Impact of Rankings & Personalized Recommendations in Marketplaces

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Research Question

What are the implications of rankings and personalized recommendations in environments with & without supply-side constraints?

We study a stylized model to isolate & understand the impact of different information provisioning tools -- (public) rankings and (personalized) recommendations -- with & without supply constraints.

Fundamental interplay between the value proposition of these information provisioning tools & supply side capacity constraints

In uncapacitated settings, both tools provide benefit with their relative value depending on the level of preference heterogeneity

In capacitated setting, public rankings provide little value while personalized recommendations provide most of the value.

Model & Information Regimes

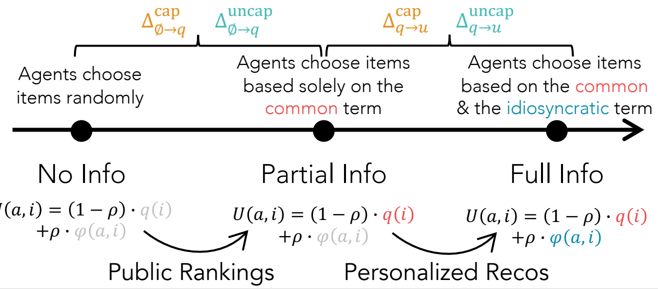
Agents' utility model

- $U(a,i) = (1-\rho)\cdot q(i) + \rho\cdot\varphi(a,i)$
- $q(i)$: Common term depends only on the item i
- $\varphi(a,i)$: Idiosyncratic term depends on the agent-item (a,i) pair
- ρ: level of heterogeneity in utility (preference heterogeneity)

Uncapacitated: n agents and n items and each item has ∞ capacity

Capacitated: n agents and n items and each item has unit capacity

Measure of interest: Expected average utility across agents



Results

We have n agents and n items. Assume that the common terms $q(i)$ and the idiosyncratic terms $\varphi(a,i)$ are drawn i.i.d from distributions F_q and F_φ and both are independent of each other.

If F_q and F_φ are bounded dist.

$\Delta^{cap}_{\emptyset\to q} = 0$ $\quad\Delta^{uncap}_{\emptyset\to q} \simeq (1-\rho)\cdot(b-\mu)$

$\Delta^{cap}_{q\to u} \simeq \rho\cdot(b-\mu)$ $\quad\Delta^{uncap}_{q\to u} \simeq \rho\cdot(b-\mu)$

If F_q and F_φ have exponential tails

$\Delta^{cap}_{\emptyset\to q} = 0$ $\quad\Delta^{uncap}_{\emptyset\to q} \simeq (1-\rho)\cdot\ln n$

$\Delta^{cap}_{q\to u} \simeq \rho\cdot\ln n$ $\quad\Delta^{uncap}_{q\to u} \simeq \max\{0, 2\rho-1\}\cdot\ln n$

If F_q and F_φ have Pareto tails

$\Delta^{cap}_{\emptyset\to q} = 0$ $\quad\Delta^{uncap}_{\emptyset\to q} \simeq c(1-\rho)\cdot n^{1/\alpha}$

$\Delta^{cap}_{q\to u} \simeq c\rho\cdot n^{1/\alpha}$ $\quad\Delta^{uncap}_{q\to u} \simeq c(g(\alpha,\rho))\cdot n^{1/\alpha}$