Appendix:
Estimating One-Sided Killings from a Robust Measurement Model of Human Rights

CHRISTOPHER J. FARISS[*]
The University of Michigan

MICHAEL R. KENWICK
Rutgers University

KEVIN REUNING
Miami University of Ohio

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Introduction to the Appendix

The supplementary material presented in this document provides additional details about the models presented in the paper "Estimating One-Sided Killings from a Robust Measurement Model of Human Rights". The main article makes reference to the materials contained here. The R code necessary to implement the models will be made publicly available here: `REDACTED`.

A Advice for Practitioners Using Estimated Quantities from Latent Variable Models

Our new estimates of one sided killing are designed to be easily used by researchers. Given that we have created point estimates along with an estimate of error around them it is necessary to outline a few easy steps for how researchers might best use these new counts. In sum, we recommend researchers taking a conservative approach by estimating their model using two of the three approaches that we outline below. By doing this researchers can confirm that their results are robust.

1. Use the mean estimate of predicted one-sided killing. Mean estimates represent the expectation for the number of one-sided killings in a country-year. These estimates are a good single statistic to capture expectations, although they do not capture the potential measurement error.

2. Use the median estimate of predicted one-sided killing. Because the count process is estimated as a zero-inflated negative binomial the expected distribution of counts is not normal. This is especially true for the cases with a large number of potential deaths. Because of this the median estimate is at times significantly smaller than the mean estimate. Using the mean estimate then provides something akin to UCDP's low estimate (although it should not be viewed as lower bound).

3. Use the distribution of counts. If you are using counts as an independent variable then it is possible to use draws from the distribution of counts. For this process the practitioner would take 20 draws the estimated one-sided killing distribution, estimate 20 separate regression models and then combine them with multiple imputation techniques. This will fully capture the variance in the estimates. Practitioners should be aware though that when the estimate mean is large the estimate variance will be at least as large as the square of the mean. This is a result of the zero-inflated negative binomial model.

In addition to using the estimated counts, we have also provided more robust estimates of human rights that might also be used in research (Reuning, Kenwick and Fariss, 2019). Reuning, Kenwick and Fariss (2019) provide simulations and advice on how to implement the robust version of the dynamic latent variable model. When estimating the latent variable model, computation is implemented in R using

Stan. Sufficient effective sample sizes were obtained using six chains, run for 2,000 iterations each, with a 1,000 iteration burn-in period. However, for some models, the number of iterations may need to be increased by a factor of 5 or 10. Conventional diagnostics suggested convergence for our model using the $\hat{R}$ metric from Gelman and Rubin (1992), and standard graphical analysis, which we recommend for other users as well.

B   UCDP One-sided Violence Dataset

Best, Low and High fatality estimates from Eck and Hultman (2007) data. The following information about the data is taken directly from the most recent code book (UCDP One-sided Violence Dataset v 19.1, 1989-2018) (Eck and Hultman, 2007; Pettersson and Eck, 2018; Pettersson, Högbladh and Öberg, 2019; Sundberg, 2009).

> (a) Best estimate. The UCDP Best estimate consist of the aggregated most reliable numbers for all incidents of one - sided violence during a year. If different reports provide different estimates, an examination is made as to what source is most reliable. If no such distinction can be made, UCDP as a rule include the lower figure given.
>
> (b) Low estimate. The UCDP Low estimate consists of the aggregated low estimates for all incidents of one - sided violence during a year. If different reports provide different estimates and a higher estimate is considered more reliable, the low estimate is also reported if deemed reasonable.
>
> (c) High estimate. The UCDP High estimate consists of the aggregated high estimates for all incidents of one - sided violence during a year. If different reports provide different estimates and a lower estimate is considered more or equally reliable, the high estimate is also reported if deemed reasonable. If there are incidents when there is some uncertainty about what party have been involved , these may also be included in the high estimate.

C   Imputing Zero for the UCDP "Low" Variable

In the main manuscript, we discuss the choice of imputing the value 0 for all count-year units that are not included in the UCDP one-sided government killing dataset. We set zero as the "low" estimate for country-years censored from UCDP data because this choices represents a reasonable lower-bound for instances where no killings were observed in the UCDP dataset.

This choice to impute 0s for the missing low values is a reasonable choice for both cases in which there true value is 0 or for cases that are censored. This is because, when we estimate the latent human rights variable, higher values of the latent trait will be associated with a lower expected one-sided government killing count. Conversely, lower values of the latent trait, will be associated with a higher expected one-sided government killing count even with the imputed 0s for the "low" estimate. The imputed 0 will increase the uncertainty for case with "high" expected counts. Thus, imputing the 0 only increases are

uncertainty about the status of the particular country-year unit. This is consistent with the choice to not include cases with sufficient evidence for meeting the 25 killing threshold for the "best" estimate.

After 1989, our concern is was that a 24 death "high" estimate would be too conservative since governments can and often do kill more than 24 of their citizens without these events being observed. We observe several plausible cases in our data. For example, the additional information that we provide about the DRC in 1994 (formerly Zaire) highlights the issue associated with imposing a ceiling for the country-year units without unobserved data. We discuss this case in more detail below.

D   All Repression Data Sources Included in the Latent Variable Model and Temporal Coverage

Figure 1, Table 1, and Table 2 contain information about the documentary sources used to generate each of the variables that enter the latent variable models presented in this paper.
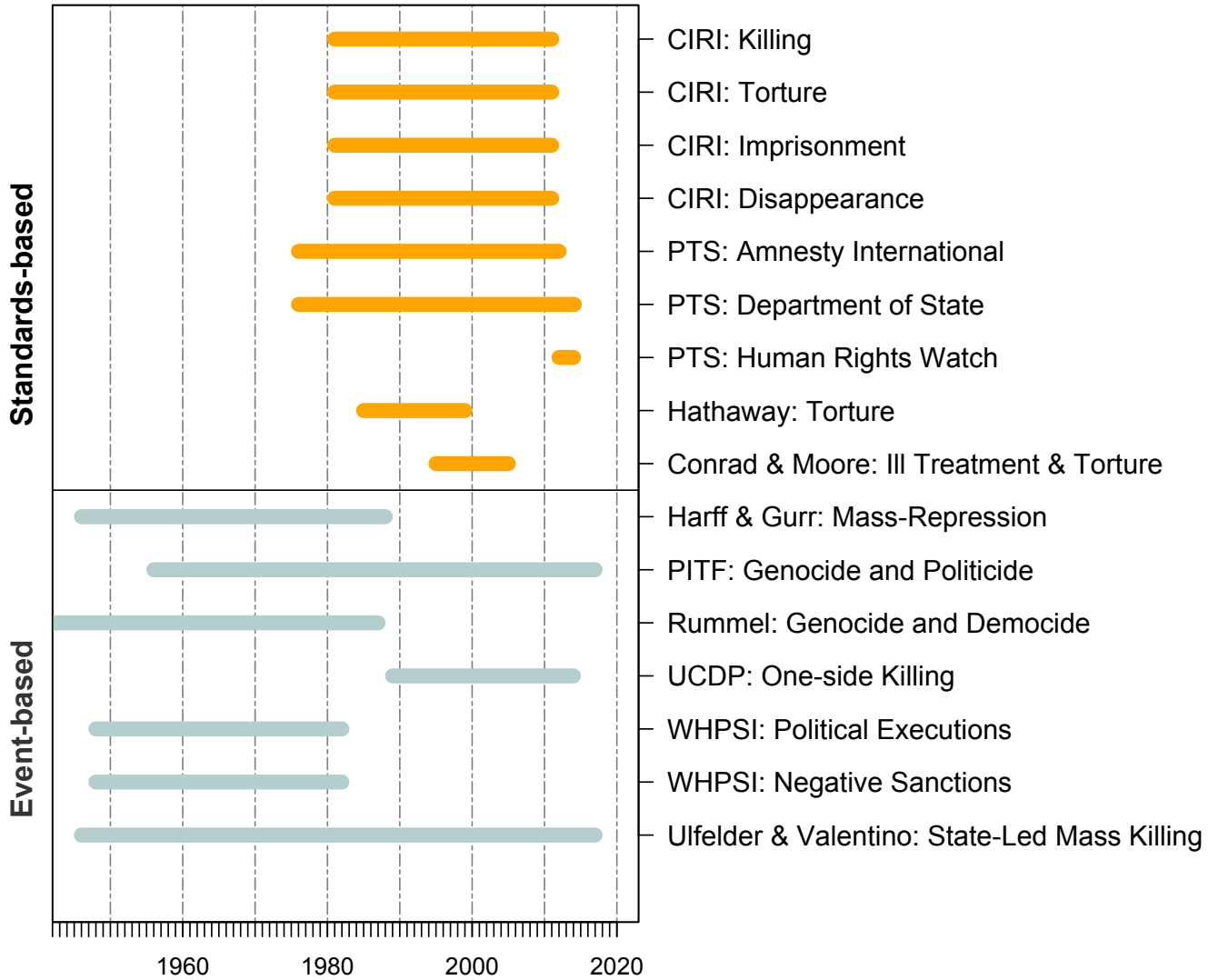
Figure 1: Temporal coverage and data type of repression data sources. See Table 1 and Table 2 for more information. Light-grey lines (bottom panel) are event-based data. Orange lines (top panel) are standards-based measures.

Table 1: Standards-Based Repression Data Sources (9 items)

Dataset Name and Variable Description	Dataset Citation and Primary Source Information
CIRI Physical Integrity Data, 1981-2011 1. political imprisonment (ordered scale, 0-2) 2. torture (ordered scale, 0-2) 3. extrajudicial killing (ordered scale, 0-2) 4. disappearance (ordered scale, 0-2)	Cingranelli, Richards and Clay (2015) Amnesty International Reports[1] and State Department Reports[2] *Information in Amnesty reports takes precedence over information in State Department reports*
Hathaway Torture Data, 1985-1999 5. torture (ordered scale, 1-5)	Hathaway (2002) State Department Reports[1]
Ill-Treatment and Torture (ITT), 1995-2005 6. torture (ordered scale, 0-5)	Conrad and Moore (2011), Conrad, Haglund and Moore (2013), Amnesty International (2006) Annual Reports[1], press releases[1], and Urgent Action Alerts[1]
PTS Political Terror Scale, 1976-2015 7. Amnesty International scale (ordered scale, 1-5) 8. State Department scale (ordered scale, 1-5) 9. Human Rights Watch scale (ordered scale, 1-5)* * Human Rights Watch scale (2013-2015)	Gibney et al. (2017), Gibney and Dalton (1996) Amnesty International Reports[1] State Department Reports[1] Human Rights Watch Reports[1]

1. Primary Source; 2. Secondary Source

Table 2: Event-Based Repression Data Sources (7 items)

Dataset Name and Variable Description	Dataset Citation and Primary Source Information
Ulfelder and Valentino Dataset, 1946-2015 10. massive killing (categorized as 1 if event occurred; 0 otherwise)	Ulfelder and Valentino (2008) historical sources (see article references)[1]
Harff and Gurr Dataset, 1946-1988 11. massive repressive events (categorized as 1 if event occurred; 0 otherwise)	Harff and Gurr (1988) historical sources (see article references)[1]
Political Instability Task Force (PITF), 1956-2010 12. genocide and politicide (1 if country-year experienced event; 0 otherwise)	Harff (2003), Marshall, Gurr and Harff (2009) historical sources (see article references)[1] State Department Reports[2] Amnesty International Reports[2]
Rummel Dataset, 1949-1987 13. genocide and democide (categorized as 1 if event occurred; 0 otherwise) (3 death count estimates: best, low, high)	Rummel (1994, 1995), Wayman and Tago (2010) New York Times[1], New International Yearbook[2], Facts on File[2], Britannica Book of the Year[2], Deadline Data on World Affairs[2], Kessing's Contemporary Archives[2]
UCDP One-sided Violence Dataset, 1989-2015 14. government killing (event count estimate) (1 if country-year experienced event 0 otherwise) (3 death count estimates: best, low, high)	Eck and Hultman (2007), Sundberg (2009) Reuters News[1], BBC World Monitoring[1] Agence France Presse[1], Xinhua News Agency[1], Dow Jones International News[1], UN Reports[2], Amnesty International Reports[2], Human Rights Watch Reports[2], local level NGO reports (not listed)[2]
World Handbook of Political and Social Indicators WHPSI, 1948-1982 15. political executions (event count estimate) 16. negative sanctions (event count estimate) (categorized as 1 if event occurred; 0 otherwise)	Taylor and Jodice (1983) New York Times[1], Middle East Journal[2], Asian Recorder[2], Archiv der Genenwart[2] African Diary[2], Current Digest of Soviet Press[2]

1. Primary Source; 2. Secondary Source

E   Qualitative Information on Killing from Zaire (Democratic Republic of Congo) in 1994 and 1996

We use qualitative information to assess the status of a well-known case. This is a type of concurrent validity check. In particular, concurrent validity is an empirical assessment that links the data obtained from the operational protocol (i.e., the latent variable model estimates) to previously obtained or known estimate of the same concept (Adcock and Collier, 2001; Trochim and Donnelly, 2008).[1] This concurrent validity assessment reveals a deviant case. This is because it takes on a unexpected value along some theoretical concept (Eck and Fariss, 2018; Seawright, 2016). For our case, we expect to observed one-sided government killings in the the DRC in 1994 but do not.

According to the US State Department Human Rights report in 1994. In the DRC (formerly Zaire), "Provincial officials continued to incite ethnic strife leading to massive displacement and deaths in Shaba, although on a smaller scale than the unprecedented violence in 1993." The report provides more detail stating (1) that the "undisciplined security forces committed numerous extrajudicial killings"; (2) "Human rights observers, the press and eyewitnesses reported several dozen such fatal altercations, many committed by uniformed personnel"; and (3) "It is highly likely that additional incidents went unreported, especially in Zaire's re- mote interior." Overall, there is substantial qualitative evidence that one-sided killings occurred in this country-year case. However, the specificity of the evidence is not sufficient for it to enter the UCDP one-sided government killing data set, whereas, our latent variable based count estimates are consistent with the qualitative account, which provide in full below. Our median estimate for this county-year case is 61 one-sided killings.

The UCDP one-sided violence dataset does include the case of Zaire in 1996. Our median estimate is 1254, the estimates from UCDP are 1253 (low), 1353 (best), 1746 (high). The median estimate from our model is very close to the low estimate from UCDP but the range of potential values accommodates all of them and suggests further that the the "true' number of one-sided killings could be as high as 4000.

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[1]Sometimes the term "face validity" is used instead of "concurrent validity". However, Adcock and Collier (2001) prefer to not use the term "face validity" because the definition varies from user to user. Instead, they prefer the term content validity. Content validity is simply a check of the operationalization against the relevant content domain for the theory" (Trochim and Donnelly, 2008).

E.1 Political and Other Extrajudicial Killing 1994

The following passage on extrajudicial killing is taken from the *The Country Reports on Human Rights Practices*, published annually but the US Department of State (United States Department of State, 1994). Relevant details about the frequency of one-sided killings are bolded by the authors.

Political and Other Extrajudicial Killing: The undisciplined **security forces committed numerous extrajudicial killings**; in some cases these were linked to personal rivalries. With only token wages–often none-for months at a time, many soldiers and gendarmes resorted to robbery and extortion, sometimes killing their victims or bystanders. **Human rights observers, the press and eyewitnesses reported several dozen such fatal altercations, many committed by uniformed personnel. It is highly likely that additional incidents went unreported, especially in Zaire's remote interior.** In January security forces shot and killed a Kinshasa currency vendor, and a soldier beat a taxi driver to death; the soldier was tried and imprisoned. In October a military tribunal sentenced a warrant officer and several enlisted troops to jail for killing a Goma businessman. However, the Government neither investigated nor punished the perpetrators in most cases, hindering efforts to determine the number of killings and the extent of the security forces' involvement. In several cases, poorly trained soldiers put down disturbances using lethal force. In April elite security forces put down armed mutiny in Mbanza-Ngungu and reportedly killed suspected looters. Human rights monitors reported that a series of confrontations between security forces and local residents left at least two civilians, a gendarme, and a soldier dead in Bukavu during several days of intermittent rioting in January. The disturbances began when gendarmes investigating a looting entered a home and wounded a resident; a crowd of civilians then beat one of the gendarmes to death. Over the next several days, security forces and others looted homes and businesses, wounded more people, and killed a security guard. Two days after the oral altercation, a Civil Guard killed a vendor, and civilian bystanders in turn killed him. Credible eyewitnesses have refuted earlier reports that security forces killed three bystanders in June when authorities arrested opposition leader Lambert Mende a a rally in Mbuji Mayi. There were no known cases in which security forces deliberately targeted political opponents or others for summary execution. In a killing that may have had political overtones, journalist Pierre Kabeya of Kin Matin was reportedly abducted, then shot to death in June. However, the motives and the perpetrators of the killing remain unknown. In a November case, journalist Adolphe Kavula of the newspaper Nsemo was found semiconscious several days after he disappeared from his Kinshasa home and died shortly after. The Kengo Government investigation found no evidence of foul play, but several human rights monitors believe security forces abducted, then fatally wounded Mr. Kavula.

E.2 Political and Other Extrajudicial Killing 1996

The following passage on extrajudicial killing is taken from the *The Country Reports on Human Rights Practices*, published annually but the US Department of State (United States Department of State, 1996). Relevant details about the frequency of one-sided killings are bolded by the authors.

Security forces, including police, are alleged to have committed over 100 killings during the year although precise estimates are unavailable. Given the administrative and security breakdown throughout the country and the often anecdotal nature of the accounts of these killings, it was often difficult to determine whether these killings were committed for political, monetary, personal or law enforcement reasons. The Zairian Association for the Defense of Human Rights (AZADHO), a respected human rights group based in Kinshasa, reported 102 cases of extrajudicial killing for the year. Reports often linked security forces to killings and random acts of robbery or extortion. For example, the local press in Kinshasa in August reported that a soldier shot and killed a merchant in the central market because she refused to pay for protection; the soldier was not arrested or charged with a crime. Only rarely have there been reports that civil or military authorities made inquiries into such incidents. **In the east, interethnic conflicts led to many deaths** (see Section 1.g.). Persons incarcerated in the country's prisons are reportedly beaten by prison officials, while other prisoners die of illness or starvation (see Section 1.c.). In July 1995, in a particularly egregious example of extrajudicial killing, civil guards used lethal force to put down an unauthorized demonstration in Kinshasa of the Unified Lumumbist Party (PALU), led by Antoine Gizenga. **Human rights monitors stated that there were 14 deaths, including a soldier, 54 others were seriously wounded**. The Government claimed, however, that there were four deaths plus one soldier killed by the protesters. Gizenga was detained for several days and released on bail. He reportedly was charged with organizing an unauthorized demonstration and possessing an M-16 assault rifle which authorities claimed was found in his house. Military forces attacked Gizenga's home and raped and killed a member of his family immediately after the 1995 incident. The military services launched official inquiries into the incident in August 1995 but failed to make public any results. The charges were dropped on February 29. In several cases, notably in the interior, citizens responded to military aggression in kind, sometimes killing soldiers. On February 15, for example, Goma residents killed a soldier whom they believed had earlier murdered a civilian. In Kinshasa in July, a group of citizens destroyed a courthouse after a gendarme working there shot and killed a taxi driver for refusing him free transportation. There are no reports that the gendarme was ever tried or sentenced for the crime. **There were extrajudicial killings of Zairian officials by Banyamulenge rebels and their allies in the Kivus in November** (see Section 1.g.).

F Top 50 Cases of One-Sided Killing Not Included in the UCDP Dataset

Here we continue our discussion of the cases where UCDP reports no one-sided killing while our model predicts high values of one-sided killing. These are important model-based predictions. We have highlighted several of these cases in the main text with special attention paid to the case of the Democratic Republic of Congo which we discussed in detail above. Each of these represents an opportunity for additional data collection to assess the performance of the latent variable model's ability to predict the distribution of potential count values. The cases we have reviewed each have qualitative evidence that suggests the model is producing a distribution that represents both the uncertainty of the case and one that captures the potential "true" value of the case.

Because there is so much uncertainty with respect to the documentation of these cases, they have not entered the UCDP dataset. However, the information available for these cases could be used to code the "low" value using the UCDP coding criteria. Our model would be able to use these values without inferring as much knowledge about these cases as those that have better documentary records. This is an important area of future data collection and predictive modeling. We leave this task to a future project but document here the top 50 cases.
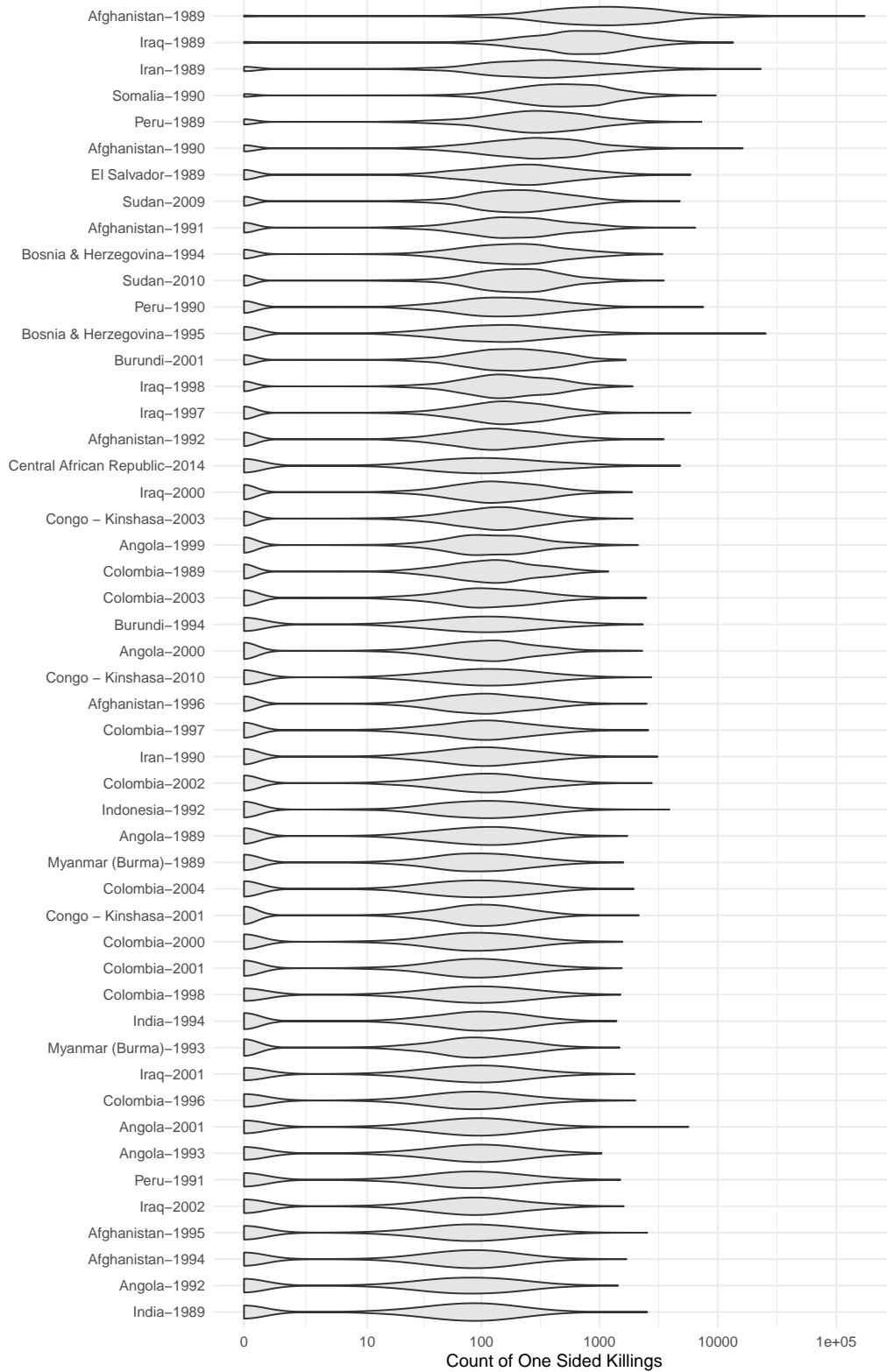
Figure 2: Predicted One-Sided Killing for Worst Country-Years with No Reported Killings in UCDP Data

Note: Violin plots showing the estimated number of one-sided killing in a country year. The country-years with the highest estimated killings with no reported killing in the UCDP are displayed. The X-axis is log transformed after adding 1 to each value to preserve 0s.

G Coverage of Observed One-Sided Killing Variable within the 33% and 66% Estimated Count Intervals
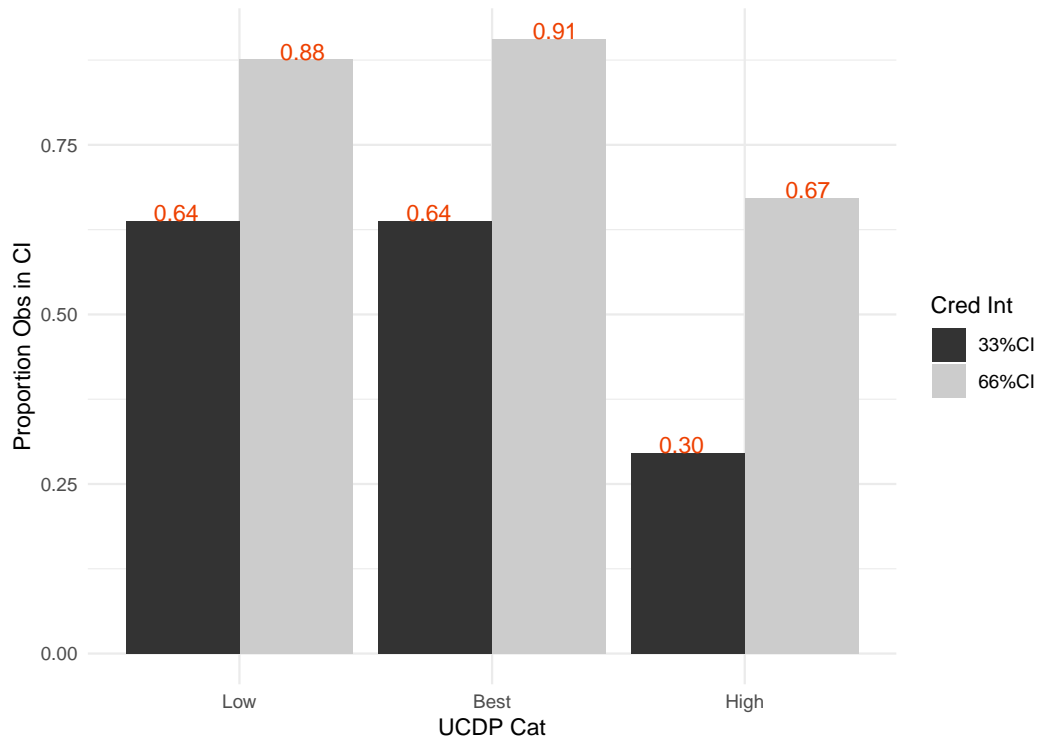

Figure 3: Coverage of Observed One-Sided Killing Variable within the 33% and 66% Estimated Count Intervals.

Note: The bars represent the proportion of observed UCDP variables that are within the 33% and 66% internals respectively. Our model does quite well for the "low" and "best" variables. The 66%CI-intervals cover 88% and 91% of the observed values respectively. For the "high" value the 66%CI-intervals cover 67% of the observed values. Overall, our model is producing estimates that are very similar to the observed data but also showing us new places for which additional data collection and qualitative evidence might improve estimates. The discussion of the top-10 and top-50 missing cases from UCDP highlights this as well because it points to several likely cases that additional document collection and case analysis could provide UCDP with sufficiently reliable or at least reasonable documentary information to produce new observed counts.

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