Reputation Mechanisms for Electronic Marketplaces

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Introduction

In electronic marketplaces (such as eBay):

- The seller sees the item he has for sale
- Potential buyers only see the seller's description

Reputation mechanisms:

- Collect ratings on seller's past transactions
- Provide aggregate information to potential buyers

Question:
How should we aggregate ratings to incentivize sellers to always describe their items accurately?

Model

r_i : rating seller received i periods ago ($\in \{0, 1\}$)
$s(\vec{r})$: reputation score for ratings $\vec{r} = (r_0, r_1, \ldots)$

In every period the seller has an item of value v_H or $v_L < v_H$

At the beginning of the period,
he observes the value and chooses a description $v \in \{v_H, v_L\}$

The expected payment to the seller is $v \cdot b(s)$,
where $b(\cdot)$ non-negative and non-decreasing

Seller's attributes
p_H : probability of having an item of value v_H for sale
δ : discount factor

Seller's optimization

$$V(\vec{r}) = p_H(v_H b(s(\vec{r})) + \delta V(1, \vec{r})) \\ p_L \max\{v_H b(s(\vec{r})) + \delta V(0, \vec{r}), v_L b(s(\vec{r})) + \delta V(1, \vec{r})\}$$

Dishonest behavior results in higher payments now,
but also lower reputation–and thus lower payments–in the future.

Unweighted Reputation Mechanism

Buyers see total number of ratings (N)
and number of positive ratings (P)

Theorem: If $b(N, N) > c$ for large N;
and $b(N, N) - b(N-1, N) \to 0$ as $N \to \infty$,
then it is optimal for the seller to falsely advertise for some large N.

For a large class of payment functions,
the seller is not truthful when N is large

Weighted Reputation Mechanism

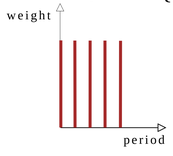
Weight recent ratings more

$s(\vec{r}) = \sum_{i=0}^{\infty} w_i \cdot r_i$

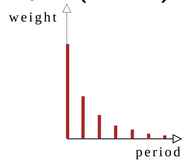
- w_i decreasing in i
- $\sum_i w_i = 1$
- $w_i \geq 0$

Examples of Weighted Mechanisms

Window mechanism:
$w_i = 1/T \cdot 1_{\{i<T\}}$



Exponential smoothing:
$w_i = (1-\alpha)\alpha^i$



Will the seller always be truthful?

Theorem:

- Yes, if payment is strictly convex; $p_H + \frac{v_L}{v_H - v_L} > 1$;
  δ sufficiently large; and $b_{\vec{w}}(0) = 0$.
- No, if payment function is concave; and $p_H + \frac{v_L}{v_H - v_L} < 1$.

For $v_L = 0$ and any $\vec{w}$ with $w_0 < 1$ we get a dichotomy:
If $b_{\vec{w}}$ strictly convex, sellers with large δ and p_H are incentivized
If $b_{\vec{w}}$ concave, no seller is incentivized

Optimal Weighted Mechanism

Given an aggregate buyer behavior $b_{\vec{w}}$,
choose $\vec{w}$ to maximize the range of parameters (δ, p_H)
for which it is optimal for the seller to be always truthful

- Given δ, maximize range of p_H
- Given p_H, maximize range of δ

How many ratings should affect the reputation score?

Theorem: If $b_{\vec{w}}(\cdot) = b(\cdot)$ log concave and strictly convex,
then the optimal number is

- increasing in δ
- decreasing in p_H
- finite

Optimal Window Mechanism

Theorem: If b_T is log-concave for all T,
then the optimal window is

- increasing in δ
- decreasing in p_H

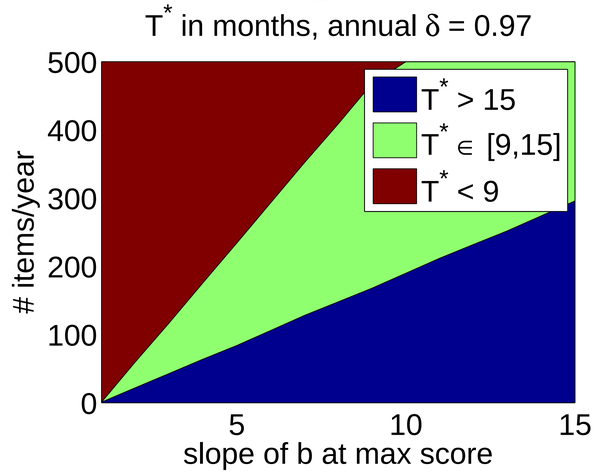
Tradeoff between incentivizing
***patient* sellers (i.e., with large δ) and**
***high quality* sellers (i.e., with large p_H)**

eBay's Reputation System

- Prior to May 2008, all ratings were weighted equally
  in primarily shown information
- Now the Positive Feedback percentage is calculated based
  only on ratings received in the last 12 months

12 months also used by the Amazon Marketplace

When is 12 months a good choice?



Conclusions

- Weighting all ratings equally does not incentivize truthfulness
- Weighting recent ratings more can incentivize truthfulness
  under increasing returns to reputation
- Information from a larger number of past transactions
  better incentivizes patient sellers,
  but does not incentivize higher quality sellers as well