StateDynamics: Six-Factor Forecasting Engine

Working Paper v0.1

Hongyi Gao

Draft: April 26, 2025

1. Introduction

Traditional instability models use single-layer cycles or resource factors. **We propose** the first *six-factor* coupled framework:

- Multi-Layer Life-Cycle
- Tension Function W,C,S + Elite Payoff
- Narrative Bandwidth $B(t)$
- External Shock Convolution $\mathcal{F}(t)$
- Capital-Skill Velocity Gap
- Cross-Jurisdiction Friction μ_k

This in-progress draft shows core equations and roadmap.

2. Comparison to Existing Models

Feature	**Prior Art**	**This Work**
Lifecycle	Single cycle (Turchin)	Multi-layer convolution
Tension	Wealth only	W+C+S, adj. by E
Narrative	Qualitative soft power	$S_{\text{eff}} = S_{local} + B(t)S_{import}$
Shocks	One-off dummy	$\sum A_k e^{-_k(t-t_k)}$
Capital	Absent	$\dot{M}$ – Skill
Friction	Qualitative risk	Explicit μ_k param.

3. Core Equations (Placeholders)

$$Life(t) = \sum_L w_L \, Stage_L(t - \tau_L)$$

$$T = \alpha\,\Delta W + \beta\,\Delta C + \gamma\,\Delta S, \quad T_{\text{adj}} = T\,(1 - \eta E)$$

$$S_{\text{eff}} = S_{\text{local}} + B(t)\,S_{\text{import}}$$

$$\mathcal{F}(t) = \sum_k A_k e^{-\lambda_k(t-t_k)}$$

$$\Pi_{\text{ind}} = \sigma\,\text{Skill} - \mu_k + \rho\dot{M} - \psi\,\text{Tax}$$

$$Collapse if R_{\text{eff}} < R_{\min} \ \vee \ S_{\text{eff}} < S_{\min}$$

4. Roadmap

1. **Toy Dataset**: US/FIN/ETH (2000–2020)
2. **Prototype Code**: core.py $\rightarrow$ risk_score()
3. **Demo Back-Test**: Jupyter plots
4. **arXiv v0.3**: Upload 4-page draft
5. **Expand Data**: add WB, Polity, Proxy–$B(t)$
6. **Publish & Present**: NetSci/SFI 2025 April 26th