

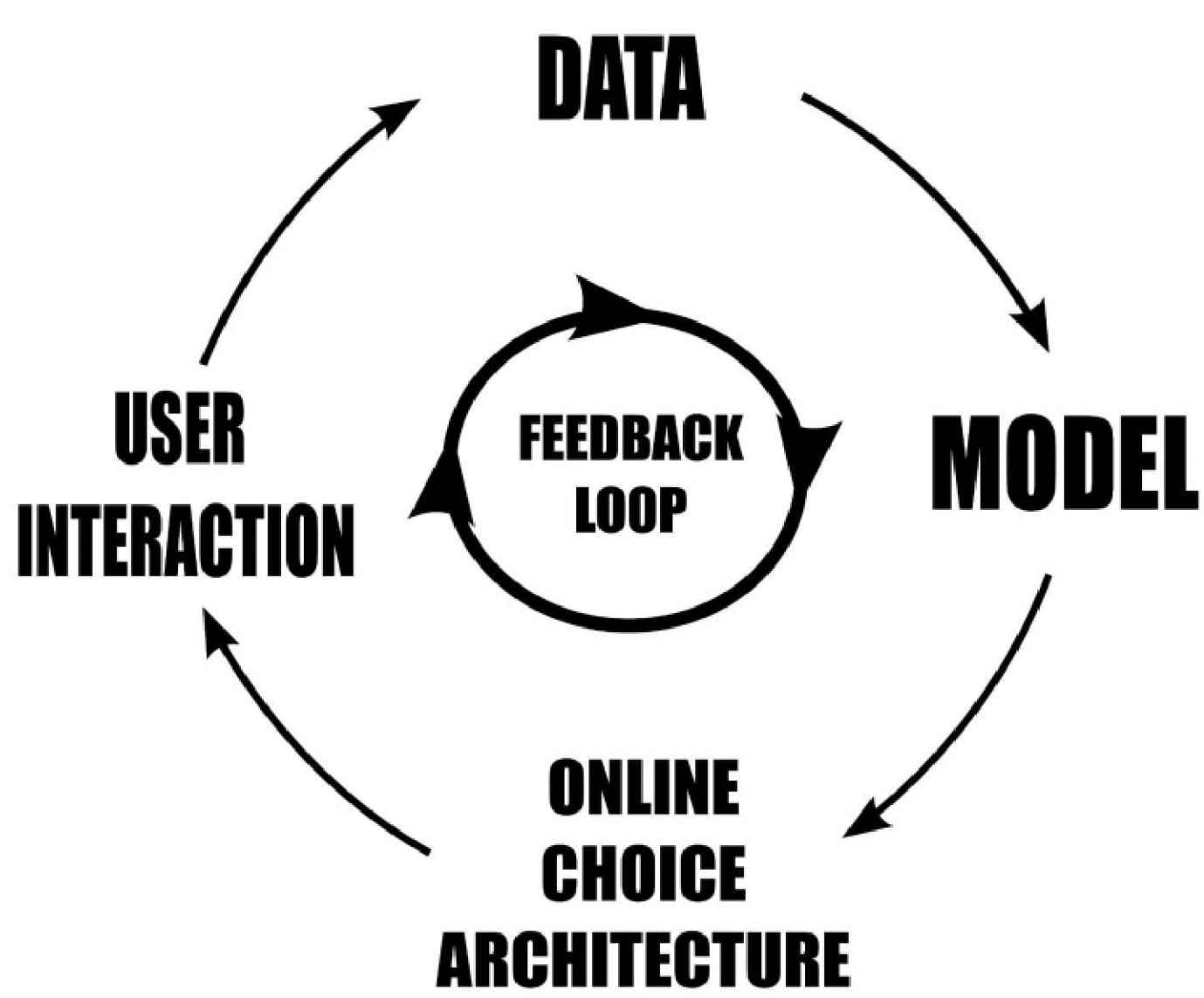
Trustworthy Autonomous Recommender Systems on Music Streaming Platforms

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RS as a source of bias

Rich body of CS evidence on the biases in the RS pipeline



- Data collection**
- Selection bias
 - Herding bias
- Model design**
- Population bias
 - Homogeneity bias
- Choice architecture**
- Framing bias
 - Exposure bias
- User interaction**
- Interface bias
 - Features bias

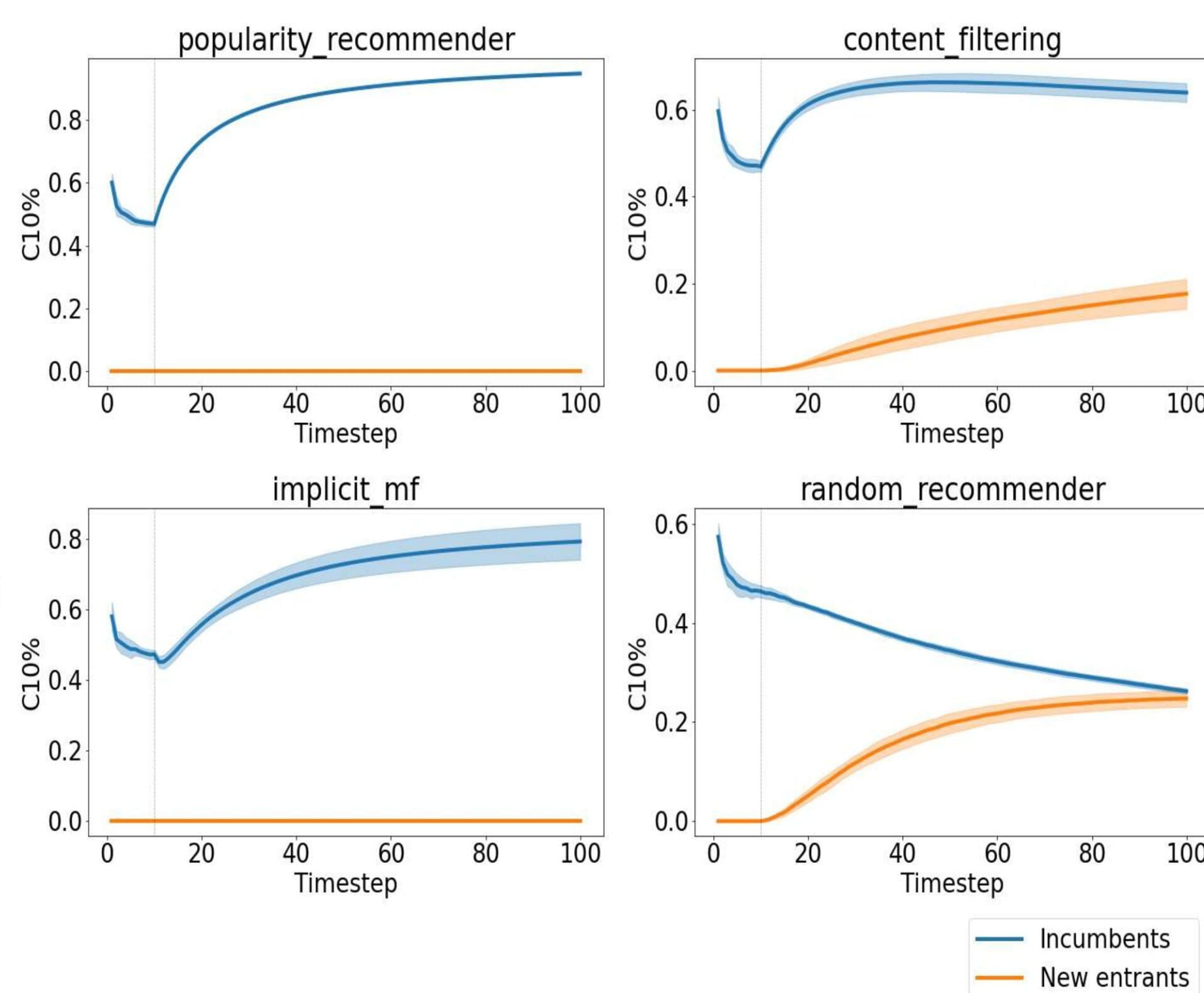
AMPLIFIED BY FEEDBACK LOOPS

RS and market entry

Popularity bias can create barriers to entry and expansion for smaller players.

If RS favour established players over new ones (the 'cold start' problem or 'incumbency bias'), this will also create/increase barriers to entry.

Feedback loops make this worse, as the RS is more likely to log interactions on popular and incumbent items as opposed to new entrants.



The case of music streaming

'Manufacturing' popularity bias in music streaming

- Editorial playlists are an important vehicle to streaming revenue.
- Are all suppliers represented fairly on these playlists?
- Early large scale exposure boosts popularity bias in the RS.
- Major labels have better access to these key playlists.

Hypothesis: Featuring on key editorial playlists shortly after release, boosts chances to be recommended by RS.

A Spotify example	% Independent label recordings
Top 100 playlists	19.0
Top 1,000 playlists	22.8
Top 10,000 playlists	22.3
Top 100,000 playlists	35.4

Short term impact

- Distortion of competition between suppliers.
- More homogeneous choice for consumers.
- Loss in revenue for some suppliers.

Long term impact

- Fall in innovation (reduction in the long tail)
- Fall in dynamic consumer welfare.

Recommender systems (RS) and the market

Online platforms – choice proliferation

- Consumers face a huge range of products and services on online platforms.
- RS facilitate choice by providing relevant suggestions that reflect the consumer's preferences, but are influenced by multiple financial factors.
- This reduces/eliminates search and decision costs.

Focus is on impact of RS on competition between suppliers.

- RS operate in a multi-sided market which depend on and are entangled with platforms, advertising, and music industries.
- Market impact even if a consumer-centric RS is assumed and there is no malintent by the platform.

Industry insights: music streaming markets

- How are music companies (with songs on streaming platforms) affected by RS?

Linking RS bias to market outcome

The RS is deployed on the platform.

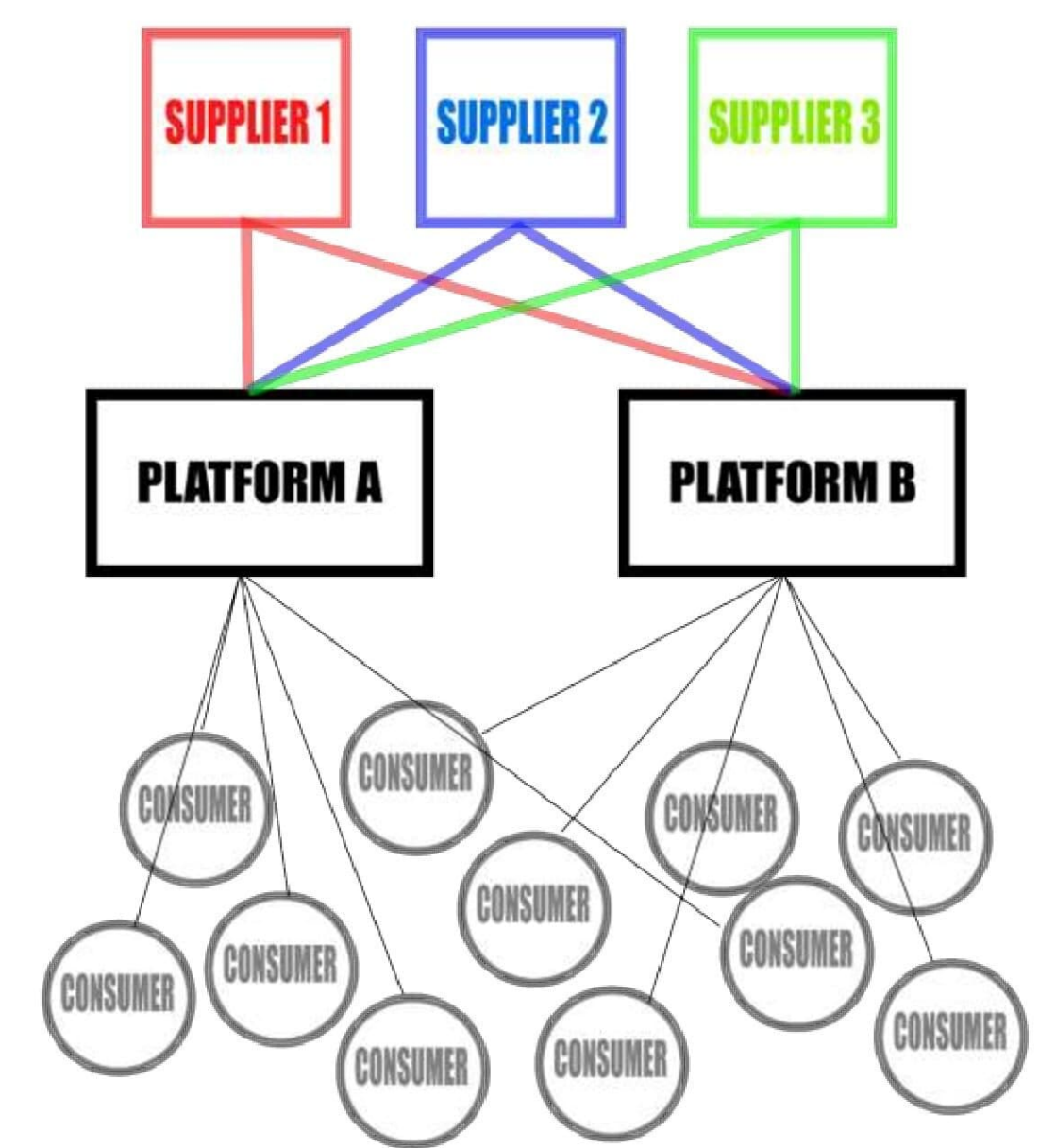
- Things are worse if there is already limited competition between platforms (e.g. network effects and scale economies), or with 'single homing' consumers.

RS biases affect competition between suppliers.

- Consumers have a strong propensity to engage with these recommendations.
- Through this influence on consumer decision-making, RS also affect competition between the suppliers.

Which in turn affects consumers as well.

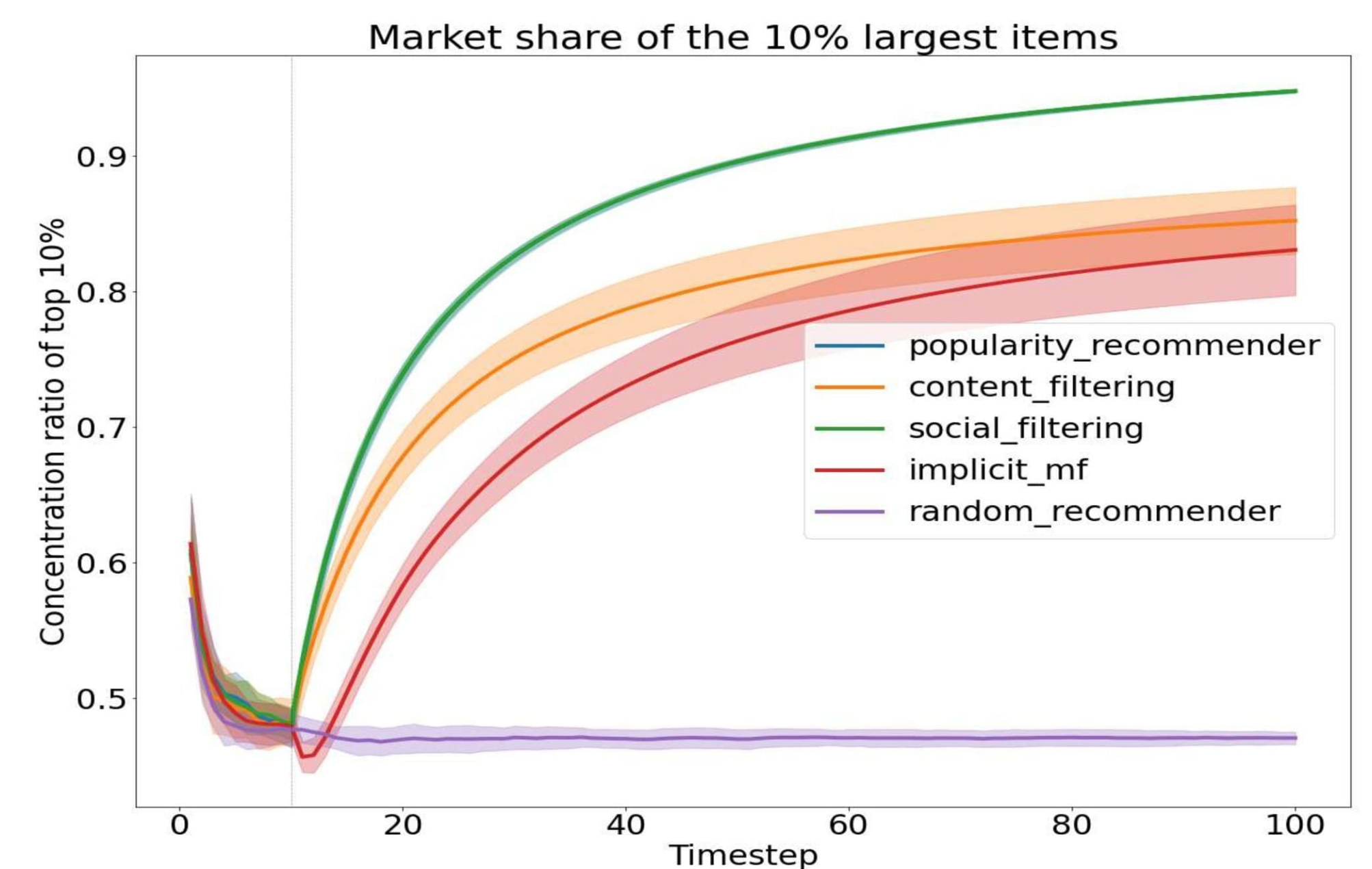
- Through shaping of taste and experience/feelings
- Through less competition – higher prices
- Through fall in innovation.



RS and market concentration

As RS increases barriers to entry, it can lead to markets becoming more concentrated.

Potentially with just one or two very popular products in each category.



'Blockbuster' effect in less dynamic markets risks serious long-term concentration.

This is sometimes known as the 'Matthew' effect or the 'Rich get richer' effect.

The regulatory framework

Recommender systems do not operate in silos, but depend on and are entangled with platforms, advertising, consumers, and suppliers.

No existing regulatory framework, but various ways in which regulatory strategies and instruments may address concerns associated with RS bias.

EU Law

- **EU AI Act:**
 - Transparency obligation (Art. 52 (1))
 - Regulatory sandboxes (Art. 53)
 - Codes of conduct (Art. 69)
- **P-2-B Regulation (EU) 2019/1150:**
 - Disclosure obligation on ranking characteristics and conditions of ranking against remuneration (Art. 5)
 - Disclosure obligation of any differentiated treatment between the goods/services provided by the online intermediation service or businesses controlled by them and other business users (Art. 7)
- **EU competition law (Art. 101 and 102 TFEU)**

UK Law

- **Competition law:**
 - Prohibition of **self-preferencing** through platform regulation - UK New pro-competition regime for digital markets) if RS operator qualifies as a gatekeeper platform / platform with strategic market status.
 - Chapter I and II Competition Act 1998.