] Prunier, G (1995), The Rwanda Crisis: History of a Genocide. New York: Columbia University Press.
- [63] Schelling, T.C. (1978), Micromotives and Macrobehavior. New York: W.W. Norton Company.
- [64] Staub, E. (1989), The Roots of Evil: The Origins of Genocide and Other Group Violence. Cambridge, UK: Cambridge University Press.
- [65] Straus, S. (2004), "How Many Perpetrators Were There in the Rwandan Genocide? An Estimate," *Journal of Genocide Research*, 6(1):85-98.
- [66] Straus, S. (2007), "What Is the Relationship between Hate Radio and Violence? Rethinking Rwanda's "Radio Machete," *Politics & Society*, 35:609.
- [67] Stromberg, D and Snyder, J. (2010), "Press Coverage and Political Accountability," *Journal of Political Economy*, 118(2): 355-408.
- [68] Tilly, C. (2008), The Politics of Collective Violence. Cambridge.
- [69] Verpoorten, M. (2005), "The Death Toll of the Rwandan Genocide: a Detailed Analysis for Gikongoro Province," *Population* 60(4):331-68.
- [70] Verwimp, P. (2005), "An Economic Profile of Peasant Perpetrators of Genocide: Micro-level Evidence from Rwanda," *Journal of Development Economics*, 77(2):297-323.
- [71] Verwimp, P. (2006), "Machetes and Firearms: the Organisation of Massacres in Rwanda," Journal of Peace Research, 43(1):5-22
- [72] Welch, D. (1993), "The Third Reich: politics and propaganda." London: Routledge

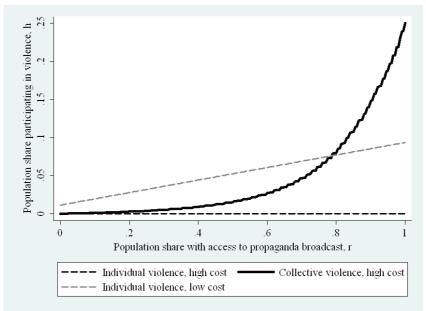


Figure 1. Example of information and coordination effects of mass media.

The graph plots the equilibrium participation as a function of the share of the population receiving the propaganda, and is based on numerical solutions under different parameter values. The dashed black line is the predicted effect under a relatively high cost of individual violence, theta, (i.e., no strategic complementarities), while the solid black line shows the predicted effect on collective violence (strategic complementarities) under otherwise identical parameter values. The difference captures the coordination effect of mass media. The dashed grey line shows the effect when the cost of individual violence is relatively low, but with otherwise identical parameter values as the dashed black line. In this case, participation increases solely due to the information contained in the content of the broadcasts. Together, the graph shows that the composition of violence can be affected by propaganda broadcasts, leading to a substantially higher fraction of coordinated collective violence once a critical mass has access to media broadcasts.

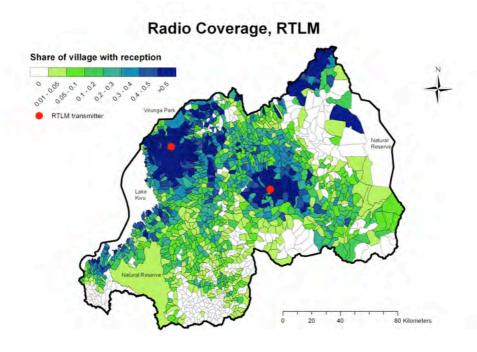


Figure 2. RTLM radio coverage

The figure shows the radio coverage in villages (share of village area with sufficient radio reception) based on the Longley-Rice propagation model. Source: Author's calculations in ArcGIS using the Longley-Rice Propagation Model.

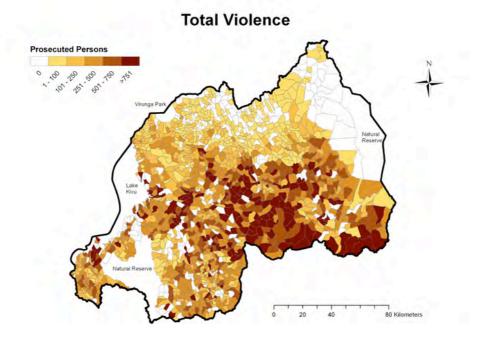


Figure 3. Level of genocide violence in Rwandan villages.

The categories represent the total number of prosecuted persons in the village (sum of collective and individual violence). White areas are missing data, either because of geography, such as parks and natural reserves, or villages that lack data in the sample.

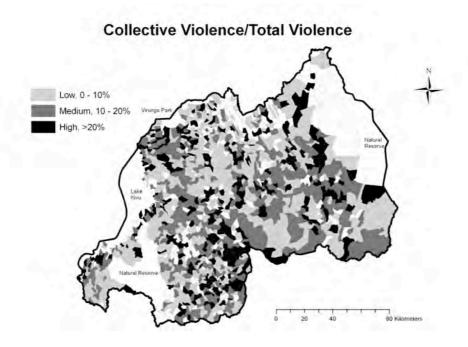
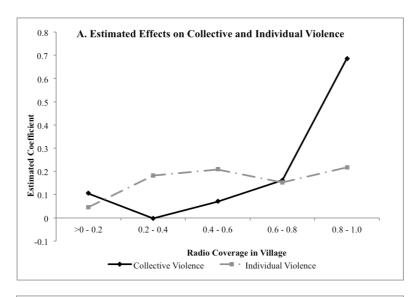


Figure 4. Composition of Violence.

The categories reflect the number of persons prosecuted for collective violence (e.g., militia, communal police, gendarmerie, and army) as a share of the total number of prosecuted persons. White areas are missing data.



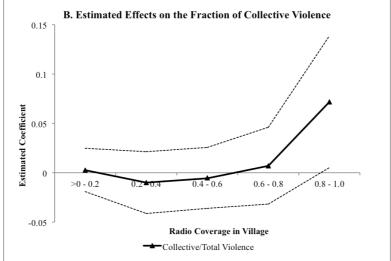


Figure 5. Flexible specifications. Figure A plots the estimated coefficients of the radio coverage dummies for collective and individual violence (from appendix table 1). Figure B plots the estimated effects and confidence intervals of the share of violence that is collective, and shows that once a sufficiently large share of the village has access to radio, the share of the violence that is collective is significantly higher.

Table 1. Summary Statistics	Obs	Mean	Std. Dev.
Dependent Variables			
Prosecuted Persons, Total Violence	1065	388.5	329.4
Prosecuted Persons, Collective Violence	1065	58.8	72.9
Prosecuted Persons, Individual Violence	1065	329.7	284.6
Level of Coordination, Collective/Total Violence	1045	0.150	0.128
Independent Variables			
Radio Coverage in Village	1065	0.185	0.225
Radio Coverage in Nearby Villages, within 10 km	1065	0.187	0.184
Radio Coverage in Nearby Villages, within 10-20 km	1065	0.197	0.161
Mean Altitude, km	1065	1.712	0.231
Variance in Altitude, meters	1065	9074	10401
Distance to Transmitter, km	1065	5.194	2.850
Mean Distance to Major Town, km	1065	20.06	12.03
Mean Distance to Major Road, km	1065	5.822	5.283
Mean Distance to the Border, km	1065	21.79	12.71
North Sloping Village, dummy	1065	0.239	0.427
East Sloping Village, dummy	1065	0.246	0.431
West Sloping Village, dummy	1065	0.262	0.440
South Sloping Viliage, dummy	1065	0.253	0.435
Population Density in 1991, pop per square km	1065	521.3	875.2
Population in 1991, '000	1065	4.852	2.482
Tutsi Minority Size, 1991	1065	0.099	0.085
% Literate Hutu, 1991	1065	50.30	5.681
% Literate Tutsi, 1991	1061	92.17	7.467
% Hutu with Primary Education, 1991	1065	57.85	6.093
% Tutsis with Primary Education, 1991	1061	69.26	12.08
Share of Hutu HH with Cement Floor	1065	0.098	0.551
Share of Tutsi HH with Cement Floor	1061	0.199	0.162

The dependent variables are prosecuted persons divided by the village population in 1991; Collective Violence is crime category 1 prosecutions and Individual Violence is crime category 2 (see data section). Total violence is the sum of collective and individual violence. Level of Coordination is the number of prosecuted person for collective violence divided by the total number of prosecutions. Radio Coverage is the share of the village area that has RTLM reception. Mean Altitude is the mean altitude of the village in kilometers. Variance in Altitude is the village variance in altitude in meters, Distance to Transmitter is the distance in kilometers to the nearest RTLM transmitter. Hutu Literacy Rate is the fraction of Hutu household heads in the commune that are literate. Hutu Primary Education is the fraction of Hutu household heads in the commune that have at least some primary education. Education and literacy data are taken from the 1991 Census, available only at the commune level. There are 128 communes in the sample. Population is the population number in the village and Population Density is 1000 people per square kilometers, also from the 1991 Census.

Table 2. Exogeneity Check

										Radio	Radio
			Distance		Distance					Coverage	Coverage
	Population	Population	to Major	Distance	to the					in Nearby	in Nearby
	in 1991,	Density in	Town,	to Major	Border,	North	East	South	West	Villages	Villages
	log	1991, log	log	Road, log	log	Sloping	Sloping	Sloping	Sloping	(<10 km)	(10-20 km)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Radio Coverage in Village	-0.049	0.196	0.092	-0.238	0.082	0.113	-0.008	0.020	-0.125	0.029	-0.009
	(0.071)	(0.145)	(0.086)	(0.154)	(0.189)	(0.087)	(0.099)	(0.089)	(0.109)	(0.018)	(0.020)
Observations	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065
R-squared	0.460	0.426	0.908	0.705	0.921	0.150	0.138	0.145	0.162	0.957	0.952
Propagation Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Commune FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: The radio propagation controls are: latitude, longitude, and second-order polynomials in village mean altitude, village altitude variance, and distance to the nearest RTLM transmitter. Standard errors in parentheses, adjusted for spatial correlation (Conley, 1999). Significance levels at *10%, **5%, ***1%.

Table 3. Main Effects

Dependent Variable: Log(Prosecuted Persons)

	7	Total Violen	ce	Со	ollective Viol	ence	Individual Violence			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	
Radio Coverage in Village	0.507**	0.526**	0.484**	0.582**	0.559***	0.544***	0.450*	0.465*	0.418*	
	(0.226)	(0.242)	(0.235)	(0.239)	(0.216)	(0.206)	(0.233)	(0.252)	(0.246)	
Population in 1991, log			0.590***			0.589***			0.624***	
			(0.131)			(0.171)			(0.150)	
Population Density in 1991, log			-0.014			0.004			-0.015	
			(0.070)			(0.101)			(0.069)	
Distance to Major Town, log			0.068			-0.233			0.113	
			(0.150)			(0.149)			(0.152)	
Distance to Major Road, log			-0.196**			-0.245***			-0.193**	
			(0.076)			(0.090)			(0.075)	
Distance to the Border, log			0.171*			0.030			0.186*	
			(0.103)			(0.126)			(0.103)	
East Sloping, dummy			0.017			0.098			0.014	
			(0.070)			(0.092)			(0.084)	
North Sloping, dummy			0.065			0.041			0.079	
			(0.068)			(0.092)			(0.068)	
South Sloping, dummy			-0.013			-0.028			-0.012	
			(0.074)			(0.101)			(0.077)	
Observations	1065	1065	1065	1065	1065	1065	1065	1065	1065	
R-squared	0.63	0.64	0.66	0.52	0.53	0.55	0.62	0.63	0.65	
Commune FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Propagation Controls	N	Y	Y	N	Y	Y	N	Y	Y	

Notes: Collective Violence is crime category 1 prosecutions against organizers, leaders, army and militia; Individual Violence is crime category 2 prosecutions for homicides, attempted homicides and serious violence. Total Violence is the sum of collective and individual violence. Radio Coverage is the share of the village area that has RTLM reception. The radio propagation controls are: latitude, longitude, and second-order polynomials in village mean altitude, village altitude variance, distance to the nearest RTLM transmitter. Standard errors in parentheses, adjusted for spatial correlation (Conley, 1999). Significance levels at *10%, **5%, ***1%.

Table 4. Indirect Effects: Spatial Spillovers

			Composition of Violence									
	Collective Violence			Individual Violence			Total Violence			Collective/Total Violence		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Radio Coverage in Nearby Villages , within 10 km	2.18*** (0.797)	2.04*** (0.771)	1.757** (0.760)	0.468 (0.570)	0.348 (0.572)	0.682 (0.588)	0.688 (0.613)	0.553 (0.62)	0.790 (0.608)	0.194*** (0.060)	0.184*** (0.059)	0.103 (0.063)
Radio Coverage in Nearby Villages , within 10-20 km	-0.341 (0.739)	-0.277 (0.763)	-0.163 (0.821)	-0.223 (0.675)	-0.167 (0.721)	-0.303 (0.751)	-0.264 (0.629)	-0.202 (0.68)	-0.298 (0.712)	-0.016 (0.091)	-0.012 (0.089)	0.021 (0.092)
Radio Coverage in Village		0.505** (0.199)	0.198 (0.443)		0.437* (0.249)	0.801 (0.551)		0.492** (0.240)			0.036 (0.027)	-0.052 (0.051)
Radio in Village * Radio in Nearby Villages, within 10 km			0.841 (1.029)			-0.999 (0.971)			-0.708 (0.979)			0.240* (0.123)
Observations	1065	1065		1065	1065		1065	1065		1045	1045	1045
R-squared	0.56	0.56		0.65	0.65		0.66	0.66		0.260	0.261	0.263
Commune FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Propagation Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Propagation Controls, Nearby Villages	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Additional Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: *Radio Coverage in Village* is the share of the village area with RTLM radio reception. *Radio Coverage in Nearby Villages* is the population weighted share of the village areas with RTLM radio coverage, within a given distance from the village. For nearby villages, the propagation control is the within 10 km population weighted average of the standard propagation variables. Additional controls are the logs of population, population density, distance to nearest major road, distance to the border and slope dummies. Standard errors in parenthesis, adjusted for spatial correlation (Conley, 1999).

Table 5. Heterogeneous Effects: Ethnic Minority Size

	Dependent Variable: Log(Prosecuted Persons)									
	Total Violence		Coordinate	ed Violence	Individual	Violence				
	(1)	(2)	(3)	(4)	(5)	(6)				
Radio Coverage in Village * Small Tutsi Minority	0.75** (0.37)	0.77** (0.35)	0.72* (0.37)	0.83*** (0.32)	0.66* (0.38)	0.66* (0.37)				
Radio Coverage in Village * Large Tutsi Minority	0.16 (0.25)	0.04 (0.21)	0.30 (0.41)	0.10 (0.35)	0.15 (0.26)	0.04 (0.23)				
Observations R-squared	1065 0.64	1065 0.66	1065 0.53	1065 0.55	1065 0.63	1065 0.65				
Additional Controls	0.04 N	Y Y	0.33 N	Y Y	0.03 N	Y Y				

Note: All regressions include commune fixed effects and propagation controls. Small Tutsi Minority is a dummy variable indicating whether the share of Tutsi household heads in 1991 in the commune is below the median in the sample (7.7 percent Tutsi households). Large Tutsi Minority indicates above the median. The control variables are defined as previously. Standard errors in parenthesis, adjusted for spatial correlation (Conley, 1999).

Table 6. Heterogeneous Effects: Literacy and Primary Education

	Dependent Variable: Log(Prosecuted Persons)									
	Total V	iolence	Coordinated	Violence	Individual Violence					
	(1)	(2)	(3)	(4)	(5)	(6)				
Radio Coverage	0.519**	0.394	0.564***	0.442**	0.461*	0.341				
•	(0.264)	(0.263)	(0.212)	(0.207)	(0.278)	(0.276)				
Radio Coverage * % Literate Hutu	-0.121**		-0.117**		-0.119**					
č	(0.054)		(0.057)		(0.056)					
Radio Coverage * % Hutu with Primary Education		-0.105**		-0.102**		-0.099**				
Ç		(0.048)		(0.046)		(0.049)				
Radio Coverage * % Hutu with Cement Floor	0.063**	0.043*	0.069*	0.049*	0.058*	0.037*				
C	(0.032)	(0.022)	(0.041)	(0.027)	(0.032)	(0.021)				
Observations	1065	1065	1065	1065	1065	1065				
R-squared	0.66	0.66	0.55	0.55	0.65	0.65				
Additional Controls	Y	Y	Y	Y	Y	Y				

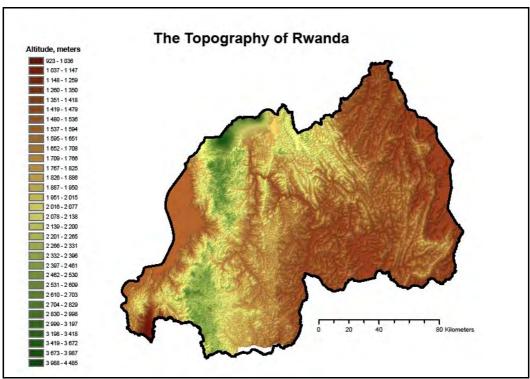
Note: All regressions include commune fixed effects and propagation controls. *% Literate Hutu* is the percentage of Hutu household heads in the commune that are literate in 1991. *% with Primary Education* is the percentage of Hutu household heads in the commune that have at least some primary education. The wealth proxy is the fraction Hutu households in the commune whose house has a cement flooe. The control variables are the same as in the previous tables. Standard errors in parenthesis, adjusted for spatial correlation (Conley, 1999).

Table 7. Aggregate Effects

	Prosecuted persons, counterfactual	Prosecuted persons, actual	Violence caused by RTLM, prosecuted persons	Violence caused by RTLM, percent
Total Violence	459,111 (21,358)	509,826	50,715	9.9%
Coordinated Violence, excl. indirect effects	71,311 (2,098)	77,269	5,958	7.7%
Coordinated Violence, incl. indirect effects	54,841 (6,204)	77,269	22,428	29.0%
Individual Violence	404,240 (15,179)	432,557	28,317	6.5%

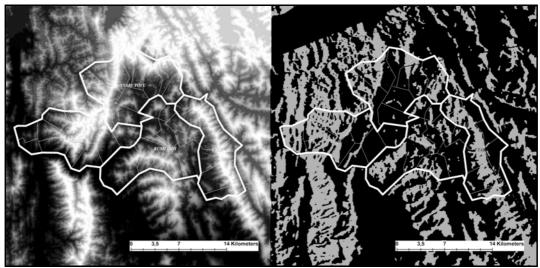
Note: The first column shows the mean and standard deviation (in parentheses) of the counterfactual estimates. They are calculated in the following manner: First, the coefficient is drawn from a normal distribution with mean and standard deviation equal to the estimated coefficient and standard error from column 6 of table 4 for coordinated violence, and column 9 of table 3 for individual violence. For a given draw, in each village the counterfactual number of persons prosecuted as if radio coverage was zero is calculated. The aggregate counterfactual is then then sum of village counterfactuals. This procedure is repeated five hundred times using random draws to produce the distribution of aggregate counterfactuals. The first and second columns report the difference between the actual and the counterfactual number of prosecuted persons The counterfactual for total violence is the sum of collective(incl. indirect effects) and individual violence.

Appendix 1. Figures and Tables



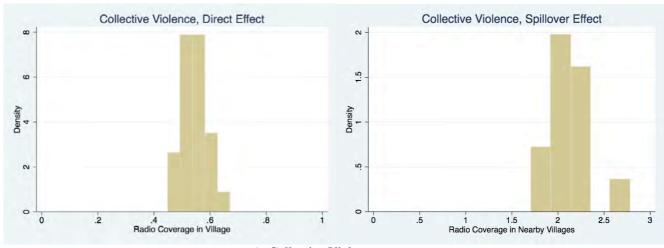
Appendix Figure 1. The Topography of Rwanda

Source: Shuttle Radar Topography Mission

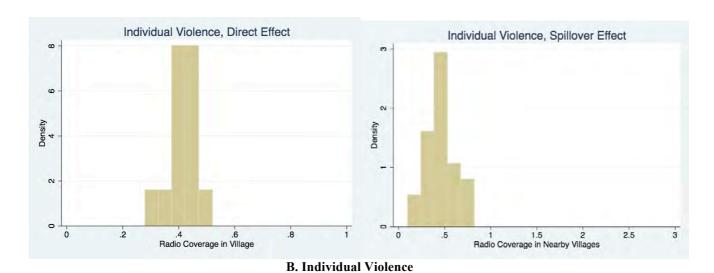


Appendix Figure 2. Predicted Radio Coverage, 4 communes example

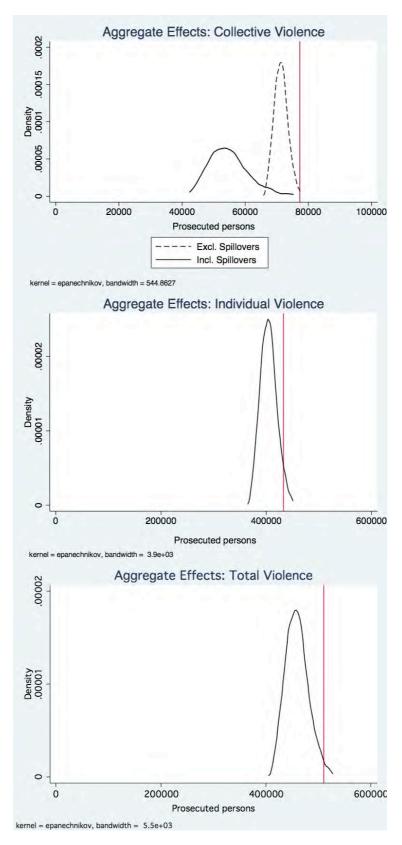
This left picture shows the height of ground, where brighter marks higher altitude. The right picture shows the empirical radio coverage, where grey marks radio coverage. The signal comes from the Mount Muhe transmitter located 30 km to the west (outside the figure). The figures show that within each commune (boundaries in thick white lines), villages (boundaries in thin white lines) to the east of hilltops have low radio coverage due the hilltops in the line-of-sight to the transmitter. Source: SRTM 90m topography data, author's calculations of radio coverage in ArcGIS.



A. Collective Violence



Appendix Figure 3. Robustness Tests. Distribution of point estimates from 26 regressions of direct effects (table 3: specifications 4 and 8) and cross-village spillover effects (table 5: specifications 2 and 4), where each regression drops one of the 26 districts from the sample.



Appendix Figure 4. Aggregate Effects. The graphs plot the distributions of the estimated counterfactual violence under the assumption that RTLM did not broadcast. The vertical lines in red represent the actual number of prosecuted persons. The upper figure presents the counterfactual distribution for collective violence, and includes the distribution when spillover effects are ignored. The middle figure is for individual violence. As there is no evidence of cross-village externalities for individual violence, the counterfactual estimates are only due to direct effects. The bottom graph is for total violence. Table 8 provides the summary statistics.

Appendix Table 1. Flexible Specifications

		Dep Var.: Log(Prosecuted Persons)									
	Collective	e Violence	Individua	l Violence	Total V	iolence	Collective/Total Prosecutions				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)			
Radio Coverage, >0 - 0.2	0.107	0.107	0.046	0.046	0.045	0.045	0.003	0.003			
	(0.097)	(0.089)	(0.089)	(0.084)	(0.085)	(0.083)	(0.011)	(0.012)			
Radio Coverage, 0.2 - 0.4	-0.002	-0.007	0.183	0.183	0.175	0.175	-0.010	-0.010			
	(0.126)	(0.119)	(0.153)	(0.143)	(0.151)	(0.144)	(0.016)	(0.017)			
Radio Coverage, 0.4 - 0.6	0.071	0.054	0.210	0.178	0.205	0.177	-0.005	-0.003			
	(0.168)	(0.157)	(0.168)	(0.162)	(0.168)	(0.164)	(0.016)	(0.016)			
Radio Coverage, 0.6 - 0.8	0.163	0.229	0.153	0.186	0.161	0.195	0.007	0.010			
	(0.177)	(0.166)	(0.162)	(0.155)	(0.160)	(0.153)	(0.020)	(0.021)			
Radio Coverage, 0.8 - 1	0.687**	0.608**	0.218	0.109	0.311	0.206	0.072**	0.076**			
	(0.241)	(0.251)	(0.188)	(0.162)	(0.170)*	(0.146)	(0.034)	(0.034)			
Observations	1065	1065	1065	1065	1065	1065	1,045	1,045			
R-squared	0.530	0.551	0.627	0.648	0.638	0.657	0.252	0.258			
Commune FE	Y	Y	Y	Y	Y	Y	Y	Y			
Propagation Controls	Y	Y	Y	Y	Y	Y	Y	Y			
Additional Controls	N	Y	N	Y	N	Y	N	Y			

Note: *Radio Coverage* is the share of the village area that has RTLM radio reception. The radio propagation controls are: latitude, longitude, and second-order polynomials in village mean altitude, village altitude variance, distance to the nearest RTLM transmitter. Additional controls are the logs of population, population density, distance to nearest major town, distance to nearest major road, distance to the border; and slope dummies. Standard errors in parenthesis, adjusted for spatial correlation (Conley, 1999).

Appendix Table 2. Robustness. Clustered Standard Errors.

		Dependent Variable: Log(Prosecuted Persons)											
		Collective Violence			Individual Violence					Total Violence			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
Radio Coverage in Village	0.54**	0.50**		0.56***	0.42*	0.44*		0.46*	0.48**	0.49**		0.52**	
	(0.23)	(0.24)		(0.20)	(0.23)	(0.24)		(0.25)	(0.22)	(0.24)		(0.24)	
Radio Coverage in Nearby Villages		2.04**				0.35				0.55			
, within 10 km		(0.87)				(0.67)				(0.72)			
Radio Coverage in Nearby Villages		-0.28				-0.17				-0.20			
, within 10-20 km		(0.91)				(1.01)				(0.93)			
Radio Coverage in Village*Small Tutsi Minority			0.83				0.66				0.77		
			(0.38)				(0.40)				(0.39)		
Radio Coverage in Village*Large Tutsi Minority			0.10				0.04				0.04		
			(0.42)				(0.29)				(0.28)		
Radio Coverage * % Literate Hutu				-0.12*				-0.12**				-0.12**	
				(0.07)				(0.05)				(0.06)	
Radio Coverage * % Hutu with Cement Floor				0.07				0.06**				0.06	
				(0.06)				(0.03)				(0.04)	
Observations	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	
Commune FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Propagation Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Propagation Controls, Nearby Villages <10 km	N	Y	N	N	N	Y	N	N	N	Y	N	N	
Additional Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	

Note: The control variables have the same definitions as in previous tables. Standard errors in parenthesis, clustered at the district level. There are 26 districts in the sample. Significance levels at *10%, **5%, ***1%.

Appendix 2. Proofs

1 Uniqueness

Members without access to the propaganda

For members without access to the propaganda, we can directly use the Morris and Shin (1998) uniqueness result with only a private signal. The Bayes-Nash equilibrium threshold κ^N is pinned down by setting participation utility $u(\bar{\theta}_i^N = \kappa^N) = 0$. This is equal to

$$\kappa^N = -\frac{\alpha}{2t}.\tag{1}$$

Members with access to the propaganda

Members with access to the public propaganda signal take the threshold of equation (1) as given. The equilibrium participation threshold κ^R is the solution to the equilibrium condition

$$\kappa^{R} + \frac{\alpha}{t} \left[r\Phi \left(\frac{\sigma_{x}^{2}(p - \kappa^{R})}{\sigma_{p}^{2}\gamma} \right) + (1 - r) \Phi \left(\frac{\alpha}{2t} + \kappa^{R} \right) \right] = 0, \tag{2}$$

where $\gamma \equiv (2\sigma_x^2\sigma_p^2 + \sigma_x^4)^{1/2}(\sigma_x^2 + \sigma_p^2)^{-1/2}$ and Φ is the standard normal cumulative distribution function. The two terms within the curly brackets capture the expected participation rate for a member exposed to the propaganda with an expectation about the government's policy equal to: $\bar{\theta}_i^R = \kappa^R$. The first term is equal to the expected participation rate among those that receive the propaganda, and the second term is the expected participation rate among those that do not receive the propaganda.

Furthermore, the equilibrium is unique under the regularity condition

$$\sigma_x^2/\sigma_p^2\gamma \leq \sqrt{2\pi}t/\alpha,$$

where $\gamma \equiv \sqrt{\left(2\sigma_x^2\sigma_p^2 + \sigma_x^4\right)/(\sigma_x^2 + \sigma_p^2)}$. This is the Morris and Shin (1998) uniqueness result under a public signal, with the distinction that only some proportion r of the players receive the public signal. Morris and Shin prove uniqueness when everybody receives a public signal by iterative deletion of strictly dominated interim strategies, which can equally be applied in this context. Here, we show a sketch of the proof following Morris and Shin (2001).

Define $f(r, \kappa^R)$ as the left-hand side function of the equation (2). A sufficient condition for a unique solution is that the left-hand side increases weakly

monotonically in κ^R , $f'_{\kappa^R} \geq 0$. The uniqueness condition is therefore that the derivative with respect to κ^R is non-negative (the monotonicity condition),

$$f'_{\kappa^R} = 1 + \frac{\alpha}{t} \left(-r\phi \left(\frac{\sigma_x^2(p - \kappa^R)}{\sigma_p^2 \gamma} \right) \frac{\sigma_x^2}{\sigma_p^2 \gamma} + \frac{\alpha}{t\gamma} (1 - r) \phi \left(\frac{\frac{\alpha}{2t} + \kappa^R}{\gamma} \right) \right)$$

$$> 0,$$

where ϕ is the standard normal density function. We see that the function reaches its lowest value when r=1. Substituting for r=1 and rearranging gives

$$1 \geq \frac{\alpha}{t} \phi \left[\frac{\sigma_x^2(p - \kappa^R)}{\sigma_p^2 \gamma} \right] \frac{\sigma_x^2}{\sigma_p^2 \gamma}.$$

The density of the standard normal $\phi(\cdot)$ reaches its maximum value of $1/\sqrt{2\pi}$ when the argument of $\phi(\cdot)$ is zero. Substituting $\phi(\cdot)$ with $1/\sqrt{2\pi}$ then gives the sufficient condition for a unique solution

$$\frac{\sigma_x^2}{\sigma_p^2 \gamma} \le \frac{\sqrt{2\pi}t}{\alpha}.\tag{3}$$

2 Proof of Lemma 1

Given a government policy θ , we can calculate the proportion of members with beliefs $\bar{\theta}_i^N \geq \kappa^N$, given equation (1), and the proportion of radio members with beliefs $\bar{\theta}_i^R \geq \kappa^R$, given equation (2). Using the distributions for the private signal and the propaganda signal, conditional on θ , the participation rate is a function of the population with access to the propaganda

$$h = rh^R + (1 - r)h^N , (4)$$

where h^R is the participation rate among the members exposed to the propaganda, and h^N is the participation rate among the non-exposed. In equilibrium,

$$h^{N} = \Phi\left[\left(\frac{\alpha}{2t} + \theta\right) / \sigma_{x}\right]. \tag{5}$$

and

$$h^{R} = \Phi \left[\left(\frac{\sigma_{x}^{2}}{\sigma_{p}^{2}} p + \theta - \frac{\sigma_{x}^{2} + \sigma_{p}^{2}}{\sigma_{p}^{2}} \kappa^{R} \right) / \sigma_{x} \right], \tag{6}$$

Taking the derivative of h with respect to r in equation (4) gives

$$\frac{\partial h}{\partial r} = h^R - h^N + r \frac{\partial h^R}{\partial r},\tag{7}$$

since h^N is independent of r.

We will show that the sufficient condition for $\frac{\partial h}{\partial r} \geq 0$ is $p \geq -\frac{\alpha}{2t}$. By equation (7), $\frac{\partial h}{\partial r} \geq 0$ if $h^R \geq h^N$ and $\frac{\partial h^R}{\partial r} \geq 0$. We first derive the condition under which $h^R \geq h^N$ is fulfilled.

$$h^{R} \geq h^{N}$$

$$\Leftrightarrow$$

$$\Phi\left[\left(\frac{\sigma_{x}^{2}}{\sigma_{p}^{2}}p + \theta - \frac{\sigma_{x}^{2} + \sigma_{p}^{2}}{\sigma_{p}^{2}}\kappa^{R}\right)/\sigma_{x}\right] \geq \Phi\left[\left(\frac{\alpha}{2t} + \theta\right)/\sigma_{x}\right]$$

$$\Leftrightarrow$$

$$\frac{\sigma_{x}^{2}}{\sigma_{p}^{2}}p + \theta - \frac{\sigma_{x}^{2} + \sigma_{p}^{2}}{\sigma_{p}^{2}}\kappa^{R} \geq \frac{\alpha}{2t} + \theta$$

$$\Leftrightarrow$$

$$p \geq \frac{\sigma_{p}^{2}}{\sigma_{x}^{2}}\left[\frac{\alpha}{2t} + \frac{\sigma_{x}^{2} + \sigma_{p}^{2}}{\sigma_{p}^{2}}\kappa^{R}\right].$$

This is also the sufficient condition for $\frac{\partial h^R}{\partial r} \geq 0$. To see this, take the derivative

$$\frac{\partial h^R}{\partial r} = -\phi \left[\left(\frac{\sigma_x^2}{\sigma_p^2} p + \theta - \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \kappa^R \right) / \sigma_x \right] \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \frac{\partial \kappa^R}{\partial r},$$

which is weakly positive if $\partial \kappa^R/\partial r \leq 0$. From equation (2) we use the implicit function theorem and take the total derivative

$$\frac{\partial \kappa^R}{\partial r} = -\frac{f_r'}{f_{\kappa^R}'}$$

Since by the monotonicity assumption we know that $f'_{\kappa^R} \geq 0$, we have to show that

$$f'_r = \frac{\alpha}{t} \left(\Phi \left[\frac{\sigma_x^2 (p - \kappa^R)}{\sigma_p^2 \gamma} \right] - \Phi \left[\frac{\frac{\alpha}{2t} + \kappa^R}{\gamma} \right] \right) \ge 0.$$

Applying the sufficient condition for $h^R \ge h^N$, we let $p = \frac{\sigma_p^2}{\sigma_x^2} \left[\frac{\alpha}{2t} + \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \kappa^R \right] + \varepsilon$, where ε is a small positive number. This gives us

$$f'_{r} = \frac{\alpha}{t} \left(\Phi \left[\frac{\sigma_{x}^{2} \left(\frac{\sigma_{p}^{2}}{\sigma_{x}^{2}} \left[\frac{\alpha}{2t} + \frac{\sigma_{x}^{2} + \sigma_{p}^{2}}{\sigma_{p}^{2}} \kappa^{R} \right] + \varepsilon - \kappa^{R} \right)}{\sigma_{p}^{2} \gamma} \right] - \Phi \left[\frac{\frac{\alpha}{2t} + \kappa^{R}}{\gamma} \right] \right)$$

$$= \frac{\alpha}{t} \left(\Phi \left[\frac{\frac{\alpha}{2t} + \kappa^{R} + \frac{\sigma_{x}^{2}}{\sigma_{p}^{2}} \varepsilon}{\sqrt{\frac{2\sigma_{x}^{2} \sigma_{p}^{2} + \sigma_{x}^{4}}{\sigma_{x}^{2} + \sigma_{p}^{2}}}} \right] - \Phi \left[\frac{\frac{\alpha}{2t} + \kappa^{R}}{\sqrt{\frac{2\sigma_{x}^{2} \sigma_{p}^{2} + \sigma_{x}^{4}}{\sigma_{x}^{2} + \sigma_{p}^{2}}}} \right] \right)$$

$$> 0$$

Together with the uniqueness condition (3), $p \ge \frac{\sigma_p^2}{\sigma_x^2} \left[\frac{\alpha}{2t} + \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \kappa^R \right]$ therefore implies

$$\frac{\partial \kappa^R}{\partial r} \le 0 \tag{8}$$

with equality if $\alpha = 0$, and strict inequality if $\alpha > 0$.

We now show that $p \geq -\frac{\alpha}{2t}$ implies that the condition $p \geq \frac{\sigma_p^2}{\sigma_x^2} \left[\frac{\alpha}{2t} + \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \kappa^R \right]$ is fulfilled for all values of r. Since $\frac{\partial \kappa^R}{\partial r} \leq 0$, the maximum value of κ^R is achieved when r=0. Substituting for r=0 in the equilibrium condition (2), we get

$$\kappa^R + \frac{\alpha}{t} \Phi \left[\frac{\frac{\alpha}{2t} + \kappa^R}{\sqrt{\frac{2\sigma_x^2 \sigma_p^2 + \sigma_x^4}{\sigma_x^2 + \sigma_p^2}}} \right] = 0$$

The equilibrium condition is fulfilled only when $\kappa^R=-\frac{\alpha}{2t}$, since substituting $\kappa^R=-\frac{\alpha}{2t}$ gives

$$-\frac{\alpha}{2t} + \frac{\alpha}{t}\Phi \left[\frac{\frac{\alpha}{2t} - \frac{\alpha}{2t}}{\sqrt{\frac{2\sigma_x^2\sigma_p^2 + \sigma_x^4}{\sigma_x^2 + \sigma_p^2}}} \right]$$

$$= -\frac{\alpha}{2t} + \frac{\alpha}{t}\Phi [0]$$

$$= -\frac{\alpha}{2t} + \frac{\alpha}{2t}$$

$$= 0$$

The maximum value of κ^R is therefore $-\frac{\alpha}{2t}$, which is when r=0. Substituting for the maximum value of κ^R , the sufficient condition for $\frac{\partial h}{\partial r} \geq 0$ is

$$p \geq \frac{\sigma_p^2}{\sigma_x^2} \left[\frac{\alpha}{2t} + \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \left(-\frac{\alpha}{2t} \right) \right]$$

$$= -\frac{\alpha}{2t}$$

$$\equiv \tilde{p}.$$

3 Proof of Proposition 1

Since collective and individual violence are separable, the following proof will hold for any γ and one only needs to show that the comparative statics hold for violence when $\alpha=0$ and $\alpha>0$, respectively.

violence when $\alpha=0$ and $\alpha>0$, respectively. Recall that $\frac{\partial h}{\partial r}=h^R-h^N+r\frac{\partial h^R}{\partial r}$. When $\alpha=0$, the equilibrium conditions imply that $\kappa^N=\kappa^R=0$, for all r. Using (8), this implies that $\frac{\partial h^R}{\partial r}=0$. Furthermore, if the condition of Lemma 1 is satisfied $(p \ge 0)$, then $\partial h/\partial r = h^R - h^N = \bar{c} \ge 0$, where \bar{c} is a constant independent of r. To see this,

$$h^{R} - h^{N} = \Phi \begin{bmatrix} \frac{\sigma_{x}^{2}}{\sigma_{p}^{2}} p + \theta \\ \sigma_{x} \end{bmatrix} - \Phi \begin{bmatrix} \theta \\ \sigma_{x} \end{bmatrix} = \bar{c} > 0.$$

Therefore, without strategic complementarities ($\alpha = 0$), the participation rate increases linearly in the population exposed. What is left is to show is that scale effects occur when the condition in Lemma 1 is fulfilled and $\alpha > 0$.

Take the second derivative of h w.r.t. r in equation 7 gives

$$\frac{\partial^2 h}{\partial r^2} = \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \phi(z) \left[-2 \frac{\partial \kappa^R}{\partial r} - r \left[z \frac{\sigma_x^2 + \sigma_p^2}{\sigma_p^2} \left(\frac{\partial \kappa^R}{\partial r} \right)^2 + \frac{\partial^2 \kappa^R}{\partial r^2} \right] \right]$$
(9)

, where $z\equiv\frac{\frac{\sigma_x^2}{\sigma_p^2}p+\theta-\frac{\sigma_x^2+\sigma_p^2}{\sigma_p^2}\kappa^R}{\sigma_x}$. It can be shown that equation 9 implies that $\frac{\partial^2 h}{\partial r^2}>0$ for all r as long as less than half of the majority population participates $(h^R<1/2)$. However, to prove existence of scale effects, the easiest approach is the following: Let $\alpha>0$. At r=0, using (8), $\frac{\partial^2 h}{\partial r^2}=-2\frac{\partial \kappa^R}{\partial r}\frac{\sigma_x^2+\sigma_p^2}{\sigma_p^2}\phi(z)>0$.