Time line

1. There is a fixed, finite, connected, undirected, and commonly known network.
2. Players of two types— *R* or *I* —chosen by nature according to a probability distribution.
   - *R*: Rebel; *I*: Inert
3. Types are then fixed over time.
4. Players play a stage game— a collective action —infinitely repeatedly with common discount factor.

Model

What player can/cannot observe

- Players can observe own/neighbors' types and actions, but not others'.
- Pay-off is hidden.

- Stage game—k-threshold game: a protest ([Chwe 2000])
  - R-type's action set$= \{\mathbf{1}, \mathbf{0}\}$
  - I-type's action set$= \{\mathbf{0}\}$
  - Pay-offs for R-type:

$$\begin{aligned}
u_R(a_i, a_{-i}) &= 1 && \text{if } a_i = \mathbf{1} \text{ and } \#\{j : a_j = \mathbf{1}\} \geq k \\
u_R(a_i, a_{-i}) &= \text{-1} && \text{if } a_i = \mathbf{1} \text{ and } \#\{j : a_j = \mathbf{1}\} < k \\
\\
u_R(a_i, a_{-i}) &= 0 && \text{if } a_i = \mathbf{0}
\end{aligned}$$

Static ex-post Pareto efficient outcome

Type profile	Static ex-post efficient outcome
At least k R-types exist	All R-types play **1**
Otherwise	All R-types play **0**

APEX (*approaching ex-post efficient*) equilibrium

DEFINITION (APEX STRATEGY)

An equilibrium is APEX $\Leftrightarrow$

$$\forall\theta, \text{ there is a finite time } T^\theta$$

such that the actions in the equilibrium path repeats the static ex-post efficient outcome after T^θ.

Result 1: APEX for $k = n$

Theorem ($k = n$)

If $k = n$, then an APEX sequential equilibrium exists whenever discount factor is sufficiently high.

DEFINITION FOR APEX FOR $k < n$

DEFINITION

θ has **strong connectedness**$\Leftrightarrow$ for every pair of R-types, there is a path consisting of R-types to connect them.

DEFINITION

π has **full support on strong connectedness**$\Leftrightarrow$

$\pi(\theta) > 0$ **if and only if** θ has strong connectedness.

Result 2: APEX for $k < n$

Theorem ($k < n$)

If $k < n$, then if network is a tree, if prior π has full support on strong connectedness, then an APEX WPBE exists whenever discount factor is sufficiently high.