GenerationalWealthPolicySim: A Multi-Generation Wealth Simulation Tool

EKO

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Abstract

This report presents *GenerationalWealthPolicySim*, a Python-based toolkit for simulating wealth dynamics across multiple generations under varying economic policies. Our model incorporates:

- **Life-cycle income & consumption** (youth, working years, retirement).
- **Shocks** (with adjustable frequency and impact).
- **Inflation** and **investment returns** that depend on wealth level.
- **Forced saving rates**, **Universal Basic Capital (UBC)**, and **inheritance guarantees**.
- A simple **random search "optimization"** to find policy parameter sets that maximize final wealth.
- A **Tkinter GUI** to adjust parameters and visualize results.

We demonstrate how different settings (inflation, shock probability, forced saving, etc.) can drastically alter multi-generation wealth outcomes. This tool aims to illustrate the interplay of policy levers in a finite, shock-prone economy.

1 Introduction

Compound interest and multi-generation wealth accumulation are often misunderstood as straightforward exponential growth processes. In reality, shocks, taxes, finite resources, life-cycle phases, and policy constraints lead to diverse and often less optimistic outcomes.

GenerationalWealthPolicySim addresses these concerns by:

1. Simulating three generations (each living 85 years).
2. Tracking income, consumption, and saving each year.
3. Imposing forced saving and policy constraints (UBC, inheritance minimum).
4. Adding random shocks (probabilistic income or return losses).
5. Adjusting inflation, so nominal returns translate into real gains or losses.
6. Optionally searching for policy settings that maximize final generation wealth.

2 Methodology

2.1 Life-Cycle Model

Each generation lives 85 years. We segment:

- **Youth (0–21):** No income, fixed baseline consumption.

- **Working (22–64):** Income drawn from a normal distribution (mean $\sim 35k$). Shocks can reduce income by a fraction.
- **Retirement (65–85):** Fixed pension, higher consumption.

At *death*, remaining assets are divided among children (2 by default), taxed, then *guaranteed* up to a minimum threshold.

2.2 Economic Parameters

- **Inflation (π):** We subtract π from nominal returns to get real returns.
- **Shock Probability / Impact:** E.g. a 15% chance each year of losing 30% of that year's income or returns.
- **Forced Saving Rate (s):** Reduces the fraction of income spent, raising net savings.
- **Universal Basic Capital (UBC):** A lump sum at age 21.
- **Inheritance Guarantee:** If post-tax inheritance is below this, it's topped up.

2.3 Wealth and Taxes

- **Income Tax:** A fixed rate (e.g. 30%).
- **Wealth Tax:** Above a threshold (e.g. £300k), assets incur a small annual rate.
- **Progressive Inheritance Tax:** 10–35% depending on inheritance size.

2.4 Monte Carlo Simulation

We run N independent "families," each with random incomes and shocks, to generate distributions of final wealth. We then compute:

- **Average Final Wealth** by generation.
- **Single Lifecycle Plots** for a representative run.

3 Implementation Details

3.1 Tkinter GUI

The final design includes a **Tkinter** user interface that allows:

- Direct input of key parameters (inflation, shock prob, etc.).
- Checkboxes to specify which parameters to "optimize."
- A "Run Simulation" button for immediate results.
- An "Optimize" button that performs a small random search (20 samples by default) over the chosen parameters, selecting the scenario with the highest average wealth in Generation 3.

3.2 Random Search Optimization

When “Optimize” is clicked:

1. We define parameter ranges for each “checked” parameter (e.g. 0–0.1 for inflation).
2. We sample a small number of random sets (e.g. 20).
3. We run the 3-generation simulation for each set.
4. We pick the set that yields the highest final (Gen-3) wealth on average.

This is a simple demonstration—more sophisticated methods (grid search, Bayesian optimization) could be integrated.

4 Results

4.1 Sample Outcomes

In harsh conditions (e.g. high inflation, frequent shocks, modest forced saving), the *average* final wealth can remain negative, even if some families do well. Increasing forced saving, UBC, or the inheritance guarantee can push the distribution upward, but may require significant public spending or reduce consumption in working years.

4.2 Policy Trade-offs

- **Higher UBC** and **larger inheritance guarantees** help more families avoid collapse but cost more (or require higher taxes).
- **Forced saving** raises net wealth but can hurt short-term living standards.
- **Lower inflation** or **lower shocks** produce more stable outcomes but might not be fully controllable by policy alone.

5 Conclusion

GenerationalWealthPolicySim demonstrates how compound interest, life-cycle phases, and random shocks combine to shape multi-generation wealth trajectories. Simple changes—like forced saving or a modest inheritance floor—can drastically alter who thrives and who fails in a finite, shock-prone world. The included Tkinter app provides an interactive way to experiment with policy settings and observe how they impact 3-generation average wealth and single-lifecycle trajectories.

Future work might incorporate:

- More advanced optimization (e.g. genetic algorithms).
- Distribution metrics (Gini coefficient, percentile breakdowns).
- Heterogeneous families (different initial wealth, incomes, fertility).
- More realistic retirement and healthcare cost models.

References

[1] Van Parijs, P. (1995). *Real Freedom for All: What (if anything) can justify capitalism?* Oxford: Clarendon Press.