Dynamic Simulation of the Thai-Boosty ARC–USDC Stimulus

From DSGE-Inspired Theory to a Negotiation-to-Settlement App

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November 9, 2025

Objective & Thesis

- **Objective:** Evaluate a geo-fenced digital stimulus (*Thai-Boosty*) on ARC with USDC settlement.
- **Thesis:** Tiered leakage controls + geo-fenced circular spending $\Rightarrow$ higher local multipliers, mild inflation, significant VAT recapture, and increased venture formation.
- Bridge **theory** (NK + multipliers + Markov propagation) $\leftrightarrow$ **application** (negotiation engine, tx stream, real-time dashboard).

Model Overview

Blocks

1. **Provincial multipliers with tiered leakage**: $k_i = \dfrac{1}{1 - \lambda_i(1 - L_i)}$.
2. **NK backbone** (output gap x_t feeds inflation π_t): $\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$.
3. **Entrepreneurial emergence**: $P_{v,i} = \alpha_0 + \alpha_1 D_i + \alpha_2 \sigma_i^2(\pi)$, with $D_i = M_i / P_i$.
4. **VAT feedback**: $T_i = \tau\, G_i \dfrac{1 - L_i}{1 - \lambda_i(1 - L_i)}$.
5. **Markov spending propagation** across tiers; VAT/LEAK are absorbing.

Multipliers & Calibration

Tier leakages: $L_1 = 0.0,\ L_2 = 0.5,\ L_3 = 0.7$, with $\lambda = 0.8$.

$$k_1 = \frac{1}{1-0.8} = 5.0, \quad k_2 = \frac{1}{1-0.8\cdot 0.5} = 2.5, \quad k_3 = \frac{1}{1-0.8\cdot 0.3} \approx 1.538.$$

Mix: $(\omega_1, \omega_2, \omega_3) = (0.3, 0.5, 0.2) \Rightarrow k \approx 3.16$.

$$\Delta M \approx k \cdot G \approx 3.16 \times 300\text{B} \approx 948\text{B THB}.$$

Implication: Tiered circularity $\Rightarrow \uparrow$ effective money creation per baht injected.

VAT Recapture

- VAT rate $\tau = 7\%$.
- Closed form (constant λ, L_i):

$$T_i = \tau\, G_i\, \frac{1 - L_i}{1 - \lambda(1 - L_i)}, \quad T = \sum_i T_i.$$

- Under the calibration: $T \approx 49.6$B THB $\Rightarrow \sim 16.5\%$ within-year fiscal feedback.
- Live system maps this via **Eligible spend** $\rightarrow$ **VAT (est.) KPI**.

NK Backbone & Inflation

- Resource constraint with controlled leakage:

$$Y_t = C_t + I_t + G_t(1 - \bar{L}_t).$$

- Higher $1 - \bar{L}_t$ (via tiering) $\Rightarrow$ larger demand impulse, small output gap $x_t \sim 2\%$.
- NK Phillips curve slope $\kappa \Rightarrow \Delta\pi$ on the order of 0.2–0.3 pp (mild).
- Reserve-backed funding + import leakage control $\Rightarrow$ contained price impact.

Entrepreneurial Emergence

- Liquidity density $D_i = M_i/P_i$ drives venture probability:

$$P_{v,i} = \alpha_0 + \alpha_1 D_i + \alpha_2 \sigma_i^2(\pi).$$

- Example: from baseline $P_{v,0} = 0.02$ to $P_{v,i} \approx 0.11$ when D_i triples ($\alpha_1 \approx 0.03$).
- Expected ventures: $V_i = P_{v,i} N_i^{\text{active}}$.
- In app: **Active SMEs** KPI as operational proxy; can add D_i-based hazard for live estimation.

Delivered System: Negotiation → Settlement → Monitor

- **Negotiation engine (FastAPI)**: Buyer/Seller/Judge (or heuristic) → `negotiation_log`, final `deals` with `commitment_json`.
- **Tx Stream**: three-wallet enactment; tags: Mint / Eligible / Leak; tier transitions $T_a \to T_b$.
- **APIs**:
  - `GET /api/mon/stream`, `/deals`, `/deals/{id}/log`
  - `POST /api/mon/enact` (returns tx count, transferred, deal id, elapsed)
- **DB (SQLite) + migrations**: `negotiation_log`, `deals`, `transactions`.

Real-Time Dashboard & KPIs (React)

- **Recent Transactions**: time, txid, from→to, amount, tags, linked deal id.
- **Deals**: status, mode, buyer/seller, notional, created; drill-down to **negotiation log** + **final commitment**.
- **KPIs**:
  - **M1 observed** ⇒ multiplier path
  - **Leakage** ⇒ effective L
  - **VAT (est.)** ⇒ fiscal feedback
  - **Active SMEs** ⇒ venture proxy
- **Ops guard**: bounded updater (e.g., `--runs=10`) to prevent indefinite deal upserts.

Learnings & Next Steps

Learnings

- Tiered circularity is observable in streams; VAT/LEAK absorption can be inferred.
- Negotiation-to-commitment pipeline is robust; logs & deals render cleanly after schema alignment.

Next Steps

- Plug exact paper formulas for live $k, \Delta M, T$; add Markov estimator ($\boldsymbol{Q}, \boldsymbol{R}, \boldsymbol{N}$).
- Compute liquidity density D_i and estimate $P_{v,i}$ online; refine **Active SMEs** mapping.
- Scenario switcher (Baseline/Open vs Tiered vs Optimized) with real-time deltas in KPIs.