Macroeconomics and Monetization

Chris Georges

WEHIA, Ancona, June 2026

Hamilton College

Introduction

1. Preliminary

Capitalist firms balance investments in

- development of new and improved products
- monetization of their products.

Monetization is often associated with platform providers/services, but is more general.

Monetization: the good the bad and the ugly

- Some forms are necessary and/or efficiency enhancing under capitalism, others not so much:
  - investments in the excludability of products and services
  - efforts to build sustained rent extraction through intermediation, monopolization, M&A, political influence, ...
  - taking losses to exploit network externalities and switching costs to build and lock-in user bases
  - investments in consumer attention and addictive qualities of products and services
  - exploiting asymmetric info, bounded rationality, and cognitive biases ("phishing for phools")
  - ...

Examples

- Take **losses** / make investments to set up **future extraction regime**: Amazon, Uber, Starbucks, Grubhub, OpenAI, M&A (Google, Sysco, ..), private equity/VC (urgent care..) — what Doctorow has called "enshtification" or "crapification.' '
- Building **excludability** via investments in tech (DRM, payments tech, bioengineering), public policy (lobbying, patenting and copyright, ...): software, news, film, music, arts, agriculture, health, ...
- Converting public to private goods / **enclosing the commons** by lobbying against public provision: tax prep software, weather apps, prisons, ...
- **Regulatory capture** to reduce competition/secure monopoly power: credit cards, prison contracts, public vs private transportation; vs. ATT and the transistor, . . .

- **Phishing for phools**, coercive decision environments: payday lending, opioids, takeout food delivery, private equity, advertising, credit card fees ...
- Promoting **addiction**: social media algos/**attention** economy, gaming, gambling, ..

Note

Note **generally a combo** of offering new and useful services and both productive and non-productive/wasteful/destructive efforts to monetize these.

2. Focus

This paper explores the relationship between investments in monetization and product innovation, economic dynamism, and consumer welfare in an agent-based macroeconomic model.

3. Some Related Literature

- Monetization, Rent Seeking, Misallocation
  - Veblen (1904)
  - Baumol (1990)
  - Murphy, Shleifer and Vishny (1991)
  - Warusawitharana and Zucchi (2022)
  - Heijdra and Heijnen (2023)
  - Naude (2023)
  - Farbodie and Veldekamp (2024)
  - Geloso (2025), Gallay and Galoso (2023)
  - Bowles (2025), Bowles and Carlin (2021)

Related Literature (cont.)

- Product Innovation, Income, and Inequality
  - Jaravel (2019, 2024)
  - Georges (2011, 2018, 2019)
  - Comin, Lashkari, and Mestieri (2021)
  - Hubmer (2023)
  - Imas and Madarasz (2024)

Related Literature (cont.)

- ACE Modeling of Product Innovation, Consumer Choice, Income Dynamics, Growth
  - Chen and Chie (2005, 2007, 2013, 2014, 2020)
  - Ciarli, Lorenz, Savona, Valente (2010, 2016)
  - Marengo and Valente (2010)
  - Dawid, Gemkow, Harting, van der Hoog, Neugart (2016)
  - Fagiolo and Roventini (2017)
  - Columbo, Dawid, and Harting (2023)
  - DelliGatti, Gallegati, Palestrini, Tedeschi, Vidal-Tomas (2024)
  - ...

4. Approach

- Build on Agent-Based Macroeconomic Model of Georges (2011, 2018, 2019)
  - Growth and Business Cycles Driven by Product Innovation
    - Ongoing Product Innovation and Adaptation by Firms
    - Lancasterian Product Space and Nested CES Preferences
    - Bounded Rationality in Firm and Consumer Adaptation
    - Perpetual Disequilibrium
- Two Classes of Consumer/Workers
  - Wage Labor and Salaried Employees Consume Different Products
- Investments in monetization capacity have both direct and indirect effects on
  - consumer welfare
  - economic dynamism

The Model

5. Macroeconomic Environment

- $n_1 + n_2$ **firms** at any time, each produces a unique product.
  - **Type 1 firms** produce for production workers. **Type 2 firms** produce for salaried overhead workers.
- m **product characteristics** valued by all consumers.
- All firms **produce** with both variable and overhead labor to meet forecasted demand.
- 2 **representative consumers** spend all their income (wages and salaries, respectively), and search for better bundles of goods within their market segments.
- Prices are constant **markup** over marginal costs.

Macroeconomic Environment (cont.)

- Both **product innovation** and **monetization innovation** depend stochastically on **R&D**, which is outcome of DC rule.
- Product innovation improves **true product quality**
- Monetization innovation creates **artificial or perceived product quality**

Macroeconomic Environment (cont.)

- **Consumers search** over the product space to update their consumption baskets, i.e., their consumption shares of various goods, **based on effective quality = true + artificial quality**.
  - I.e., they use prospective **effective utility** to compare consumption bundles and make consumption decisions
  - whereas their **actual welfare** depends on their utility from true quality only.
- Insolvent firms **exit** and are replaced. Entering firms have some opportunity to switch markets.

6. Alternative Approaches

- Note that we could alternatively think of monetization innovation as working in other ways. E.g., on
  - the ability to alter markups,
  - consumer demand or demand shares,
  - ...
- However, our approach is fairly general
- and allows a straightforward distinction between true and effective utility.

7. Timing of Events

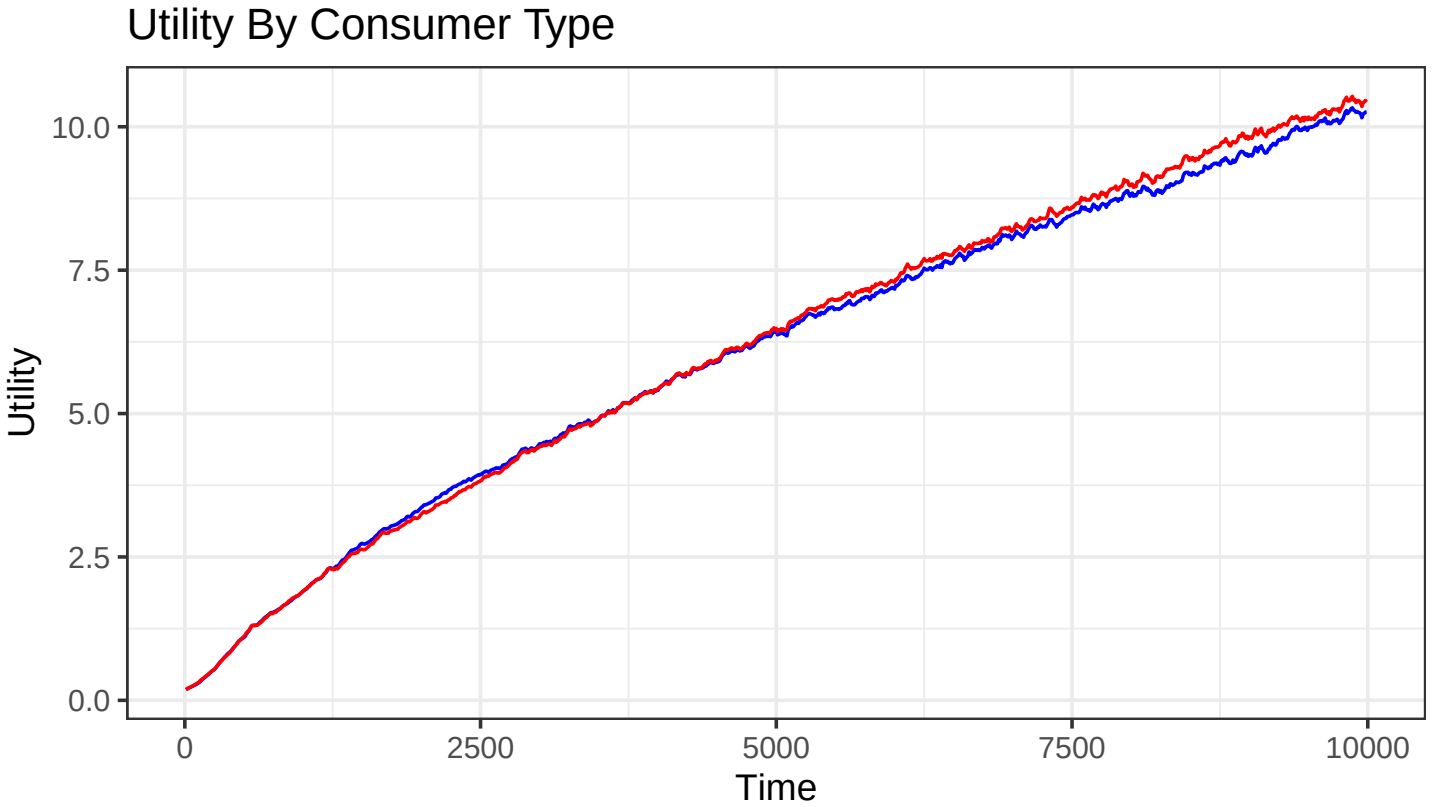
- **R&D:** firms chose their current R&D investment levels (0 or 1).
- **Product Innovation:** firms experience product innovation with probabilities related to their recent R&D investments in product quality (with preferential attachment wrt hedonic quality elements)
- **Monetization Innovation:** firms experience monetization innovation which enhances artificial quality, via simple mechanism:
    - True qualities convert (above a threshold) to artificial qualities at a slow stochastic rate.
    - Artificial qualities also depreciate at slow stochastic rate.
- **Production:** firms forecast sales, hire production labor, and produce to meet forecasted demand.

Timing of Events (cont.)

- **Incomes:** all firms pay wages to their production workers and salaries to their overhead workers.
- **Consumer Search:** representative consumers search (based on effective utility) and update their consumption baskets.
- **Sales:** the consumers spend all of their labor incomes on their consumption baskets.
- **Entry and Exit:** firms with insufficient working capital are replaced. The new entrants may migrate across the two markets.

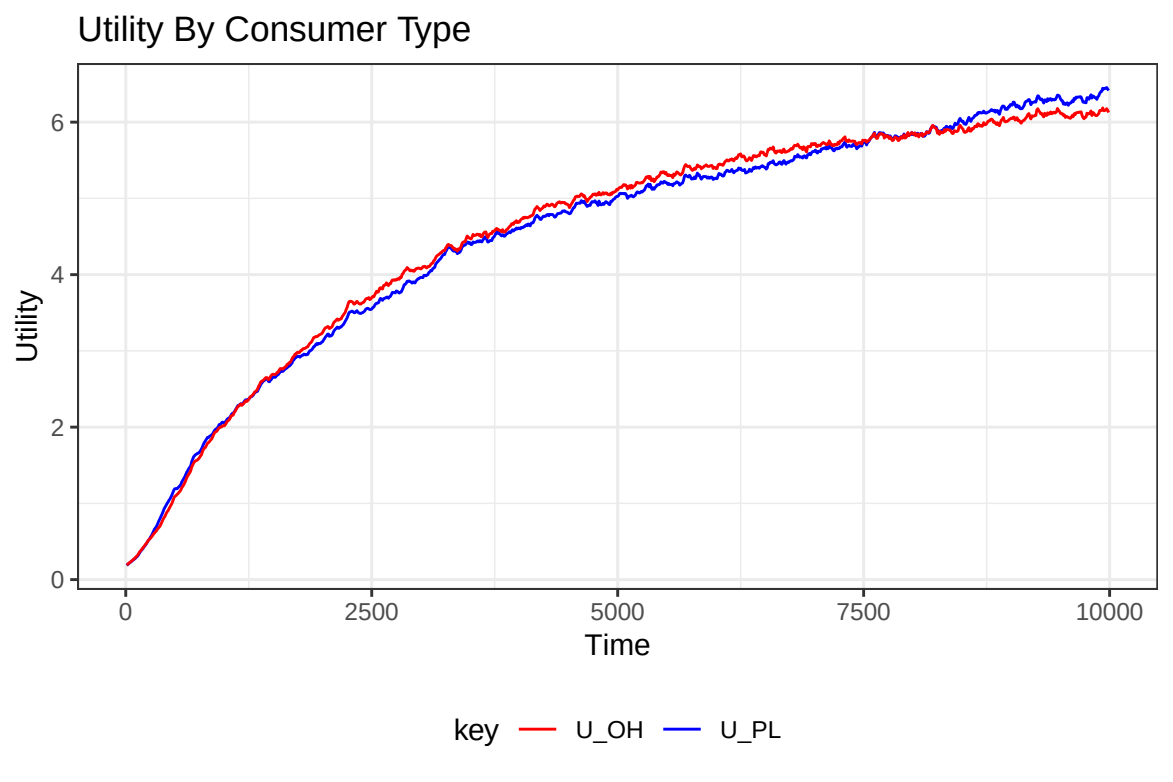
Preliminary Simulations

Baseline: No Monetization



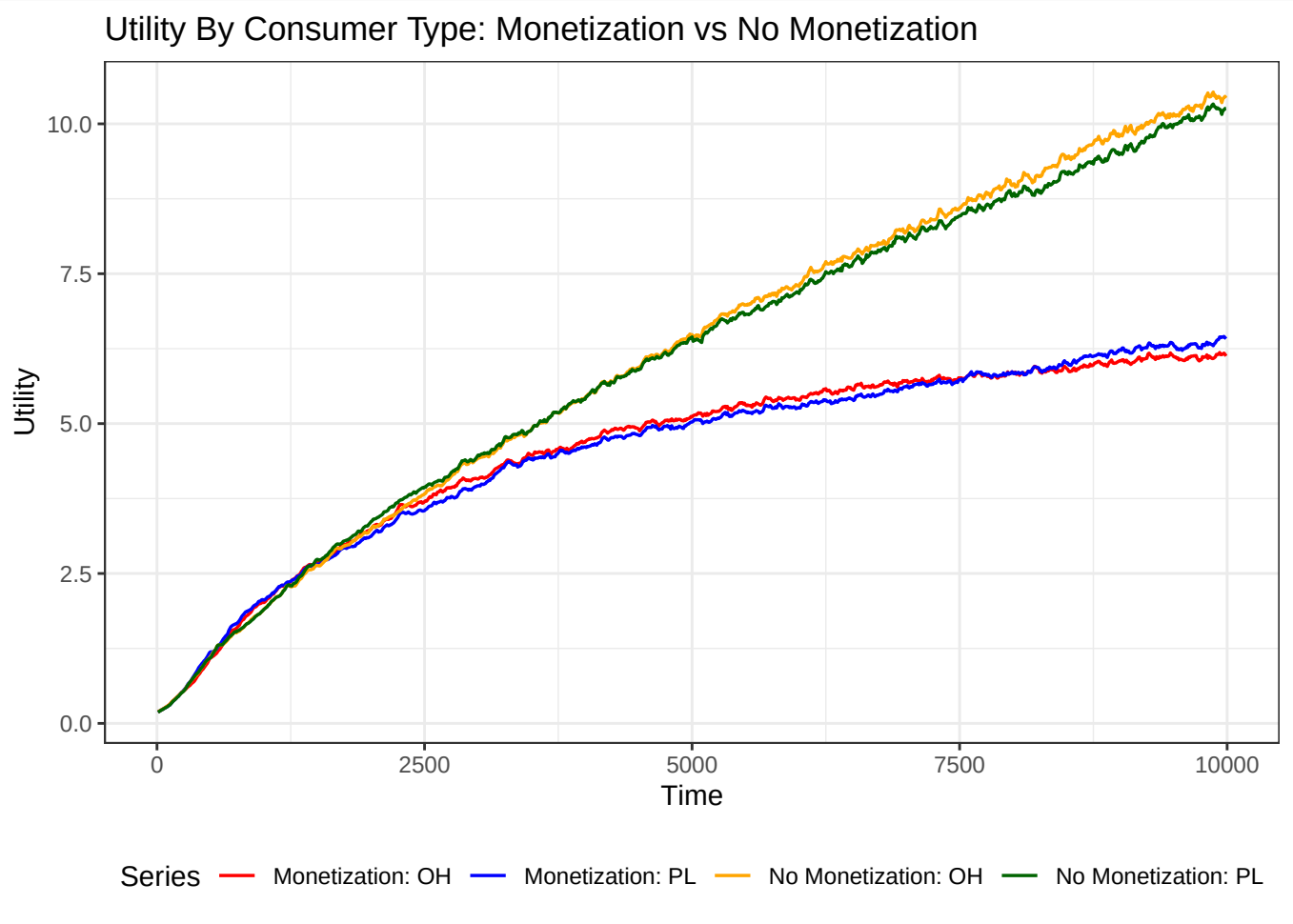
Baseline: With Monetization

- True and artificial qualities are incremented through R&D driven innovation as above,

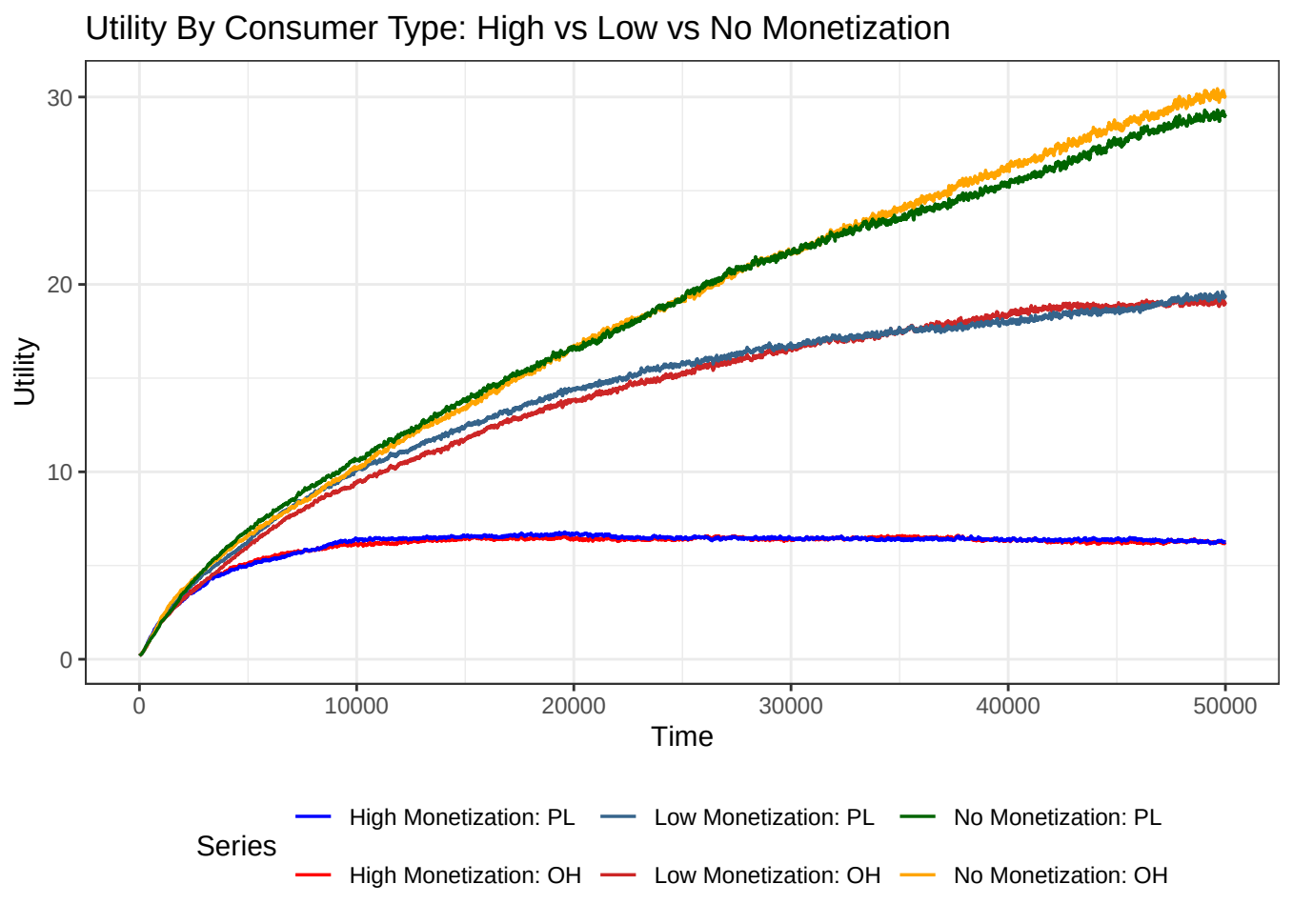


Single run example: artificial quality conversion rate on hedonic quality elements $>$ threshold 0.05. Depreciation rate of artificial quality 0.001.

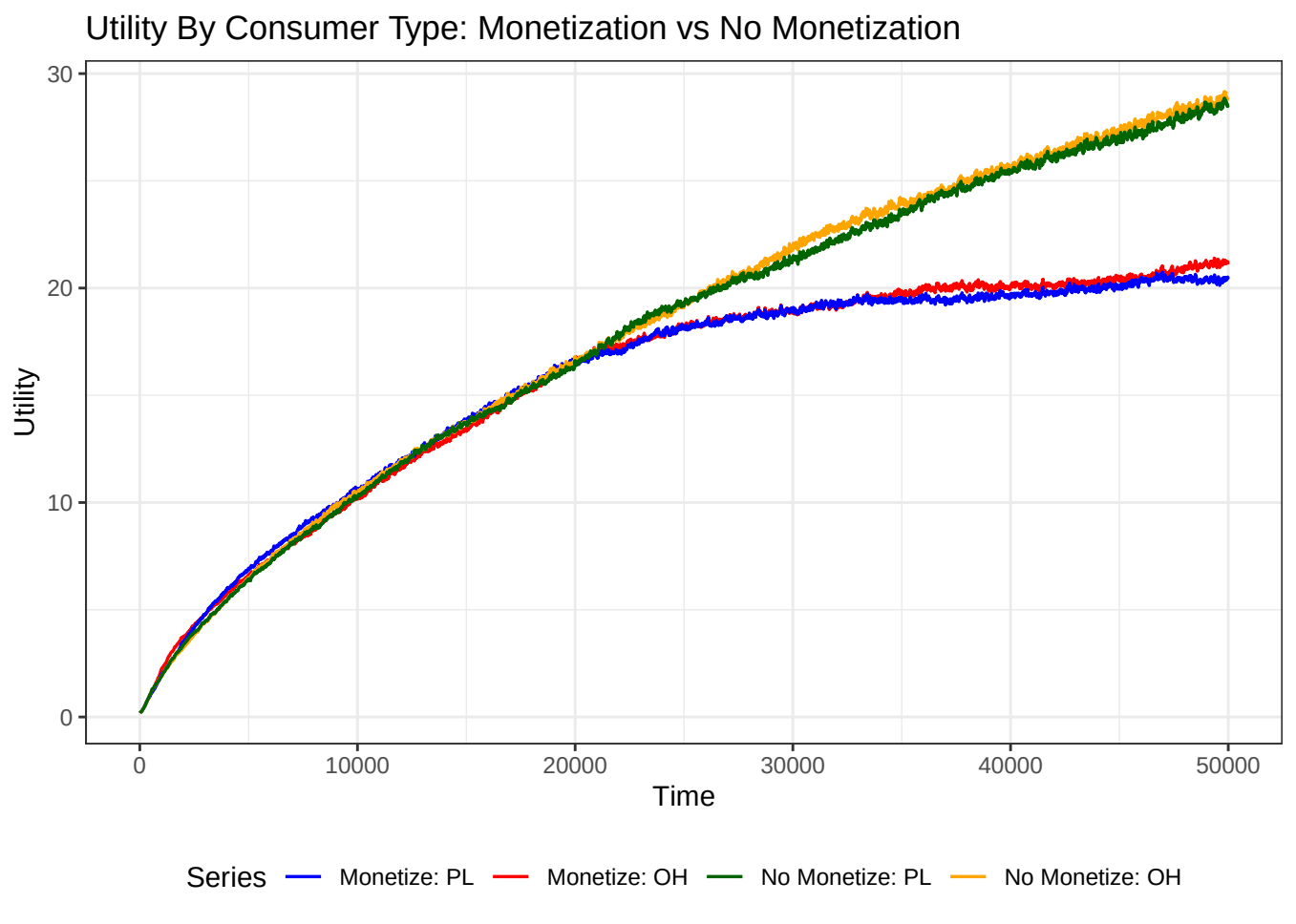
Comparison: Utility With and Without Monetization



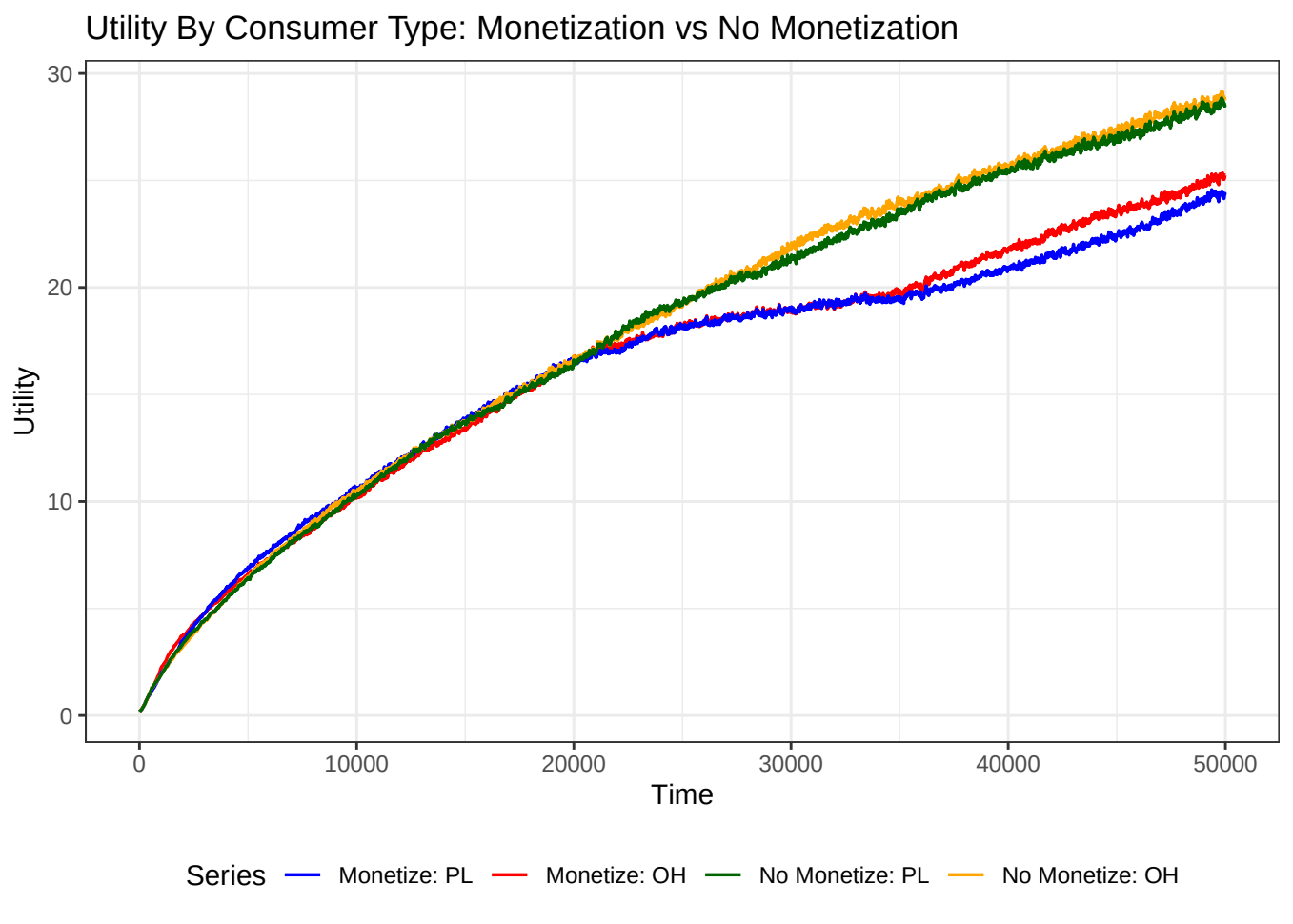
Comparison: Longer Run. Utility With High, Low, and No Monetization



Comparison: Longer Run. Utility With Low Monetization After round 20K



Comparison: Longer Run. Utility With Low Monetization in rounds 20K-35K

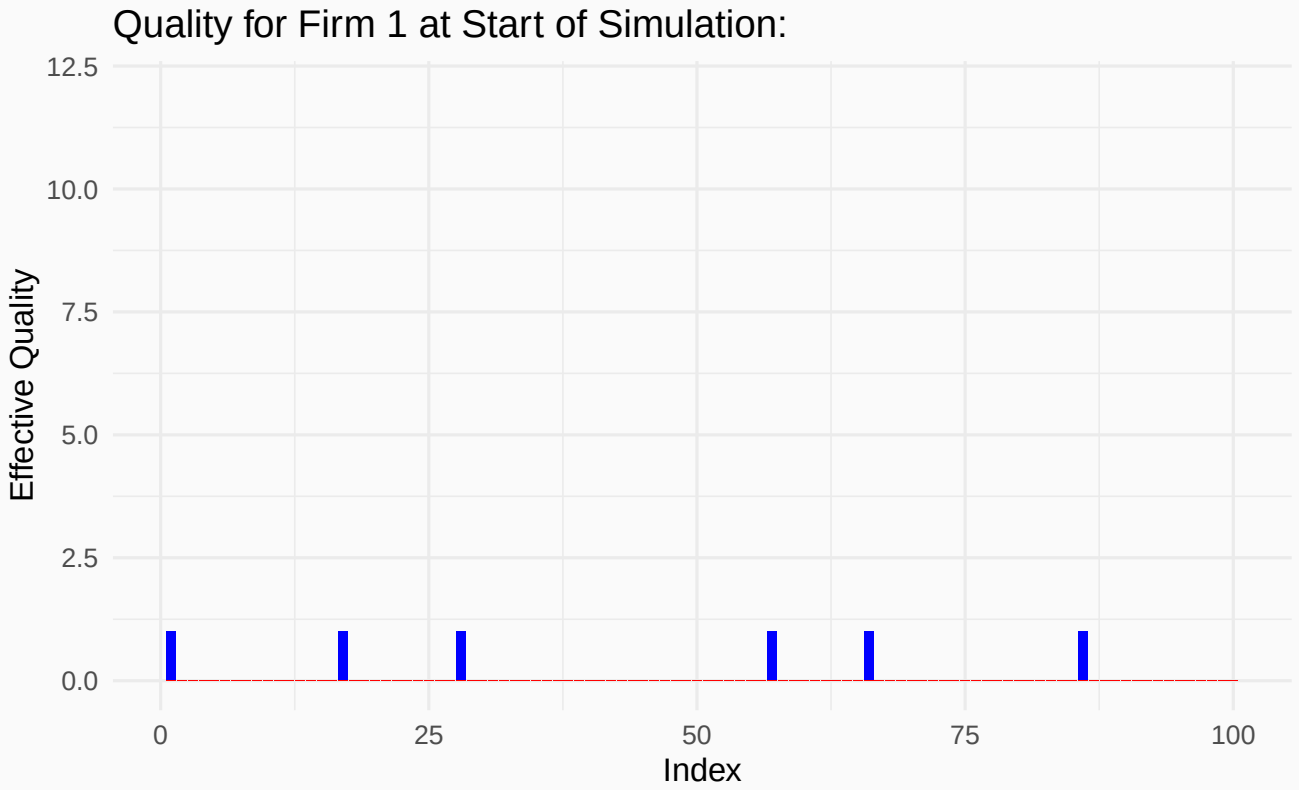


Mechanisms:

- diversion from true to artificial quality
- misallocation due to consumer search driven by effective rather than true quality

Evolution of True and Artificial Quality: Start of Simulation

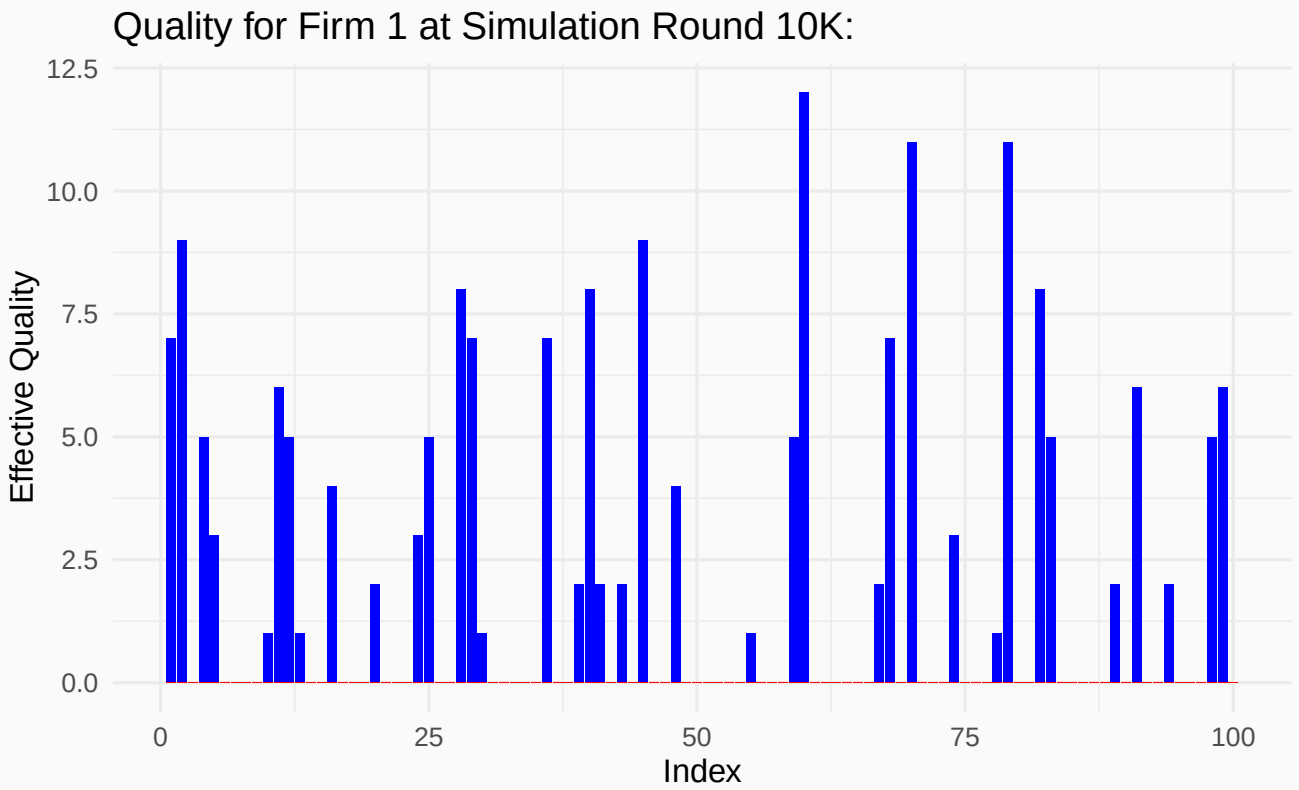
Baseline run: start of simulation:



Single baseline run: hedonic quality values (100 elements) for Firm-1 at start of simulation.

Evolution of Quality: Baseline without Monetization, Round 10K

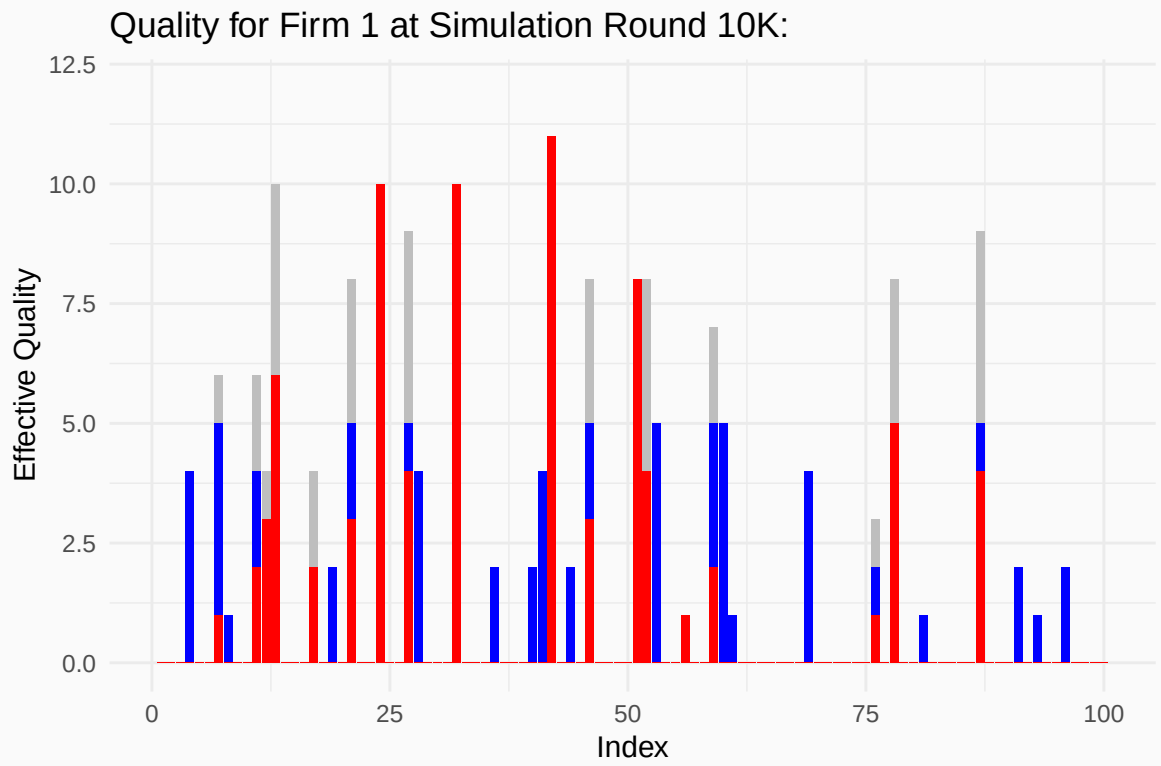
Baseline run, no monetIzation, round 10K:



Same run. hedonic quality values (100 elements) for Firm-1 after 10k rounds of baseline model (artificial quality conversion and depreciation suppressed).

Evolution of Quality: With Monetization, Round 10K

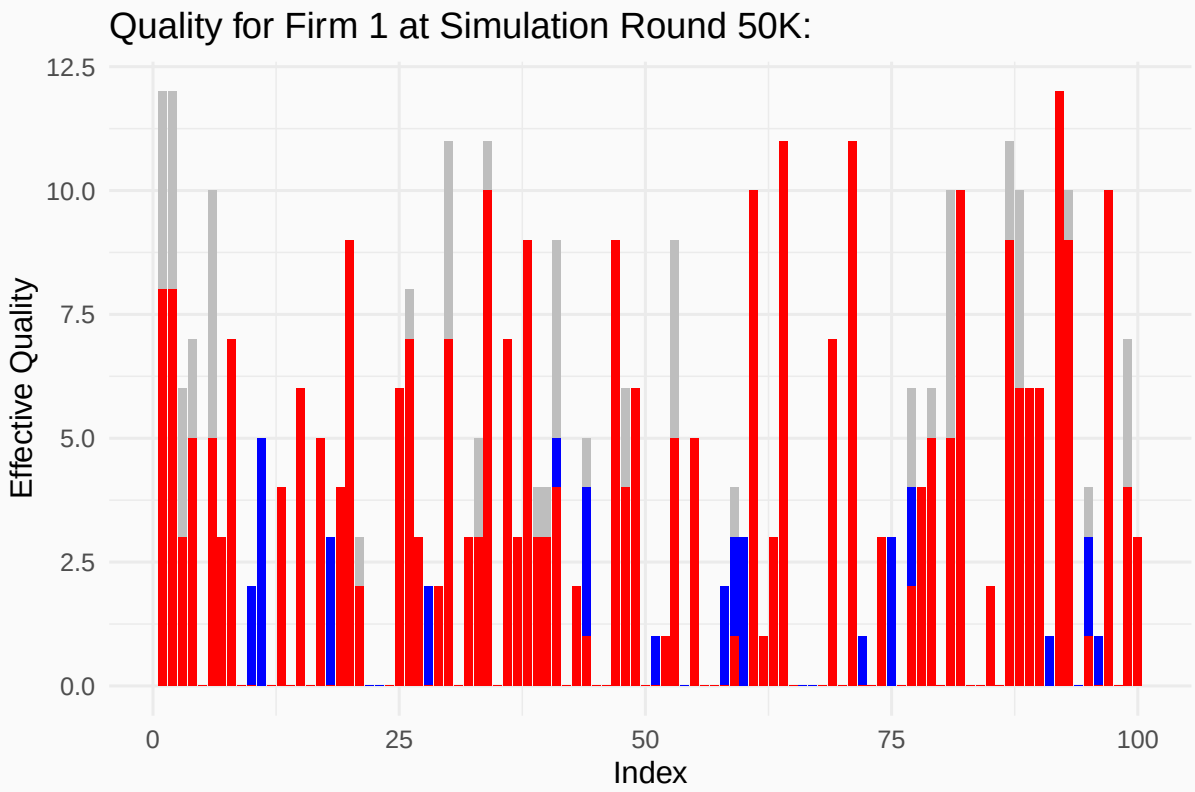
Baseline run, with monetization, round 10K:



Same run as above except quality conversion and depreciation activated. For firm 1: hedonic quality values (100 elements) after 10k rounds. True Quality (blue) + Artificial Quality (red) = Effective Quality (grey).

Evolution of Quality (cont.)

Same as above but without depreciation on artificial quality



Same run as above except with quality conversion but not depreciation activated. For firm 1: hedonic quality values (100 elements) after 10k rounds. True Quality (blue) + Artificial Quality (red) = Effective Quality (grey).

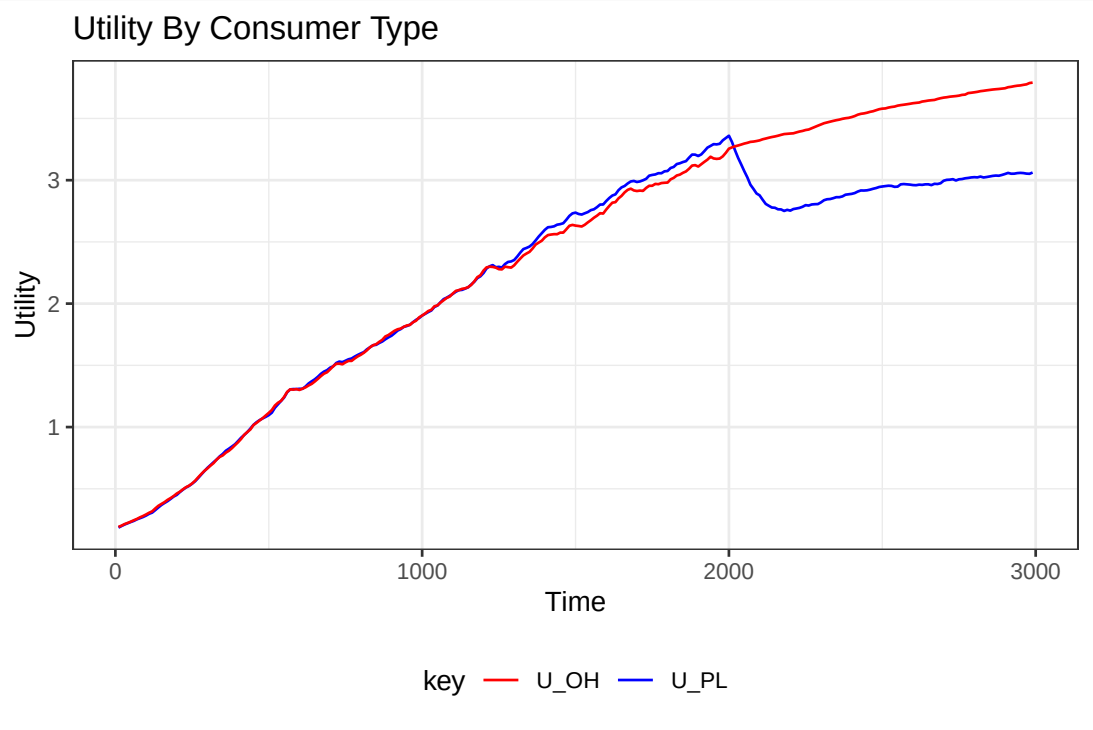
Evolution of Quality(cont.)

- Note that **effective quality** is lower under artificial quality conversion **and** depreciation due to:
  - Diversion of investment toward artificial quality (monetization), indirectly, as this
    - reduces experience with true quality and thus innovation via preferential attachment
    - and may increase net depreciation of quality (as is the case above)
- Whereas **true utility** is lower under artificial quality conversion and depreciation due to:
  - Diversion of investment toward artificial quality (monetization), directly and indirectly
  - Misallocation of consumer budgets due to artificial quality: consumer search depending on effective quality.

Visualizing the Misallocation Mechanism

Consider a **large exogenous** monetization innovation for illustration.

- Exogenous addition of artificial quality to half of type 1 consumers' perceptions leads to misallocation of their consumption budgets and thus reduction in their actual utility



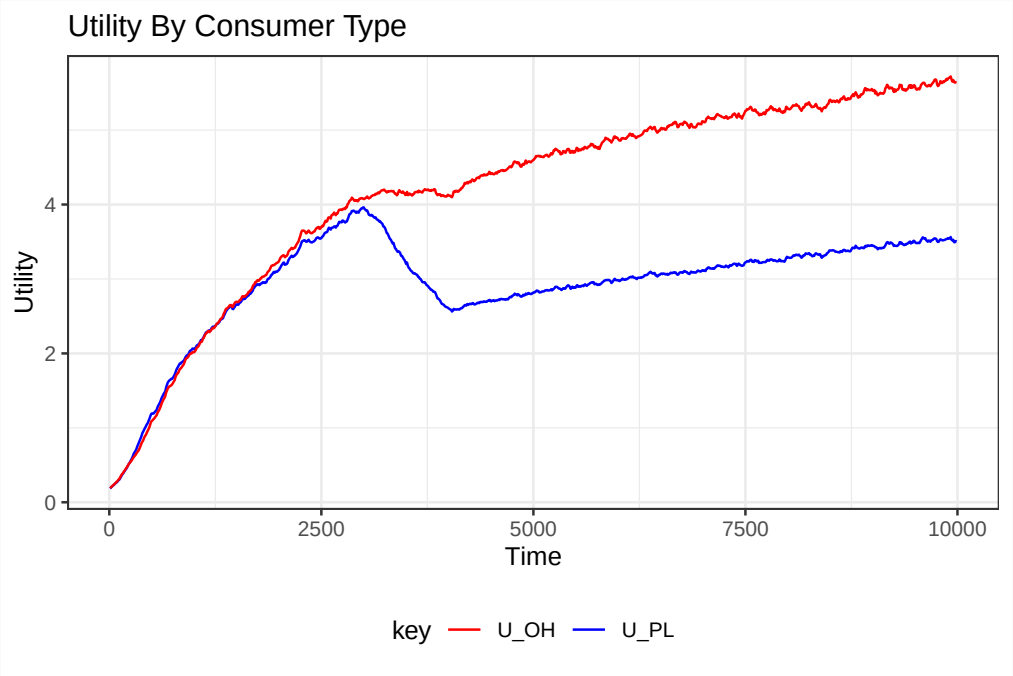
Visualizing the Misallocation Mechanism (cont.)

- In last frame: Half of PL workers face positive artificial quality shocks – 20% chance of bump to each hedonic element of between 0 and 20 in round 2000.
- Here relative utility u_2/u_1 increases approx 25% (relative to baseline with no artificial quality inserted in round 2000 but RandD frozen and innovation set to zero after round 2000 as above).

Consumption Inequality:

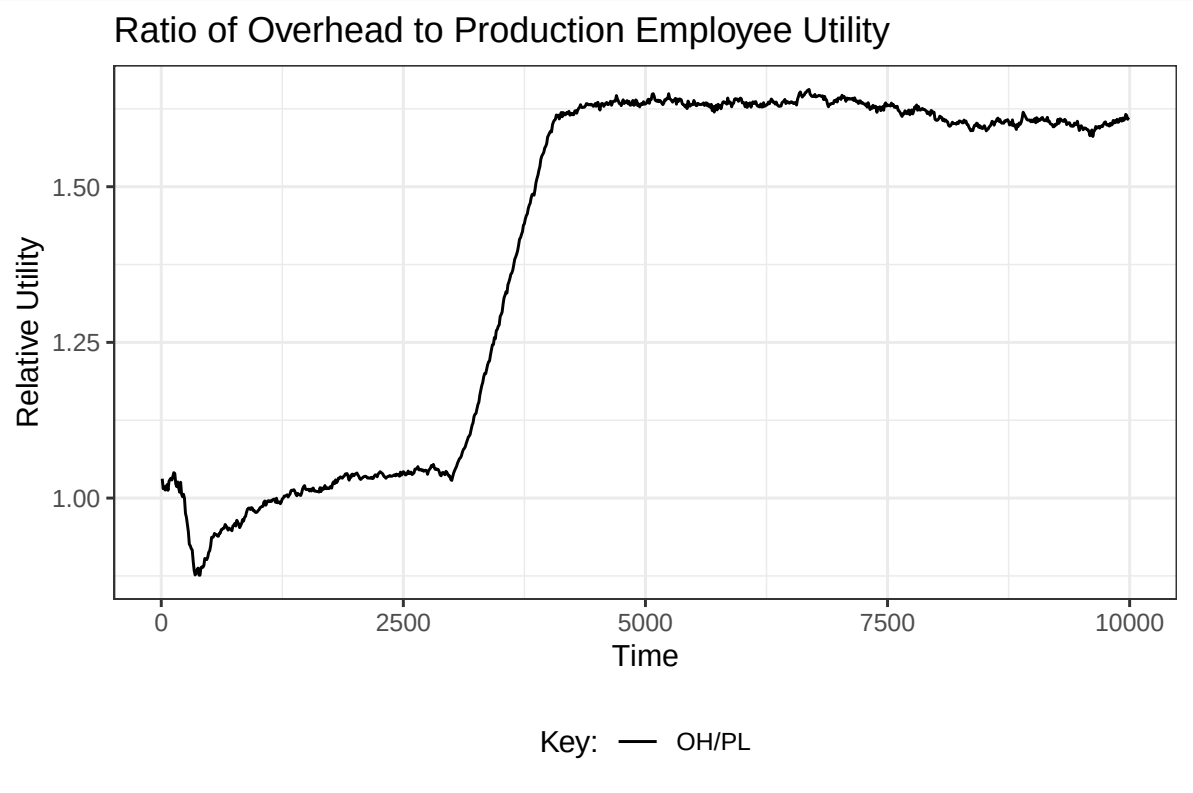
Increased markup as driver of consumption inequality (Georges, 2019, 2025):

- A gradual rise in markup causes **stagnation** of U_1 and increased consumption inequality.



Single run: μ increased from 2 to 2.4 gradually during periods 3000-4000. This reduces both u_1 and u_2 ...

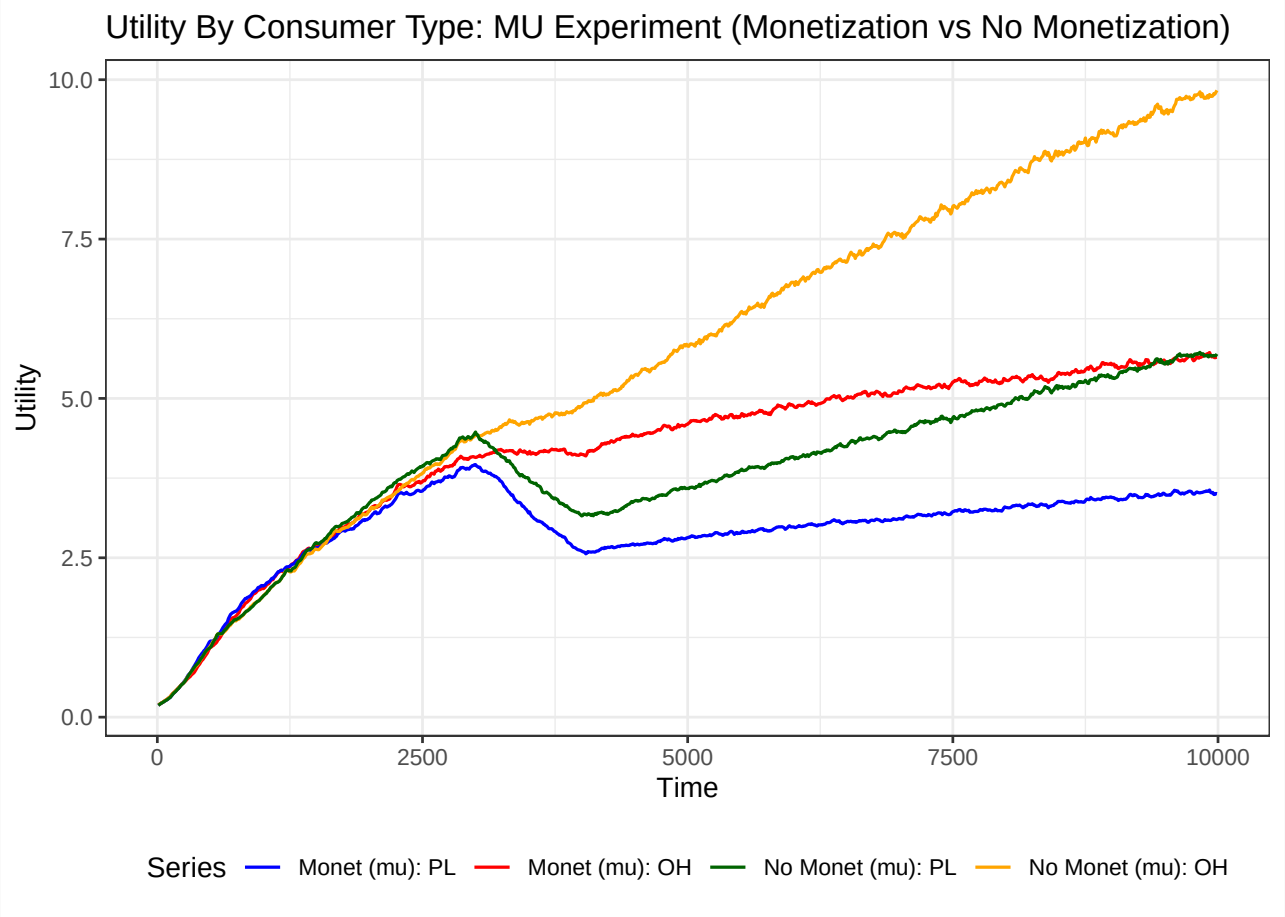
... and raises relative u_2/u_1 via three channels: income, variety, and innovation $\rightarrow$ Macroeconomic Gentrification.



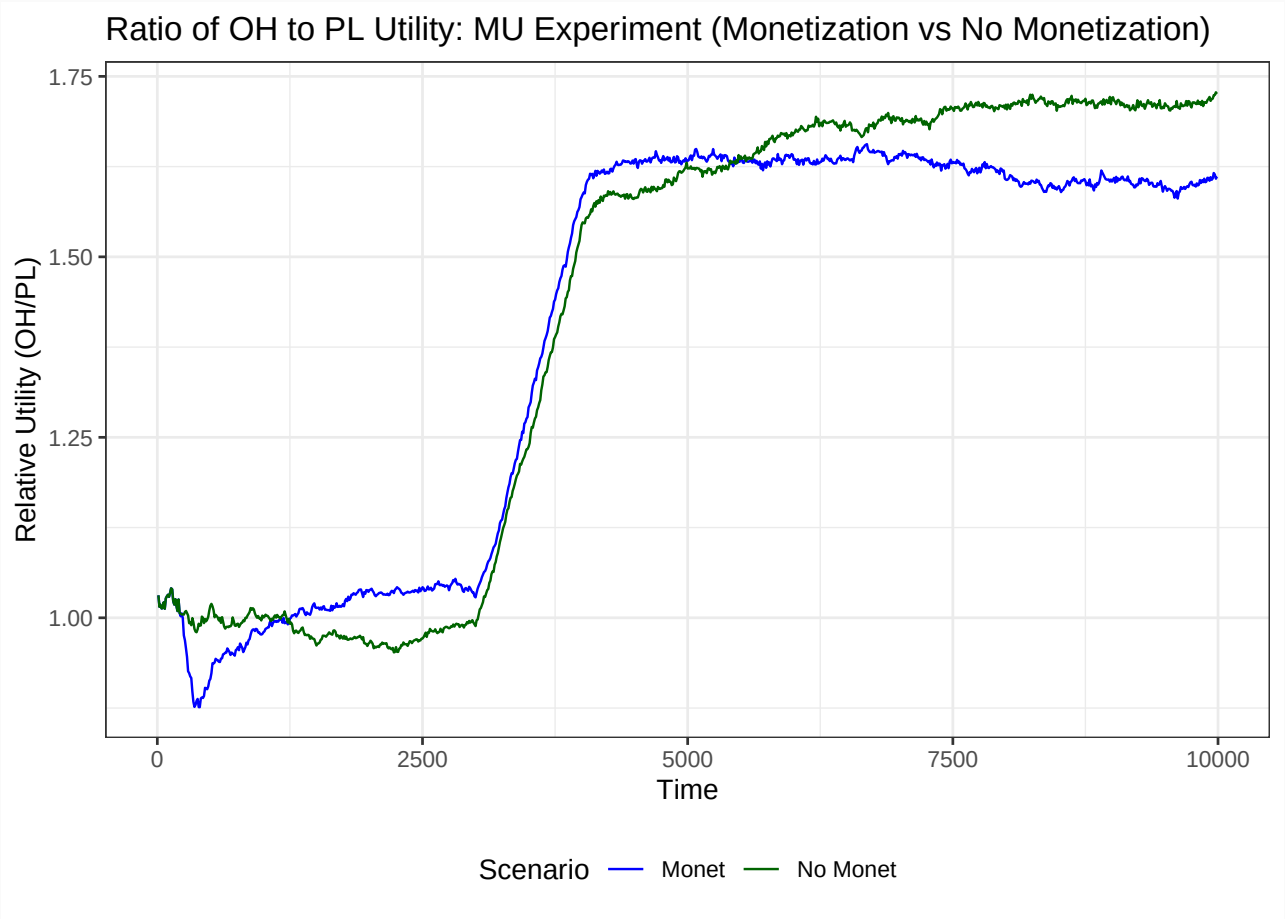
Same run as above.

Comparison: With and Without Monetization

Compare same experiment with and without monetization:

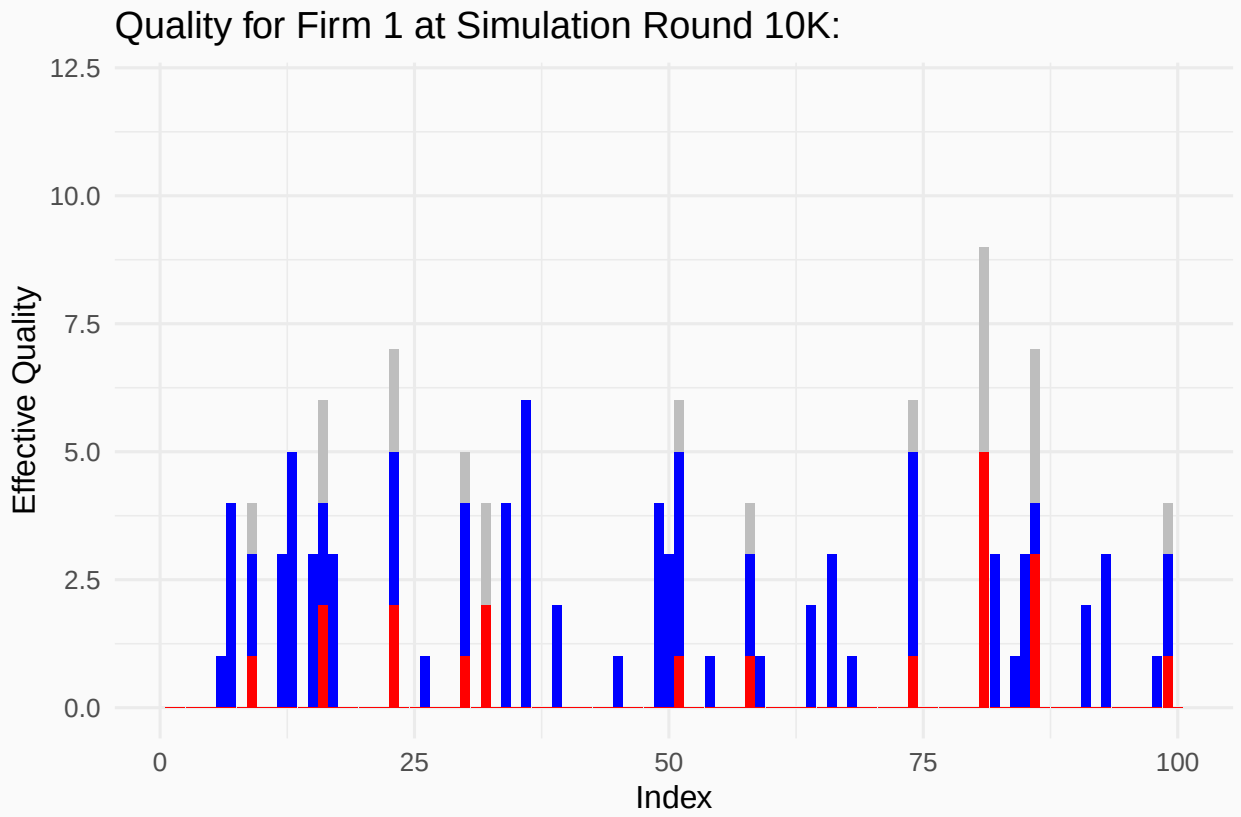


Same run as above, with and without monetization.



Same run as above. Somewhat larger effect on inequality here without monetization. Perhaps due to larger relative R&D effects without monetization – dampening effect of monetization. Will require montecarlo experiments.

Firm 1 quality in rd 10K for run as above with monetization:



Run above with monetization. True Quality (blue) + Artificial Quality (red) = Effective Quality (grey).

Dynamism and Inequality:

Dynamism story to further test and explore:

- Monetization reduces u_1 and u_2 as well as growth of both
- Are there systemic effects on consumption inequality?

Questions, comments welcome!

Additional Slides

A1. Consumer Preferences

For each consumer type:

- $q \in R_n$ is vector of products consumed
- $z \in R_m$ is corresponding vector of characteristics consumed
  - $z = g(q)$: map from products to characteristics (home production function)
  - Specifically, CES aggregator for characteristic j over goods i
    - $z_j = \left[\sum_{i=1}^{n} (q_i \cdot z_{i,j})^{\rho_1}\right]^{1/\rho_1}$
- $u = u(z)$ map from characteristics to utility (utility function)
  - CES aggregator over characteristics j
    - $u(z) = \left[\sum_{j=1}^{m} z_j^{\rho_2}\right]^{1/\rho_2}$
- nested CES utility imposes taste for variety over both characteristics and goods

A2. Product Innovation

- Product Innovation:
  - Product innovation increments z_i by (pos or neg) integers
  - Probability of a product innovation depends on recent R&D investment (distributed lag).
  - Preferential Attachment
- R&D
  - Firms decide whether to turn on/off R&D investment by social learning (discrete choice rule)
  - Two possible reference pairs:
    - Firms with high and low recent *R*&D
    - Firms in own or other market
  - For low profit group, probability of changing R&D status depends on

$$\Phi = \frac{e^{\gamma \pi_1}}{e^{\gamma \pi_1} + e^{\gamma \pi_2}}$$

    π_1 and π_2 are the recent profits of the reference pairs: e.g., high and low R&D firms, $\gamma > 0$.

A3. Consumer Search

- Representative Consumer Search:
  - Consumer establishes budget constraint
  - Searches for optimal bundle of goods by experimentation
  - Experimentation takes form of testing random mutations in which nominal spending shares are shifted between collections of pairs of goods within own market segment
  - Search is subject to election operator. Adopt only changes in spending that increase utility.

A4. Pricing, Production, and Trade

- Firm Pricing and Production:
  - Markup pricing (markup η)
  - Leontief technology: constant marginal production labor requirements.
- Production by Firm i
  - Production Labor requirement is $y_{i,t}/A$
  - Overhead Labor requirement has
    - fixed component $H = s \cdot h$
    - R&D component $R = s \cdot r$ (only when engage in R&D)
  - Firm produces to meet expected demand.
  - Firm forecasts demand by simple extrapolation of past nominal demand.
- Markets:
  - Trade takes place on the short side of the market. Products and residual income are perishable. No saving or inventories.
  - Firm/product is replaced if working capital falls to zero. Entering firms imitate existing firm and may switch markets.

A5. Representative Agent Benchmark

- If firms are homogenous, other than market label, and all engage in $R\&D$, then equilibrium production and sales of consumption good is

$$Y^* = Y_1^* + Y_2^* = \left(\frac{1}{\eta - 1}\right) \cdot \frac{A}{W} \cdot (h + r) \cdot s \cdot (n_1 + n_2)$$

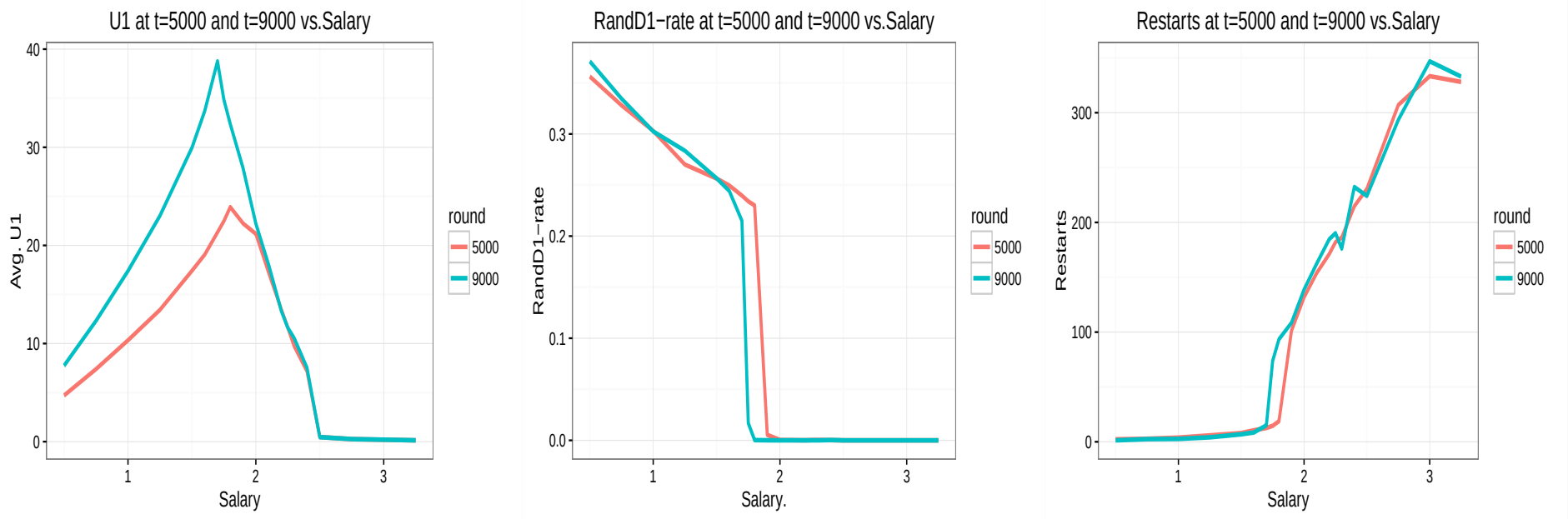
  - Independent of, characteristic magnitudes, and preferences over characteristics.
  - Partials $\frac{\partial Y}{\partial A} > 0$, $\frac{\partial Y}{\partial W} < 0$, $\frac{\partial Y}{\partial s \cdot (h+r)} > 0$, $\frac{\partial Y}{\partial \eta} < 0$ all demand driven.
  - Is a locally stable steady state.
- Utility of PL and OHL each:
  - grows in the LR via product innovation in the own market.
  - depends positively on variety in the own market, and thus n_1/n_2.

A6. Impacts of Other Parameter Changes

- Income shares are driven exclusively by the markup: increasing the markup lowers U_1 and U_2 and raises $\frac{U_2}{U_1}$.
- Increasing salary or overhead requirements moderately raises (aggregate) incomes and turnover and lowers R&D spending
- Increasing wages moderately lowers (aggregate) incomes but leaves R&D spending unchanged
- Low R&D spending may (or may not) be offset by higher turnover – creative destruction
- Reducing finance for new entrants moderately increases turnover, lowers R&D, and increases utilities

A6. Impacts of Other Parameter Changes (cont.)

- Increasing salary or overhead requirements **sufficiently** can kill off R&D and lower utility **dramatically**
  - This effect is *not evident in the representative agent version* of the model, in which e.g., salary increases output and utility.
  - The sustainability of R&D depends on the ecology of agents and the cost of overhead labor. As salary increases, R&D becomes fragile and can collapse.



Effect of increasing salary rate on U1, R&D rate, and turnover rate.