

Temporal Patterns in Protest Events

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STATIC VERSUS DYNAMIC APPROACH

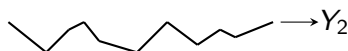
$$X_1, X_2, X_3, X_4, \dots \rightarrow Y_1$$

$$X_1, X_2, X_3, X_4, \dots \rightarrow Y_2$$

$$X_1, X_2, X_3, X_4, \dots \rightarrow Y_3$$

Covariate sets
as unit of analysis


$$\rightarrow Y_1$$


$$\rightarrow Y_2$$


$$\rightarrow Y_3$$

Time sequences
as unit of analysis

STATE REPRESSION AND DISSIDENCE NEXUS

- * The 'punishment puzzle' (e.g., Davenport 2007)
- * Dissidence-repression interactions as strategic processes (e.g., Pierskalla 2010)

Patterns in protest as observable implications of repression-dissidence interactions (Tarrow 2011). → Dynamic approach

PROTEST WAVES

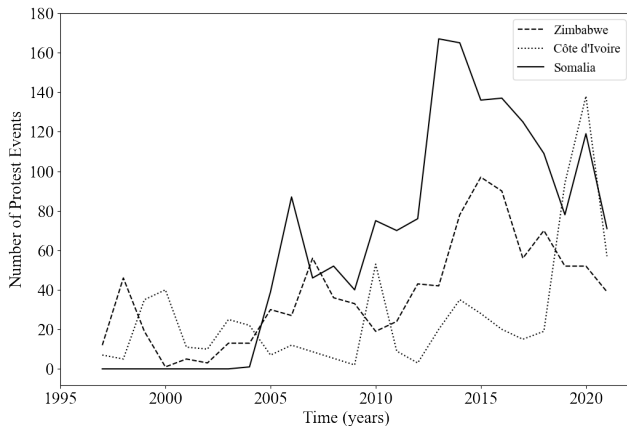
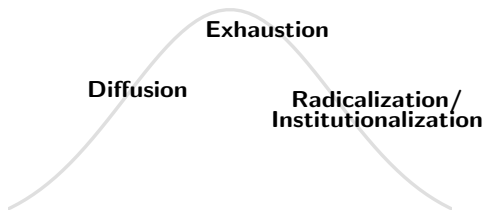


Figure: Number of protest events per year (1997–2021) in Zimbabwe, Côte d'Ivoire, and Somalia, obtained from Raleigh et al. (2010).

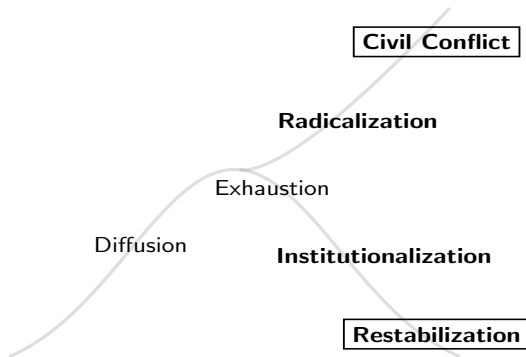
CYCLES OF CONTENTION

ADOPTED FROM TARROW (2011) AND DEMIREL-PEGG (2011)



CYCLES OF CONTENTION

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CYCLES OF CONTENTION

ADOPTED FROM TARROW (2011) AND DEMIREL-PEGG (2011)



Expectation: Patterns in protest events repeat. Similarities in sequences of protest events serve to predict the future course in the protest cycle.

DATA

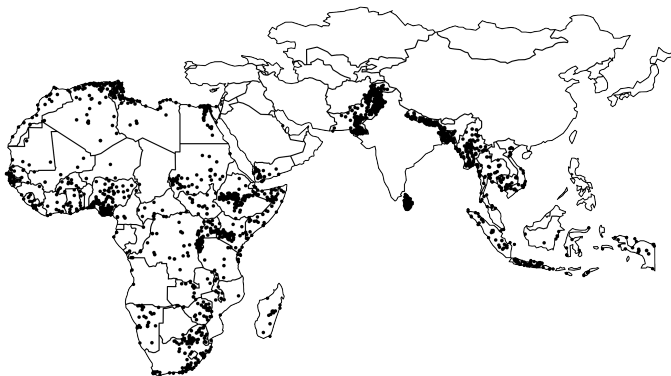


Figure: Protest events in 2015 in Africa, and Asia and the Pacific Group, obtained from Raleigh et al. (2010).

HOW TO MEASURE SIMILARITIES?

→ Time series clustering based on time warped sequences, using K-means algorithm.

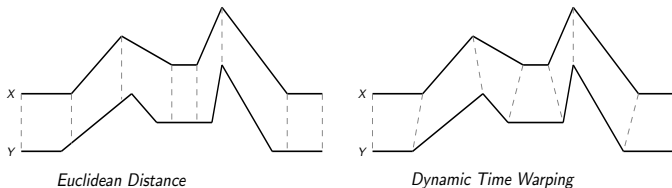


Figure: Comparing Euclidean Distance with Dynamic Time Warping—Adopted from Chadeaux (2021, 7) and Keogh and Ratanamahatana (2005, 359).

TIME SERIES CLUSTERING

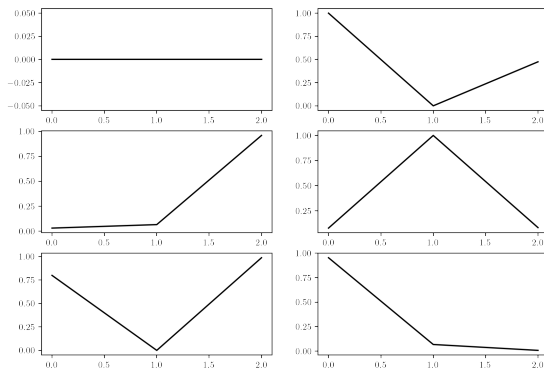


Figure: The obtained six clusters with window length three months.

→ Use as dummy set, assign each observation to one cluster

TIME SERIES FORECASTING

ADOPTED FROM KOTU (2019)

Autoregressive Integrated Moving Average (ARIMA): linear combination of p past observations, $y_t = \theta_0 + \theta_1 y_{t-1} + \theta_2 y_{t-2} + \dots + \theta_p y_{t-p}$

- * ARIMA, $p = 1$
- * ARIMA, optimized
- * ARIMAX, optimized and additional X which is dummy set of extracted clusters

Evaluation score:

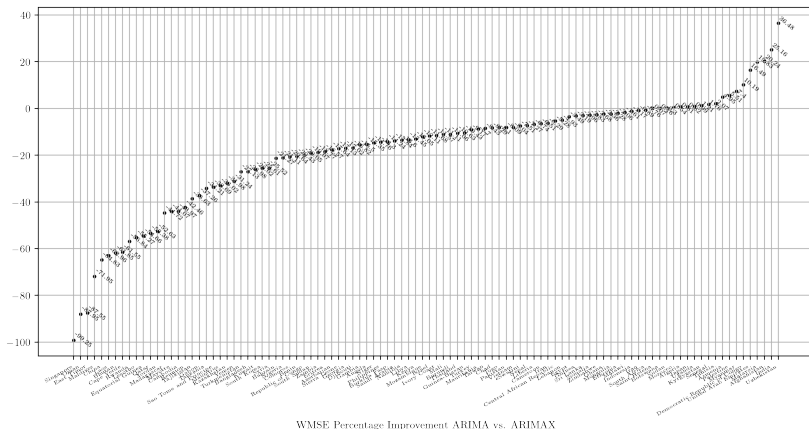
- * Weighted mean squared error (WMSE): Mean squared error weighted by actual values on outcome, number of protest events

PREDICTION ACCURACY OVERALL

Model	WMSE
ARIMA(1,0,0)	4197.140778
ARIMA(optimized)	3240.739375
ARIMAX	3071.106989

Table: Weighted mean squared error for ARIMA(1,0,0), ARIMA(optimized) and ARIMAX.

PREDICTION ACCURACY PER COUNTRY



WELL PERFORMING ARIMAX

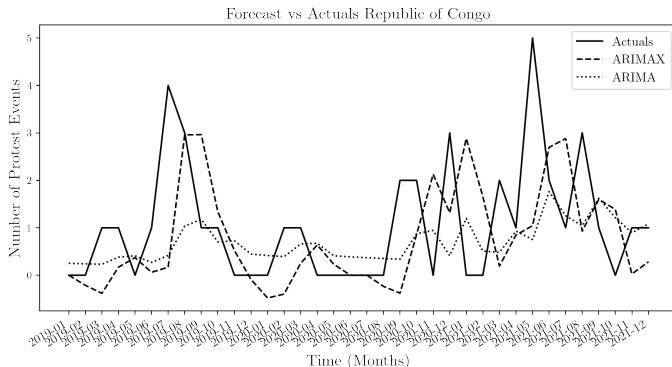


Figure: Predictions (ARIMA and ARIMAX) and actual values for Congo.

POORLY PERFORMING ARIMAX

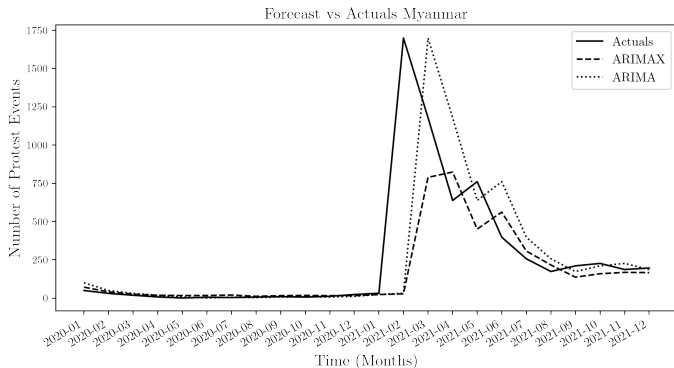


Figure: Predictions (ARIMA and ARIMAX) and actual values for Myanmar.

THANK YOU

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