Cancer Benefit Application Model with Stigma and Social Influence

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Motivating Story

Background:

- A patient with cancer faces a financial dilemma: apply for benefits or risk social judgment.
- Applying may reveal illness—activating stigma and perceived undeservingness.
- Patients weigh *monetary gain* versus *social cost*.

Question: *How do stigma, visibility, and social norms jointly determine benefit take-up?*

Welfare and Health-Related Stigma

- **Welfare stigma:** people may hesitate to claim benefits because they fear moral judgment or being seen as undeserving Moffatt and Noble 2015; Lapham and Martinson 2022.
- **Health-related stigma:** negative attitudes, social exclusion, or blame directed at individuals based on their illness status Heley, Vanderpool, and Vedham 2024; Stangl et al. 2019.
- **Social signaling:** individuals anticipate how others will judge them and adjust their behavior based on social image concerns Festré 2010; Friedrichsen, König, and Schmacker 2018.

Novel contribution:

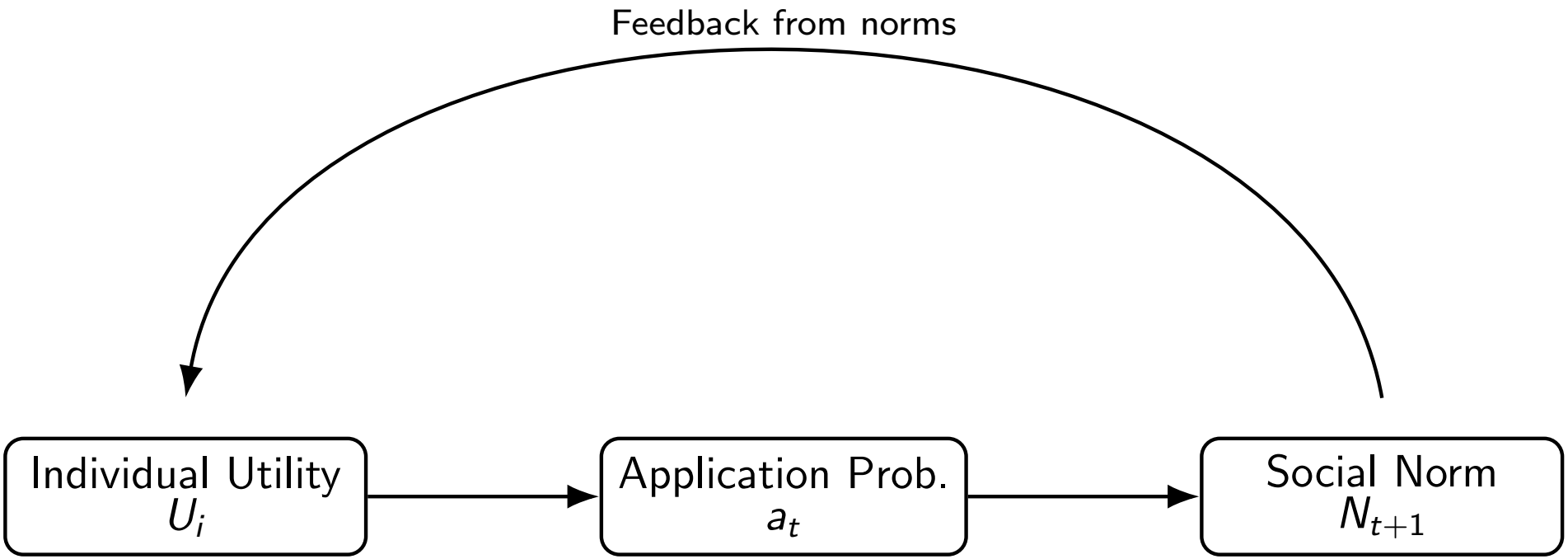
- Distinguishes *illness justification* (having cancer) from *able-bodied stigma* (appearing healthy while applying).
- Shows how visibility of illness alters the effective stigma cost, shaping collective take-up dynamics.

Experimental Framework

Behavioral foundations (experimental logic):

- **Visibility manipulation:** public vs. private claiming
  - "Claiming" = deciding whether to take the monetary benefit.
  - Public visibility tests whether people avoid claiming when others can see.
- **Justification manipulation:** visible illness vs. remission
  - Tests whether visible illness provides a social justification for claiming.
- **Outcome:** difference in take-up rates
  - Private take-up − Public take-up.
  - Larger gaps ⇒ stronger stigma or social-image cost.

Model Structure: Behavioral–Dynamical Pipeline



Model Overview

(1) Individual utility (apply):

$$U_i = q_i PV(B) - k_i - \sigma_{\text{stigma}} N_i + \eta_i$$

(2) Application probability:

$$a_t = \Phi\left(\frac{A - \sigma_{\text{stigma}} C(1 - N_t)^m}{\eta}\right)$$

(3) Norm update:

$$N_{t+1} = N_t + \alpha(a_t - N_t) + \delta G_t(1 - N_t)$$

Interpretation:

- The utility of not applying is normalized to 0.
- Follows motivation-based social norm theory.

Individual Utility: Variables and Ranges

$$U_i^{\text{apply}} = q_i PV(B) - k_i - \sigma_{\text{stigma}} N_i + \eta_i$$

$$U_i^{\text{not apply}} = 0$$

Symbol	Meaning	Range / Units	Origin
q_i	Eligibility probability	0–1	†
$PV(B)$	Present value of benefit	\$ or utility	†
k_i	Emotional/admin cost	0.1–0.6	*
σ_{stigma}	Stigma multiplier	0.3–1.0	*
N_i	Perceived social norm	0–1	†
η_i	Noise	Normal$(0, \eta)$	*

Application Probability: Structure and Parameters

Application probability at time t:

$$a_t = a(N_t) = \Phi\left(\frac{A - \sigma_{\text{stigma}}\, C\,(1 - N_t)^m}{\eta}\right)$$

Interpretation: Higher stigma (σ_{stigma}) or stronger social resistance $(1 - N_t)^m$ depresses take-up.

Symbol	Meaning	Range	Origin
A	Net attractiveness of claiming	0–1	†
σ_{stigma}	Stigma disutility multiplier	0.3–1.0	*
C	Claim burden constant	0.5–2.0	*
m	Stigma curvature	1–3	†
N_t	Social norm at time t	0–1	†
η	Noise scale	0.05–0.20	*
a_t	Take-up rate at time t	0–1	†

Social Norm Dynamics: Variables and Ranges

$$N_{t+1} = N_t + \alpha(a_t - N_t) + \delta G_t(1 - N_t)$$

As participation increases, individuals become more willing to apply, creating potential tipping dynamics similar to classical threshold models of collective behavior Granovetter 1978.

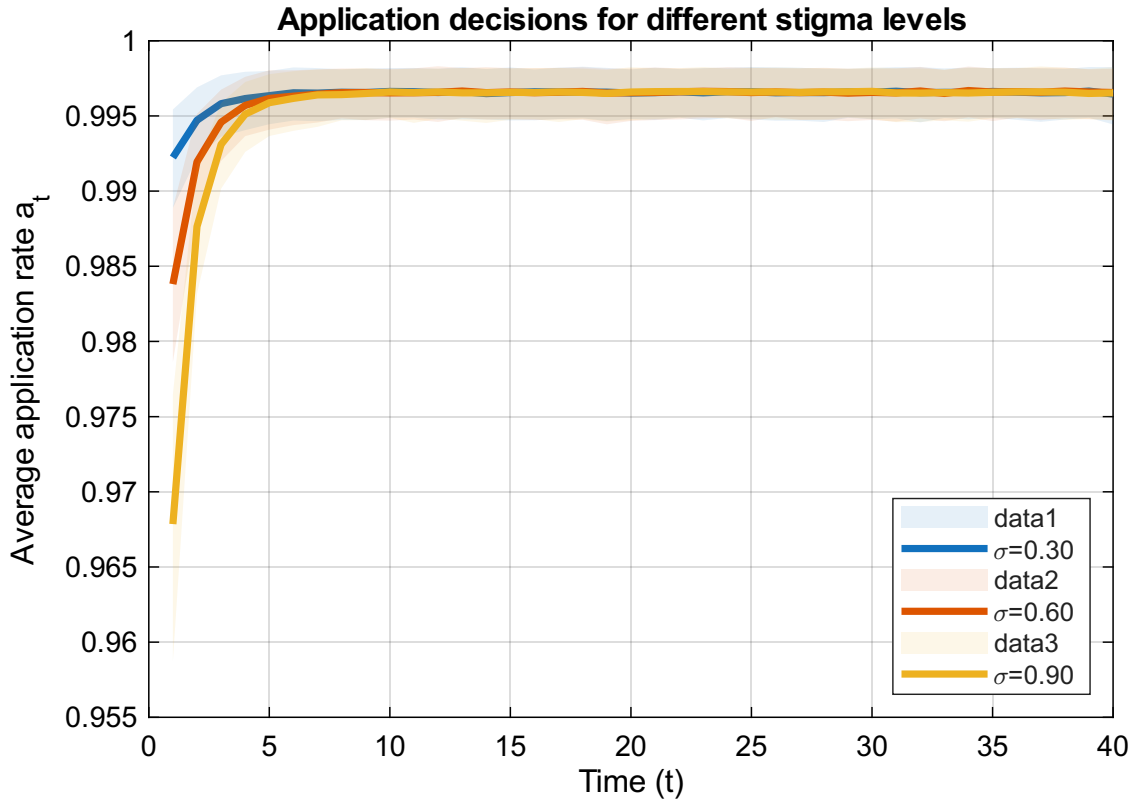
Symbol	**Meaning**	**Range**	**Origin**
N_t	Current social norm	0–1	†
a_t	Application rate	0–1	†
α	Norm adaptation rate	0.05–0.30	*
δ	Authority influence	0–0.20	*
G_t	External encouragement	0–1	†
N_{t+1}	Next-period social norm	0–1	†

* Ranges consistent with empirical social-influence and norm-updating studies.

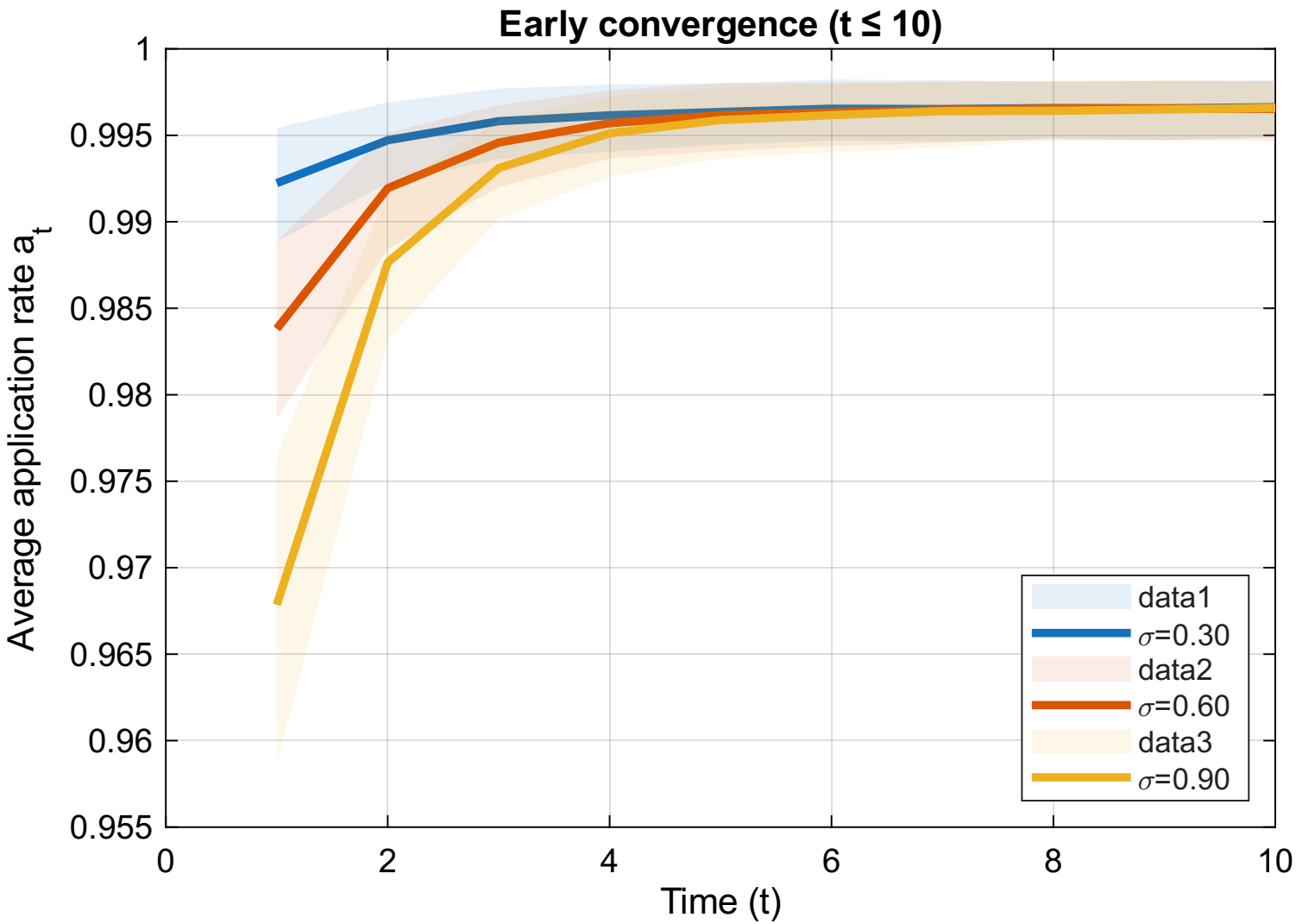
† Normalized or calibrated for the model's stability and interpretability.

Simulation Results: Individual Decisions

- $T = 40$, $\eta = 0.15$, $\alpha = 0.15$, $\delta = 0.05$, $G = 1$ and , $m = 3$.
- Patient gets encouragement, info, reassurance. Helps them apply even when norms are low.
- Stigma skyrockets when few apply $\rightarrow$ tipping points & traps.



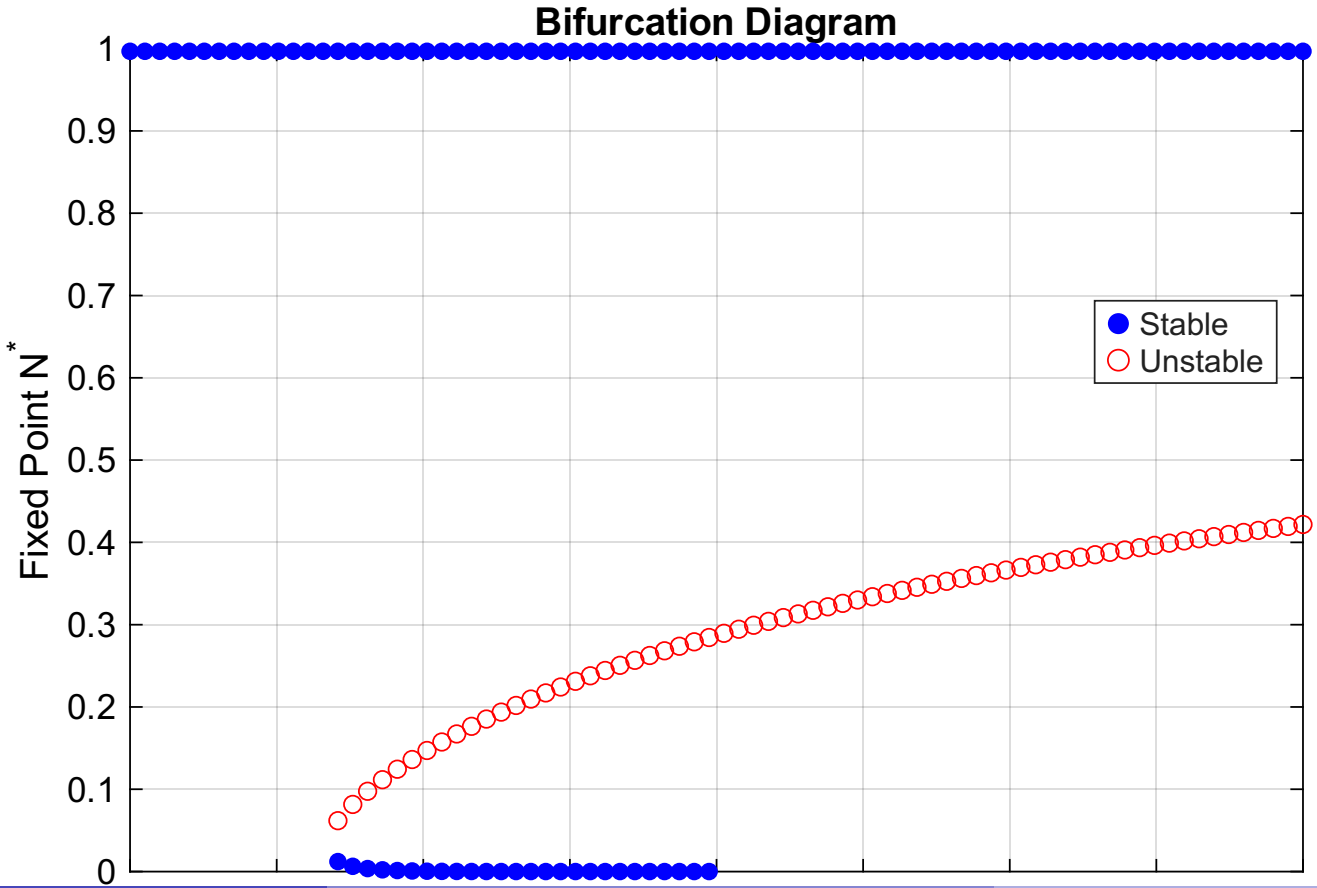
- $\sigma = 0.3$: high participation.
  $\sigma = 0.6$: moderate.
  $\sigma = 0.9$: low take-up.



Bifurcation Diagram: Social Equilibria vs Stigma

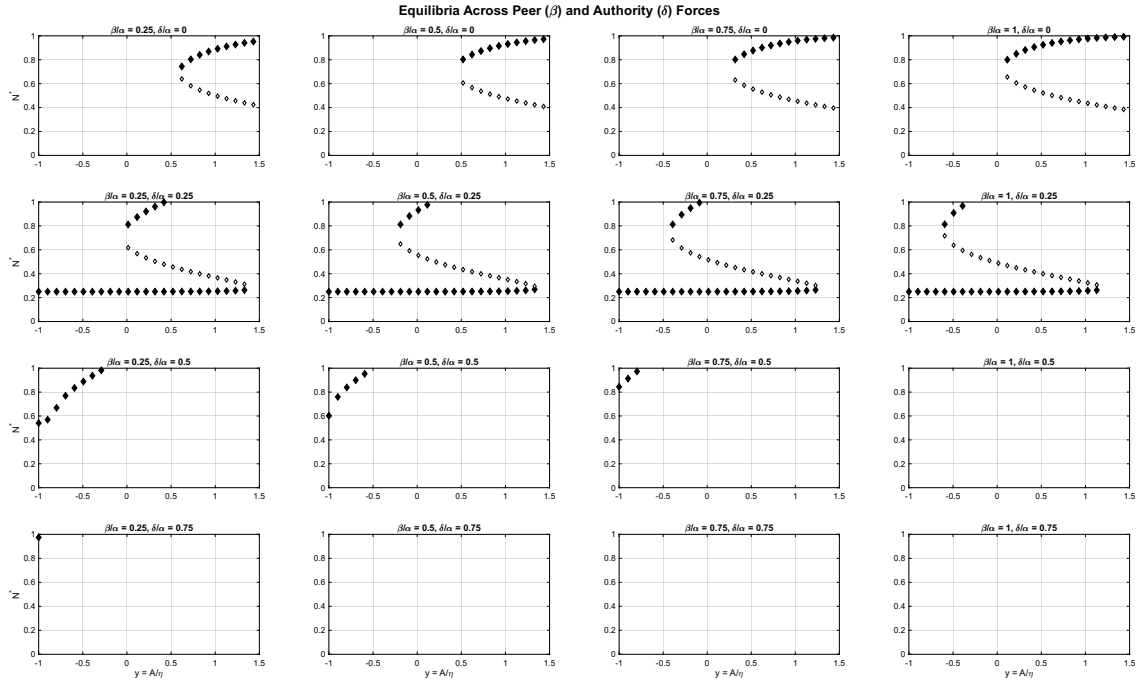
$$N^* = a(N^*)$$

- Saddle-node bifurcation: critical stigma threshold generates a low–take-up trap.

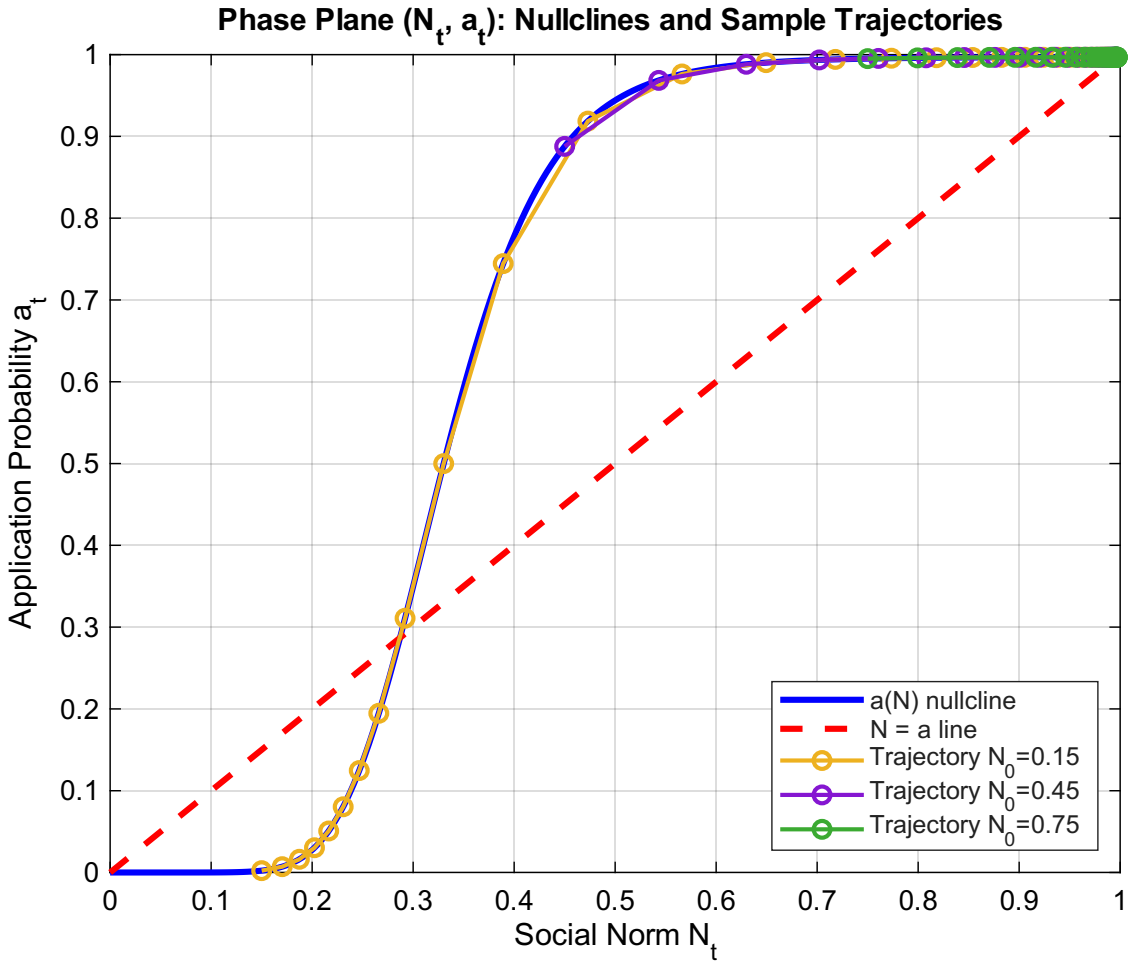


Peer and Authority Effects

- Peer influence (β): conformity and reinforcement.
- Authority influence (δ): institutional encouragement.

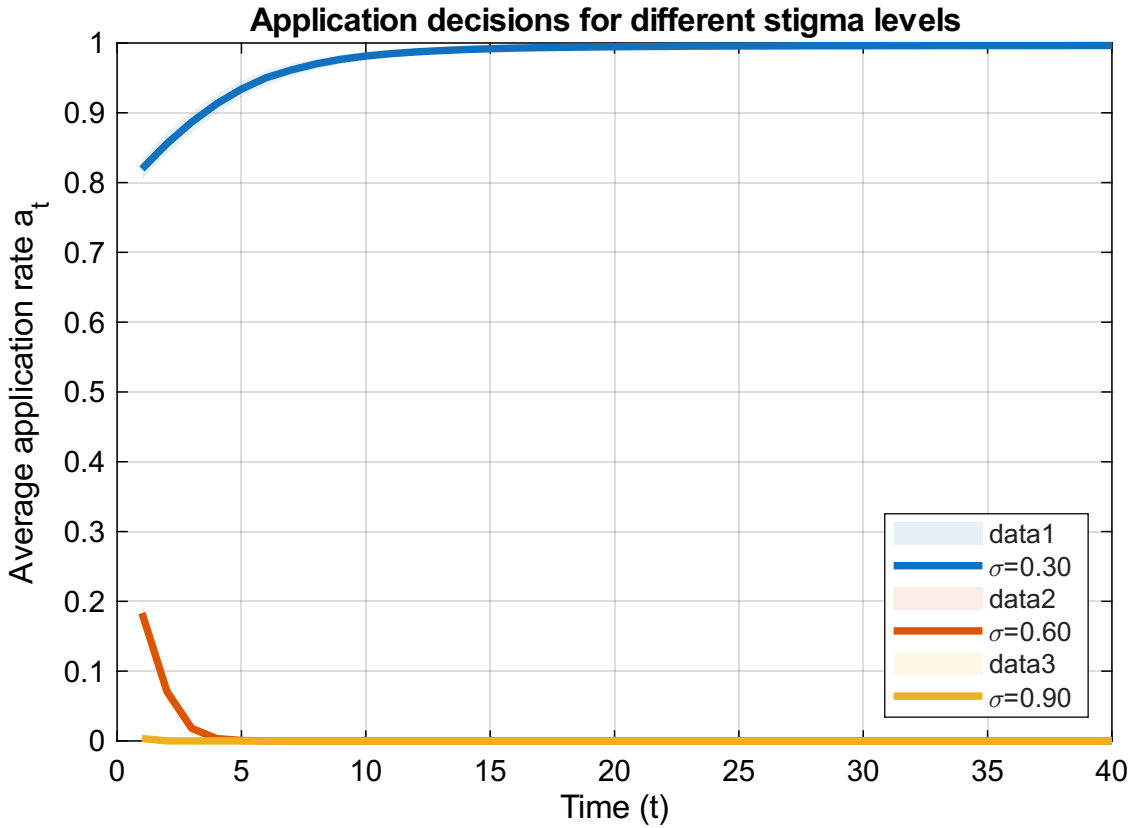


Peer and Authority Effects

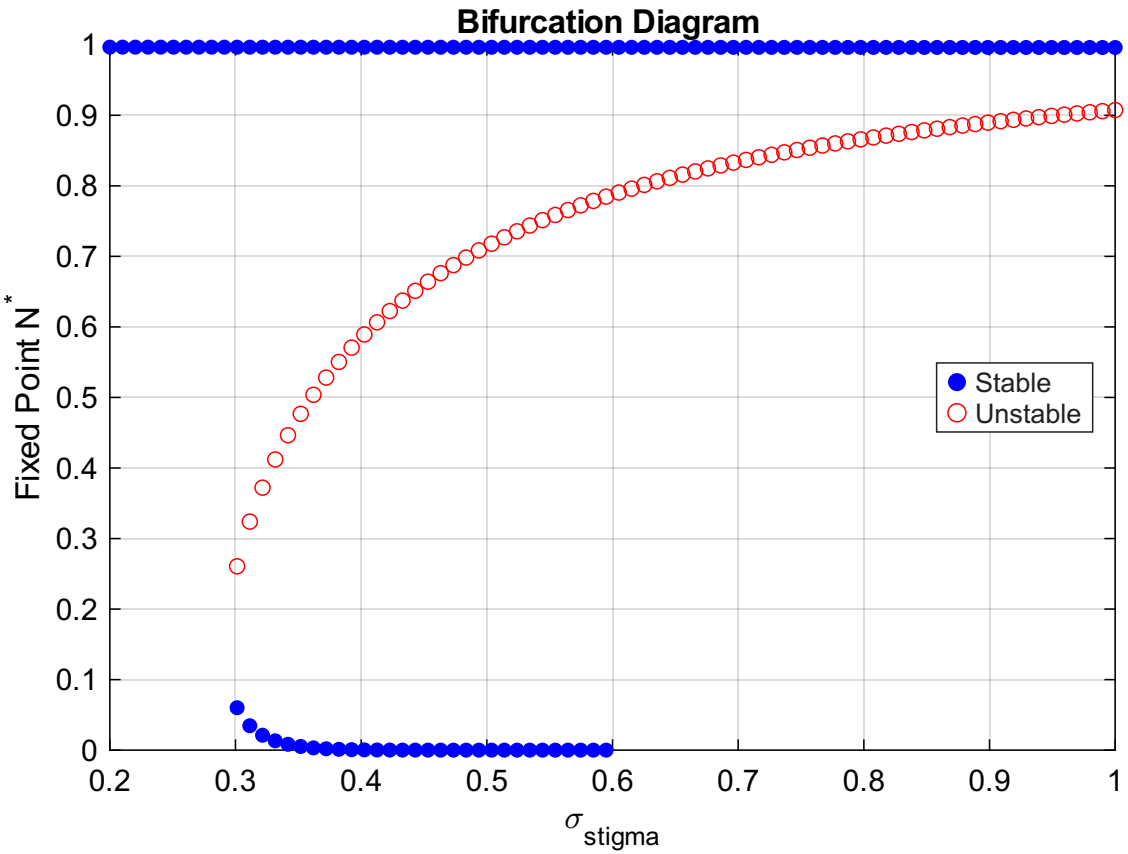


More Plots

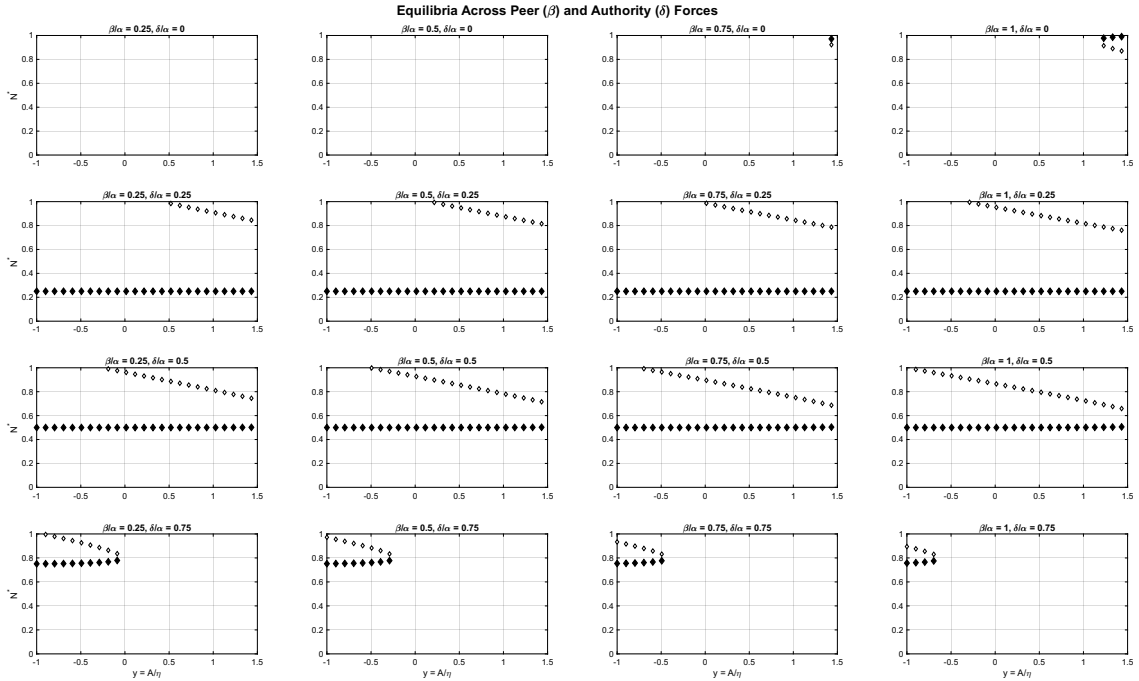
- $T = 40$, $\eta = 0.15$, $\alpha = 0.15$, $\delta = 0.05$, $G = 0$ and , $m = 1$
- Patient is alone; norms dominate.
- Stigma rises slowly, smoothly.



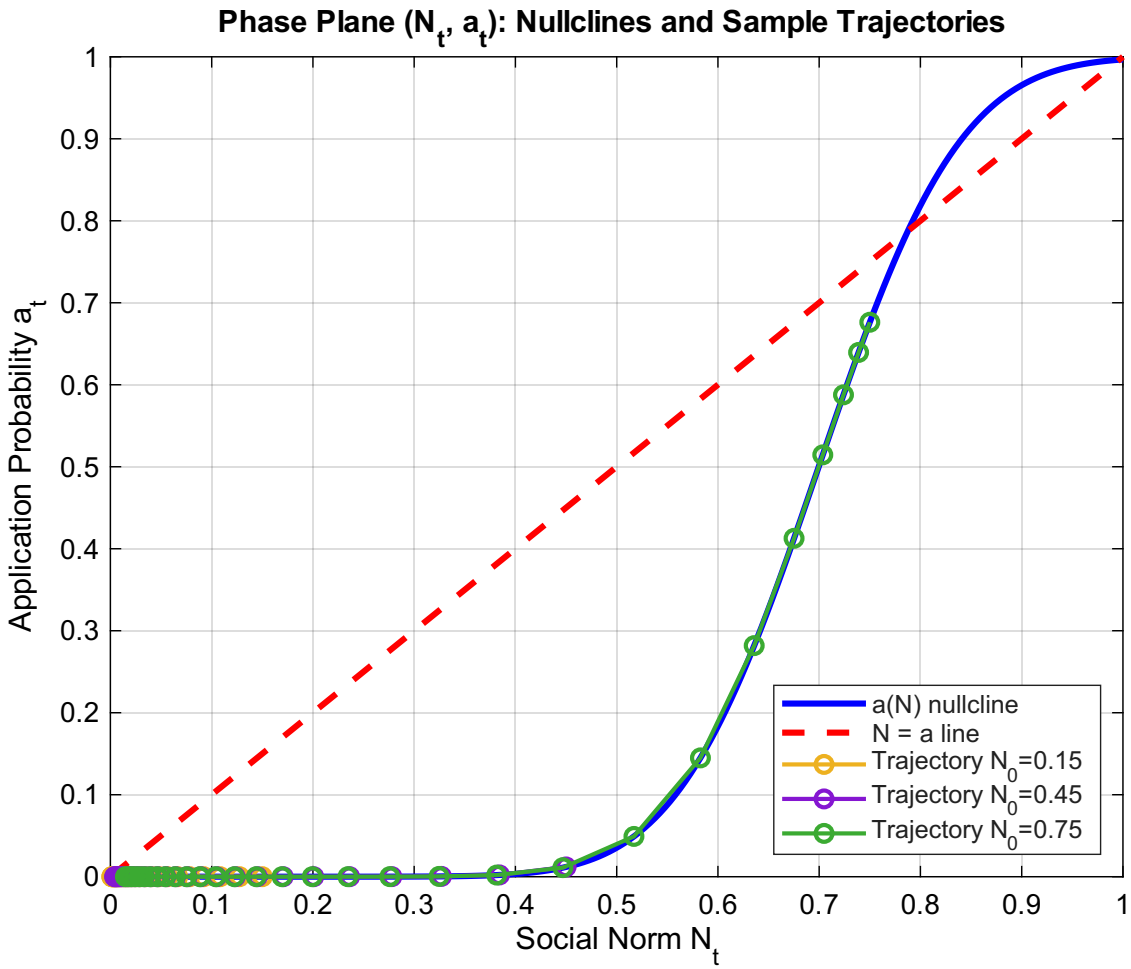
More Plots


Bifurcation Diagram
Fixed Point N*
σstigma
Stable
Unstable
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

More Plots


Equilibria Across Peer (β) and Authority (δ) Forces
βlα = 0.25, δlα = 0
βlα = 0.5, δlα = 0
βlα = 0.75, δlα = 0
βlα = 1, δlα = 0
βlα = 0.25, δlα = 0.25
βlα = 0.5, δlα = 0.25
βlα = 0.75, δlα = 0.25
βlα = 1, δlα = 0.25
βlα = 0.25, δlα = 0.5
βlα = 0.5, δlα = 0.5
βlα = 0.75, δlα = 0.5
βlα = 1, δlα = 0.5
βlα = 0.25, δlα = 0.75
βlα = 0.5, δlα = 0.75
βlα = 0.75, δlα = 0.75
βlα = 1, δlα = 0.75
N*
y = Al/η

More Plots


Phase Plane (N_t, a_t): Nullclines and Sample Trajectories
Application Probability a_t
Social Norm N_t
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
a(N) nullcline
N = a line
Trajectory N_0=0.15
Trajectory N_0=0.45
Trajectory N_0=0.75

Putting the Pieces Together

- Stigma makes people less likely to apply for benefits.
- The model shows how this individual hesitation spreads through the group.
- When fewer people apply, norms drop, which makes applying feel even harder.

Big idea: Lowering stigma or giving clear encouragement can push the whole group toward higher participation.

Different Experiences of Stigma

- Not everyone experiences stigma the same way.
- Factors like race, gender, and income can change how people are judged.
- Messages in media and policy can make these feelings stronger or weaker.

Why it matters: Support systems and positive messaging can help reduce stigma for the people who feel it most.

Conclusion

- Stigma can push a whole community into a low-participation pattern.
- Once participation drops, it becomes harder to recover without help.
- Encouragement from trusted sources can raise confidence and increase take-up.
- Small changes in messages or visibility can shift the system toward better outcomes.

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