REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
AUG 2011	**Conference Paper** (Post Print)	APR 2009 - NOV 2010

4. TITLE AND SUBTITLE

PREDICTIVE SOCIETAL INDICATORS OF RADICALISM - FORECASTING DOMESTIC POLITICAL VIOLENCE

5a. CONTRACT NUMBER
FA8750-09-C-0132

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER
65502F

6. AUTHOR(S)

Alper Caglayan*, David Cingranelli^, Sam Bell**, Amanda Murdie**, Laura Stroh*, Dustin Burke*

(*Milcord, ^SUNY Binghamton University, **Kansas State University)

5d. PROJECT NUMBER
09SB

5e. TASK NUMBER
R0

5f. WORK UNIT NUMBER
65

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

MILCORD LLC, 1050 WINTER ST STE 1000, WALTHAM MA 02451-1406
SUNY Binghamton University, 4400 Vestal Pkwy East, Binghamton, NY 13902
Kansas State University, Manhattan, KS 66506

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

AFRL/RIEF
525 Brooks Road
Rome NY 13441-4505

10. SPONSOR/MONITOR'S ACRONYM(S)
N/A

11. SPONSORING/MONITORING AGENCY REPORT NUMBER
AFRL-RI-RS-TP-2011-11

12. DISTRIBUTION AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED. PA #: 88ABW-2010-6266
DATE CLEARED: 29 NOV 2010

13. SUPPLEMENTARY NOTES
Paper presented at HSCB Focus 2011 Conference 8 –10 Feb 2011. This work was funded in whole or in part by Department of the Air Force contract number FA8750-09-C-0132.

14. ABSTRACT
The Predictive Societal Indicators of Radicalism (PSIR) Model of Domestic Political Violence forecasts political violence levels at yearly intervals into the future. The model enables policymakers, particularly in the COCOMS, to proactively plan for instances of increased domestic political violence, with implications for resource allocation and intelligence asset assignment. Using a regression model applied to a large number of drivers of conflict variables spanning numerous open source social science datasets, the PSIR model uses a novel Negative Residuals technique. Negative Residuals result from the model predicting higher levels of violence than actually experienced, indicating nation states that are predisposed to increasing levels of violence based on the presence of environmental conditions and drivers of conflict with demonstrated correlation with political violence.

15. SUBJECT TERMS
Forecasting Domestic Political Violence, Social Cultural Models

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			MICHAEL L. HINMAN
U	U	U	UU	5	19b. TELEPHONE NUMBER (*Include area code*) N/A

PREDICITVE SOCIETAL INDICATORS OF RADICALISM – FORECASTING DOMESTIC POLITICAL VIOLENCE

Alper Caglayan*, David Cingranelli^, Sam Bell**, Amanda Murdie**, Laura Stroh*, and Dustin Burke*
*Milcord
^Political Science Department, SUNY Binghamton University
** Department of Political Science, Kansas State University

ABSTRACT

The Predictive Societal Indicators of Radicalism (PSIR) Model of Domestic Political Violence forecasts political violence levels at yearly intervals into the future. The model enables policymakers, particularly in the COCOMS, to proactively plan for instances of increased domestic political violence, with implications for resource allocation and intelligence asset assignment. Using a regression model applied to a large number of drivers of conflict variables spanning numerous open source social science datasets, the PSIR model uses a novel Negative Residuals technique. Negative Residuals result from the model predicting higher levels of violence than actually experienced, indicating nation states that are predisposed to increasing levels of violence based on the presence of environmental conditions and drivers of conflict with demonstrated correlation with political violence.

The Negative Residuals forecast states where we expect to observe increases in violence – not necessary high levels of violence – a nuanced interpretation that we believe will be of more use to the decision maker to highlight changes in situations, as opposed to simply high levels of violence in already violent states. In this way, our key dependent variable allows for differentiation between country-years with high numbers of low-level violence and country-years with high numbers of more extreme political violence.

PRIMARY TRACK

Application of Social Cultural Methods, Models, and Tools (MMT)

SECONDARY TRACK

Analytic Methods Science and Technology (S&T)

DESCRIPTION

Created in collaboration with Professor Cingranelli at the Political Science Department, SUNY Binghamton University and Professors Sam Bell and Amanda Murdie at the Department of Political Science, Kansas State University, the Predictive Societal Indicators of Radicalism (PSIR) Model of Domestic Political Violence forecasts political violence levels at yearly intervals into the future. The model enables policymakers, particularly in the COCOMS, to proactively plan for instances of increased domestic political violence, with implications for resource allocation and intelligence asset assignment. Creating a model for predicting the level and intensity of domestic political violence in a country has significant policy implications regarding counterinsurgency and stability operations. Recent experiences in Iraq and Afghanistan have placed a renewed focus on unconventional operations. Being able to forecast levels of domestic political violence is significant for gauging population sentiments towards a

government. Indeed, insurgents often exploit popular narratives and grievances for their own purposes. Therefore, capturing the level and intensity of domestic political violence directed at the government provides an important measure for identifying situations that harbor the necessary conditions for violent and extremist movements to gain traction and incubate.

Using a regression model applied to a large number of drivers of conflict variables spanning numerous open source social science datasets, the PSIR model uses a novel Negative Residuals technique. Negative Residuals result from the model predicting higher levels of violence than actually experienced, indicating nation states that are predisposed to increasing levels of violence based on the presence of environmental conditions and drivers of conflict with demonstrated correlation with political violence.

The methodology of the model is borrowed from Gurr and Moore [1] and is straightforward. Our dependent variable captures the overall level and intensity of domestic anti-government violence within a state in a given year relying on the Integrated Data for Event Analysis (IDEA) dataset [2] that codes instances of political violence in "who" did "what" to "whom" manner from Reuters Global News Service. Additional indicators from open-source social science datasets include the CIRI Human Rights Dataset [3], Polity IV Dataset [4], World Bank [5], OECD [6], Correlates of War project [7], and Fearon and Laitin datasets [8]. To capture intensity, we rely on augmented Goldstein [9] scores that use a weighting system developed from a survey of foreign policy officials on the "conflictual" or "cooperative" nature of various political or economic events. The first step is then to estimate the model and generate the residuals from that model (actual-predicted y). We then examine the residuals to identify all cases where the residuals are negative. This helps in identifying the cases where there is more predicted violence than actual violence. Any time that the predicted violence is greater than the actual violence in a country year there is a negative residual.

Where there are cases with negative residuals, this is where our model predicts that there should be more violence than there actually is. The interpretation that Gurr and Moore [1] and Poe, Rost, and Carey [10] make is that these are cases where the conditions suggest that there should be more of whatever the dependent variable represents in future years (in our case violent protest). Since the violence is not occurring in that year, we might expect to see increases in the future. What this method should tell us is which states have the potential for future violent actions against the state by the citizenry. In other words, there is some excess demand for violence against the state. We may not see it in the present year but that very fact makes it more likely that we will see increases in violence in future years.

This method provides some insight into where and when we should see the opportunity for increased violence. Though political violence might not actually increase in every case, the conditions are ripe for such increases in anti-state violence to occur. As such, it is important to note that this method allows us to capture where increased violence should occur, regardless of the overall pre-existing level of violence. This method is useful in telling us that a state has the characteristics that make more domestic anti-government violence likely; this is different than predicting that a state will have extremely high levels of domestic anti-government violence.

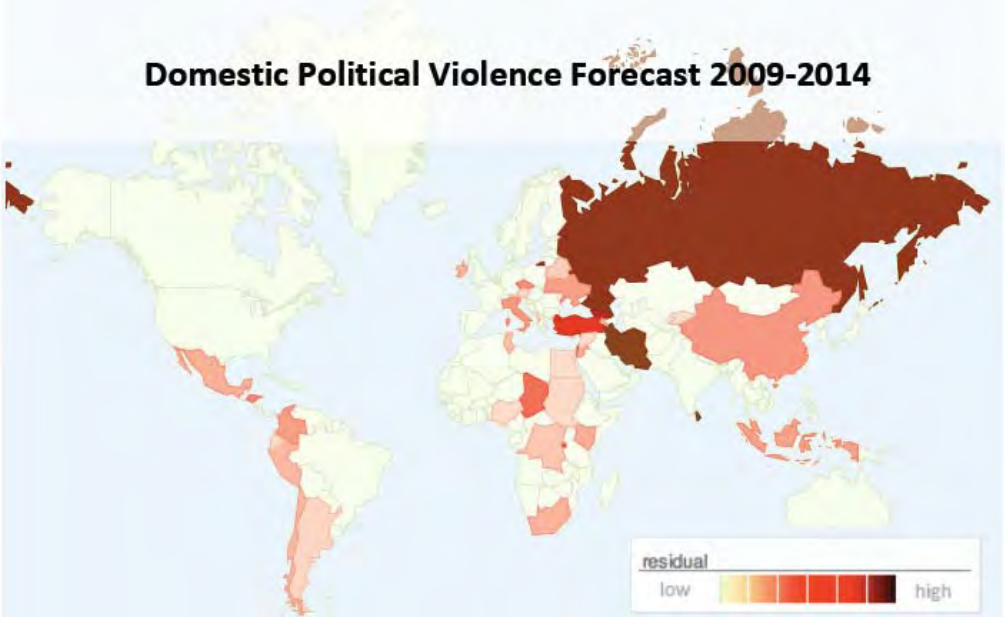

Figure 1: Global heat map of domestic political violence forecasts based on intensity of negative residuals for 2009-2014 time period.

The regional variation in performance of the PSIR model compares favorably against the target levels of 80% accuracy and recall and 70% precision specified by the DARPA ICEWS program. Our model complements the DARPA ICEWS models that use a binary dependent variable for conflict by using a nuanced dependent variable that captures the intensity of the conflict.

Measuring domestic political violence targeted at the government captures the pulse of a population and how it views governing authorities. Significant areas of unrest are likely breeding grounds for violent movements, and therefore the results of our model will provide decision makers with knowledge needed to proactively address security concerns effecting U.S. interests.

ACKNOWLEDGEMENTS

This work is part of the Predictive Societal Indicators of Radicalism (PSIR) project supported by Air Force Research Laboratory (AFRL) under the direction of Mike Hinman.

BIOGRAPHY

Dr. Alper Caglayan's – Senior Scientist at Milcord – research interests include applied artificial intelligence and semantic knowledge management, and the application of these technologies to human social culture and behavior modeling. Alper's recent research on HSCB modeling and analysis includes building developing predictive indicators of radicalism, global models for forecasting political violence, multiple criteria decision making tool for SSTR operations, semantic wiki for complex operations, decision models for effective shura building. Dr. Caglayan has co-founded four companies including Peoplestreet, a social network company for managing professional relationships; Open Sesame, the first implicit personalization server software now part of Adobe; Bowne Internet Solutions, an Internet consulting company now part of Lionbridge; and Charles River Analytics. Dr. Caglayan is the principal author of Agent Sourcebook, and has published and contributed to five books and over 100 articles. Alper has a Ph. D., Electrical Engineering from Virginia Tech.

REFERENCES

[1] Gurr, T. (1997) "Ethnopolitical Rebellion: "A Cross-Sectional Analysis of the 1980s with Risk Assessments for the 1990s," *American Journal of Political Science* 41 (4): 1079-1103.

[2] "Integrated Data for Events Analysis," Virtual Research Associates. Available from: <http://vranet.com/idea/>.

[3] "CIRI Human Rights Data Project," SUNY Binghamton University. Available from: <http://ciri.binghamton.edu/>.

[4] Marshall, M. "Polity IV Project," Center for Systemic Peace, Colorado State University. Available from: <http://www.systemicpeace.org/polity/polity4.htm>.

[5] "Data Catalog," The World Bank. Available from: < http://data.worldbank.org/data-catalog>.

[6] "Statistics Portal," Organization for Economic Cooperation and Development. Available from: <http://www.oecd.org/statsportal/0,3352,en_2825_293564_1_1_1_1_1,00.html>.

[7] "Correlates of War Project," Department of Political Science, Pennsylvania State University. < http://www.correlatesofwar.org/>.

[8] Fearon, J. and Laitin, D. "Ethnicity, Insurgency, and Civil War," Department of Political Science, Stanford University. Available from: <http://www.stanford.edu/group/ethnic/>.

[9] Goldstein, J. (1992) "A Conflict -Cooperation Scale for WEIS Data," *Journal of Conflict Resolution* 36 (2): 369-385.

[10] Poe, S., Rost, N., and Cary, S. (2006) "Assessing Risk and Opportunity in Conflict Studies: A Human Rights Analysis," *Journal of Conflict Resolution* 50 (4): 484-507.