# The Early Spread of Mass Media Increases the Probability of Civil War: A Research Note

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A recent article in *International Organization* suggests that by enhancing the soft power of states, the spread of mass media decreases the probability of civil war onset. This research note contributes an improvement to the logic of that argument (internal consistency) and demonstrates a substantively different and improved accounting of the empirical relationship between mass media and civil war (internal and external validity). Mass media density decreases the likelihood of civil war only after the threshold at which it constitutes a mass communications system; before that threshold, year-to-year increases in mass media density significantly increase the likelihood of civil war.

*Intro*

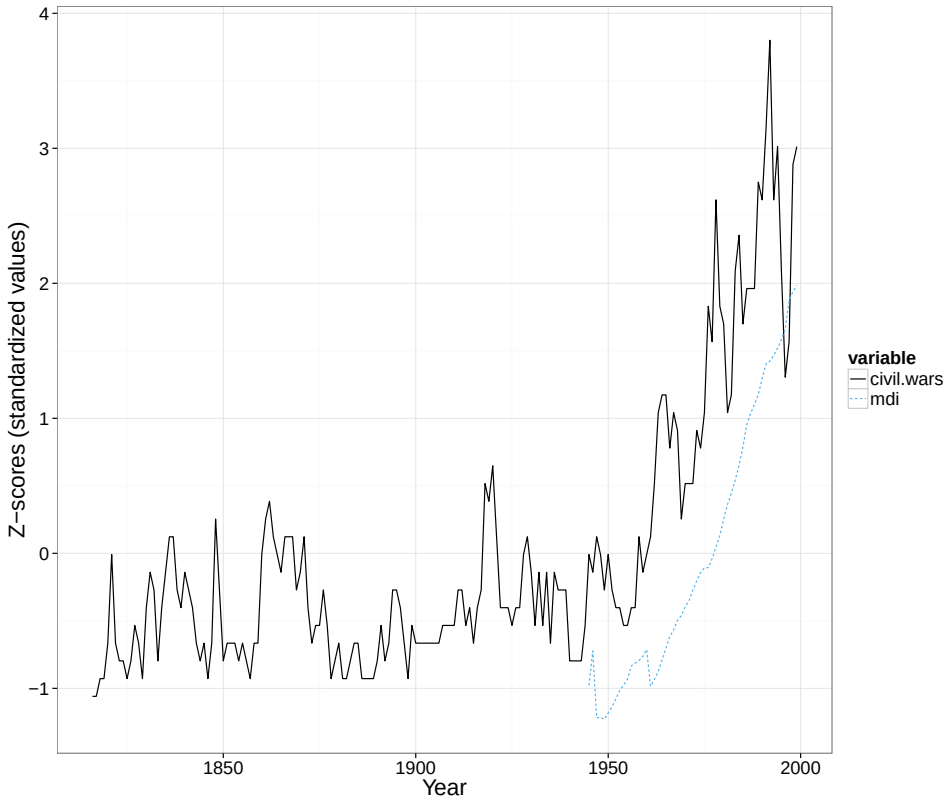


Figure 1: Mass Media Density and Civil Wars Globally, 1816-1999

*Why Mass Media Density is Supposed to Decrease the Likelihood of Civil War*

In a recent issue of *International Organization*, Camber Warren argues that the spread of mass media technologies throughout a particular country decreases the probability of observing civil war because mass media technologies increase state strength and therefore deter insurgencies. The reason that technologies such as televisions, radios, and newspapers enhance the state's strength is because they increase the state's normative influence and there-

fore its power to induce loyalty from citizens. More specifically, mass media technologies increase this "soft power" of the state in two ways.

First, mass media technologies lower the costs of communication in general, for states as well as insurgents. Second, however,mass media technologies increase the normative influence of the state in particular because of economies of scale which are unique to the production of normative influence. Because a media message achieves a larger effect on receivers who believe the message was widely disseminated, the production of normative influence through mass media brings increasing marginal returns for each additional unit of effort, as each additional recipient receiving the message increases the effect of the message on the rest of the receivers. Because the state is inherently a larger-scale producer of symbolic content than potential insurgent groups, Warren argues, higher levels of mass media will be associated with normatively stronger states and therefore lower probabilities of observing civil war.

Grounding this theoretical model in the tradition of figures such as Karl Deutsche and Benedict Anderson who first diagnosed the role of mass media in the rise of modern nationalism, as well as contemporary experimental research on mass-media messaging, Warren's theory stresses the unique effects of mass communications relative to small-scale interpersonal communications. Using state-level data for a large panel of countries from 1945 to 1999, Warren demonstrates that, after controlling for other predictors of civil war, mass media density (televisions, radios, and newspapers per person) is associated with more than a tenfold decrease in the likelihood of observing civil war in a particular country-year.

*A Critique*

If higher levels of mass media density decrease the likelihood of civil war, it is extremely puzzling that in modern history, the international system's most rapid and widespread proliferation of mass media density has coincided with its most dramatic increases in civil war. If mass media density decreases the likelihood of civil war as strongly and robustly as Warren argues, then why has

the global proliferation of mass media since 1945 had no appreciable effect in pacifying the global prevalence of civil war?

The first shortcoming of Warren's argument is that, while there should be increasing marginal returns to the production of normative influence in the context of *mass communications,* there should not be a linear, one-to-one relationship between a country's mass media density and its capacity for mass communications. When only a very small proportion of the population has access to mass media technologies, those technologies do not imply the presence of a mass communications system at merely low levels; they imply a country which still categorically lacks the infrastructural capacity for properly mass communications.[1] If only a very small proportion of a population has access to television, radio, or a newspaper, recipients of mass media messaging will know that the vast majority of others will not be affected by the message. Thus, within the subset of countries characterized by very low levels of media density, the normative influence of messages delivered by mass media technologies should not be enhanced by increasing marginal returns as these are contingent on the recipient believing the message to be *widely* spread.

Mass media density only captures the reach of mass communications within a particular country beyond the threshold at which mass media technologies are sufficiently widespread to effectively consititute a mass public network.[2]

The second shortcoming is that if the level of mass media *in general* increases state strength as Warren argues, then for this very reason, the *first appearance and early growth* of mass media within a country should increase

[1]Of course, there is no way to know *a priori* how many people need access to mass media technologies before they constitute a mass public network and therefore the categorical presence of a mass communications system. In any event, the question is pursued empirically below. At this stage, it suffices simply to note the contention that very low levels of mass media density do not reflect the positive presence of a mass communications capacity.

[2]I assume throughout that mass media typically first appears within countries at very low levels relative to the population (low media density). I also assume throughout that, despite variable rates of change and short-run decreases, media density has a long-run tendency to increase. In other words, I assume that the dynamics of media density are non-stationary and trend upward. The Levin-Lin-Chu (2002) and Im-Pesaran-Shin (2003) tests for stationarity in panel data fail to reject the null hypothesis that media density is non-stationary ($p = 0.75$ and $p = 0.1$, respectively). See the Appendix for details.

the utility of controlling the state relative to other means of merely influencing it. Especially given that mass media density is non-stationary and trends upward in every country in which it has been introduced, the first appearance of mass media technology should increase the incentives of opposition groups to risk insurgency before the development of a mass communications system significantly increases the power of the incumbent and decreaes the power of opposition groups outside the state. Additionally, the closer a country's mass media density is to the threshold at which it will constitute a capacity for mass communcations, the more attractive it will be for opposition groups outside the state to gain control of the state. It is increasingly urgent as the state becomes nearer to consolidating its normative domination via mass communications and therefore significantly less vulnerable to insurgency; also, the closer the country is to the threshold the less time will a successful insurgency be vulnerable to yet another insurgency before it consolidates its own normative consolidation via mass communications. Thus, if it is true that increasing mass media density makes state power increasingly safe from insurgency, then before media density crosses the threshold of constituting mass communications power, *each increase* in mass media density should further increase the payoffs to violent insurgency.

*A Modified Theory of Mass Media Technology and Civil War*

Based on the implications of the previous section, this research note advances a crucially modified theory of the relationship between mass media technology and civil war: while high levels of mass media density should indeed decrease the likelihood of civil war by increasing state power and deterring insurgents, for this very reason the *introduction and early growth* of mass media density within a country should *increase* rather than decrease the likelihood of civil war. Precisely because a capacity for mass communications increases state power and becomes a robust deterrent against insurgents, but low levels of mass media density do not yet constitute that power, year-to-year increases in mass media density up to a certain threshold should be positively

associated with civil war onset.[3] It is only beyond that threshold that Warren's finding of a negative relationship between mass media density and civil war should hold.

To test whether this modified theory is preferable to Warren's attractively parsimonious theory, I pursue a strategy of increasing causal leverage relative to the original analyses (G King, Keohane, and Verba 1994, 30). A first strategy to increase causal leverage is to deduce from the modified theory additional observable implications exclusive to the modified theory, which expose the modified theory to new opportunities for falsification.

Thus, I deduce three distinct observable implications of the modified theory which either contradict the original theory or are not implied by the original theory. If the modified theory is correct, then each of the following should be true:

**Observable implication 1:** There should exist a threshold of mass media density below which year-to-year increases in mass media density *increase* the probability of civil war. This implication flows directly from the logical critique of the original theory: If a system of mass communications constitutes a significant increase in the soft power of states and makes insurgency significantly more difficult, then every increase in mass media density (the dynamics of which are non-stationary and upward-trending) incentivizes insurgency without yet increasing the risks.

**Observable implication 2:** Because newspaper and television production are subject to more significant economies of scale and higher fixed costs than radio production, increases in newspaper and television density should be more strongly associated with civil war onset than increases in radio density before the threshold of mass communications.[4] While each newspaper

[3] It stands to reason that the same logic characterizes the incentives of incumbents, as each increase in mass media density up to that threshold also increases the utility of defeating insurgencies relative to stepping down or sharing power, thus further predicting civil war onsets. Yet the calculus of incumbents is likely more complicated given that under certain conditions it could be preferable to share the state's new mass communications power rather than risk losing it. At present, I focus on the calculus of insurgents and leave the calculus of incumbents to future research.

[4] While these technologies are equally subject to economies of scale in their "symbolic"" production (each additional message communicated decreases the cost of convincing another

and television production requires subsantial technological and logistic investment the average costs of which decrease with scale, radio productions are far less technologically and logistically costly and therefore do not benefit as much from scale. The substantive political implication of this difference is evidenced by historically and geographically widespread examples of anti-state radio projects but far fewer instances of anti-state television or newspapers with mass audiences. While semi-illegal "underground" newspapers have been historically and geographically widespread, the significant economies of scale in newspaper production are such that they are almost always limited to very limited circulation. After the threshold of mass communications, the state's soft power increases more from mass newspaper and television audiences than mass radio audiences, because the economics of radio make mass radio audiences comparatively more contestable by resource-poor challengers. Note that year-to-year increases in radio density should still be positively associated with the likelihood of civil war as radio production is still subject to material and symbolic economies of scale which nonetheless will privilege the state after the threshold of mass communications is crossed, however less significant they are in comparison to newspaper and television production.

**Observable implication 3:** Given that mass media technologies increased markedly after World War II as measured at the international level, year-to-year increases in mass media density at the international level should be associated with increases in the quantity of civil wars at the international level. On the contrary, if the general pacification theory is correct, then a greater density of mass media around the world should be associated with a greater number of civil war onsets. Note, however, that the war-before-peace theory is consistent with the general pacification theory in the expectation that mass media density in the long run has a pacifying effect on the likelihood of civil war onset, after controlling for the bellicose implications of year-to-year changes.

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person of the message), here I refer to traditional or material economies of scale in the concrete production processes.

*Data and Method*

This section outlines the data, method, and overall analytical strategy designed to weigh the general pacification theory (levels of mass media density monotonically decrease the likehlihood of civil war onset) with the war-before-peace theory (early increases in mass media density increase the likelihood of civil war before levels of mass media density decrease it in the long-run). As already discussed, the first feature of the research strategy was to deduce distinct observable implications of the new, competing hypothesis, at multiple levels of analysis, which contradict or are not implied by the original hypothesis. This section first details the data and methodological strategy for testing the first two observable implications, and then considers separately the data and methodological strategy for testing the third implication at the international level.

The first two stages of analysis for the first two observable implications use the replication data from Warren (2014), a panel dataset of country-level variables covering 0 countries over a maximum of 55 years in the period 1945-1999. As the variables used in the present analyses follow the original analyses as exactly as possible, for the sake of consistency and comparison, readers may consult the original article for a more detailed discussion of the data. Briefly, the dependent variable in all analyses is *CIVIL WAR ONSET*, which takes a value of 1 for all country-years in which a civil war begins and zero otherwise. Civil wars are defined, following Sambanis (2004), as any armed challenge to state sovereignty with explicit political objectives, local recruits, and more than 500 deaths in the first year or more than 1,000 deaths within the first three years. The main indepdendent variable is *MDI,* which captures overall mass media density, or the total number of newspapers, televisions, and radios per 100 people. *NEWSPAPER*, *TV*, and *RADIO* reflect the number of each particular technology per 100 people. A battery of control variables which are believed to be associated with civil war onset include the following. *OIL EXPORTER* takes a value of 1 if greater than one-third of a country's total export revenus are from fossil fuels. *DEMOCRACY* is the traditional measure from the well-known Polity IV data set, on a scale from 1-21. *DEMOCRA-*

*CY^2* is the square *DEMOCRACY*, to control for the possibility of non-linear effects. *PEACE YEARS* counts the number of years since a previous civil war, and a natural cubic spline of peace years to control for temporal dependence. Finally, *GDP PER CAPITA*, *ETHNIC FRACTIONALIZATION*, *RELIGIOUS FRACTIONALIZATION*, and logarithms for *LAND AREA*, *MOUNTAINOUS TERRAIN*, and *POPULATION* complete the main battery of controls dictated by previous research and employed in the original analyses. Also following the original analyses, all independent variables are lagged by one year.

Because observable implication 1 posits a threshold or tipping-point beyond which the hypothesized effect of mass media changes direction, it raises the question of how to test for the presence of such a threshold. The typical procedure for testing the presence of curvilinear effects is to include in regression analysis a polynomial of the independent variable of interest; if both the linear term and the polynomial are differently signed and significant, it is taken as evidence of a curvilinear effect. The first problem with this convention is that it does not conveniently inform us about the thresholds for the independent variable's heterogenous effects, and indeed is typically used as a substitute for having to do so. More importantly, however, parametric estimates can fail to detect important curvilinear effects (Frölich 2006). On the other hand, nonparametric regressions are significantly less theoretical and less parsimonious and therefore less valuable for theory testing.

To balance these trade-offs, analysis begins with a combination of classic graphical analysis and non-parametric regression to test for the presence of a threshold at which the effect of mass media density changes, and then traditional parametric regressions will provide additional tests and more useful estimates of effect sizes. Graphical analysis is used to explore several features of the distributions of mass media density and civil war relevant to understanding their relationship, discussion of which is postponed until the analysis in the following section. To statistically test whether mass media density has a non-linear effect on civil war onset, and to gain further insight into the threshold at which mass media density constitutes a mass communications system, a semi-parametric Generalized Additive Model (GAM) is estimated such that the effect of mass media density is estimated via nonpara-

metric smooth but all other predictors are estimated traditionally. Estimation via non-parametric smooth basically allows for the maximum-likelihood estimate of a traditional logistic regression to inductively identify curvature in the relationship between the independent and dependent variable; the smoothness of the curves is determined by penalized regression splines which are themselves estimated to maximize likelihood. While the GAM model with non-parametric smoothing is a well-established tool for testing non-linear hypotheses, it is not readily interpretable and inferentially problematic precisely because it lacks a parameter (coefficient) which could straightforwardly represent a hypothesized effect. Thus, a simple analysis of variance (ANOVA) is used to test whether a non-linear fit of mass media density better explains variation in civil war onset than a linear fit; and graphical visualization of the smooth terms will be used to further understand the threshold at which mass media density constitutes a mass communications system. If a non-linear fit of mass media density is superior to a linear fit and the graphical inspections reveal a non-trivial subset of civil war onsets increasing in mass media below an identifiable threshold at which mass media density is robustly associated with decreasing probability of civil war, then we will consider observable implication 1 to be tentatively confirmed and the subsequent analyses will be informed by these preliminary analyses.

To further explore observable implication 1 and test oservable implication 2, the analysis replicates a baseline model from Warren's original analysis (2014) and tests whether the pacification effect is observed even within the subset of country-years characterized by mass media density levels below the threshold (if any) identified in the first analyses. If observable implication 1 is shown to be consistent with the data in the first stage of analyses, it will be expected that the pacification effect of mass media density will not hold within the subset of country-years below the threshold at which it constitutes a mass communications system. On the contrary, the expectation advanced by the war-before-peace theory is that year-to-year increases in mass media density will *increase* the likelihood of civil war onset rather than decrease it. Observable implication 2, which predicts that the bellicose effects of mass media density should be greatest for newspaper and television density compared to

radio density, is examined by additional regression analyses which disaggregate the indepedent variable of mass media density into its component parts. Observable implication 2 will be affirmed if the coefficients for newspaper and television density are greater than and statistically distinguishable from the coefficients for radio density.

Observable implication 3 seeks causal leverage from a level of analysis distinct from the level at which the original theory was tested (country-level). Additionally, observable implication 3 permits examination of a substantially expanded historical range because for many of the key variables data are available beginning from the early nineteenth century. For the dependent variable, the Correlates of War data provide a comprehensive record of all intra-state wars since 1816. The Polity IV measure of democracy, discussed above, covers many countries as far back as 1800 and is commonly used for international-level estimates. For the other key determinant of civil war onset, GDP per capita, the Maddison Project provides widely-used estimates for all countries as far back as possible, in many cases extending well before 1800. Finally, while no general measure of mass media density is available before 1945, I exploit a pecularity of television diffusion to reliably and substantially extend its time-series. Because the international mean for television density is zero in the earliest year available (1945) and the time-series of television density is an integrated (unit-root) process which trends upward, the international mean for television density in every year prior to 1945 is highly likely to be zero. Thus, I construct an historically-extended international-level variable for *TV* equivalent to the one discussed above but which takes a zero for all years prior to 1945.

To test observable implication 3, I estimate a series of regressions using the negative binomial distribution for count data, where the dependent variable is the total count of civil wars in the international system. While the theoretical issues of time-series modeling of count data are not negligible, a lagged dependent variable is conventiently interpretable as a growth rate and adequately controls for autocorrelation given an integrated dependent variable (BRANDT). To increase robustness, I consider two versions of the dependent variable. A first model considers the count of onsets, as in the main

analyses, and a second model considers the number of intra-state wars taking place (civil war prevalance).

One drawback to this strategy is that several of the other control variables in the main regressions are not available for such a long historical period and their omission could lead to biased or spurious estimates. Luckily, there are several good reasons why the threat of omitted variable bias is outweighed by the leverage gained by testing these hypotheses at the international-level and with an elongated time-series. First, the variables related to physical geography such as *OIL EXPORTER*, *LAND AREA* and *MOUNTAINOUS TERRAIN* are unlikely to vary appreciably because, while in principle they can vary from changes in the number or size of states, they refer to quantities which are ultimately fixed at the international level. Second, while variables such as *RELIGIOUS FRACTIONALIZATION* and *ETHNIC FRACTIONALIZATION* are likely to have varied since 1816, a far greater proportion of their variance is likely to be cross-sectional and therefore irrelevant to modeling civil wars at the international level. Third, if one re-estimates the original models from the 1945-1999 period with only the democracy variables and GDP per capita as the only control variables, the estimates are not substantially different than the full models with all controls, suggesting that time-series analysis excluding these variables is still a credible strategy for hypothesis testing. The fourth key reason why these risks of omitted variable bias are not prohibitive is that the theoretical and subsantive gains of extending the original sample to a long-run historical time-series analysis are great: theoretically it is necessary because the arbitrarily truncated nature of the original sample does not contain enough information regarding the key relevant comparison (namely, the difference between positive and zero mass media density), substantively because the most politically salient and puzzling stylized fact about civil war is its far greater prevalence in the period 1945-1999 *compared* to the previous period of modern world history.

Another drawback to this strategy is that considering only television density apart from newspaper and radio density may fail to capture mass media density in general. However, first, television density is highly correlated with mass media density and disaggregated regressions in the original analyses

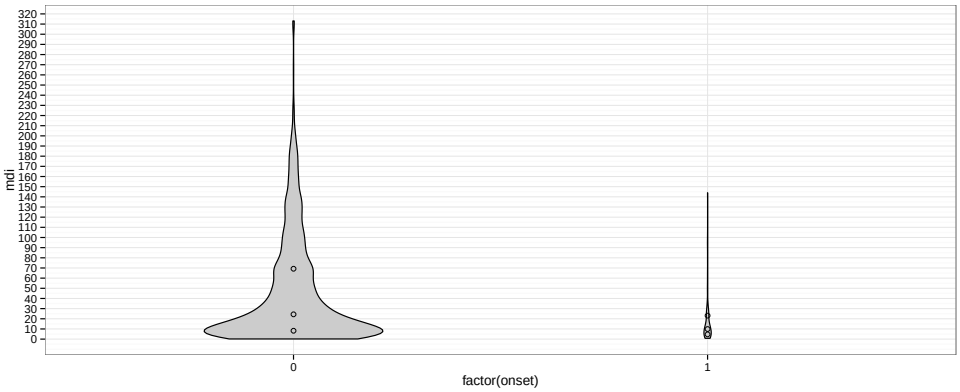
also show that television density has strong and robust effects in the same, expected direction of mass media density. Second, because television, with newspapers, is subject to greater economies of scale than radio and is therefore more likely to be pacifying, it should therefore be a relatively harder test of the war-before-peace hypothesis than mass media density in general. If mass media density truly has a monotonic pacifiying effect on the likelihood of civil war rather than the non-linear effect hypothesized here, then a long-run time-series analysis of television density should be more likely to suggest monotonic pacification than mass media density in general. If the war-before-peace implication is observed for television density, it would be stronger evidence of the hypothesis than would be a fuller measure of mass media density.

## Analysis

### *Graphical analysis*

To gain a better sense of the bivariate relationship between mass media density and civil war onset, while keeping the distributions in perspective, Figure 2 displays four violin plots.[5] The violin plots on the left display the distribution of mass media density for all country-years in which there is no civil war onset, while the violin plots on the left display the same distribution for all country-years in which there is a civil war onset. The violin plots in the top half of the figure are scaled by the total count of cases for all country-years whereas the plots in the bottom half are scaled with respect to the count of cases within each distribution. Each plot contains three points which indicate the 25th percentile, median, and 75th percentile within each distribution. These plots illustrate three important facts about the distributions of civil war onset and mass media density in this sample of countries between 1945-1999.

[5]The violin plot is a simple graphical device similar to the traditional boxplot but with a density trace (Hintze and Nelson 1998; Kastellec and Leoni 2007).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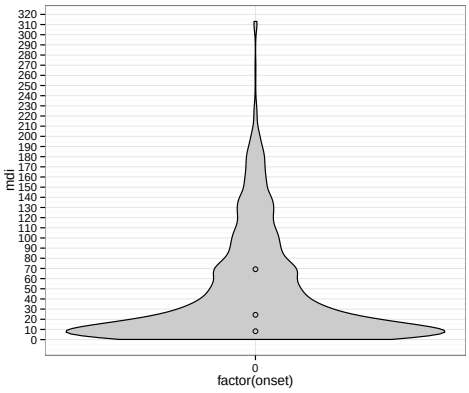
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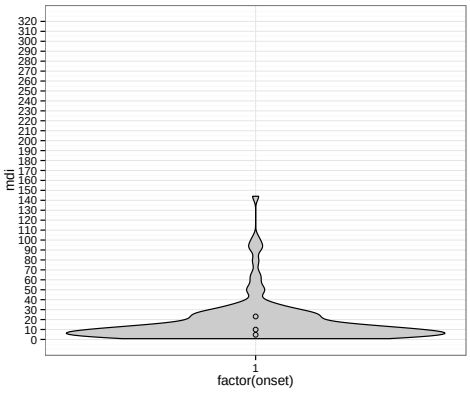
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First, these distributions challenge Warren's key rationale for questioning the prior belief that mass media plays a causal role in generating civil war onsets. Warren argues that those cases in which mass media are known to have played a significant role in civil war–cases such as Yugoslavia and Rwanda in the early 1990s (MDIs of 40.5 and 6.3, respectively)–"unrepresentative cases… characterized by unusual levels of mass media weakness" (Warren 2014, 132). Warren argues that because analysts have effectively selected these cases on the dependent variable, they "observe mass communication behavior only in those countries that are experiencing the outbreak of large-scale civil conflict"(Warren 2014, 132). The implication is that the positive association between mass media and civil war established by previous qualitative research is "spurious" (132) and that "expanding our focus to the full universe of cases reveals quite a different picture" (123).

Illustrating the entire distribution of the full universe of cases, however, Figure 2 illustrates that cases such as Yugoslavia and Rwanda are indeed fairly typical country-years in the period 1945-1999. While it is true that in these cases mass media density is below the global average *in that year*, these cases bracket the global median of MDI (37.03) by less than half of one standard deviation (8) on either side. Thus, some of the well-known cases which illustrate the bellicose effects of mass media are indeed highly representative of MDI levels globally in the post-war period until 1999.

Second, if there is a problem of unrepresentativeness it is that the extreme right-skew of MDI in peaceful country-years likely drives a disproportionate amount of the negative association between levels of MDI and civil war. Figure 2 illustrates that no civil war has ever been observed in any country-year characterized by MDI greater than roughly 150, but that these are highly unrepresentative cases (in the 94% percentile). This is important because, as the following stage of analysis will investigate more thoroughly, it indicates that the actual relationship between mass media and civil war may be driven by a minority of cases with uncommonly high values on the independent variable, leading us to inferences which do not necessarily describe most cases.

Finally, civil wars are most frequently observed at low but positive levels of MDI, compared to the zero level. *Prima facie* this is contrary to what we would

expect from the general pacification hypothesis; if the relationship between MDI and civil war onset is negative and monotonic, we would expect civil wars to be more frequent at the zero level of mass media density. Rather, the distribution suggests the possibility of non-linearity at low levels of mass media density, precisely as predicted by the war-before-peace hypothesis. Of course, some third variable could very well account for this apparent non-linearity in the bivariate relationship. For this reason, the following section turns to a statistical test of this non-linearity, controlling for all of the other variables in the original model.

*Considering Non-Linearity with Semi-Paramtric Regression*

To test whether mass media density has a non-linear effect on civil war onset, this section compares the fit of a baseline logistic regression replicated from Warren (2014) with an additive semi-parametric regression model identical in every respect except that the effect of MDI is estimated with a nonparametric smooth allowing it to vary at different levels of MDI. Specifically, I estimate the model

$$Onset_{it} = \alpha + f_1(LogMDI_{it}) + Controls_{it}\beta + \varepsilon_i$$

where the partial-regression function $f_1(\cdot)$ is fit by a smoothing spline (Fox 2002; Wood 2000) and $CONTROLS_{it}$ is the vector of control variables used in Warren's original models. The number of smoothing splines is determined by generalized cross validation as part of the estimation procedure.[6]

Figure 3 plots the value of the smooth terms for each level of the logarithm of MDI, i.e. the estimated effect of the logarithm of MDI on the probability of civil war onset across its range. The result is consistent with the war-before-peace hypothesis: MDI is positively associated with civil war onset up to a threshold, the estimated effect slightly increasing up to that threshold, before changing direction and decreasing monotonically. To determine whether the non-linear fit is superior to the linear fit, a simple analysis of variance

[6]The model was estimated using the function *gam* in the *mgcv* package for R.

(ANOVA) can be used to contrast the deviance of each model. Table 3 displays the results, which suggest that the non-linear fit reduces the deviance by 17.9 and is statistically significant.

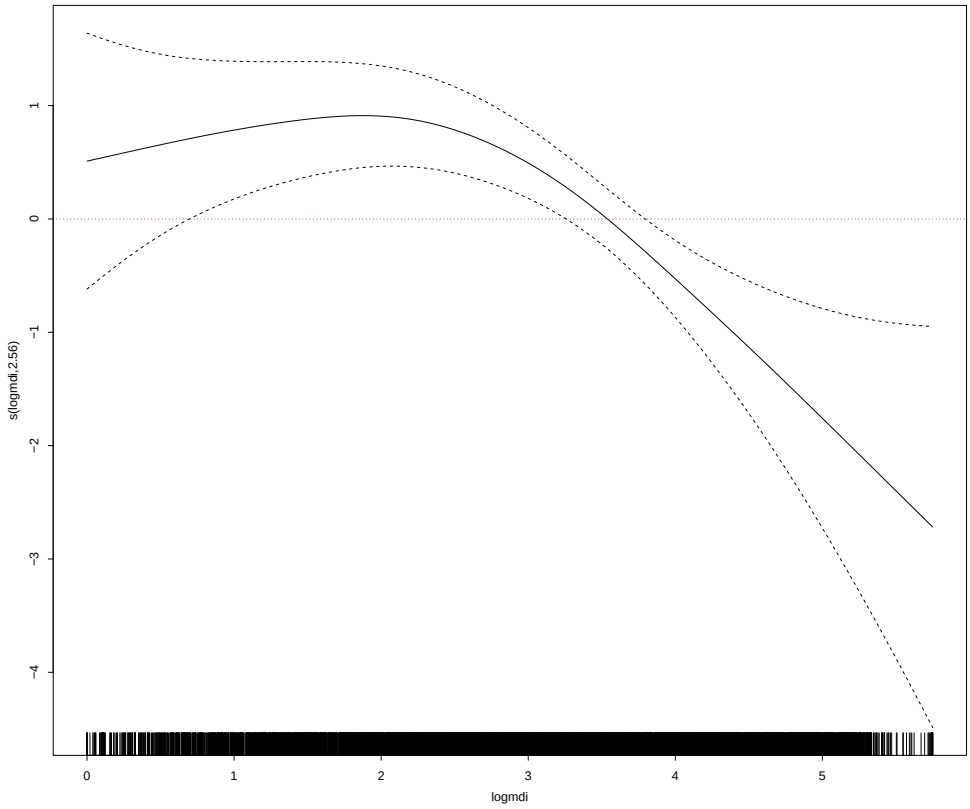



Figure 2: The Non-Linear Effect of MDI on Civil War Across Levels of MDI

Table 1: ANOVA Comparing Linear and Non-Linear Effects of MDI on Civil War Onset

| | RESID. DF | RESID. DEV | DF | DEVIANCE | P-VALUE |
|---|---|---|---|---|---|
| 1 | 5,884 | 1,070.00 | | | |
| 2 | 5,882.00 | 1,052.00 | 1.60 | 18.00 | 0.0001 |

Due to the atheoretical nature of nonparametric regression and the difficulty of drawing inferences from multiple smoothed terms, the following sec-

tion proceeds with traditional parametric logistic regressions on subsets of the sample suggested by the semi-parametric model. The second observable implication is also considered in the following section.

*Estimating the Effect of Mass Media Density Before and After the Threshold of Mass Communications*

To further test the hypothesis that MDI increases the likelihood of civil war before it is sufficiently high to represent a mass communications system (and to obtain a parsimonious estimate of the effect size), I began by creating a subset of the original sample containing only country-years with MDI levels below the inflection point identified by the non-linear regression. Figure 2 suggests that the relationship between MDI and civil war begins to change direction when the logarithm of MDI is equal to about 2, which is an MDI level of about 6.38. While it is reasonable to think such a low threshold might only correspond to a substantively trivial number of cases, on the contrary, this subset contained 1358 cases or about 20% of the original sample. Furthermore, to ensure the robustness of the results, all of the models in this section pertaining to this subset of pre-mass communications systems were tested separately using a series lower and higher cutoff values. The main results reported below for changes in MDI under the threshold of mass communications are consistent using a cutoff as low as 4 (13% percentile) and as high as 10 (27% percentile).[7] To avoid "cherry-picking" a cutoff within this range, the models below report results for the 25% percentile (MDI = 28.23), a conventional value for segmenting distributions.

Table 1 shows coefficients and standard errors from several logistic regressions modeling the determinants of civil war onset, with adjustment for rare events (Gary King and Zeng 2001).[8] Before analysis, I subtracted the mean

[7] See online appendix for full results.

[8] Traditional logistic regression estimated by maximum-likelihood would likely underestimate the probability of civil war onsets because civil wars begin in relatively very few country-years. There are 114 (2.01%) onsets in the full sample and 53 (3.36%) in the subset of low-MDI country-years.

from each continuous independent variable and then divided it by two standard deviations so that all resulting coefficients are readily comparable.[9]

The first two columns of the following table display the results of a baseline model which replicates Warren's original findings (Model 1) and the same model estimated on the subset of country-years below the median level of MDI (37.03). While Model 1 successfully replicates Warren's main finding with a negative and statistically significant coefficient for MDI levels, Model 2 indicates that this coefficient is not statistically significant for country-years below the median level of MDI. The second two columns estimate models nearly equivalent to the first two but only for country-years below the 25th percentile of MDI, roughly the inflection point suggested by the semi-parametric regression estimated in the previous stage of analysis. Distinct from Models 1 and 2, the independent variables of interest in Models 3 and 4 are first differences of media density ($X_t - X_{t-1}$), rather than levels of MDI, for two reasons. First, by restricting attention to the 25th percentile of media density, Models 3 and 4 are, in effect, already controlling for the level of media density because they only include units at a relatively similar (low) level of the independent variable. Thus, level of media density would unlikely capture any causal effect, positive or negative, which media density may exert on the likelihood of civil war onset, whereas the first-differenced variable within this subset effectively captures variations in national experiences of the early spread of mass media.[10] In other words, year-to-year differences are both substantively pertinent and theoretically appropriate for testing the observable implications of the hypothesis developed above.

The results suggest that Warren's general pacification theory would significantly under-estimate the probability of civil war onset in countries first observing the introduction and early spread of mass media. Warren's baseline model (Model 1) would lead us to predict that a country moving from zero MDI

[9]For continuous independent variables, the coefficient indicates the change in log-odds of a civil war beginning due to a two standard deviation increase from the mean of the independent variable; for dichotomous variables, the coefficient reflects the change in log-odds of a civil war beginning due to a change from 0 to 1 on the dichotomous variable, which is roughly equivalent to a two-standard deviation change in a continuous variable (Gelman 2008).

[10]The smallest year-to-year change within this subset is -5.43 and the maximum is 3.41.

to the 25th percentile (7.65) would, on average, cause the probability of civil war onset to decrease negligibly by -0.01, from an already low 0.03 to 0.03. However, when we estimate the same model on only those country-years in the 25th percentile of mass media density (Model 3), we would predict that an increase of 7.65 would cause the probability of civil war onset to increase by an average of 0.51, from 0.02 to 0.53.

While the difference between zero MDI and the 25th percentile 7.65 is a useful yardstick with respect to the entire range of *levels* observed in the sample, the mean year-to-year change observed in the subset of pre-mass communications systems is only 0.24 and the maximum is only 3.41. Thus, to gain a more realistic sense of how the early spread of mass media shapes civil war onset in the world, and to better compare the substantive implications of the general pacification effect with the war-before-peace effect, Figures 3 and 4 display the predicted probability of civil war onset given different values of MDI levels and year-to-year MDI changes across their historically observed ranges.

Considering all communications systems, the predicted probability of civil war onset decreases from about .03 at the zero level of MDI to roughly zero for any level of MDI greater than about 150, on average. However, considering only pre-mass communications systems, a 3-point change in MDI increases the probability of civil war onset from about .03 to roughly .1, on average. Figures 3 and 4 also highlight the essential assymetry of estimating negative influences, compared to positive influences, on an already rare type of event. The pacifying effect of levels of MDI as identified by Warren is an inherently small effect because the probability of observing civil war onset is already very small in general. However, the size of the war-before-peace effect is notably larger (and arguably more politically salient) in part for the same reason. Indeed, it is within the 95% confidence bands that a 3-point change in MDI is associated with as much as a 30% increase in the probability of civil war onset.

Table 2: Early Growth of Media Density Compared to Media Density in General

| | Warren | < Median MDI | < 25th Percentile MDI | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| MDI | −2.50*** | −2.00 | | |
| | (0.71) | (1.50) | | |
| ΔMDI | | | 0.43* | |
| | | | (0.25) | |
| ΔNEWSPAPER | | | | 0.26 |
| | | | | (0.32) |
| ΔRADIO | | | | 0.30 |
| | | | | (0.25) |
| ΔTV | | | | 0.40* |
| | | | | (0.22) |
| GDP PER CAPITA | −0.23 | −0.08 | −0.77* | −0.78* |
| | (0.37) | (0.42) | (0.40) | (0.40) |
| AREA | −0.39 | −0.37 | 0.10 | 0.01 |
| | (0.33) | (0.36) | (0.48) | (0.48) |
| MOUNTAINOUS | 0.49** | 0.49* | 0.34 | 0.37 |
| | (0.25) | (0.26) | (0.39) | (0.40) |
| POPULATION | 0.86*** | 0.89*** | 0.75* | 0.80* |
| | (0.26) | (0.27) | (0.41) | (0.42) |
| OIL EXPORTER | 0.83*** | 0.62* | 1.30*** | 1.30*** |
| | (0.28) | (0.32) | (0.49) | (0.50) |
| DEMOCRACY | 3.10*** | 2.50* | 2.70* | 2.50 |
| | (1.20) | (1.30) | (1.50) | (1.50) |
| DEMOCRACY$^2$ | −2.90** | −2.30* | −2.20 | −2.00 |
| | (1.20) | (1.40) | (1.40) | (1.50) |
| ETHNIC FRAC. | 0.11 | 0.17 | −0.43 | −0.38 |
| | (0.22) | (0.23) | (0.35) | (0.36) |
| RELIGIOUS FRAC. | 0.62*** | 0.62** | 0.40 | 0.47 |
| | (0.23) | (0.25) | (0.36) | (0.36) |
| PEACE YEARS | −1.50 | −1.80 | −0.55 | −0.18 |
| | (2.60) | (2.70) | (2.60) | (2.60) |
| SPLINE 1 | 0.27 | −1.40 | 3.30 | 4.50 |
| | (16.00) | (17.00) | (13.00) | (13.00) |
| SPLINE 2 | −5.70 | −2.40 | −6.00 | −6.60 |
| | (19.00) | (20.00) | (15.00) | (15.00) |
| SPLINE 3 | 3.50 | 1.20 | 1.80 | 1.60 |
| | (5.60) | (6.30) | (4.70) | (4.70) |
| CONSTANT | −4.60*** | −4.20*** | −3.80*** | −3.80*** |
| | (0.18) | (0.45) | (0.22) | (0.22) |
| *Observations* | 5,787 | 3,472 | 1,445 | 1,445 |
| *Log likelihood* | −506.00 | −433.00 | −182.00 | −182.00 |
| *Akaike information criterion* | 1,042.00 | 897.00 | 395.00 | 397.00 |

*Notes:* ***p < .01; **p < .05; *p < .1

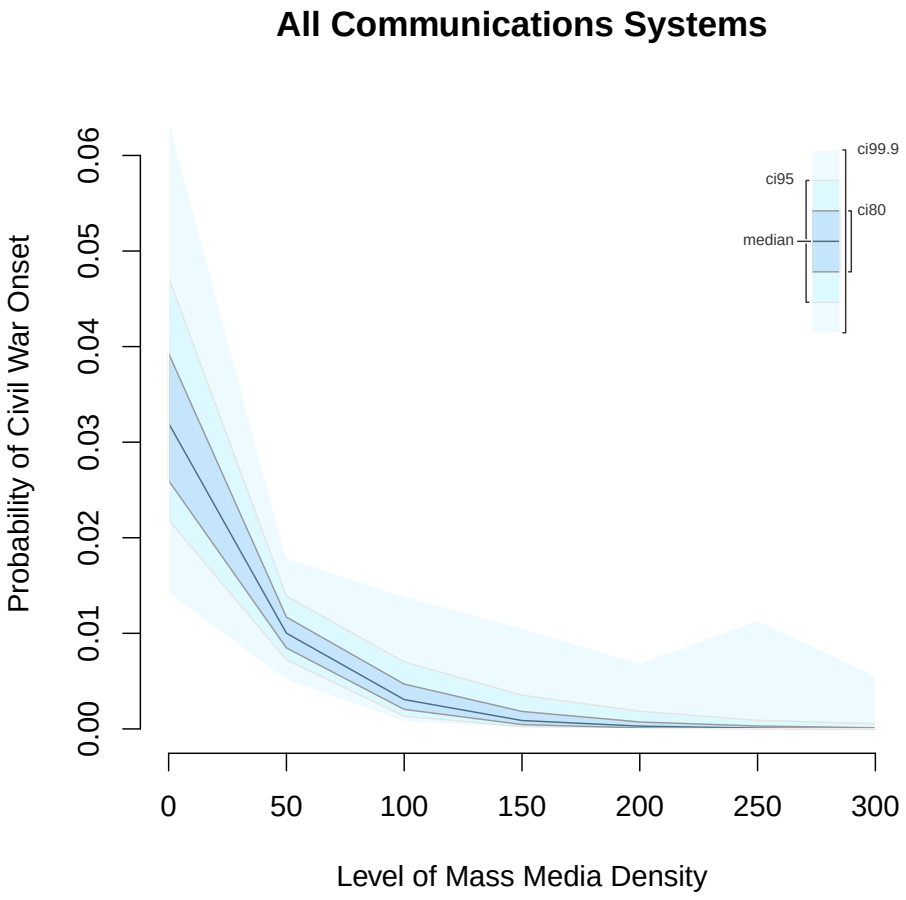



Figure 3: Changes

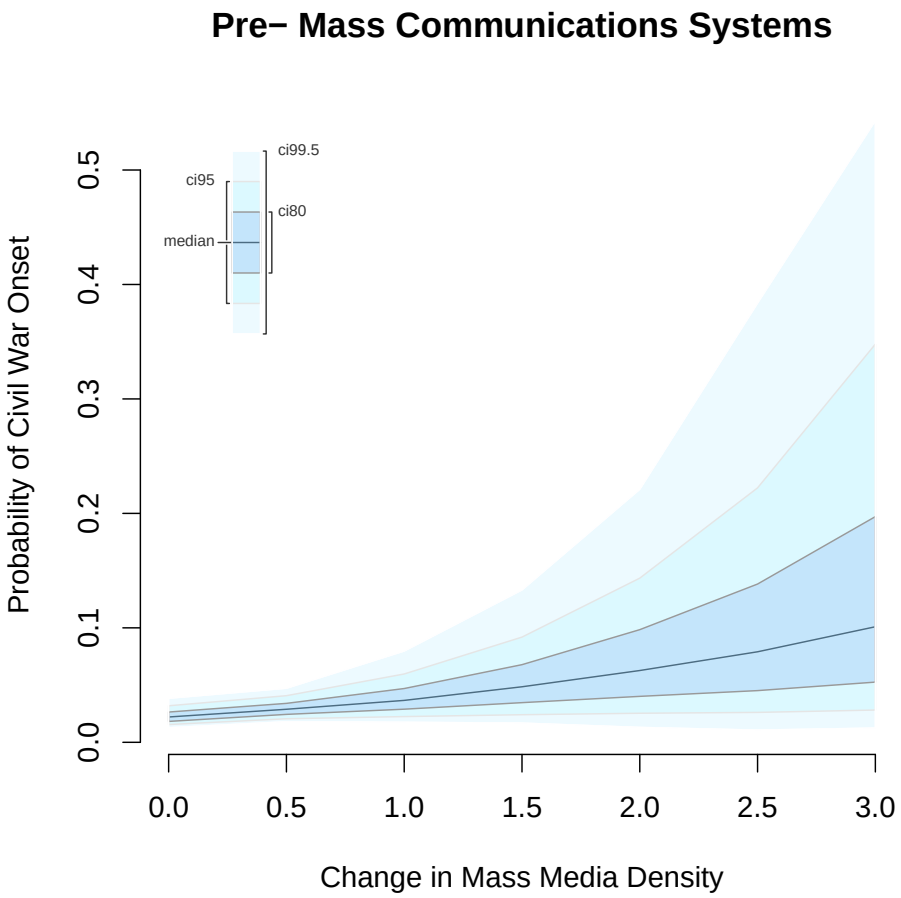



Figure 4: Changes

To further assess the hypothesized mechanism, Model 4 considers the separate effects estimated for each component of MDI (newspapers, radios, and televisions per person), within the subset of pre-mass communications systems. The results suggest mixed evidence of Observable Implication 3, namely that television density should have the strongest bellicose effect, whereas newspaper and radio density should have the second and least strongest effects, respectively. Model 4 reveals that controlling for each component, tele-

vision does appear to have the largest and most statistically robust effect compared to newspaper and radio. However, the model provides no evidence that newspaper or radio have any independent effect.

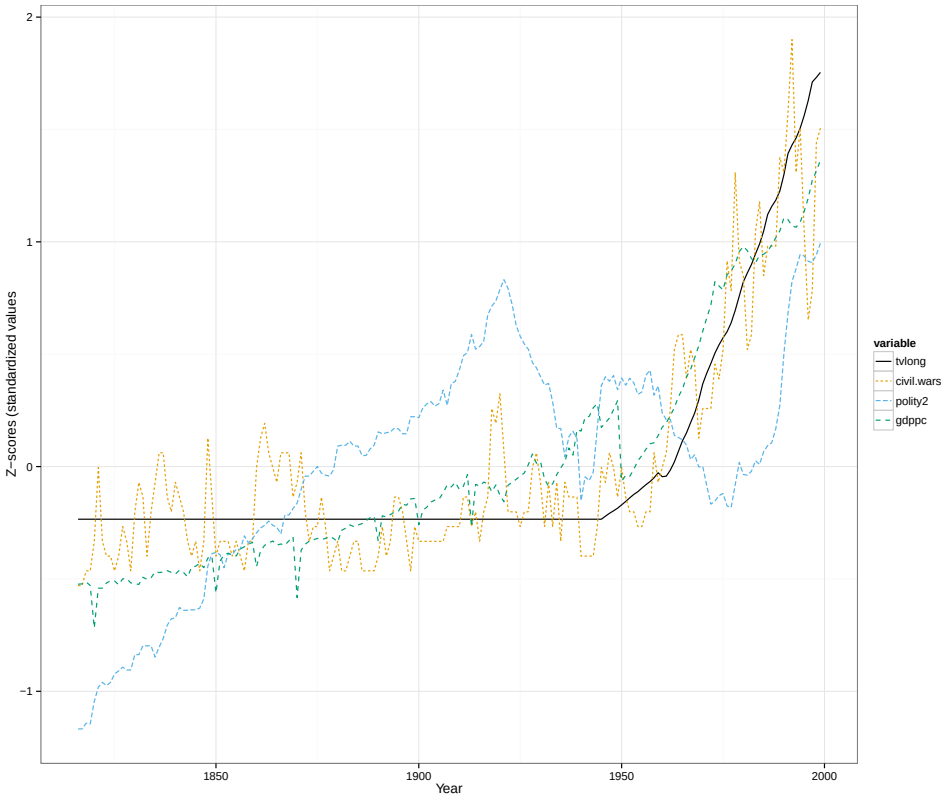



Figure 5: TV, Democracy, Economic Growth, and Civil Wars Globally, 1816-1999

Table 3: International Regressions

| | onsets | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| $TV_{t-1}$ | $-0.80^{***}$ | $-0.53$ | $-0.40$ |
| | (0.30) | (0.35) | (0.34) |
| $\Delta$TV | $0.36^{**}$ | $0.46^{***}$ | $0.37^{***}$ |
| | (0.14) | (0.15) | (0.12) |
| GDP PER CAPITA$_{t-1}$ | $-0.11$ | $-0.06$ | 0.80 |
| | (0.50) | (0.55) | (0.53) |
| $\Delta$GDP PER CAPITA | $-0.01$ | $-0.03$ | $-0.01$ |
| | (0.06) | (0.06) | (0.06) |
| DEMOCRACY$_{t-1}$ | 0.20 | $0.86^{***}$ | $0.75^{***}$ |
| | (0.16) | (0.22) | (0.24) |
| $\Delta$DEMOCRACY | $-0.21^{**}$ | $-0.21^{**}$ | $-0.27^{***}$ |
| | (0.09) | (0.09) | (0.08) |
| DEMOCRACY$^2_{t-1}$ | 0.21 | $0.36^{*}$ | $-0.21$ |
| | (0.15) | (0.20) | (0.50) |
| CIVIL WARS | $0.94^{***}$ | $0.97^{***}$ | $0.85^{***}$ |
| | (0.22) | (0.24) | (0.22) |
| ONSETS$_{t-1}$ | $0.91^{***}$ | $0.97^{***}$ | $0.77^{***}$ |
| | (0.16) | (0.16) | (0.14) |
| $\Delta$ONSETS | $0.16^{***}$ | $0.17^{***}$ | $0.14^{***}$ |
| | (0.02) | (0.02) | (0.02) |
| YEAR | $-0.09$ | $-0.93^{*}$ | $-2.70^{***}$ |
| | (0.39) | (0.55) | (0.84) |
| WWI | | $-0.10$ | 0.17 |
| | | (0.17) | (0.18) |
| WWII | | $0.43^{**}$ | $0.72^{***}$ |
| | | (0.22) | (0.27) |
| COLD WAR | | $-0.88^{***}$ | $-0.62^{***}$ |
| | | (0.20) | (0.20) |
| CONSTANT | $0.53^{***}$ | $0.56^{***}$ | $0.66^{***}$ |
| | (0.04) | (0.08) | (0.22) |
| *Observations* | 182 | 182 | 109 |
| *Log likelihood* | $-260.00$ | $-257.00$ | $-164.00$ |
| $\theta$ | 45,390.00 (485,212.00) | 45,395.00 (461,838.00) | 67,652.00 (750,223.00) |
| *Akaike information criterion* | 544.00 | 544.00 | 358.00 |
| *Notes:* | $^{***}$p < .01; $^{**}$p < .05; $^{*}$p < .1 | | |

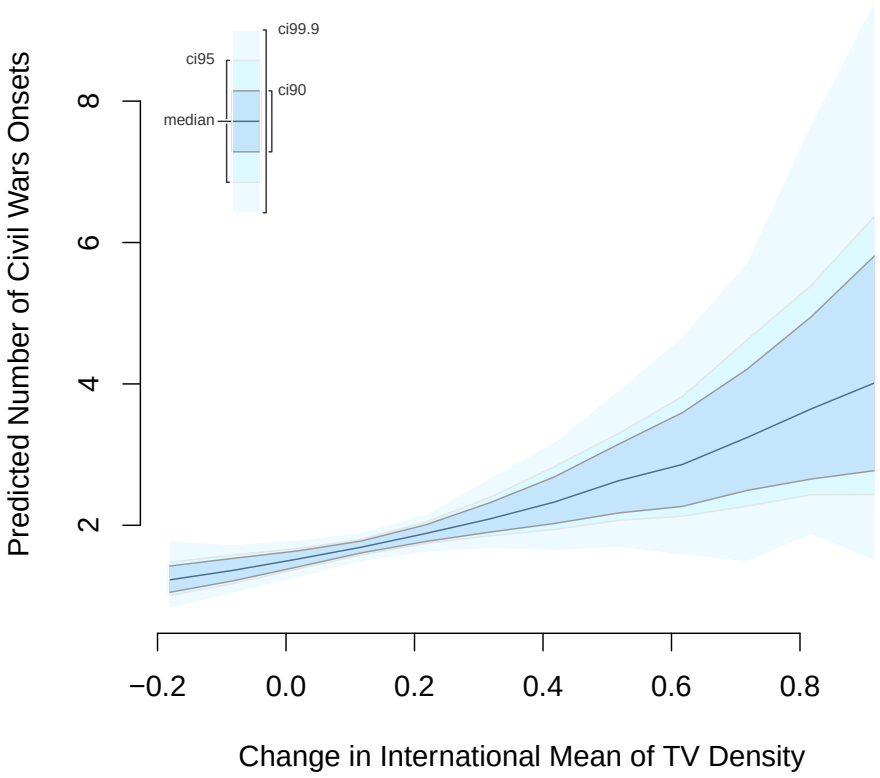
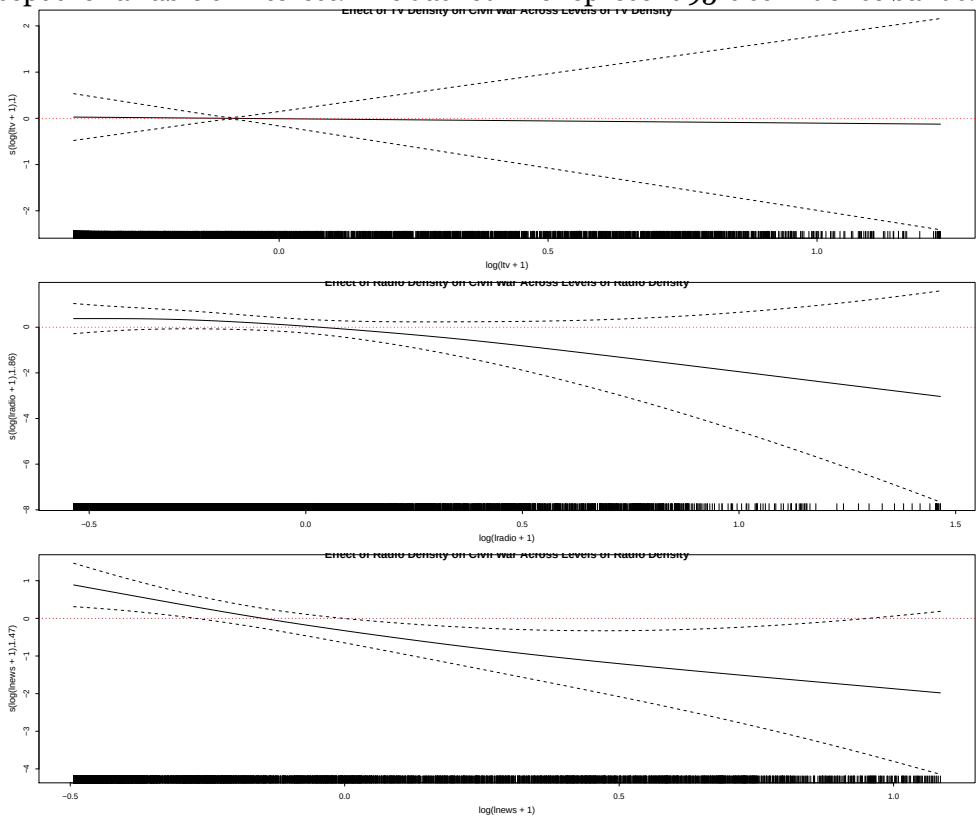



Figure 6: Changes

The following plots display the smoothed terms for each of the components of MDI, controlling for all the independent variables of the baseline model and the other components of MDI. All of the components of MDI are logged before estimation. Each plot was generated by a semi-parametric regression in which all independent variables are estimated parametrically except the variable of interest. The dashed line represent 95% confidence bands.



# Conclusion

# Supporting Information

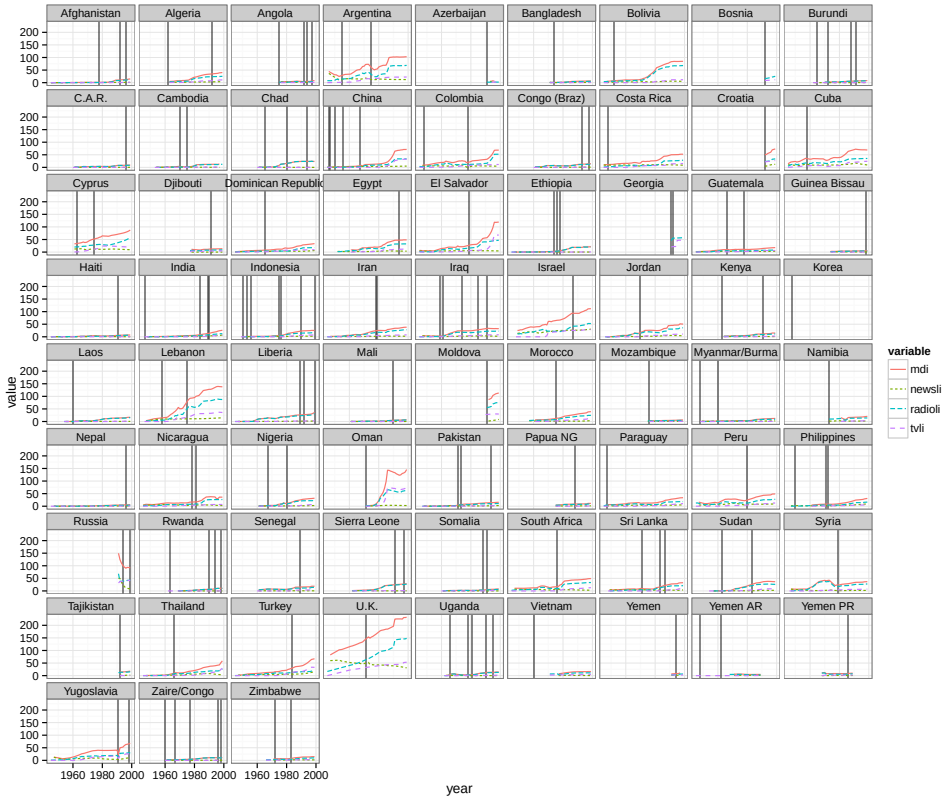



Figure 7: Disaggregated media density and all civil war onsets over time, by country

The Levin-Lin-Chu statistic is a standard test for the presence of a unit root, otherwise known as non-stationarity or integration of order I(1), in a time series variable observed across multiple cross-sectional units. The Im-Pesaran-Shin test is a "second generation" test which is robust to cross-sectional dependence, common in cross-national panel data. For each test, the null hypothesis is the presence of a unit root. Because the tests require balanced panels, they were applied only to the 24 countries with the maximum time-series of 55 years, a subset which still contains significant variation in geography, in-

come, regime type, and other factors. Specifically, the countries in this subset are: Canada, Cuba, Haiti, Dominican Republic, Mexico, Honduras, El Salvador, Nicaragua, Costa Rica, Uruguay, Ireland, Netherlands, Belgium, Luxembourg, France, Switzerland, Hungary, Romania, Finland, Sweden, Norway, Denmark, Afghanistan, China.

```
Levin-Lin-Chu Unit-Root Test (ex. var. : Individual Intercepts
and Trend )
```

data: unit$mdi z.x1 = -0.32, p-value = 0.7473 alternative hypothesis: stationarity

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Pesaran's CIPS test for unit roots
```

data: unit$mdi CIPS test = -2.1, lag order = 2, p-value = 0.1 alternative hypothesis: Stationarity

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