A General Theory of Oligarchic and Egalitarian Attractors in Socioeconomic Systems

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1. A General Theory of Oligarchic and Egalitarian Attractors in Socioeconomic Systems
    1. Abstract
    2. Part I: Core Dynamics
    3. Part II: Reinforcement Dynamics in Resource-Contingent Systems
    4. Part III: Power Asymmetry and Empathy Modulation
    5. Part IV: Coupled Dynamics
    6. Part V: Emergent Stratification
    7. Part VI: Scaling and Conclusion
    8. References

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Formal, Mathematical, Publication-Oriented

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This is the rigorous version with full mathematical formulation. For a plain-language explanation, see the narrative version.

Abstract

This paper presents a formal systems-level theory demonstrating that oligarchic concentration is a conditional attractor of socioeconomic systems characterized by persistent accumulation, asymmetrical access, and weak countervailing mechanisms. By integrating mathematical modeling, behavioral reinforcement theory, and anthropological evidence, we show that inequality is not an inevitable outcome of human social organization but emerges under specific structural conditions.

We extend standard wealth dynamics models by incorporating redistribution strength (σ), dominance suppression (ω), hierarchical amplification, and behavioral propagation. We further incorporate anthropological data from egalitarian societies, particularly the San, as empirical counterexamples demonstrating the long-term stability of non-oligarchic systems (Boehm, 1999; Woodburn, 1982).

The resulting framework defines a phase-space model of socioeconomic systems with at least two stable attractors: oligarchic and egalitarian. The analysis concludes that preventing oligarchy requires structural interruption of accumulation persistence and dominance formation, rather than reliance on individual behavior or moral preference.

Part I: Core Dynamics

1. Introduction

The persistence of inequality in modern societies is often attributed to individual differences, institutional imperfections, or historical contingencies. However, such explanations fail to account for the systematic recurrence of wealth concentration across diverse contexts.

This paper advances the hypothesis that oligarchic outcomes are not incidental but arise from structural features inherent to currency-based and accumulation-permissive systems (Piketty, 2014).

At the same time, anthropological evidence demonstrates that egalitarian systems have existed and persisted under certain conditions (Woodburn, 1982; Boehm, 1999). This raises a critical question:

> Are inequality and hierarchy inherent to human nature, or are they emergent properties of specific system architectures?

2. State Variables and System Dynamics

Let:

- $W_i(t)$ — wealth of agent i
- $D_i(t)$ — dominance or influence
- $E_i(t)$ — empathy or prosocial weighting
- $P_i(t)$ — access to opportunity

2.1 Wealth Dynamics

$$\frac{dW_i}{dt} = \alpha W_i^{\beta} - \gamma W_i - \sigma S_i(W)$$

Where:

- $\beta > 1$ — superlinear reinforcement
- σ — redistribution strength

2.2 Opportunity Access

$$P_i \propto W_i^{\delta}$$

Higher wealth increases future opportunity (Stiglitz, 2012).

2.3 Dominance Formation

$$\frac{dD_i}{dt} = f(W_i, H_i) - \omega C(D_i)$$

Where ω represents suppression of dominance (Boehm, 1999).

2.4 Behavioral Reinforcement

$$P(\text{adopt behavior } B_j) \propto \text{success}(B_j)$$

Behavioral distributions evolve toward rewarded strategies (Skinner, 1953).

2.5 Empathy Feedback

$$E_i = \frac{E_0}{1 + k \cdot \ln(W_i + 1)}$$

Power correlates with reduced empathic response (Keltner et al., 2003).

3. Dual Attractor Model

3.1 Oligarchic Attractor

Conditions:

- $\sigma \approx 0$ — weak redistribution
- $\omega \approx 0$ — weak dominance suppression
- $\beta > 1$ — superlinear reinforcement

Result: wealth concentration, dominance consolidation, reduced redistribution.

3.2 Egalitarian Attractor

Conditions:

- σ high — strong redistribution
- ω high — strong dominance suppression
- Accumulation constrained

Result: stable distribution, limited dominance, high participation.

4. Anthropological Evidence

Egalitarian societies such as the San exhibit:

- Active suppression of dominance
- Generalized sharing
- Minimal accumulation

These mechanisms align directly with high σ and high ω (Woodburn, 1982; Boehm, 1999).

5. Stability Theorem (Informal Statement)

> Oligarchic concentration emerges when accumulation persists and dominance is not effectively suppressed.
>
> A system avoids oligarchic convergence if:
>
> - σ remains above threshold
> - ω remains above threshold
> - Coordination remains distributed
> - Information remains transparent
> - Failure modes are actively corrected

Part II: Reinforcement Dynamics in Resource-Contingent Systems

6. Framework

We consider a population of agents making decisions in an environment where access to essential resources depends on economic success, and economic success depends on behavior.

6.1 Reinforcement Mechanism

Behavior evolves according to:

$$P(a_i^{t+1}) = \frac{P(a_i^t) \cdot \exp(\lambda \cdot U_i(t))}{Z}$$

Where:

- a_i^t — action at time t
- λ — sensitivity to reinforcement
- $U_i(t)$ — utility

6.2 Survival-Weighted Utility

$$U_i(t) = u(\text{consumption}_i(t)) + \phi \cdot \log P(\text{survival}_i(t))$$

Where survival probability depends on resource access:

$$P(\text{survival}_i) = h(\text{income}_i)$$

7. Reinforcement Bias and Convergence

If:

$$\frac{d\,P(\text{survival})}{d\,\text{income}} > 0$$

Then actions increasing income are disproportionately reinforced.

Over time, the distribution of strategies converges toward:

$$a^* = \arg\max E[U_i]$$

This implies convergence toward economically productive behaviors and suppression of non-aligned strategies.

8. Structural Stabilization

This creates a macro-level feedback:

$$\text{Economic structure} \rightarrow \text{Reinforced behavior} \rightarrow \text{Structural persistence}$$

Additional effects under survival pressure:

- **Behavioral narrowing:** risk-taking declines, experimentation decreases
- **Cognitive load:** scarcity increases cognitive burden, reduces long-term planning capacity (consistent with research by Mullainathan)

Part III: Power Asymmetry and Empathy Modulation

9. Conceptual Model

Let:

- P_i — power (control over resources or outcomes affecting others)
- E_i — empathic response

Empirical studies suggest:

$$\frac{dE_i}{dP_i} \leq 0$$

10. Mechanisms

- Reduced perspective-taking
- Decreased sensitivity to others' outcomes
- Increased goal-directed cognition

11. Decision-Making Implications

If empathy decreases with power, decisions become less sensitive to external impacts and more internally optimized. In systems with concentrated power, aggregate decisions reflect reduced empathic weighting.

Part IV: Coupled Dynamics

12. The Feedback Loop

$$W \to P \to E \to D \to W$$

Where:

1. Wealth increases power
2. Power influences decision-making (via empathy modulation)
3. Decisions affect resource distribution
4. Distribution reinforces wealth patterns

13. Stability

The coupled system may reach stable inequality states and path-dependent equilibria. Persistence arises from multiple reinforcing subsystems operating simultaneously.

> Coupled dynamics can stabilize structural inequality beyond simple economic mechanisms.

Part V: Emergent Stratification

14. Access Dynamics

$$A_i = h(W_i)$$

If:

$$\frac{dh}{dW} > 0$$

Then access inequality increases with wealth inequality.

15. Lock-In and Compression

Low-wealth agents face:

- Reduced mobility
- Limited opportunity access

Intermediate wealth groups may shrink over time and bifurcate, producing persistent stratification structures with durable access asymmetry.

Part VI: Scaling and Conclusion

16. The Scaling Problem

Egalitarian systems historically operate at smaller scales (Kelly, 2013). As N increases, coordination complexity grows as N^2 and information fragmentation increases. The central challenge is scaling anti-accumulation and anti-dominance mechanisms.

17. Structural Resolution

- **Polycentric governance** (Ostrom, 1990)
- **Distributed coordination (NWW)** — reduces information asymmetry and coordination cost

18. Failure Dynamics

Systems drift toward oligarchy when:

- Accumulation pathways emerge
- Coordination fails
- Governance centralizes

19. Conclusion

> Oligarchy is not inevitable. It is the predictable result of specific system conditions. Alternative stable regimes exist and are empirically grounded.

Egalitarian systems:

- Are empirically real
- Can be scaled with proper architecture
- Require active maintenance

Inequality is structurally produced. Redistribution alone is insufficient. System design determines outcomes.

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