A trick of the tail
The role of social networks in experience-good market dynamics

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motivation

- technology
- phone, e-mail, electronic social networks
- increased density of social networks
  - in terms of links, not nodes

- social interaction and consumption decisions
  - cultural products
  - experience goods

- denser networks $\rightarrow$ access to richer information
- effects of denser networks on aggregate outcomes
  - e.g. market share distributions
what effect can increased social network density have on market organization?

the simplest of all conjectures

- more varied information will make our choices more “random”
- → longer long tail and death of blockbusters
model

- a simple model
  - no preferences
  - no changing consumer demography
  - no prices difference across the options
  - no budget constraint

- consumers representing nodes of a fixed social network
- market supplies a number of options/goods
- each consumer has to choose (buy one unit of) one of the options
- consumers share information about their choices with their friends
- individual decisions on “when” and “what”
When to choose

- during each $t$ each consumer (who has not already chosen in any of previous $t$s) considers a decision to choose/buy
- maximum of two draws
- first draw
  - with small probability $\epsilon$ she chooses today
- if $1 - \epsilon$ realized in first draw $\rightarrow$ second draw
  - with probability $\mu$ (share of her friends who have already chosen as of $t - 1$) she chooses today
- if $1 - \mu$ realized in the second draw $\rightarrow$ consumer does not choose in $t$
What to choose

- if none of your friends have chosen as of \( t - 1 \), then choose by a coin-toss
- otherwise
  - probability of choosing an option that none of your friends have chosen is zero
  - probability for other options is

\[
x_{ij} = \frac{\exp(\alpha \times n_{ij})}{\sum_{h \in N_i} \exp(\alpha \times n_{ih})}
\]

where \( i \) is a consumer, \( j \) is an option, \( n_{ij} \) is the number of friends of consumer \( i \) that have chosen option \( j \), \( N_i \) is a set of options chosen at least once by the friends of consumer \( i \), \( \alpha \) is a parameter which allows us to control the level of non-linearity in choices
methodology

- ABM
- initialization
- stoppage rule
- settings

<table>
<thead>
<tr>
<th>Description</th>
<th>Num. values</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of agents $N$</td>
<td>1</td>
<td>10,000</td>
</tr>
<tr>
<td>Av. degree (# friends) $\nu$</td>
<td>6</td>
<td>2, 20, 40, 60, 80, 100</td>
</tr>
<tr>
<td>Number of films</td>
<td>2</td>
<td>100, 200</td>
</tr>
<tr>
<td>Pr. of ind. choice $\epsilon$</td>
<td>1</td>
<td>$10^{-4}$</td>
</tr>
<tr>
<td>Exp. of film prob. $\alpha$</td>
<td>3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>Network types</td>
<td>4</td>
<td>Reg; Rnd; SmWorld; PrefAtt</td>
</tr>
</tbody>
</table>

for each of the 144 combinations we produced 100 independent runs, for a total of 14,400 runs.
we want to study a general relation between network density and market structure (while controlling for all other effects – e.g. size of supply, topology of the network and choice exponent)

- statistical approach
- generalized linear regressions
- choice of the link function based on out of sample prediction power
- bootstrapping
- logistic link function
definitions

- “head” and “tail”
- number of the smallest firms and number of the largest films
head, 100 options

![Graph showing market share and average degree for different network models: small world, preferential attachment, lattice, random, and baseline (global interaction).]
head, 200 options

motivation

model

methodology

results

conclusion

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0 20 40 60 80 100

0 .005 .01 .015 .02

market share

average degree

small world
preferential attachment
lattice
random
baseline: global interaction
tail, 100 options
tail, 200 options

- Market share vs. average degree for different network models:
  - Small world
  - Preferential attachment
  - Lattice
  - Random
  - Baseline: global interaction

The graph shows the market share on the y-axis and the average degree on the x-axis. Different line styles represent different network models.
### Results

<table>
<thead>
<tr>
<th></th>
<th>Head</th>
<th>Tail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average degree</strong></td>
<td>0.029 (0.000)</td>
<td>0.018 (0.000)</td>
</tr>
<tr>
<td><strong>Choice exponent</strong></td>
<td>0.661 (0.009)</td>
<td>0.896 (0.014)</td>
</tr>
<tr>
<td><strong>Number of films</strong></td>
<td>0.004 (0.000)</td>
<td>0.015 (0.000)</td>
</tr>
<tr>
<td><strong>Network architecture controls</strong></td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Number of observations</strong></td>
<td>14 400</td>
<td>14 400</td>
</tr>
<tr>
<td><strong>Implied elasticity with respect to the average degree</strong></td>
<td>1.280</td>
<td>0.892</td>
</tr>
</tbody>
</table>

Notes: Presented coefficients are the estimates from the generalized linear regression with Logistic link function and robust standard errors. Standard errors are given in parentheses. Network architecture controls comprise the dummy variables for three out of four network topologies (lattice, small world and preferential attachment; random network is used as a baseline). All coefficients reported are significant at 99% level of confidence. The film is identified to belong to the head of the distribution if its market share is at least twice higher than the population average. The film is identified to belong to the tail of the distribution if its market share is at least twice lower than the population average. Variable head is calculated as the sum of market shares of all films in the head of the distribution. Variable tail is calculated as the sum of the market share of all films in the tail of the distribution.

Table 2: Head and tail

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**Motivation**

**Model**

**Methodology**

**Conclusion**
<table>
<thead>
<tr>
<th></th>
<th>Dependent variable</th>
<th>Number of smallest films</th>
<th>Number of largest films</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average degree</strong></td>
<td></td>
<td>0.003</td>
<td>-0.007</td>
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<tr>
<td></td>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td><strong>Choice exponent</strong></td>
<td></td>
<td>0.128</td>
<td>-0.179</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.001)</td>
<td>(0.002)</td>
</tr>
<tr>
<td><strong>Number of films</strong></td>
<td></td>
<td>0.001</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
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<td></td>
<td><strong>YES</strong></td>
<td><strong>YES</strong></td>
</tr>
<tr>
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<td>14 400</td>
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</tr>
<tr>
<td><strong>Implied elasticity</strong></td>
<td></td>
<td>0.135</td>
<td>-0.341</td>
</tr>
<tr>
<td>with respect to the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>average degree</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
more business generated by the head
by less options
more business generated by the tail
by more options
hollowing out of the middle of the distribution
evidence?
movie blockbusters