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IZA DP No. 15311

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ABSTRACT

Types of Communications Technology and Civil Conflict

This paper introduces a unifying theoretical framework to understand the relationship between different types of communications technology (CT) and the incidence of civil conflict. In our model, one-way CT allows the government to broadcast messages they use to (mis)inform dissidents about the size of the available rents. This decreases the dissident group's marginal returns from fighting against the government. Two-way CT facilitates dialogue among dissident group members, helping them to overcome coordination issues and improve their chances of winning a fight against the government. The model predicts one-way CT decreases and two-way CT increases conflict incidence. Empirical evidence from country-level panel databases (studying up to 189 countries) and individual-level survey responses (from up to 74 countries) is consistent with these predictions. Radio and television penetration and usage are associated with diminished levels of civil conflict and anti-government attitudes. On the contrary, cell phone and internet penetration and usage correlate with greater likelihoods of conflict and higher anti-government sentiment.

JEL Classification: D74, L82, O14

Keywords: civil conflict, communications technology, cell phones, internet, radio, television

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1 Introduction

Histiaeus, a tyrant under Darius I of Persia, shaved the head of his most trusted slave, tattooed a message on his head, and then waited for his hair to grow back to communicate his instructions to Aristagoras, triggering the Ionian revolt of 499 BC (Waters, 2014). From these ancient means of communication to Native Indians' use of smoke signals, to radio and television propaganda, to group communication and coordination using the internet (e.g., the Arab Spring), communications technology (CT) has played a pivotal role in instigating, shaping, and diffusing conflict throughout history. A number of studies propose the availability and effectiveness of CT, like that of traditional weapons technology, can decidedly affect conflict. Nevertheless, establishing a systematic link between CT and civil conflict has remained difficult. The empirical evidence remains mixed, with some studies identifying a positive association between CT and civil conflict and others documenting the opposite. We also lack a framework that delineates the impact *different types* of CT might have on conflict.

The following pages introduce a simple unifying theory to understand the underlying relationships. We distinguish between one-way and two-way CT in their links to civil conflict. The former relates to innovations that allow one party to transmit information to another, while back-and-forth exchanges remain largely impossible. Specific examples of such CTs are newspapers, the radio, and the television. Two-way CT are tools that, by design, facilitate *dialogue*. Prominent examples include the telephone, the cell phone, or the internet.

Our simple theoretical framework illustrates how one-way and two-way CT can be incorporated in a canonical theory of civil conflict between a ruling party and a rebel group. Embarking from a standard contest success function (Tullock, 1980; Hirshleifer, 1989), we explore how the profit-maximizing level of fighting responds to changes in these technologies. Building on previous literature, we assume one-way CT disproportionately allows a ruling regime to (mis)inform the dissident group about the potential payoffs from taking control of the government. Improvements in one-way CT decrease the marginal returns from fighting for the dissidents and, as a result, the amount of time they invest in fighting. In contrast, we assume two-way CT improves the productivity of dissident fighting efforts. Following existing theoretical and descriptive work, this could happen through improvements in their ability to communicate with, coordinate, and monitor infinitesimal dissident

group members.[1] As a consequence, the model predicts improvements in two-way CT systematically translate to greater fighting effort from the dissident group.

With these propositions in mind, we turn to country-level data, relating the incidence of civil conflict to the availability of radios and televisions (for one-way CT), as well as cell phones and the internet (for two-way CT). Data availability allows us to study longitudinal data for up to 189 countries, spanning several decades. Indeed, both the spread of radio and television within a country systematically correlate with lower likelihoods of civil conflict, while the opposite is true for the share of cell phone subscriptions and internet users. While our analysis is unable to fully resolve latent endogeneity concerns, these results prevail when controlling for a comprehensive set of civil conflict predictors with GDP per capita, population size, and political constraints on the executive. We address remaining concerns about unobservable variation by incorporating country- and year-fixed effects. Robustness checks, using country-specific time trends, potential nonlinearities, and natural resource rents, also yield consistent estimates.

Finally, we study up to 156,000 individual-level survey responses from the World Values Survey covering 74 countries, allowing us to discern whether there are systematic links between a respondent's usage of different CT types and their attitudes towards the political system and the reigning government. If our theoretical predictions were sensible, we would expect more government-favorable views when one-way CT is readily accessible and consumed. However, we should observe the opposite for greater accessibility and consumption of two-way CT (i.e., cell phones and the internet). Indeed, the data confirm these predictions. Notably, the associations are robust to accounting for a comprehensive set of potential confounders relating to an individual's demographics, income and education levels, as well as their religious status, and country- and year-fixed effects. These results further buttress the systematic correlations from our country-level analyses.

Considered separately, the country- and individual-level associations may, at the margin, potentially be influenced by endogeneity. For example, country-level aggregates are notoriously imprecise in identifying within-society heterogeneity. However, this actually stacks the deck *against* identifying statistically significant relationships because it introduces measurement error in the independent variable that makes the estimate vulnerable to attenuation bias. Individual-level estimates can be driven by unobservables that vary across people. However, taken together, the consistency with which the derived esti-

[1] Of course, two-way CT may also affect the governing group's internal coordination and fighting efforts. Our model only requires for such dynamics to disproportionately facilitate the dissidents' production function of violence.

mates conform to our theoretical predictions provide evidence supportive of our theoretical propositions.

2 Related Literature

The literature cited here by no means forms an exhaustive review of the research involving different types of CT and civil conflict. Rather, we lay out that, although a number of studies focus on such relationships, studies have usually focused exclusively on specific types of CT or particular conflict settings. While we draw on observations made by these studies, our emphasis here is on developing a framework that unites the common patterns of these works pertaining to the role CT can play in civil conflict settings.

In general, the role of different types of CTs in shaping civil conflict has increasingly been recognized.[2] For example, Armand et al. (2020) find radio to be a powerful instrument to demobilize rebels of Uganda's Lord's Resistance Army, thereby tilting the scales in favor of the government. Adena et al. (2015) document how the Nazis, once in power, were able to use the radio to their advantage. Related, Yanagizawa-Drott (2014) documents how the Hutu-led government exploited radio technology in their persecution of the Tutsi minority. More generally, Warren (2014) proposes mass media, such as television and radio, as a systematic correlate of limited civil conflict within a polity. What unites these studies is that radio or television as types of CT can allow ruling groups to broadcast powerful, conflict-relevant messages.

In contrast to radio and television, however, cell phones and the internet frequently appear to benefit dissident groups. The corresponding explanations usually center on phones' ability to "overcome collective action problems... and improve in-group cooperation, and coordination" (Pierskalla and Hollenbach, 2013, p.207). For instance, Pierskalla and Hollenbach (2013) identify cell phones in Africa as important catalysts of political violence (also see Bailard, 2015 and Manacorda and Tesei, 2020). Finally, recent analyses explore effects of the internet, and specifically social media platforms made possible by the internet, on civil conflict. Internet, like cell phones, can improve within-group coordination and communication (e.g., see Loyle and Bestvater, 2019 and Gohdes, 2018). The role of social media in the Arab Spring constitutes a useful example of recent history (also see Clarke and Kocak, 2020 and Zhuravskaya et al., 2020).

Following Armand et al. (2020) and Yanagizawa-Drott (2014), we model one-way CT

[2]Civil conflicts are defined as intra-state disputes that draw at least 25 battle-related deaths in a year.

(i.e., the radio and television in recent history) as primarily an instrument government employs to advance their interests. While effects of the internet in civil conflict environments can be multidimensional (e.g., see Gohdes, 2015, 2020, Reuter and Szakonyi, 2015, Zeitzoff, 2017, and Campante et al., 2018), the common thread it shares with cell phones, for example, is the two-way flow of information. Multiple parties can communicate back and forth with each other in real time. This aspect of two-way CT stands at the core of our theoretical model and is contrasted against the inherent one-directional nature of one-way CT, such as radio or television.

3 Theoretical Framework

Consider a society with two profit-maximizing, equally-sized groups, rulers (G) and dissidents (D), and available rents R that consist of natural resources, foreign aid, and comparable windfalls. The ruling group enjoys control of R. Following previous theoretical work on the topic, we model domestic conflict as violent actions the dissident group takes with the aim to gain control of R (Grossman, 1991; Blattman and Miguel, 2010; Besley and Persson, 2011).

Each group is endowed with one unit of labor that it allocates between home production and contesting for or maintaining control of R ($l_i + e_i = 1, \forall i \in \{G, D\}$). Labor put into home production, l_i, converts into output per the production function λl_i, where λ denotes a non-negative technology parameter. We assume $\lambda_G = \lambda_D = \lambda$ for simplicity.[3] e_G and e_D constitute the respective group's efforts to maintain or gain control of R. The returns to fighting emerge from the likelihood to win (or maintain) control of R. Following the canonical contest success function (Tullock, 1980; Hirshleifer, 1989; Skaperdas, 1996), we model the opposition's likelihood to seize power as

$$\beta = \frac{\theta e_D}{\theta e_D + e_G}, \tag{1}$$

where θ captures the productivity of the dissident group's fighting efforts relative to the productivity of the ruling group's fighting effort that we normalize to one. In line with Andersen et al. (2021), we assume $\theta \leq 1$. We assume the ruling group's fighting technology to be superior to the rebels'.

[3]This assumption does not affect the model's predictions but simplifies notation.

3.1 Communications Technology

The ruling group has one explicit informational advantage: They have precise knowledge of the content of public coffers, whereas the dissident group does not. The rebel group instead receives a signal, $\delta \in [0, 1]$, such that their expectations of resource income are given by δR. As $\delta \to 1$, the dissident group's expectations become more accurate, while smaller values of δ suggest substantial underestimation.

What informs the realization of δ? The ruling group would prefer δ to be as small as possible. The less the dissidents think is available to appropriate, the less they would be inclined to invest into efforts to seize power. We posit rulers affect the dissidents' perception of R through one-way technology.

We assume the ruling group enjoys greater control of the informational content of television and radio broadcasts. Everything else equal, their greater control allows the ruling group to systematically 'inform' (or rather misinform) dissidents' estimates of R. Formally, we model this as a decrease in δ due to improvements in one-way CT. Our model assumes $\delta'(o) < 0$ and $\delta''(o) > 0$, where o denotes the level of one-way CT.

Two-way CT, on the other hand, enters fighting technology, θ. The probability that the dissidents' effort will succeed depends crucially on their ability to communicate, coordinate, and monitor among themselves. Besides reducing the cost of coordination, it facilitates ensuring allegiance, securing funding, and recruiting soldiers (Walter, 2017). It also fosters a greater sense of group identity among the infinitesimal dissidents by reducing informational, ideological, and geographical distances between them (Gates, 2002). With the ruling group's disproportionate control of one-way technologies, communicating using radio and television broadcasts is not always possible, safe, or prudent. Two-way CT, such as the internet and mobile phones, on the other hand, are more difficult for the ruling groups to monitor and control. Thus, improvements in these technologies or in their penetration reduce the cost of communication or coordination for the dissidents and improve the productivity of their efforts.

For example, the Enough Project, discussing the Lord's Resistance Army of Uganda, writes "...LRA commanders have successfully used sophisticated communications technology in the past. Apart from the use of maps and satellite phones, [leader Joseph] Kony and his commanders also use dual systems phones (using satellite and mobile phone coverage), GPS monitors which the LRA commanders use to *navigate and arrive at prearranged meeting places, maps, and laptops*." (emphasis added; Cakaj, 2010). In another setting, mobile phones helped the Libyan Rebels avoid communication surveillance and obstruction dur-

ing their fight against Gaddafi (Hill, 2011). Other examples include the use of Facebook and satellite phones by the Arakan Army rebel group in 2018-2020 in their fight against the National Army of Myanmar and the use of social media platforms by Al-Shabaab, Boko Haram, and ISIS to radicalize and recruit followers, coordinate activities, and secure funding (Cox et al., 2018; Tønnesson et al., 2021).

Building on these observations, we assume increases in the penetration of or improvements in two-way CT (t) increase θ, but at a decreasing rate, i.e., $\theta'(t) > 0$ and $\theta''(t) < 0$. Note that equation (1) implicitly assumes no effect of two-way CT on the ruling group's conflict technology. This is a simplifying assumption. Results are consistent as long as we assume two-way CT to be relatively more important for the dissident group than for the rulers. In practice, this assumption is reflected in the fact that ruling groups tend to be better organized, with fewer free rider problems to begin with.

3.2 Profit Functions

From these assumptions, the ruler's optimization problem becomes

$$\begin{aligned} &\max_{\{l_G, e_G\}} && \lambda l_G + (1-\beta)R \\ &\text{subject to} && l_G + e_G = 1. \\ \\ \Rightarrow &\max_{\{l_G, e_G\}} && \lambda l_G + (\frac{e_G}{\theta e_D + e_G})R \\ &\text{subject to} && l_G + e_G = 1. \end{aligned} \tag{2}$$

D's decision problem shapes up largely analogously. The one difference is that D receives the signal δ to arrive at an estimate of available rents.

$$\begin{aligned} &\max_{\{l_D, e_D\}} && \lambda l_D + \beta\delta(o)R \\ &\text{subject to} && l_D + e_D = 1. \\ \\ \Rightarrow &\max_{\{l_D, e_D\}} && \lambda l_D + (\frac{\theta e_D}{\theta e_D + e_G})\delta(o)R \\ &\text{subject to} && l_D + e_D = 1. \end{aligned} \tag{3}$$

3.3 Equilibrium

The ruling group and the dissidents move simultaneously to select their respective labor and fighting efforts. Substituting for β in (2) and (3) and solving the maximization problems yields the following first-order conditions:

$$\lambda = \frac{\beta}{\theta(t)e_D + e_G}R \tag{4}$$

and

$$\lambda = \frac{\theta(t)(1-\beta)}{\theta(t)e_D + e_G}\delta(o)R. \tag{5}$$

Intuitively, equations (4) and (5) imply both groups decide on a level of fighting effort such that marginal costs in terms of forgone home production equal expected marginal returns from fighting. Substituting (5) in (4) leads to

$$e_D = \delta(o)e_G. \tag{6}$$

Thus, the more the dissident group invests in trying to gain control of resources, the more the ruling group invests in trying to maintain its control, and vice versa. This result follows from the nature of the contest success function (e.g., see Andersen et al., 2021). Further, a lower δ decreases the dissident group's perception of the prize they are fighting for, reducing the effort they invest in fighting.

Substituting (6) back in (4) and simplifying yields

$$e_D^* = \frac{(\delta(o))^2\theta(t)R}{\lambda(1+\delta(o)\theta(t))^2}. \tag{7}$$

3.4 Comparative Statics

Several insights follow. First, equation (7) generates conclusions that align with stylized facts about the relationship between economic conditions and conflict (Chassang and i Miquel, 2009). As home production (λ) becomes more profitable, dissidents' efforts to overthrow the government decrease, $\frac{\mathrm{d}e_D^*}{\mathrm{d}\partial\lambda} < 0$. In turn, dissidents put more effort into fighting when there are more resources to appropriate, i.e., $\frac{\mathrm{d}e_D^*}{\mathrm{d}\partial R} > 0$.

More relevant to our study's focus, an improvement in two-way CT translates to an increase in domestic conflict efforts, leading to *Proposition 1*:

$$\frac{\mathrm{d}e_D^*}{\mathrm{d}t} > 0. \tag{8}$$

Proposition 1 *An increase in two-way communications technology raises the dissidents' efforts dedicated to violence.*

Proof: Differentiating equation (7) w.r.t t

$$\frac{\mathrm{d}e_D^*}{\mathrm{d}t} = \frac{\delta^2\theta' R}{\lambda(1+\delta\theta)^2} - \frac{2\delta^3\theta'\theta R}{\lambda(1+\delta\theta)^3}$$

$$\Rightarrow \frac{\mathrm{d}e_D^*}{\mathrm{d}t} = \frac{\theta'(1-\delta\theta)}{\theta(1+\delta\theta)} e_D^* > 0$$

Everything else held constant, an improvement in t and, therefore, θ increases the chances of the dissident group winning control of the resources. This increases the marginal benefits from fighting effort at all levels. Meanwhile, the marginal costs in terms of lost output from home production remain unchanged, so the dissident group responds by increasing its level of fighting effort.

Finally, an increase in the penetration of one-way CT permits the ruling group to play down the income from rents. This decreases the valuation of the prize dissidents believe they are fighting for. Consequently, the marginal gains from devoting more effort to fighting are smaller. Therefore, an improvement in the reach of one-way CT will incentivize the dissident group to fight less:

$$\frac{\mathrm{d}e_D^*}{\mathrm{d}o} < 0. \tag{9}$$

Proposition 2 *An improvement in one-way communications technology is associated with a decrease in the effort dissidents devote to fighting the rulers.*

Proof: Differentiating equation (7) w.r.t o

$$\frac{\mathrm{d}e_D^*}{\mathrm{d}o} = \frac{2\delta\delta'\theta R}{\lambda(1+\delta\theta)^2} - \frac{2\delta^2\delta'\theta^2 R}{\lambda(1+\delta\theta)^3}$$

$$\Rightarrow \frac{\mathrm{d}e_D^*}{\mathrm{d}o} = \frac{2\delta'}{\delta(1+\delta\theta)} e_D^* < 0$$

From (6), it is straightforward to see that we obtain similar comparative statics if we were to evaluate the impact of changes in CT on e_G^*. Thus, conclusions are consistent whether we measure civil conflict by the dissidents' fighting efforts alone (e_D^*) or whether we incorporate the ruler's fighting efforts (e.g., $e_D^* + e_G^*$).

4 Data and Empirical Methodology

To empirically test these propositions, we explore two perspectives: *(i)* cross-country longitudinal data on civil conflict and CT penetration, as well as *(ii)* individual-level attitudes towards government and one- and two-way CT usage.

4.1 Empirical Strategy: Country-Level Analysis

To examine the association between civil conflict and different types of CT in country i and year t, we estimate the following linear specification:[4]

$$\text{Conflict}_{i,t} = \beta_0 + \beta_1 CT_{i,t} + \mathbf{X_{i,t}} + \lambda_i + \gamma_t + \epsilon_{i,t}. \tag{10}$$

$\text{Conflict}_{i,t}$ denotes a binary indicator for experiencing civil conflict. When examining the relationship between conflict and one-way CT, $CT_{i,t}$ measures the number of radios or televisions per capita in country i and year t. When we turn to two-way CT, $CT_{i,t}$ measures cell phone subscriptions or internet users per capita. Third and final, in the spirit of Warren (2014, p.124), we construct 'media density indices' by averaging radio and television penetration or cell phone and internet usage. If our propositions from Section 3.4 were sensible, we should observe a negative and statistically significant coefficient β_1 when studying one-way CT and a positive and statistically significant coefficient β_1 for two-way CT.

$\mathbf{X_{i,t}}$ represents a vector of time-varying control variables, including the natural logarithm of population size and GDP per capita, as well as a measure of executive constraints. Section 4.2 shortly describes these in detail. λ_i and γ_t constitute country- and year-fixed effects. Finally, $\epsilon_{i,t}$ captures the usual error term.

[4]Since we are interested in approximating the partial effects of the explanatory variables, choosing a linear probability model or a non-linear logit-type specification makes little difference for our findings (see Hellevik, 2009 and Wooldridge, 2010, p.563). Examples of studies that use linear probability models to study conflict include Miguel et al. (2004), Bazzi and Blattman (2014), and Berman and Couttenier (2015).

4.2 Country-Level Data

Table A1 reports summary statistics for all country-level variables. We access the Uppsala Conflict Data Program/International Peace Research Institute, Oslo (UCDP/PRIO) Armed Conflict Dataset to identify country-year observations that experience civil conflict. These are years in which a country experiences at least 25 battle-related deaths in conflicts where one of the fighting parties is the government (Gleditsch et al., 2002; Pettersson and Öberg, 2020). To capture the level of penetration of one-way CT, we calculate the number of radios and televisions per capita from the Cross-National Time-Series (CNTS) Data Archive (Banks and Wilson, 2017). Data availability from these sources allows us to study 188 countries from 1960 to 2003 for radio and 189 countries from 1960 to 2005 for television.

For two-way CT, we employ data on the number of mobile phone subscriptions from the United Nations Statistical Yearbooks (UNSYB) from 1992 to 2016 (UN, 2016).[5] Finally, we use data on the percentage of internet users from the World Telecommunication/ICT indicators Database (ITU, 2019).

To account for potential confounders, we first control for population size and GDP per capita levels using information from the World Development Indicators (WDI, 2020). As is common in the corresponding literature, we log transform both variables (Fearon and Laitin, 2003; Collier and Hoeffler, 2004; Miguel et al., 2004; Bluhm et al., 2021). Population size not only absorbs size differences across countries but also accounts for the effect of population growth on resource-scarcity driven violence (Acemoglu et al., 2020). GDP per capita captures economic development and its potential relationship with civil conflict *and* CT. For example, potential dissident groups from richer polities often enjoy better labor market opportunities *and* better CT, but the corresponding payoffs from conflict can also change as societies prosper (Bazzi and Blattman, 2014; Berman and Couttenier, 2015; McGuirk and Burke, 2020). To capture institutional environments, we also account for executive constraints as a potential correlate of conflict incidence and CT usage (Lai and Slater, 2006; Colaresi and Carey, 2008; Lei and Michaels, 2014). Following a convention in the associated literature, we code a binary variable measuring whether the country-year observation features a constrained executive, i.e., a value above two on the *xconst* variable from the Polity 5 database (e.g., see Colaresi and Carey, 2008 or Lai and Slater, 2006).[6]

[5] We prefer UNSYB to data from the International Telecommunication Union (ITU) because UNSYB clearly delineate the country-year observations when data were not reported and therefore interpolated. We only study observations with actual reported data, excluding interpolated observations.

[6] A score of one signals the executive enjoys unlimited authority and a score of seven suggests the executive is equally or more constrained than the citizenry (Marshall and Gurr, 2020).

In essence, this delineates regimes in which the executive enjoys unlimited authority and no independent judiciary.

Beyond these time-varying covariates, we incorporate country-fixed effects that allow us to account for each country's time-*invariant* characteristics. Thus, our derived estimates correct for cross-country differences in conflict-relevant characteristics that do not change over time (or only slowly), such as geography, historical particularities like colonization, or cultural and ethnic diversity (Montalvo and Reynal-Querol, 2005; Esteban et al., 2012; Chowdhury et al., 2016; Arbatlı et al., 2020; Yuki, 2021). Year-fixed effects, on the other hand, guarantee common global events, such as the Cold War, global recessions, or technology shocks, are not driving our coefficients of interest. These time-specific binary indicators are particularly important in our analysis because technological developments usually increase over time, which likely also affects CT.

The derived estimates are also consistent when including natural resource rents (Lei and Michaels, 2014; Bhattacharyya and Mamo, 2021) – a variable we exclude in our main regressions to preserve sample sizes. Finally, we also move beyond country- and year-fixed effects and account for country-specific time trends to acknowledge each country may have had its own development path that could have coincided with technological innovations as well as conflict dynamics. The corresponding estimates also yield consistent conclusions (see Table A2).

4.3 Empirical Strategy: Individual-Level Analysis

Next, we turn to individual-level survey responses from the World Values Survey (Haerpfer et al., 2021) to explore whether individual attitudes yield correlations that are consistent with our theoretical predictions.[7] Our model predicts the availability of one-way CT should be associated with less combative attitudes towards the ruling government. In contrast, the availability of two-way CT should correlate with more government-critical views.

Specifically, we access responses to two survey questions that have been fielded in the two most recent waves in several countries: (i) satisfaction with the political system and (ii) confidence in government. We re-code satisfaction to take values from one to ten, with higher values denoting higher levels of satisfaction with the political system. We code

[7]The Integrated Value Survey is constructed from the European Value Survey (EVS) and World Value Survey (WVS) trend files based on the common EVS/WVS dictionary. However, we do not use the IVS because the EVS does not include communications technology-related questions comparable to what we find in the WVS.

confidence from zero to three, with higher values denoting higher levels of confidence in government. We predict the corresponding response of respondent i from country j surveyed in year t with:

$$\text{Response}_{i,j,t} = \alpha_0 + \alpha_1 CT_{i,j,t} + \mathbf{Z_{i,j,t}} + \lambda_j + \gamma_t + \delta_{i,j,t}. \tag{11}$$

To measure $CT_{i,j,t}$, we access i's survey responses regarding their frequency of using the radio, television, the mobile phone, or the internet as sources of information. For each one of these four items, the corresponding responses range from zero (never), over one (less than monthly) and two (monthly), to three (daily). Thus, higher values indicate more frequent usage of the respective CT. Based on our theoretical predictions, we expect a positive and statistically significant coefficient α_1 for one-way CTs but a negative and statistically significant α_1 for two-way CTs.

$\mathbf{Z_{i,j,t}}$ incorporates a number of control variables that could independently affect both attitudes towards government and usage of various types of CT. We closely follow the associated literature and control for age (linear and squared terms), gender, marriage status, income levels, educational attainment, religion, and employment status (Campante and Chor, 2014; Manacorda and Tesei, 2020; Guriev et al., 2021) . As before, λ_j and γ_t capture country- and wave-fixed effects to account for unobservables along spatial and time dimensions. Finally, $\delta_{i,j,t}$ captures the conventional error term.

4.4 Individual-Level Data

Table A3 documents the corresponding summary statistics for all variables used in our individual-level analyses. In Waves 6 (2010-14) and 7 (2017-2019) of the WVS, respondents were asked four independent questions about the frequency with which they use the radio, television, mobile phones, and the internet as a source of information. We recode the variables such that higher values denote higher frequency of usage, i.e., zero (never), one (less than monthly), two (monthly), three (weekly), and four (daily).

While the survey question about *satisfaction with the political system* was included in Waves 3 (1995-98), 4 (2000-04), and 7 (2017-2019), the question about a respondent's level of *confidence in government* has been consistently employed since Wave 2 (1989-1993). Overall, we are able to use up to 160,000 individual responses to explore system-

atic links between the use of different types of CT and government-related attitudes.

5 Empirical Findings

5.1 Country-Level Analyses

Table 1 documents results from our first set of country-level analyses, relating the penetration of radio and television to the incidence of civil conflict. In Columns (1) and (2), we focus on radio, while Columns (3) and (4) report results for television. The final two columns employ an average of the two as a comprehensive measure of one-way CT. For each independent variable of interest, we first report results from a parsimonious regression and then include the full set of covariates introduced in Section 4.2. For completeness, we also display the estimates for the time-variant control variables.

Table 1: The association between one-way CT and the incidence of civil conflict.

	(1)	(2)	(3)	(4)	(5)	(6)
	Civil conflict$_{i,t}$ (yes/no)					
Mean of dependent variable:	0.137	0.154	0.134	0.150	0.138	0.154
Radios/capita$_{i,t}$ (standardized)	-0.069*** (0.010)	-0.063*** (0.013)				
Televisions/capita$_{i,t}$ (standardized)			-0.037*** (0.006)	-0.024** (0.009)		
(Radios+televisions)/capita$_{i,t}$ (standardized)					-0.075*** (0.009)	-0.061*** (0.012)
Ln(GDP/capita)$_{i,t}$		-0.041** (0.018)		-0.034** (0.015)		-0.039** (0.019)
Ln(population size)$_{i,t}$		0.035 (0.028)		0.057** (0.027)		0.025 (0.028)
Executive constraints$_{i,t}$		0.025* (0.015)		0.026* (0.014)		0.026* (0.015)
Country- and year-fixed effects		✓		✓		✓
N	5,830	4,313	6,522	4,881	5,810	4,309
Adjusted R^2	0.474	0.517	0.467	0.509	0.475	0.517

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are reported in parentheses. The dependent variable is an indicator variable that takes a value of one if country i experiences civil conflict in year t; zero otherwise. Civil conflicts are intra-state disputes with at least 25 battle-related deaths in a given year.

Throughout Table 1, the measures of one-way CT emerge as negative and statistically significant predictors of civil conflict. Because we standardize these variables, we can compare magnitudes across specifications. A one standard deviation increase in radio penetration is associated with a 6-7 percentage point decrease in the likelihood to experience civil conflict. Roughly, this corresponds to 40 percent of the mean. That magnitude is perhaps better understood when compared to a benchmark correlate of civil conflict: GDP per capita. In column (2), we can see that a doubling of income levels corresponds to a decrease in the odds of conflict by approximately four percentage points – more than a third less than a standard deviation increase in the number of radios. Thus, radios not only matter statistically but also quantitatively. Televisions per capita yield similar insights in terms of statistical relevance but produce smaller estimates. A one standard deviation increase in the number of televisions per capita correlates with a 2.4 percentage point decrease in conflict likelihood.

Finally, combining the penetration of radio and television produces consistent results. A one standard deviation increase in that variable corresponds to a 6.1 percentage point reduction in the frequency of civil conflict. Similar to column (2), this constitutes a sizable share of the average conflict incidence with almost 40 percent of the mean. These results pertaining to the importance of one-way CT in predicting civil conflict are consistent throughout a number of robustness checks (see Table A2). Specifically, we identify consistent results when we (i) control for natural resource rents, (ii) exclude observations from China, or (iii) account for country-specific time trends instead of year-fixed effects.

In Table 2, we report country-level relationships between conflict incidence and two-way CT. As in Table 1, we first report results from parsimonious regressions and then account for the full list of potential confounders, including country- and year-fixed effects. Contrary to Table 1, and consistent with our theoretical predictions, we find two-way CTs are positively associated with civil conflict. In terms of magnitude, we identify a 2.3 percentage point increase in the likelihood to experience civil conflict when cell phone subscriptions increase by one standard deviation. This corresponds to as much as a 15 percent rise in the likelihood of experiencing civil conflict. For internet usage, the estimate suggests an increase of 1.5 percentage points. Finally, when we combine the two-way CT variables into one, we estimate a coefficient of 0.04. This implies a one standard deviation improvement in two-way CT can increase the chances of experiencing conflict by approximately 30 percent. As with one-way CT, these results are consistent when (i) controlling for natural resource rents, (ii) excluding China, and (iv) incorporating country-specific time trends instead of year-fixed effects (see Table A2).

Table 2: The association between two-way CT and incidence of civil conflict

	(1)	(2)	(3)	(4)	(5)	(6)
	Civil conflict$_{i,t}$ (yes/no)					
Mean of dependent variable:	0.113	0.135	0.109	0.131	0.109	0.131
Cell phone subscriptions/capita$_{i,t}$ (standardized)	0.016**	0.023**				
	(0.007)	(0.010)				
Internet users/capita$_{i,t}$ (standardized)			0.020***	0.015*		
			(0.008)	(0.008)		
(Cell phone subscriptions+internet users)/capita$_{i,t}$ (standardized)					0.030***	0.041***
					(0.009)	(0.012)
Ln(GDP/capita)$_{i,t}$		-0.108***		-0.067***		-0.083***
		(0.027)		(0.026)		(0.029)
Ln(population size)$_{i,t}$		-0.052		-0.073**		-0.097**
		(0.037)		(0.031)		(0.035)
Executive constraints$_{i,t}$		0.020		-0.020		-0.002
		(0.024)		(0.028)		(0.031)
Country- and year-fixed effects		✓		✓		✓
N	4,800	3,683	4,980	3,793	4,205	3,269
Adjusted R^2	0.575	0.598	0.578	0.606	0.598	0.624

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are reported in parentheses. The dependent variable is an indicator variable that takes a value of one if country i experiences civil conflict in year t; zero otherwise. Civil conflicts are intra-state disputes with at least 25 battle-related deaths in a given year.

5.2 Individual-Level Analyses

Table 3 presents estimates from our individual-level regression analyses, focusing on the usage of one-way CTs with radio and television. We follow a familiar sequence of regressions for radio, television, and the combination of the two – first reporting basic correlations and then including all control variables introduced in Section 4.3. Panel A predicts responses to individuals' *satisfaction with the political system* and Panel B turns to their *confidence in government*.

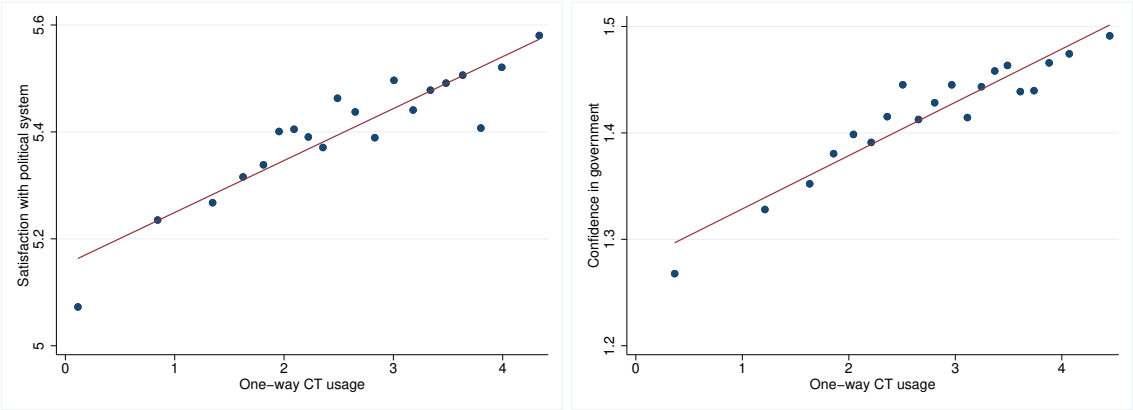
Table 3: The association between one-way CT and attitudes towards the political system and government.

	(1)	(2)	(3)	(4)	(5)	(6)
	***Panel A*: Satisfaction with political system$_i$**					
Using radio$_i$	0.057***	0.051***				
	(0.006)	(0.006)				
Using television$_i$			0.083***	0.072***		
			(0.008)	(0.008)		
Average of radio and tv usage$_i$					0.111***	0.097***
					(0.009)	(0.009)
Control variables[a]		✓		✓		✓
Country- and wave-fixed effects	✓	✓	✓	✓	✓	✓
N	73,581	69,975	73,891	70,235	73,463	69,877
Adjusted R^2	0.193	0.210	0.193	0.210	0.194	0.211
	***Panel B*: Confidence in government$_i$**					
Using radio$_i$	0.028***	0.025***				
	(0.001)	(0.002)				
Using television$_i$			0.042***	0.038***		
			(0.002)	(0.002)		
Average of radio and tv usage$_i$					0.054***	0.050***
					(0.002)	(0.002)
Control variables[a]		✓		✓		✓
Country- and wave-fixed effects	✓	✓	✓	✓	✓	✓
N	156,006	143,438	156,520	143,861	155,779	143,262
Adjusted R^2	0.215	0.223	0.215	0.224	0.217	0.225

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are reported in parentheses. *Satisfaction with the political system* ranges from 1 (very bad) to 10 (very good). *Confidence in the government* takes values from 0 (none at all) to 3 (a great deal). The independent variables *using radio* and *using television* variables have five (re-coded) responses: never (0), less than monthly (1), monthly (2), weekly (3), and daily (4). Control variables include individual-level measures of age, age^2, marriage status, income, gender, education, religious affiliation, and employment status.

In both panels, we consistently derive positive coefficients that are statistically significant at the one percent level for all measures of one-way CT. The coefficients of interest decrease only marginally in magnitude once all covariates are accounted for, highlighting the stability of the relationship between people's usage of one-way CT and their attitudes towards their government. To visualize the relationship at all points of the distribution, Figure 1 reports binned scatter plots in which all covariates are accounted for. For both response items, we observe a linear, positive relationship with one-way CT.

Figure 1: The relationship between one-way CT and attitudes towards government

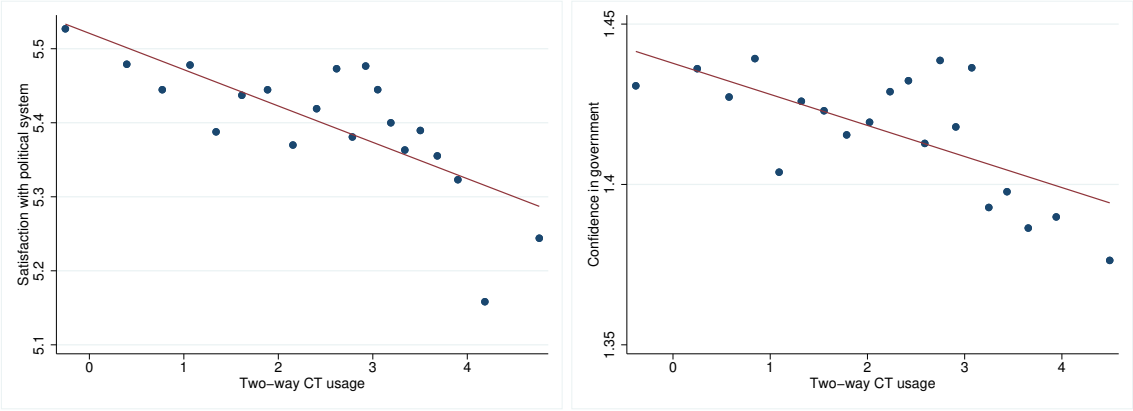


(a) Satisfaction with political system ($\beta = 0.097$; std. error: 0.009)

(b) Confidence in government ($\beta = 0.050$; std. error: 0.002)

Notes: The figure presents binned scatter based on the specification laid out in Equation (11). We control for age, age^2, marriage status, income, gender, education, religious affiliation, and employment status, as well as country- and wave-fixed effects.

Figure 2: The relationship between two-way CT and attitudes towards government



(a) Satisfaction with political system ($\beta = -0.049$; std. error: 0.007)

(b) Confidence in government ($\beta = -0.010$; std. error: 0.002)

Notes: The figure presents binned scatter based on the specification laid out in Equation (11). We control for age, age^2, marriage status, income, gender, education, religious affiliation, and employment status, as well as country- and wave-fixed effects.

Table 4 examines the relationship between attitudes towards the government and the usage of cell phones and the internet. As above, Panel A considers satisfaction with the political system, while Panel B investigates confidence in government. In 11 of the 12 regressions, we derive negative and statistically significant estimates associated with the usage of two-way CT. The only exception emerges in column (2) of Panel B, where we

derive a precisely estimated null relationship. Nevertheless, internet usage and the combination of cell phone and internet usage again produces the familiar negative relationship. Importantly, cell phone usage remains a negative and statistically significant predictor in Panel A, when predicting satisfaction with the political system, even after all covariates are incorporated. Figure 2 presents the corresponding bin scatter plots. While the relationships are generally more noisy than in Figure 1, we still identify a clear negative connection, which is consistent with our theoretical predictions.

Table 4: The association between two-way CT and attitudes towards the political system and government.

	(1)	(2)	(3)	(4)	(5)	(6)
	***Panel A*: Satisfaction with political system$_i$**					
Using cell phone$_i$	-0.030***	-0.016***				
	(0.006)	(0.006)				
Using internet$_i$			-0.068***	-0.057***		
			(0.006)	(0.007)		
Average of cell phone and internet usage$_i$					-0.062***	-0.047***
					(0.006)	(0.007)
Control variables^a		✓		✓		✓
Country- and wave-fixed effects	✓	✓	✓	✓	✓	✓
N	73,562	69,964	73,022	69,432	72,725	69,183
Adjusted R^2	0.192	0.207	0.194	0.209	0.194	0.209
	***Panel B*: Confidence in government$_i$**					
Using cell phone$_i$	-0.007***	0.001				
	(0.001)	(0.001)				
Using internet$_i$			-0.024***	-0.013***		
			(0.001)	(0.002)		
Average of cell phone and internet usage$_i$					-0.020***	-0.007***
					(0.002)	(0.002)
Control variables^a		✓		✓		✓
Country- and wave-fixed effects	✓	✓	✓	✓	✓	✓
N	155,763	143,250	155,199	142,672	154,564	142,172
Adjusted R^2	0.216	0.219	0.217	0.219	0.216	0.219

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are reported in parentheses. *Satisfaction with the political system* ranges from 1 (very bad) to 10 (very good). *Confidence in the government* takes values from 0 (none at all) to 3 (a great deal). The independent variables *using cell phone* and *using internet* variables have five (re-coded) responses: never (0), less than monthly (1), monthly (2), weekly (3), and daily (4). Control variables include individual-level measures of age, age^2, marriage status, income, gender, education, religious affiliation, and employment status.

Finally, Table 5 reports results from considering one- and two-way CTs in the same regressions. Contrary to the country-level longitudinal data, the WVS features responses on all types of CTs from the same respondents (with a negligible number of non-responses), as well as their attitudes pertaining to government. Columns (1) and (3) of Table 5 illustrate how the results from the separate analyses are comfortably confirmed when studied jointly. Finally, Columns (2) and (4) incorporate country-wave-fixed effects, which leaves our coefficients of interest virtually unchanged. In sum, WVS responses to attitudes towards government are firmly correlated with the availability of one- and two-way CT – but the respective signs differ, as predicted by our theoretical framework.

Table 5: One-way and two-way CT and attitudes towards the political system and government.

Dependent variable:	Satisfaction with political system$_i$		Confidence in government$_i$	
	(1)	(2)	(3)	(4)
Average of radio and tv usage$_i$	0.115***	0.115***	0.054***	0.052***
	(0.009)	(0.009)	(0.002)	(0.002)
Average of cell phone and internet usage$_i$	-0.062***	-0.062***	-0.015***	-0.014***
	(0.008)	(0.008)	(0.002)	(0.002)
Control variables[a]	✓	✓	✓	✓
Country fixed effects	✓	✓	✓	✓
Year-fixed effects	✓		✓	
Country-wave-year fixed effects		✓		✓
N	68,827	68,827	141,601	141,601
Adjusted R^2	0.214	0.214	0.225	0.234

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are reported in parentheses. *Satisfaction with the political system* ranges from 1 (very bad) to 10 (very good). *Confidence in the government* takes values from 0 (none at all) to 3 (a great deal). All four CT variables have five (recoded) responses: never (0), less than monthly (1), monthly (2), weekly (3), and daily (4). Control variables include individual-level measures of age, age^2, marriage status, income, gender, education, religious affiliation, and employment status. World Values Survey waves 6 and 7 were conducted in years 2010-14 and 2017-2019, respectively.

6 Conclusion

Communications technologies constitute fundamental components of intra-state conflict. Studies have shown heterogeneous effects, sometimes benefiting and other times hurting the interests of dissident groups, and usually focus on a particular type of CT, often in specific conflict settings. We propose a framework to better understand the general nexus

between different types of CT and the incidence of civil conflict. Our model delineates one-way CT, that allows for the broadcast of messages, from two-way CT that facilitates dialogue and coordination. Thus, we explicitly propose one delineating feature that sets types of CT apart in how they may inform civil conflict.

Building on a conventional contest success function, we first illustrate how both types of CT can predominantly enter the government's and the dissident group's struggle for power. Importantly, we do not claim to explain *all* CT-related conflict dynamics. Rather, we highlight what we believe are the main entry points through which different types of CT can influence a society's likelihood to experience conflict. The model predicts improvements in one-way CT diminish the chances of conflict, while improvements in two-way CT do the opposite. Specifically, one-way CT allows the government to (mis)inform the dissident group, thereby softening their hunger for power. In turn, two-way CT facilitates the dissident group's ability to communicate, coordinate, and monitor, which emboldens their contest for power.

We take two empirical avenues to test whether the data are consistent with these predictions. First, results from studying country-level panels suggest the availability of one-way CT (radio and television) indeed correlates with diminished chances of civil conflict. In contrast, the availability of two-way CT (cell phones and the internet) is consistently associated with increased conflict incidence. These results prevail when accounting for a comprehensive set of potential confounders, fixed effects, and additional robustness checks. Finally, studying survey responses from 29 to 41 countries (depending on the outcome of choice) finds anti-government attitudes diminish with the usage of one-way CT (again with the radio and television) – but flare up with the usage of two-way CT (again with cell phones and the internet).

Our paper does not imply our modeling of one-way versus two-way CT is the *only* way to connect different types of CT to civil conflict. Rather, we present *one* option of a unified theoretical framework that could explain a large part of how CT types might inform intra-state conflict. We hope our model and empirical evidence can serve as a starting point to a more general understanding of how CT can differentially inform civil conflict incidence. Such research efforts are not only of primary importance for understanding past conflicts; they are also crucial if we want to understand and predict how current and future types of CT might affect the contest for power.

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A1 Empirical Appendix

A1.1 Summary Statistics: Country-Level Analysis

Table A1: Summary statistics for country-level analysis.

Variable	Mean	(Std. Dev.)	N	Mean	(Std. Dev.)	N	Source
	Sample: Radio/capita (Years: 1960-2003)			*Sample*: TV/capita (Years: 1960-2005)			
Conflict	0.14	(0.34)	5,834	0.13	(0.34)	6,524	UCDP/PRIO
Radios/capita	0.29	(0.30)	5,834				CNTS
TVs/capita				0.14	(0.19)	6,524	CNTS
Population (in million)	28.67	(103.93)	5,831	29.21	(107.09)	6,521	WDI
GDP/capita (in thousands)	8.96	(13.96)	4,849	9.46	(14.92)	5,535	WDI
Executive constraints	0.65	(0.48)	5,104	0.67	(0.47)	5,670	Polity V
Natural resource rents (% of GDP)	7.01	(10.64)	4,212	6.96	(10.78)	4,894	WDI
	Sample: Cell phones/capita (Years: 1987-2015)			*Sample*: Internet users/capita (Years: 1990-2018)			
Conflict	0.11	(0.32)	4,800	0.11	(0.31)	4,983	UCDP/PRIO
Mobile phone subscriptions/capita	0.45	(0.55)	4,800				UNSYB
Internet users/capita				0.24	(0.28)	4,983	WTID
Population (in million)	33.26	(126.53)	4,800	33.92	(128.84)	4,983	WDI
GDP/capita (in thousands)	14.07	(20.87)	4,525	14.60	(21.21)	4,705	WDI
Executive constraints	0.82	(0.39)	3,787	0.84	(0.37)	3,896	Polity V
Natural resource rents (% of GDP)	7.14	(11.39)	4,583	6.93	(11.23)	4,786	WDI

Notes: Conflict is an indicator variable from UCDP/PRIO that equals '1' if a country experiences an intra-state dispute with at least 25 battle-related deaths in a year otherwise '0' (Gleditsch et al., 2002; Pettersson and Öberg, 2020). Radios per capita and television per capita are obtained from CNTS database archive (Banks and Wilson, 2017). Mobile phone subscription is from various editions of United Nations Statistical Yearbooks (UN, 2016), and internet variable is from World Telecommunication/ICT Indicators Database (ITU, 2019). Population, GDP per capita, and rent as % of GDP are from World Development Indicators. The executive constraint variable takes on the value of if the $xconst$ variable reaches a value of three or higher on its scale of 1 (Unlimited authority) to 7 (Executive parity or subordination) (from Marshall and Gurr, 2020).

A1.2 Robustness Checks: Country-Level Analysis

Table A2: The association between different types of CT and civil conflict: Robustness to specification and sample changes

	(1)	(2)	(3)	(4)	(5)	(6)
	Civil conflict$_{i,t}$ (yes/no)					
(Radios+televisions)/capita$_{i,t}$ (standardized)	-0.072***	-0.062***	-0.058***			
	(0.016)	(0.012)	(0.020)			
(Cell phone subscriptions+internet users)/capita$_{i,t}$ (standardized)				0.043***	0.043***	0.024*
				(0.012)	(0.012)	(0.013)
Natural resource rents$_{i,t}$	0.002**			0.001		
	(0.001)			(0.001)		
Control variables[a]	✓	✓	✓	✓	✓	✓
Country fixed effects	✓	✓	✓	✓	✓	✓
Year fixed effects	✓	✓		✓	✓	
Excluding:		China			China	
Country-specific time trends			✓			✓
N	3,508	4,269	4,310	3,250	3,245	3,269
Adjusted R^2	0.540	0.517	0.591	0.624	0.626	0.699

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors are reported in parentheses. The dependent variable is an indicator variable that takes value '1' if country i witnesses a civil conflict in year t, '0' otherwise. Control variables include ln(GDP/capita)$_{i,t}$, ln(population size)$_{i,t}$, and executive constraints$_{i,t}$. Civil conflicts are intra-state disputes with at least 25 battle-related deaths in a year.

A1.3 Summary Statistics: Individual-Level Analysis

Table A3: Summary statistics for individual-level analysis.

Variable	Mean	(Std. Dev.)	N	Mean	(Std. Dev.)	N
	Sample: Satisfaction with political system (Wave 7)			*Sample*: Confidence in government (Waves 6 & 7)		
Satisfaction with political system (1-10)	5.39	(2.74)	74,189			
Confidence in government (0-3)				1.42	(0.97)	160,622
Use of radio as info source	1.91	(1.68)	73,581	2.22	(1.69)	156,006
Use of television as info source	3.20	(1.28)	73,891	3.34	(1.20)	156,520
Use of mobile phone as info source	2.52	(1.73)	73,562	2.34	(1.79)	155,763
Use of internet as info source	2.39	(1.77)	73,022	2.03	(1.81)	155,199
Age	43.02	(16.37)	76,579	42.44	(16.48)	165,964
Female	0.52	(0.50)	76,846	0.52	(0.50)	166,320
Education			76,278			165,044
Religion			75,833			160,239
Employment			76,051			164,089
Income			75,119			161,879
Marital Status			76,558			165,879

Notes: World Values Survey waves 6 and 7 were conducted in years 2010-14 and 2017-2019, respectively. Satisfaction with political system ranges from 1 (very bad) to 10 (very good). Confidence in the government ranges from 0 (none at all) to 3 (a great deal). All four CT variables range from 0 (never used as a source of information) to 4 (daily). Education can take one of three values: (1) Lower, (2) Middle, and (3) Upper. Marriage status categories are (1) Married, (2) Living together as married, (3) Divorced, (4) Separated, (5) Windowed, and (6) Single/Never married. The income variable is the decile of the income distribution to which the respondent belongs. Religion is codes as (0) Do not belong to a denomination, (1) Roman Catholic, (2) Protestant, (3) Orthodox (Russian/Greek/etc.), (4) Jew, (5) Muslim, (6) Hindu, (7) Buddhist, (8) Other Christian (Evangelical/Pentecostal/Fee church/etc.), and (9) Others. Employment categories are (1) full time , (2) part time, (3) self employed, (4) retired, (5) housewife, (6) student, (7) unemployed, and (8) others.