# STRATEGIC GOVERNMENT RESPONSES TO PROTESTS:

# A COMPUTATIONAL SIMULATION ANALYSIS.

By

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# ABSTRACT

This thesis investigates the strategic interactions between governments and citizens during civil unrest using computational simulation models. By combining equilibrium models in economics, agent-based models (ABMs), and political science theories, the study analyzes the effectiveness of different government strategies in managing protests. The simulation incorporates citizens and law enforcement officers, examining their interactions based on factors like government legitimacy and external shocks. Results show that low-legitimacy governments are most effective with aggressive suppression, while high-legitimacy governments benefit more from continuous reforms. Mixed strategies, combining suppression and reform, are also effective under certain conditions, especially when external shocks are infrequent.

**Keywords:** *Civil Unrest, Government Strategy, Protests, Agent-Based Models (ABM), Equilibrium Models; Political Science, Strategic Interaction*

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# INTRODUCTION

Protests and civil unrest pose significant challenges to governments globally, reflecting deep-seated societal issues and widespread discontent. Understanding the dynamics that lead to successful or unsuccessful revolutions is essential for both academic inquiry and practical application. Historical events provide compelling insights into the outcomes of various movements. For example, the Arab Spring, which began in 2010, resulted in mixed outcomes: Tunisia's revolution successfully led to the establishment of a more democratic government, while the uprisings in Syria resulted in prolonged civil war and instability (Al-Ali, 2012). Similarly, the Velvet Revolution in Czechoslovakia in 1989 peacefully ended communist rule and led to democratic reforms, in contrast to the Tiananmen Square protests of the same year in China, which were violently suppressed (Kuran, 1991). These examples highlight how the nature of governmental response can significantly influence the outcomes of civil unrest. If governments fail to respond appropriately, they risk exacerbating tensions, losing legitimacy, and potentially facing prolonged periods of instability (Beissinger, 2002).

This research seeks to explore and identify the dynamics of government responses to civil unrest to better understand the strategic interactions between government and citizens. By employing simulation models, this study aims to provide empirical insights and theoretical grounding into these interactions, with the hope that this line of research will ultimately help civil societies make governments more responsive and responsible.

The simulation model developed in this study incorporates key elements from three main lines of research: equilibrium models in economics, agent-based models (ABMs), and political science theories of protest and civil unrest. Integrating these approaches allows for a comprehensive analysis of both government strategies and the behavior of protestors.

The model consists of agents representing individuals who may protest or remain inactive, influenced by various factors such as emotional and cognitive stimuli, external shocks, reform measures, and government legitimacy. Law enforcement officers, or cops, manage protests through suppression or reform strategies. Key global variables include base legitimacy, government utility, protestor ratio, shock rate, and cops ratio, which interact to influence the dynamics of civil unrest.

**Low Legitimacy Governments:** For governments with low legitimacy, the optimal strategy is to suppress protests aggressively. This approach aims to maintain order through the use of force, deterring further unrest and stabilizing governance in the short term (Acemoglu & Robinson, 2001). The intuition behind this result is that low legitimacy indicates a significant lack of public support and trust. In such environments, attempts at reform may be perceived as insincere or inadequate by the public, potentially leading to increased unrest. By contrast, aggressive suppression can quickly quell disturbances and project an image of control and strength, discouraging potential protestors. However, this strategy carries the risk of long-term instability if underlying issues are not addressed, leading to cyclical patterns of unrest and repression.

**High Legitimacy Governments:** For governments with high levels of legitimacy, the optimal strategy is to engage in continuous reforms. By addressing the underlying causes of discontent and implementing continuous improvements, these governments can maintain public support and long-term stability (Gurr, 1970). The intuition here is that high legitimacy reflects a strong base of public trust and support. In such contexts, governments have the political capital to implement reforms that can address grievances without the fear of immediate backlash. Reforms can enhance legitimacy further by showing responsiveness to public concerns, thereby reducing the propensity for unrest and creating a positive feedback loop of stability and reform.

**Special Cases and Mixed Approaches:** In certain scenarios where governments can effectively manage environmental conditions, a mixed approach may be optimal. These strategies combine elements of suppression and reform, enabling governments to maintain order and gain legitimacy over time. The intuition behind mixed approaches is that they provide flexibility in response to varying intensities and types of unrest. By initially suppressing severe disturbances to re-establish order and subsequently implementing reforms to address the root causes of discontent, governments can stabilize the immediate situation while working towards long-term solutions. This approach can be particularly effective in environments where legitimacy is neither very high nor very low, allowing for a balanced response to complex social dynamics.

In Section 2, I provide a comprehensive overview of the current state of the art. Three distinct lines of research exist: equilibrium models in economics that account for the government's optimal response but are stylized about the behavior of the population; agent-based models that are detailed about the behavior of the population but do not study the government's best response; and political science theories of protest and civil unrest.

**Equilibrium Models in Economics:** These models provide a framework for understanding optimal government responses to social unrest using game-theoretic approaches. For instance, Acemoglu and Robinson (2001) explore the trade-offs between repression and reform based on government legitimacy. Our model incorporates these trade-offs by simulating different strategies and their impact on government utility and legitimacy.

**Agent-Based Models (ABMs):** ABMs simulate detailed population behaviors and interactions, capturing the complexity of social dynamics during protests. Epstein (2002) used ABMs to simulate civil violence, emphasizing individual decisions and group interactions. Our

model leverages ABMs to simulate the behavior of agents (protestors) and their responses to government actions, providing a detailed view of population dynamics (Epstein, 2002).

**Political Science Theories:** Theories such as relative deprivation (Gurr, 1970), resource mobilization (McCarthy & Zald, 1977), and political opportunity (Tarrow, 1998) offer insights into the causes and dynamics of protests. Our model integrates these theories by considering factors like perceived grievances, resource availability, and political opportunities which influence agents' decisions to protest.

In Section 3, I present my methodology, which involves developing simulation models that incorporate elements of both equilibrium and agent-based approaches. The models simulate various government responses to protests, considering factors such as government utility, government legitimacy, and environmental conditions.

In Section 4, the results of the simulations are presented, with particular attention paid to the effectiveness of different strategies under various conditions. The findings provide support for the main conclusions regarding the optimal strategies for governments with varying levels of legitimacy.

Section 5 serves to conclude the thesis, summarizing the key insights and suggesting areas for further research. Future studies could expand upon the current analysis by incorporating additional variables and scenarios, thereby providing a more comprehensive understanding of the complex dynamics of civil unrest and government responses.

# LITERATURE REVIEW

In this section, we explore three main lines of research relevant to our study: equilibrium models in economics that account for the government's optimal response, agent-based models that detail the behavior of the population, and political science theories of protest and civil unrest. This review highlights key studies, methodologies, and findings in each area, setting the stage for our integrated approach.

## Equilibrium Models in Economics

Equilibrium models in economics provide a framework for understanding how governments can optimize their responses to social unrest. These models often rely on game-theoretic approaches to analyze the strategic interactions between governments and protestors.

**Optimal Government Response Models:** Several studies focus on how governments balance repression and concessions to maintain power and stability. Acemoglu and Robinson (2001) developed a model exploring the trade-offs between repression and reform. They argue that governments with lower legitimacy tend to rely more on repression, while those with higher legitimacy might prefer reforms to maintain social order (Acemoglu & Robinson, 2001). Besley and Persson (2011) extend this line of inquiry by examining state capacity and conflict, showing how investments in state capacity can reduce the likelihood of civil unrest and improve governance stability (Besley & Persson, 2011).

**Game Theory:** Game theory has been extensively used to model the strategic interactions between governments and protestors. Kuran (1991) uses game theory to explain why revolutions are often unpredictable and why they can happen suddenly. His model incorporates the concept of "preference falsification," where individuals' public

preferences differ from their private preferences due to fear of repression (Kuran, 1991). Tullock (1971) presents a formal model of government repression and rebellion, highlighting the costs and benefits of different strategies for both governments and protestors (Tullock, 1971).

## Agent-Based Models

Agent-based models (ABMs) simulate the actions and interactions of individual agents to assess their effects on the system as a whole. These models are particularly valuable in capturing the detailed behavior of the population during civil unrest.

**Detailed Population Behavior:** ABMs allow for the examination of complex social behaviors and interactions among diverse agents. Epstein (2002) used agent-based modeling to simulate civil violence, focusing on the interactions between individuals and groups (Epstein, 2002). Granovetter and Soong (1983) modeled how social networks influence the spread of participation in protests, highlighting the importance of network structures and thresholds in understanding how protests escalate (Granovetter & Soong, 1983). Cederman (2005) developed an ABM to explore the spread of ethnic conflict, emphasizing the importance of local interactions and group dynamics (Cederman, 2005).



## Theories of Protest and Civil Unrest in Political Science

Political science offers various theories to explain the causes and dynamics of protests and civil unrest. These theories provide a foundational understanding that can inform the development of simulation models in our study.

**Relative Deprivation Theory:** Relative deprivation theory posits that social unrest arises when there is a perceived gap between expected and actual social or economic conditions.

Gurr (1970) suggests that individuals or groups experiencing relative deprivation are more likely to engage in protests to address their grievances (Gurr, 1970).

**Resource Mobilization Theory:** Resource mobilization theory focuses on the availability and management of resources such as funding, organizational skills, and social networks to facilitate collective action. McCarthy and Zald (1977) argue that successful mobilization depends on the ability to acquire and effectively use resources (McCarthy & Zald, 1977).

**Political Opportunity Theory:** Political opportunity theory examines how the external political environment influences the likelihood of protests. Tarrow (1998) suggests that changes in political opportunities, such as shifts in power, policy openings, or alliance formations, create favorable conditions for social movements to emerge (Tarrow, 1998).

## The Role of Government Legitimacy

The effectiveness of any government's response to civil unrest is heavily dependent on the concept of legitimacy. Government legitimacy is derived from the public's perception that authorities are acting in their best interests and maintaining a fair and just system. High levels of legitimacy can act as a deterrent to unrest, as citizens are more likely to believe in the system's ability to address their grievances. Conversely, when legitimacy is low, any government action can be perceived as unjust or oppressive, intensifying tensions and leading to more widespread protests (Mazumder, 2018).



## Types of Government Responses

**Repression and Suppression:** These involve using force or restrictive measures to quell protests. Such strategies may include deploying police or military forces, using non-lethal or lethal weapons (such as tear gas and rubber bullets), arrests, and restrictions on

assembly and expression. Repression can deter further protest activity in the short term but can erode public trust and radicalize protestors over time (Asal & Brown, 2020).

**Reforms and Concessions:** These involve addressing the demands of protestors through policy changes and reforms. This strategy aims to address the underlying issues that gave rise to the protests, thereby reducing the motivation for continued unrest. Long-term stability can be achieved by addressing grievances and incorporating citizen participation in governance (Msenge & Nzewi, 2021).

**Mixed Approaches:** Mixed approaches combine elements of suppression and reform, aiming to balance immediate control and long-term solutions. Strategic use of force coupled with gradual reforms and institutional changes can enhance governance and reduce the likelihood of future protests (Pierskalla, 2010).

## Addressing the Gap

My contribution is to combine these ideas, integrating the detailed population behavior captured by agent-based models with the strategic government responses modeled in equilibrium economics. This integrated approach allows for a more comprehensive analysis of the interactions between government actions and population behaviors during civil unrest. By bridging the gap between equilibrium models and agent-based models, this research aims to provide a more holistic understanding of civil unrest dynamics and offer practical insights for civil society.

# METHODOLOGY

## Model Description

The simulation model developed in this study aims to analyze the impact of different government strategies on managing protests. The model simulates interactions between two primary entities: agents (protestors) and cops (law enforcement officers). The environment evolves over discrete time steps during which agents and cops interact based on predefined strategies and global variables.

### Agents

Agents represent individuals who may protest or remain inactive. Each agent has the following attributes:

- **Position (x, y)**: The location of the agent in the environment grid.
- **Risk Aversion ($R_a$)**: A measure of the agent's reluctance to engage in protest due to potential risks.
- **Rage ($R_g$)**: A measure of the agent's anger and propensity to protest.
- **Status**: The current state of the agent, which can be "quiet," "active," "jailed," or "killed."
- **Vision ($V$)**: The range within which the agent can observe other agents' statuses.
- **Jailed Time**: The remaining time the agent will stay in jail if arrested.
- **Neighbor Statistics**: The count of neighbors who are "killed," "active," or "jailed."

Agents update their status based on the following factors:

- **Stimuli ($S_g$ $and$ $S_a$)**: Changes in the environment such as neighbors' statuses.

- **External Shocks**: Random events that can affect the agents' rage.
- **Reform Measures**: Actions taken by the government that can decrease agents' rage and risk aversion.
- **Legitimacy ($L$)**: The perceived legitimacy of the government, which affects agents' willingness to protest.

The mathematical representation of the agents' decision-making process is as follows:

$$R_g(t+1) = R_g(t) + S_g(t) + Shock - Reform$$

$$R_a(t+1) = R_a(t) + S_a(t) - Reform$$

where $S$ is the stimuli that the agent experiences due to changes in their neighborhood. Shocks affect agents' risk aversion and rage and are modeled as random events with probabilities determined by the shock rate ($S_r$).

**Cops**

Cops represent law enforcement officers whose role is to manage protests through various strategies. Each cop has the following attributes:

- **Position (x, y)**: The location of the cop in the environment grid.
- **Vision ($V_c$)**: The range within which the cop can observe agents' statuses.
- **Violence Level ($V_l$)**: A measure of the cop's propensity to use force, influenced by government legitimacy and protest intensity.

Cops update their actions based on the following factors:

- **Suppression:** Arresting or killing active protestors within their vision range.

- **Reform Implementation:** Taking actions that reduce the rage of agents if the government opts for a reform strategy.

**Global Variables**

Global variables influence the overall dynamics of the system:

- **Base Legitimacy ($L_0$)**: The initial level of legitimacy that the government holds. Higher legitimacy makes agents less likely to protest.
- **Government Utility ($U_g$)**: A measure of the government's stability and access to resources, influenced by protest intensity and government actions.
- **Protestors Ratio ($P_r$)**: The proportion of agents who are actively protesting or jailed.
- **Shock Rate ($S_r$)**: The probability of external shocks occurring at each time step.
- **Cops Ratio ($C_r$)**: The ratio of cops to all agents, affecting the government's ability to manage protests.

**Variables Selection**

- The variables in the model mostly come from literature. The decision-making process for the citizen follows the procedure suggested by Epstein (2002) in the rebellion model. At the heart of all protest theories lies the concept of legitimacy. Agent vision, to some extent, accounts for the access of citizens to the information flow in society. Shocks not only play a significant role in literature but are also an important part of real-world scenarios.

**Relationships Between Variables**

- **Agent Rage and Risk Aversion**: Agents decide to protest based on their rage ($R_g$), risk aversion ($R_a$), and perceived legitimacy of the government ($L$). External shocks and suppression actions can increase rage, while reforms can decrease both rage and risk aversion.

$$R_g(t+1) = R_g(t) + S_g(t) + Shock - Reform$$

$$R_a(t+1) = R_a(t) + S_a(t) - Reform$$

Where $S_g(t)$ and $S_a(t)$ are the stimuli related to rage and risk aversion, respectively.

- **Legitimacy and Government Utility**: Higher legitimacy generally results in a more stable government, reducing the likelihood of intense protests. Government utility decreases with higher protest intensity and improves with successful reforms.

$$L(t+1) = L(t)e^{-a \cdot K_A(t) - b \cdot J_A(t)} + Reform\_Effect$$

Where $K_A(t)$ and $J_A(t)$ are the numbers of agents "killed" or "jailed" in the $t$-th iteration, respectively. Coefficients $a$ and $b$ are country-specific and can be calibrated using empirical data.

$$U_g(t+1) = U_g(t) - c.P_r - Reform\,Value + (L(t+1) - L(t))$$

This equation indicates that government utility can increase due to higher legitimacy and may decrease due to reforms or massive protests.

**Suppression and Reform Strategies:** The government can choose between suppression and reform strategies. Suppression reduces protest intensity quickly but can decrease

legitimacy. Reforms address underlying issues, improving long-term stability but may take longer to show effects.

**Government's Utility Function**

The government's utility function is the sum of the per period utilities discounted by a discount factor, where the discount factor is assumed to be 0.95. Formally, the government utility at time $t$ is given by:

$$Ug = \sum_{t=0}^{T} \delta^t U_{g,t}$$

where $\delta = 0.95$ is the discount factor and $U_{g,t}$ is the utility at time $t$.

The above equations are designed to keep the changes in variables within reasonable ranges and to capture the effects of all events in the system. They are constructed to reflect both theoretical expectations and practical experiences, ensuring that the model remains grounded in real-world dynamics. This approach helps in maintaining the validity and applicability of the simulation results to actual scenarios of civil unrest and government responses.

**Conditions for Government Collapse**

A government collapses under two conditions:

1. **Revolution Threshold:** When the ratio of active and jailed citizens to the entire alive population reaches a specified threshold, indicating widespread unrest.
2. **Zero Utility:** When the government's utility reaches zero, indicating that there is no longer any incentive to maintain the current political structure. This situation typically

describes a scenario where the government opts for a smooth transition in governance due to unsustainable conditions.

In this research, since the focus is on the government's optimal strategies, the government does not consider the rounds (iterations) after its collapse. However, for choosing the optimal strategy for citizens, it is necessary to consider the subsequent rounds.

**Reform Measures**

The terms "Reform," "Reform_effect," and "Reform_value" all originate from the same government action but represent different aspects:

- **Reform:** The general action of the government to implement changes aimed at reducing unrest and improving legitimacy.
- **Reform_value:** The amount of utility that the government decides to redistribute among citizens as part of the reform.
- **Reform_effect:** The impact of the reform on different variables such as agents' rage, risk aversion, and government legitimacy. The effect is proportional to the "$Reform\_value,$" but the exact influence on each variable can differ. For example, the reform's effect on government legitimacy ($Reform\_Effect$) takes a uniform random value between 0 and $Reform\_value$.

The mathematical representation of the reform's impact has been provided in the above. These equations illustrate how the reform measures affect agents' rage, risk aversion, and government legitimacy.

**Strategy Implementation**

The strategies implemented by the government in the simulation are as follows:

**Consistent Suppression Strategy:**

- **Actions:** Each cop chooses one of the active agents in their vision range randomly. Based on their violence level, the cop decides to either kill the agent or arrest them and assign a jailed time.
- **Determinants:** Both the violence level and jail time are increasing in protestors ratio and decreasing in government legitimacy.

**Consistent Reform Strategy:**

- **Actions:** No cops use violence. Instead, the government chooses an amount of its utility to redistribute among citizens.
- **Direct Reform:** The reform can be considered a direct response to protestors' demands, decreasing both the rage and risk aversion of the citizens equally.

**Mixed Strategy:**

- **Actions:** The government uses violence as described in the consistent suppression strategy whenever protests occur. If the protestors ratio is below a significant threshold (indicating a calm situation), the government initiates reform actions.
- **Indirect Reform:** The government implements reforms that are not entirely direct responses to protestors' demands. These reforms focus more on decreasing citizens' rage rather than risk aversion, aiming to maintain stability while keeping citizens' risk aversion at the same level.



# Simulation Methodology

**Initialization:**

- **Agents and Cops:** The simulation begins by placing agents and cops randomly on a $20 * 20$ grid.

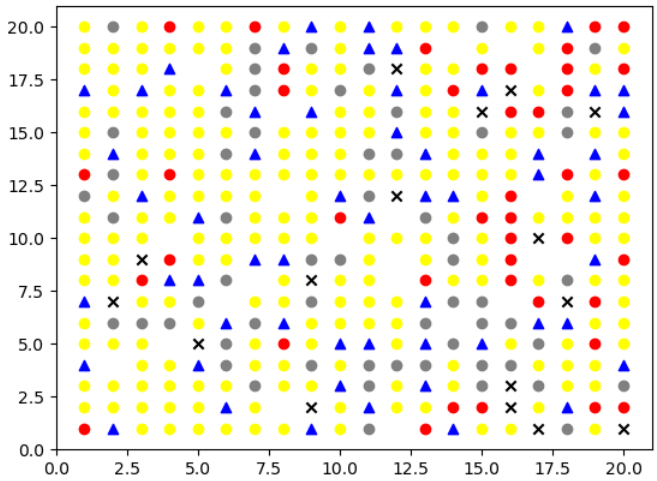


*Figure 1. A representation of the model in Python*

A grid is chosen to consider the network effects on citizens in the simplest reasonable structure. The grid structure allows for a straightforward representation of spatial relationships and interactions among agents. This setup is essential for capturing local interactions and their aggregate effects on the system.

- **Global Variables:** Set to initial values based on the specified configuration.

**Simulation Loop:** For each time step, the following updates occur:

1. **Update Globals:** Update global variables based on the current state of agents.
2. **Execute Strategies:** Cops and agents interact based on predefined strategies.
3. **Update Agents:** Each agent updates its status (quiet, active, jailed, or killed) based on interactions and global variables.

**Data Collection:** Metrics such as government lifetime utility and stability duration are recorded at each time step. These metrics are averaged over multiple iterations to ensure robustness and capture variability.

**Analysis:** Results are analyzed to determine the impact of different base legitimacy values on government responses to protests. Outcomes are visualized through plots showing the relationship between base legitimacy and recorded metrics.

## Parameter Choices:

- **Base Legitimacy (BASE_LEGITIMACY):** [0.2, 0.4, 0.6, 0.8]
- **Iterations (iterations):** 200
- **Maximum Time Steps (max_time_steps):** 50
- **Initial Agent Vision (initial_agent_vision):** 'High' and 'Low'
- **Shock Rate (shock_rate):** 'High' and 'Low'
- **Cops Ratio (cops_ratio):** 'High' and 'Low'

The scenario with "high vision, high shock rate, and high cops' ratio" is considered the benchmark model for this simulation. Dictatorial regimes commonly exhibit high vision and high cops' ratio. The high probability of shock occurrence scenario is particularly relevant and can be useful in calibrating aspects of the model.

**Simulation Scenarios:**

- **High Legitimacy Scenario:** High initial base legitimacy to test strategy resilience.
- **Low Legitimacy Scenario:** Low initial base legitimacy to explore strategy effectiveness in regaining support.
- **High Shock Rate Scenario:** Frequent external shocks to test response robustness.

- **Low Shock Rate Scenario:** Sporadic shocks to test efficiency in stable environments.
- **High Citizens' Vision Scenario:** Complete information flow among citizens.
- **Low Citizens' Vision Scenario:** Restricted information flow.

**Strategy Implementation:**

- **Consistent Suppression:** Aggressive measures to suppress protests, prioritizing immediate stability.
- **Consistent Reform:** Implementing reforms to address issues and improve legitimacy.
- **Suppression and Indirect Reform Strategy:** Aggressive suppression followed by indirect reforms if protest intensity is low.

**Simulation Execution:** For each base legitimacy value, the simulation runs multiple iterations to collect data on government lifetime utility and stability duration. Data is averaged and analyzed to identify trends in government responses to protests. Results are visualized to provide a comprehensive understanding of the impact of base legitimacy on strategy effectiveness.

# RESULTS[1]

## Overview

I conducted simulations to analyze the impact of different government strategies on managing protests under varying levels of legitimacy, shock rates, and other contextual factors. The main findings highlight the strategic importance of government responses.

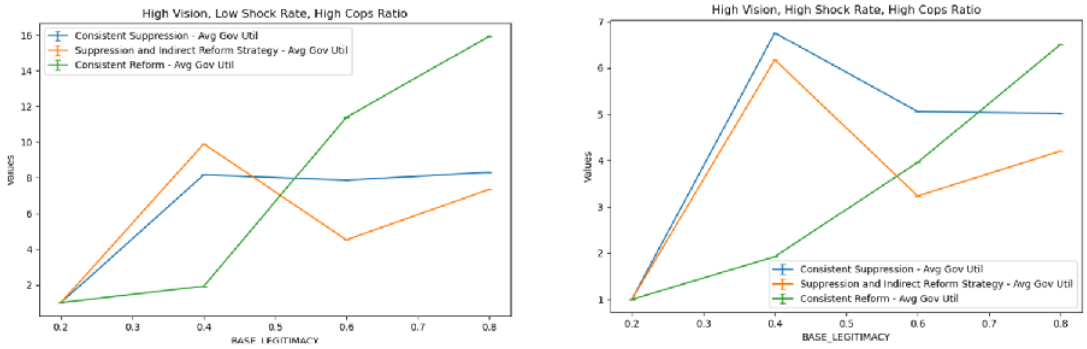


*Figure 2. Average Government Lifetime Utility Under Low Shock Scenario (left) and High Shock Scenario (right)*

## Impact of Legitimacy Levels on Government Strategies

### Main Result 1: Low Legitimacy

- **Scenario:** Low Legitimacy
- **Optimal Strategy:** Aggressive Suppression

Governments with low legitimacy benefit most from consistently suppressing protests. Reforms in these scenarios tend to be either too slow or too costly, failing to reduce unrest quickly enough to prevent potential revolutions. The quantitative results support this finding:

[1] Access to the research code and all the results is possible through this link: https://shorturl.at/1wAp0

*Table 1. Average Government Lifetime Utility and Duration of Stability under the Low Legitimacy Scenarios*

| Base Legitimacy | Strategy | Avg Gov Lifetime Utility | Avg Duration of Stability |
|---|---|---|---|
| Low | Consistent Suppression | 4.90 | 26 |
| Low | Consistent Reform | 2.91 | 7 |
| Low | Suppression and Indirect Reform | 3.76 | 12 |

**Main Result 2: High Legitimacy**

- **Scenario:** High Legitimacy
- **Optimal Strategy:** Reform

For governments with high levels of legitimacy, implementing reforms is more cost-effective and efficient in reducing unrest. The reforms enhance legitimacy further, maintaining stability more effectively than suppression. The quantitative results are as follows:

*Table 2. Average Government Lifetime Utility and Duration of Stability under the High Legitimacy Scenarios*

| Base Legitimacy | Strategy | Avg Gov Lifetime Utility | Avg Duration of Stability |
|---|---|---|---|
| High | Consistent Suppression | 6.17 | 22 |
| High | Consistent Reform | 10.50 | 35 |
| High | Suppression and Indirect Reform | 5.32 | 11 |

**Influence of Shock Probability on Strategy Selection**

**High Shock Rate Scenario**

- **Findings:** High probability of shocks reduces the effectiveness of all strategies. More frequent shocks lower the average government lifetime even with optimal strategies and justify aggressive suppression for a wider range of legitimacies.

**Main Result 3: Low Shock Rate**

- **Findings:** The "Suppress and Indirect Reform" strategy is viable when external shocks are minimal.

*Table 3. Average Government Lifetime Utility and Duration of Stability under the Low Shock Rate Scenarios, for a government with Low Legitimacy*

| Shock Rate | Strategy | Avg Gov Lifetime Utility | Avg Duration of Stability |
|---|---|---|---|
| Low | Consistent Suppression | 8.13 | 45 |
| Low | Consistent Reform | 2.04 | 3 |
| Low | Suppression and Indirect Reform | 9.98 | 51 |

**Intuitive Explanation of Findings**

- **Cost-Benefit Analysis of Reforms vs. Suppression:** In high legitimacy contexts, reforms are less costly and more effective at reducing unrest. In contrast, low legitimacy contexts find reforms either too slow or too expensive, making suppression the optimal strategy to maintain stability initially.
- **Indirect Reforms and Citizen Discontent:** Indirect reforms, which are not direct responses to protests, are effective under controlled shock conditions. These reforms

can reduce discontent more efficiently without appearing to cave to protestor demands, thus maintaining government authority and stability.

# CONCLUSION

This research provides significant insights into the strategic interactions between governments and citizens during periods of civil unrest. For governments with low legitimacy, aggressive suppression is found to be the most effective strategy to maintain stability, as reforms are often too slow or costly to mitigate unrest quickly. Conversely, for governments with high legitimacy, implementing reforms is a more efficient strategy, enhancing legitimacy further and effectively reducing unrest.

The study also highlights the influence of external shocks on the effectiveness of government strategies. High shock rates diminish the effectiveness of all strategies and broaden the optimality range for aggressive suppression. In contrast, low shock rates make mixed strategies such as "Suppress and Indirect Reform" viable, especially under controlled conditions.

These findings underline the importance of context-specific strategies for understanding how governments might manage protests and maintain stability. This knowledge can help in estimating the prior beliefs of citizens regarding the government's strategy in the coming periods and be useful in finding game equilibria and optimal strategies for civil society. Future research could explore additional parameters and extend the model to incorporate more complex networks, behaviors, and strategies, providing a more comprehensive understanding of government responses to social unrest.

# REFERENCES


1. Acemoglu, D., & Robinson, J. A. (2001). A Theory of Political Transitions. The American Economic Review, 91(4), 938-963.

2. Al-Ali, Z. (2012). The Struggle for Iraq's Future: How Corruption, Incompetence and Sectarianism Have Undermined Democracy. The Arab Studies Journal, 20(1), 7-29.

3. Asal, V., & Brown, M. (2020). Nonstate Actors in the Socialization Process. Studies in Conflict & Terrorism, 43(4), 287-305.

4. Beissinger, M. R. (2002). Nationalist Mobilization and the Collapse of the Soviet State. Cambridge University Press.

5. Besley, T., & Persson, T. (2011). The Logic of Political Violence. International Organization, 65(4), 843-871.

6. Cederman, L. E. (2005). Computational Models of Social Forms: Advancing Generative Process Theory. Journal of Conflict Resolution, 49(1), 133-153.

7. Epstein, J. M. (2002). Modeling civil violence: An agent-based computational approach. Proceedings of the National Academy of Sciences, 99(3), 7243-7250.

8. Granovetter, M., & Soong, R. (1983). Threshold Models of Diffusion and Collective Behavior. Journal of Mathematical Sociology, 9(3), 165-179.

9. Gurr, T. R. (1970). Why Men Rebel. Princeton University Press.

10. Kuran, T. (1991). Now Out of Never: The Element of Surprise in the East European Revolution of 1989. World Politics, 44(1), 7-48.

11. Mazumder, S. (2018). The Persistent Effect of U.S. Civil Rights Protests on Political Attitudes. Journal of Conflict Resolution, 62(9), 1858-1883.

12. McCarthy, J. D., & Zald, M. N. (1977). Resource Mobilization and Social Movements: A Partial Theory. American Journal of Sociology, 82(6), 1212-1241.

13. Msenge, P., & Nzewi, O. (2021). Government Responsiveness in Africa: The Impact of Social Protests. Review of African Political Economy, 48(170), 513-529.

14. Pierskalla, J. H. (2010). Protest, Deterrence, and Repression: The 2007 Kenyans Elections. British Journal of Political Science, 41(2), 377-404.

15. Tarrow, S. (1998). Power in Movement: Social Movements and Contentious Politics. Cambridge University Press.

16. Tullock, G. (1971). The Paradox of Revolution. Public Choice, 11(1), 89-99.

# TOOLS AND RESOURCES USED

In this project, several AI tools were employed to assist with various aspects of the research. These tools and their specific applications were as follows:

1. **ChatGPT:** Used for generating the framework and the final editing of the article, as well as for code debugging, cleaning, and documentation. ChatGPT facilitated the structuring of the research document and ensured the clarity and coherence of the content.
2. **Consensus App and Typeset.io:** Utilized for finding relevant papers and citations. These tools were instrumental in conducting a comprehensive literature review by identifying and retrieving pertinent academic papers that supported the research.
3. **Scite.ai:** Employed for summarizing the papers. Scite.ai provided concise summaries of the key findings from the identified papers, aiding in the synthesis of the literature and the extraction of essential insights.
4. **GitHub Copilot:** Used for code generation. GitHub Copilot assisted in the development of simulation models and algorithms by generating code snippets and offering real-time coding suggestions, enhancing the efficiency of the coding process.

The integration of these AI tools significantly contributed to the efficiency and thoroughness of the research, ensuring a high standard of academic rigor and methodological precision.