An Agent-Based Model of Stablecoin Adoption: A Study of JPY vs. JPYC

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Introduction

JPYC is Japan's first officially regulated stablecoin pegged 1:1 to the yen currency. By offering near-instantaneous settlement and significantly lower transaction fees compared to traditional banks, stablecoins present a compelling alternative to conventional bank deposits (JPY). Taking such an assumption as a foundation, an agent-based model was built to simulate the competition between traditional JPY held in commercial banks and the JPYC stablecoin within a micro-economy populated by heterogeneous agents.

The simulation is populated by two primary types of agents: Households and Banks. The core of the model is the set of rules that govern how households earn, transact, and manage their money between traditional JPY bank deposits and the JPYC stablecoin. Households dynamically update their perception of JPYC's utility based on the costs and benefits they experience during financial transactions. Furthermore, the simulation includes a mechanism for income generation, ensuring a continuous flow of new capital that agents must choose how to allocate. This approach allows us to observe how adoption patterns emerge from the bottom up, driven by the interactions of individual agents with each other and with the financial products available to them.

2. Model Structure and Assumptions

The model is designed to represent a simplified financial ecosystem between 2 types of agents of households and banks. Their transactions are governed by sets of rules following real life economic growth patterns and social phenomenons. In this model we assume that commercial banks act independently, as in they don’t interact with other banks passively to major deposit outlaws or other inconsistencies. Plus, commercial banks act

2.1. Agents

The simulation is populated by two distinct types of agents: **Households** and **Banks**.

- **Households (`turtles`):** These are the primary decision-makers. Each household agent possesses a set of properties that defines its financial state and behavioral profile:
    - **Financials:** `jpy-in-bank` (traditional bank deposits) and `jpyc-balance` (stablecoin holdings).
    - **Bank Relationship:** Each household is assigned a specific `my-bank`, creating a direct link between a customer's actions and an institution's health.
    - **Behavioral Profile:**
        - `risk-profile`: Agents are divided into "high-risk" (early adopters, colored red) and "low-risk" (conservative, colored green).
        - `adoption-propensity`: A numerical value derived from the risk profile that quantifies an agent's innate willingness to try new technologies.
        - `perceived-jpyc-utility`: The agent's core behavioral driver. This is a learned value that starts at a baseline and is dynamically updated with every transaction, representing the agent's evolving preference for JPYC.
- **Banks (`turtles`):** These agents represent commercial financial institutions. Their primary function is to hold JPY deposits for households. Their key properties are:
    - `reserves`: The total amount of JPY deposits held by the bank from its specific customers.
    - `initial-reserves`: A snapshot of the reserves at the start of the simulation, used as a benchmark for financial health.
    - `size`: A visual representation of the bank's health, directly proportional to the ratio of its current reserves to its initial reserves.

2.2. The Environment and Core Processes

In each tick, one day is represented and a series of procedures are executed.

1. **Economic Growth (`work-and-make-money`):** The model simulates a growing economy. A percentage of households (determined by the `unemployment-rate` slider) receive a small increase to their `jpy-in-bank` balance, modeling salary payments. This ensures a continuous injection of new JPY into the banking system.
2. **Transactional Learning (`perform-transactions`):** This is the model's core learning mechanism. A set number of households are chosen to perform a small

transaction. They choose their payment method (JPY or JPYC) based on their available funds and their current `perceived-jpyc-utility`. The experience of paying either high bank fees or low stablecoin fees updates this utility value, creating a powerful feedback loop.

3. **Portfolio Re-evaluation (`evaluate-portfolio`):** A small subset of households re-evaluates their financial strategy. They decide whether to move funds between their bank account and their JPYC wallet. This decision is probabilistic, based on a weighted consideration of their learned `perceived-jpyc-utility`, the global `bank-attractiveness`, social influence from their network, and their fear of their specific bank collapsing.

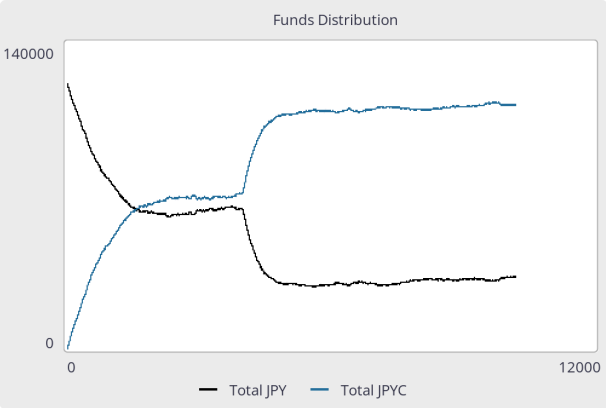
2.3. Key Assumptions

To maintain focus and computational feasibility, the model operates on a set of key assumptions:

- **Rationality:** Agents are not perfect optimizers. Their decisions are probabilistic and influenced by a combination of personal experience, social pressure, and innate biases (`adoption-propensity`).
- **Transaction tendencies:** The primary driver of stablecoin adoption is assumed to be its utility in transactions (lower fees). Other potential benefits (e.g., DeFi integration, programmability) are abstracted into the baseline utility score.
- **Static Bank Strategy:** Commercial banks are passive agents in this model. They do not react to deposit outflows by raising interest rates or lowering fees. Their `bank-attractiveness` is a fixed global parameter.
- **Income in Fiat:** It is assumed that all new income (salaries) is paid in JPY into traditional bank accounts, reflecting the current state of most economies.
- **Simplified Social Network:** The social network is random. It does not model real-world clustering of communities or demographics. Social influence is simplified to a peer-pressure mechanic.

3. Simulation Results and Analysis

Looking at the model graph that shows the `total-JPYC-balance` and `total-JPY-in-banks` we can see that there are **4 phases** of emergent phenomenon in any circumstances.



Phase 1: Steady rise of JPYC balance

The total JPYC balance (blue) starts rising steadily, and JPY in banks (black) begins a slow, steady decline.This phase is driven almost exclusively by the "high-risk" (red) agents. Their high `adoption-propensity` makes them willing to try JPYC. As they conduct transactions, they experience the low fees, which increases their `perceived-jpyc-utility`. This positive feedback loop encourages them to move more of their portfolio from JPY to JPYC.

Phase 2: The Temporary equilibrium

The system finds a temporary equilibrium as the growth of JPYC slows down significantly. The early adopters have moved a comfortable portion of their funds. The "low-risk" (green) agents are still not convinced. For them, the `bank-attractiveness` is still high, and the social pressure from their network isn't strong enough yet to make them switch.

Phase 3: The Tipping Point & Bank Run

A sudden drop in bank deposits and a corresponding explosion in JPYC holdings. The slow drain of funds during the first two phases has caused the banks to see its reserves fall below the `bank-confidence-threshold`. The moment this happens, all of that bank's customers panic. The `panic-modifier` multiplies their desire to switch by the `fear-factor`, making JPYC seem infinitely more attractive than their failing bank. They pull all their funds out in a very short span of time, causing the sharp vertical shift

Phase 4:

The system stabilizes, but at a completely different level. JPYC is now dominant, and bank deposits are much lower. The slow, steady adoption of JPYC resumes. The bank

run has fundamentally changed the market. A huge amount of capital has been forcibly moved to JPYC. So many agents now hold JPYC that the social pressure on the remaining "low-risk" agents is immense. Their friends are all using it, so it feels much safer. With more JPYC circulating, transactions using it become more common, speeding up the learning process for everyone who was left.

4. Policy Insights

For Financial Regulators: The model's primary policy insight is that systemic risk can emerge from localized vulnerabilities. Monitoring aggregate bank deposit levels is insufficient. Regulators should develop tools to assess the demographic and behavioral risk profiles of individual institutions' customer bases. A bank whose clients are predominantly young or tech-savvy early adopters may be at a higher risk of disintermediation than an institution serving a more conservative population, even if their balance sheets are identical. Appealing to e-commerce is a more urgent adoption than ever.

For Commercial Banks: The simulation serves as a clear warning against complacency and reliance on customer inertia. High transaction fees are a significant vulnerability. To remain competitive in the face of low-cost stablecoin alternatives, banks must reduce friction in their core payment services. Solely relying on established trust is not a viable long-term strategy when a competitor offers demonstrably better utility in everyday transactions.

For Stablecoin Issuers: The model underscores the paramount importance of user experience and network effects. The path to mainstream adoption lies in creating a product that is not just theoretically better, but experientially superior in frequent, low-value transactions. Building a strong initial user base, even if small, is crucial, as their positive experiences are the engine of the social learning and peer pressure that drive wider adoption.