Customer Sharing in Economic Networks with Costs

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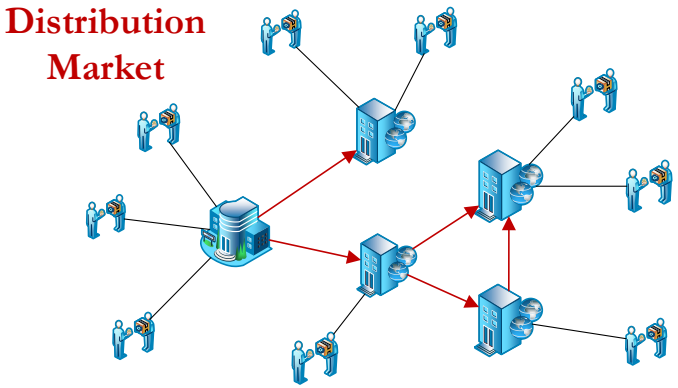
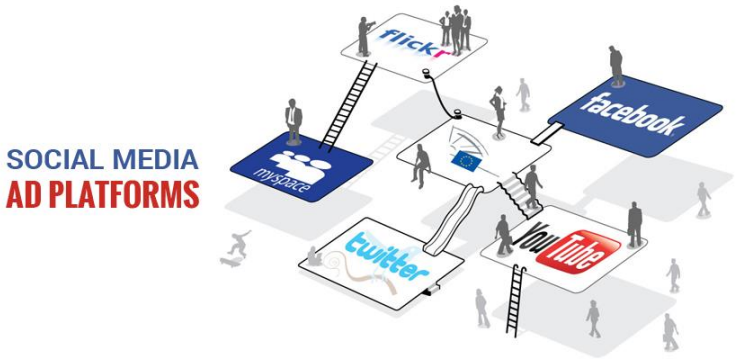
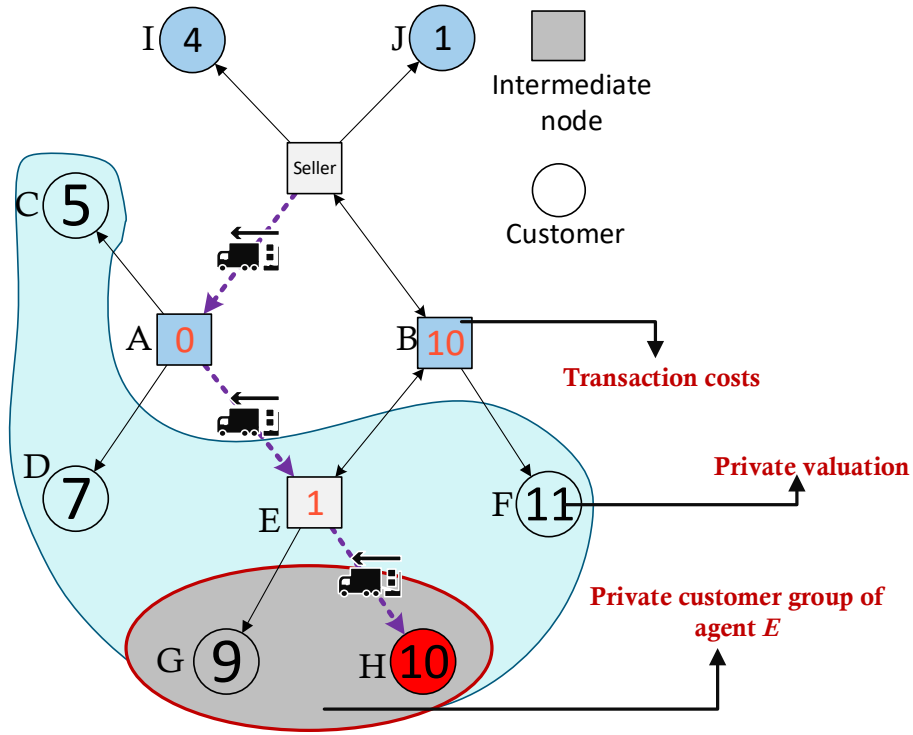
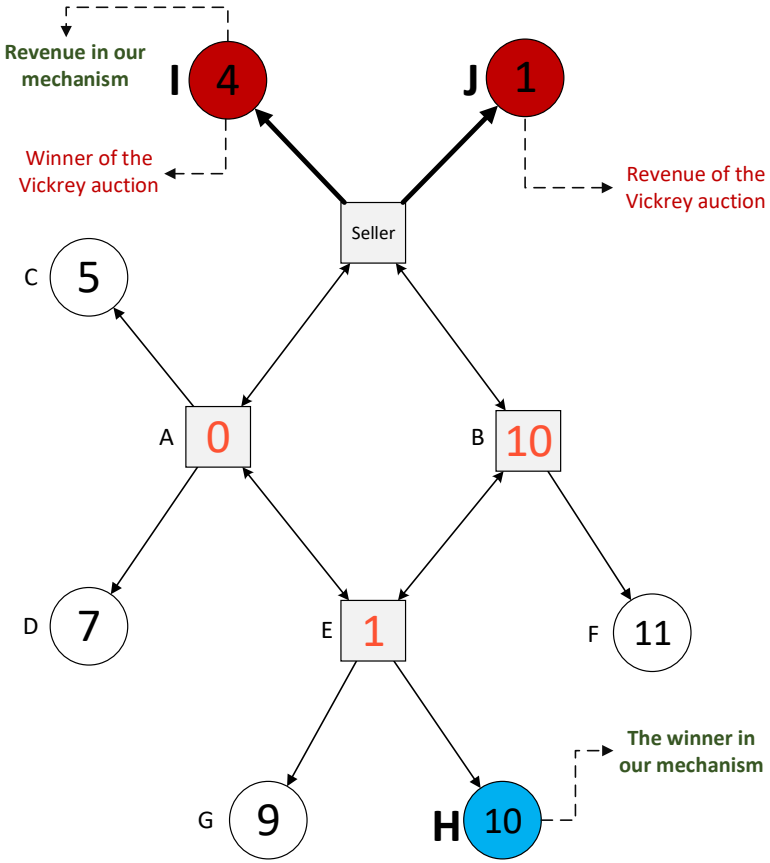
Economic Networks







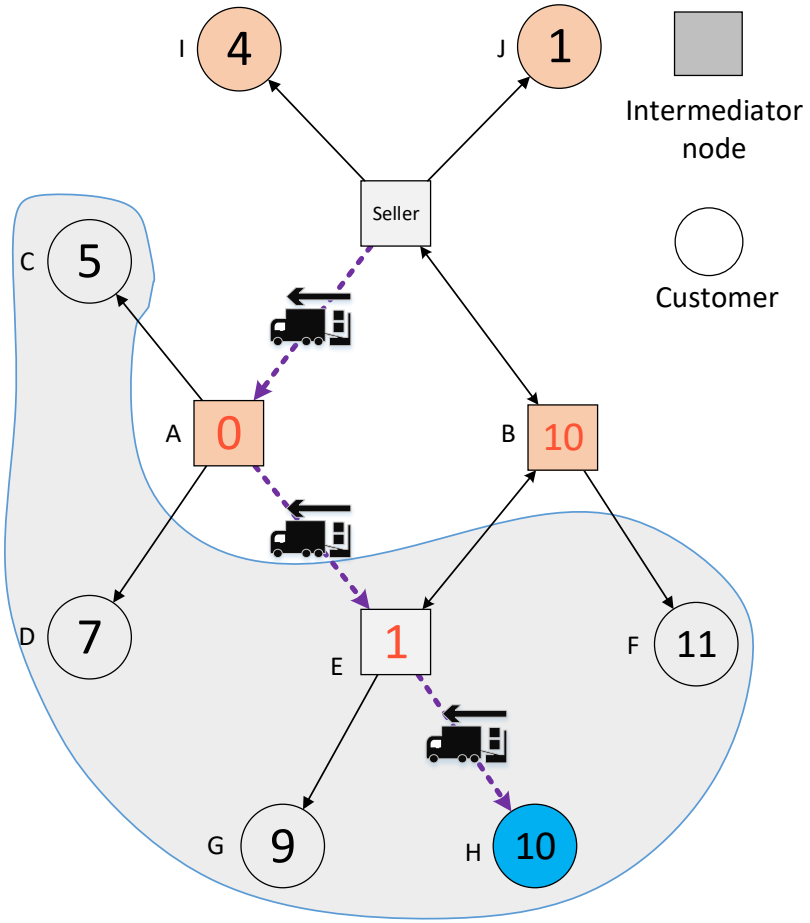
Customer Sharing



Benefits

- Sharing improves social welfare.
- Sharing increases revenue.

Customer Sharing: Single Item Auction



- Unobservable Network.
- Private Customer Group.
- Strategic Neighbour-Sharing.
- Strategic Bids Report.
- Transaction Costs.
- Limited Communication.

Customer Sharing: Single Item Auction

The Goal

Design mechanisms that incentivize intermediate nodes to **share all their neighbors to the seller** and at the same time, motivate all buyers to **reveal their true valuations** on the commodity.

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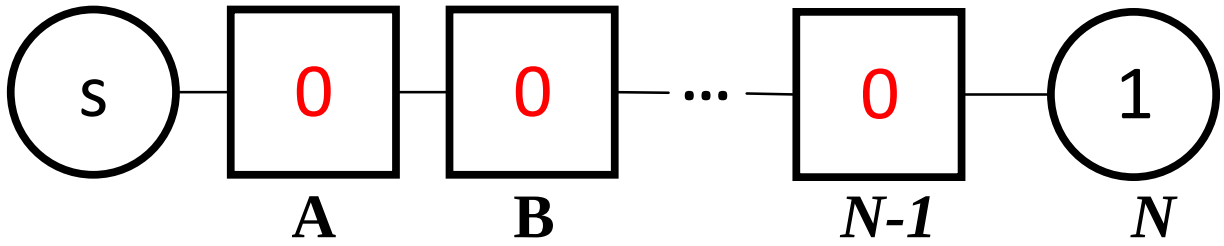
Efficiency&Revenue

More importantly, we also want **maximize the social welfare** (globally) and achieve a **higher revenue** compared with holding an auction in seller's neighbors only (the Vickrey auction).

The VCG Mechanism is not Applicable



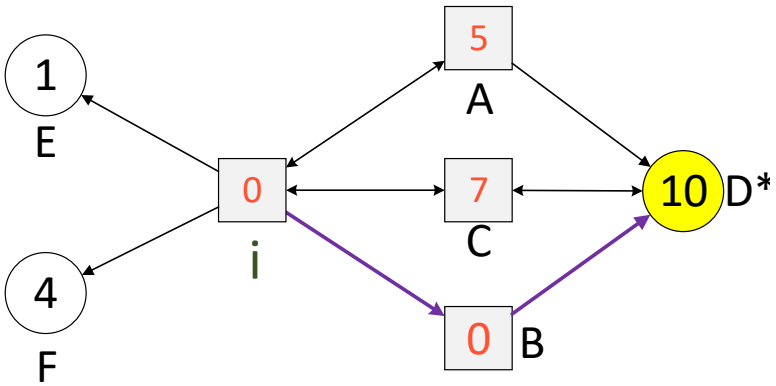
Claim.

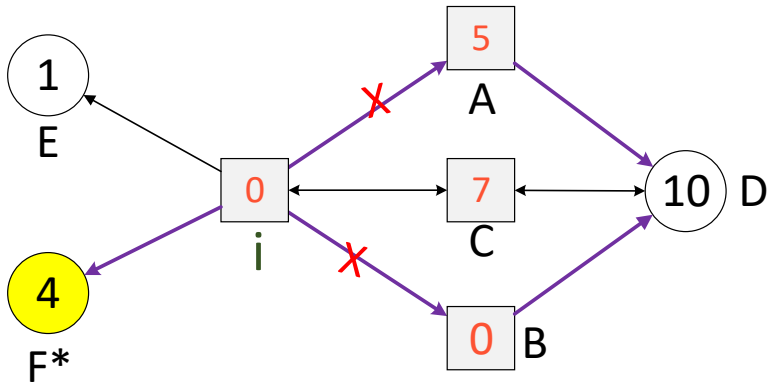
The seller's revenue is -$(N-1)$ when applying the VCG mechanism in above line network.

Customer Sharing Mechanism: Threshold Neighborhood

Definition

Given the agents' type report profile t', for each intermediate node $i \in N$, define i's *threshold neighbourhood* $r_i^{*\prime}$ as the minimum subset of r_i' that makes **the winner under efficient allocation changed if i does not share the sale information to** $r_i^{*\prime}$, i.e., $r_i^{*\prime} = \arg\min_{r_i'' \subseteq r_i'} \{|r_i''|\}$ where $\pi_{m'}(r_i' \setminus r_i'', t''_{-i}) = 1 \wedge \pi_m(r_i', t'_{-i}) = 1 \wedge m' \neq m$ and π is an efficient allocation.





Customer Sharing Mechanism(CSM)

- **Allocation policy:** Given a feasible type profile t', allocate the commodity to buyer $m = \arg\max_{j \in N} SW_j$ (i.e., efficient allocation) and trade the commodity along LCC_m.
- **Payment policy:** The payment policy is defined for each category of agents as follows.
  - for customer $i \in N$, her payment is defined as:

$$W^*_{-i} - W^*(t') + v_i(t'_i, \pi^{csm}).$$

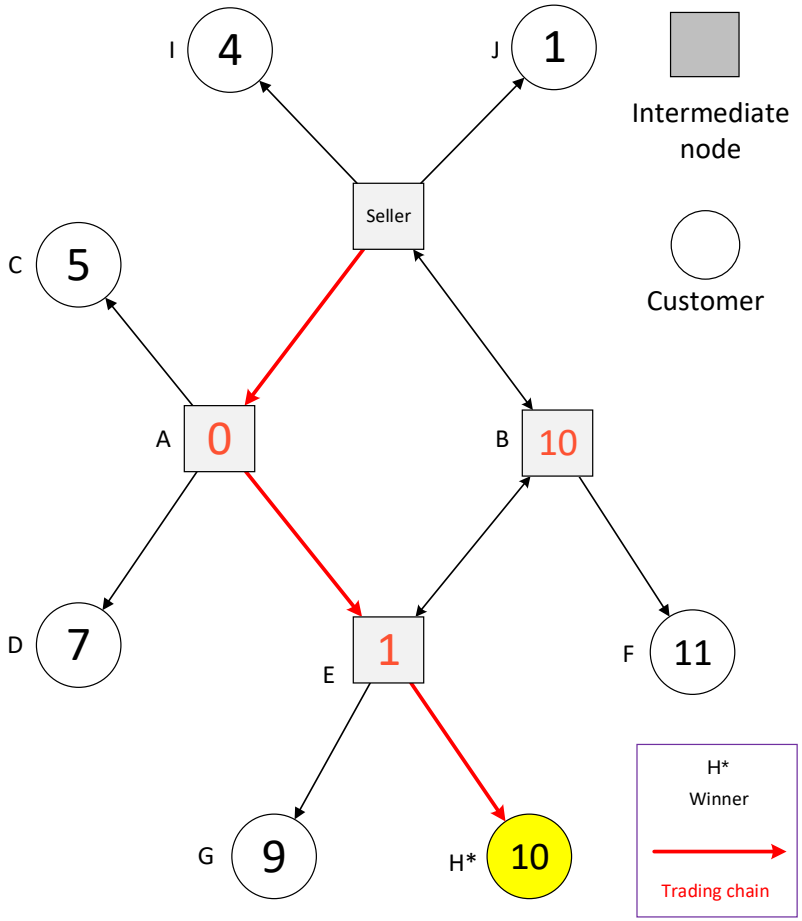
  - for an intermediate node i, her payment is:

$$W^*_{-d_i} - W^*_{-r_i^{*\prime}} + v_i(t'_i, \pi^{csm}),$$

    where $W^*_{-r_i^{*\prime}}$ denotes the maximum social welfare under feasible type profile $(r'_i \setminus r_i^{*\prime}, t''_{-i})$.

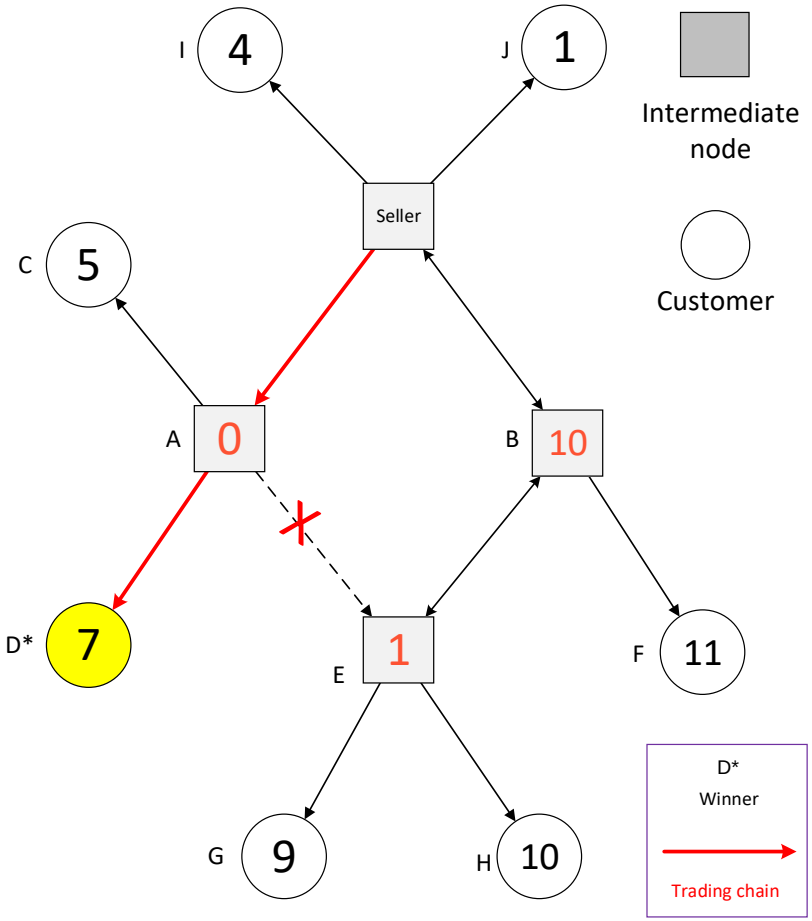
PS:LCC_m is the trading chain with least costs from s to m.

Running Example



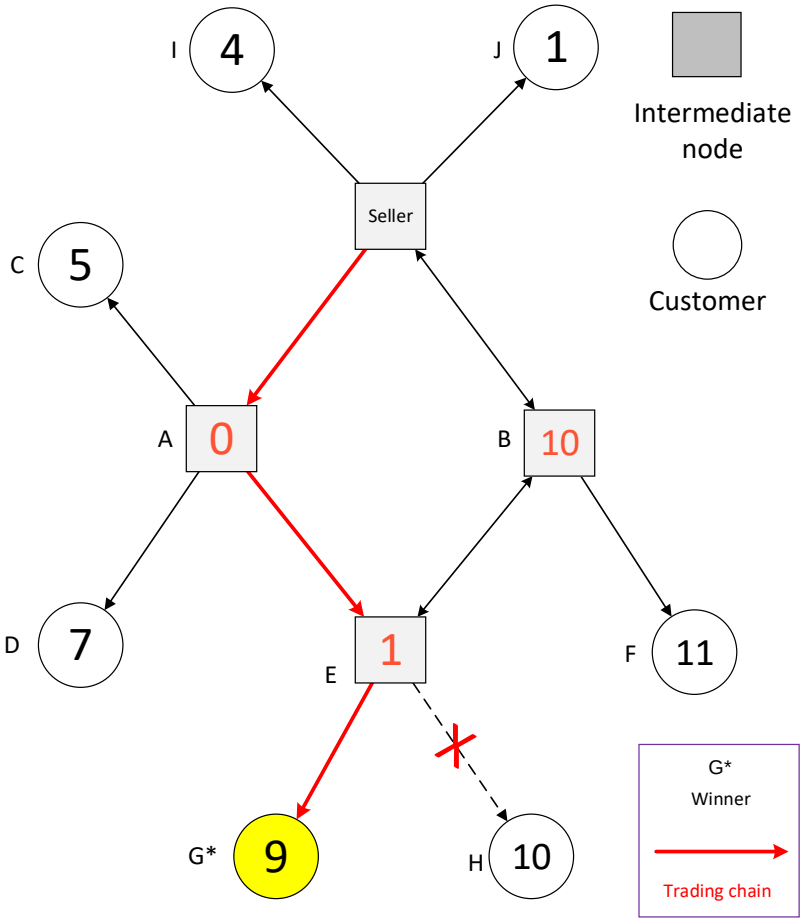
1. The trading chain is **S-A-E-H** and the winner is **H**.

Running Example



1. The trading chain is **S-A-E-H** and the winner is **H**.
2. *A*'s threshold neighborhood is **E** and her payment is **4-7+(-0)=-3**.

Running Example



1. The trading chain is **S-A-E-H** and the winner is **H**.
2. *A*'s threshold neighborhood is **E** and her payment is **4-7+(-0)=-3**.
3. *E*'s threshold neighborhood is **H** and her payment is **7-8+(-1)=-2**.

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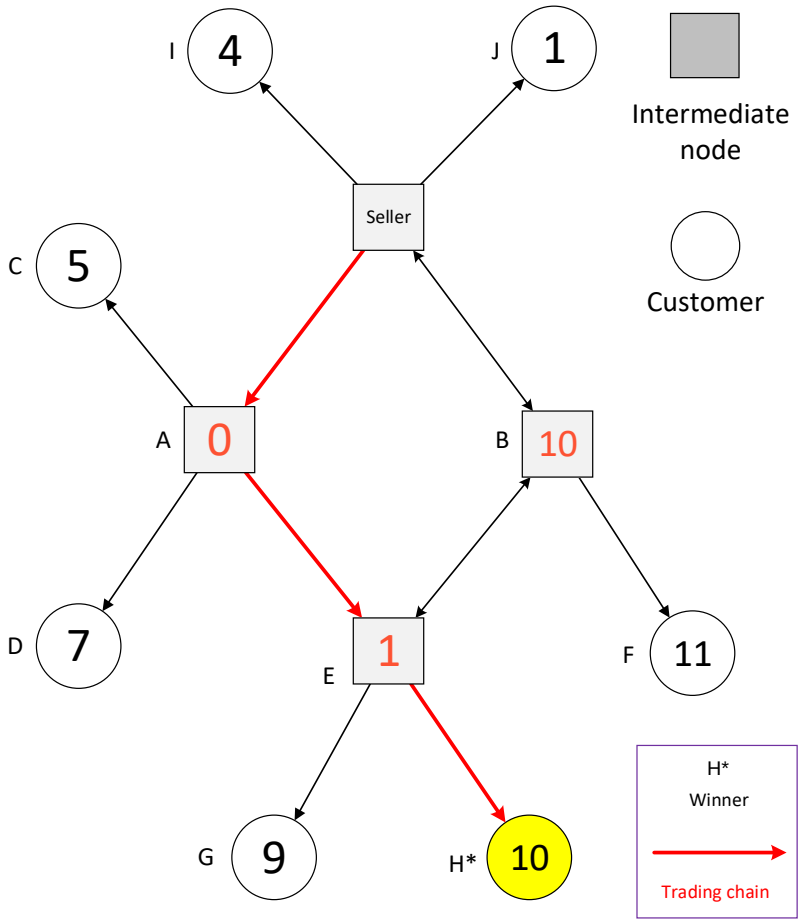

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4. *H**'s payment is **8-9+10=9**.

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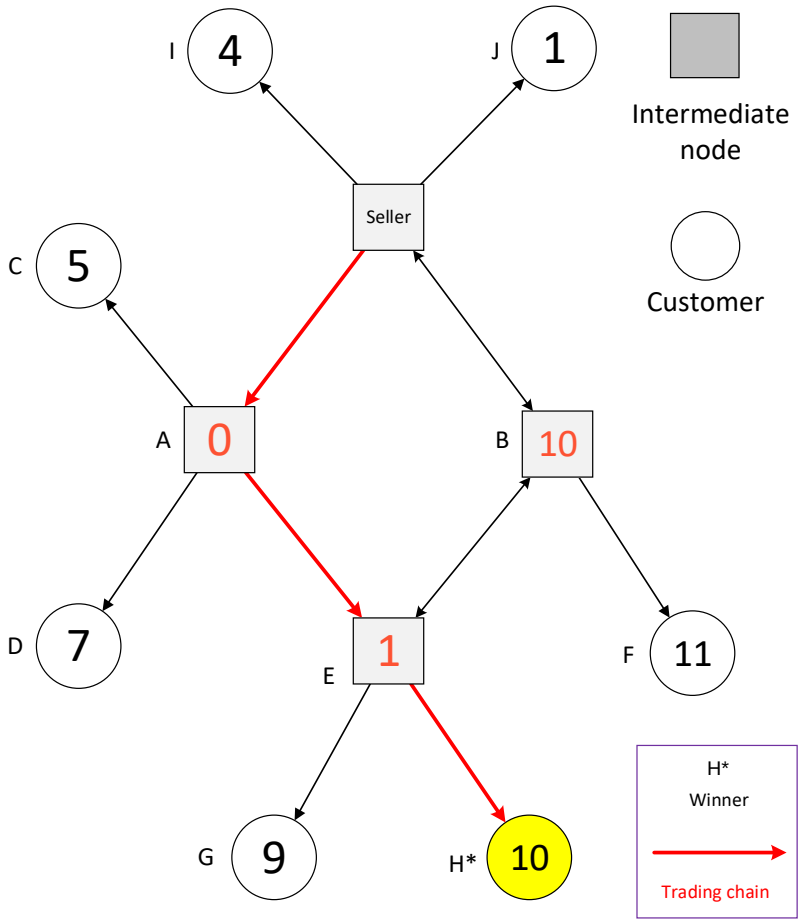

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4. *H**'s payment is **8-9+10=9**.
5. The total revenue of seller is **-3+(-2)+9=4**.

Main Theorem

Theorem

CSM is efficient, individually rational, incentive compatible and budget balanced. In particular, the seller's revenue is no less than $W^*_{-d_{1^*}}$ *(no less than that given in the Vickrey auction) where agent* 1^* *is the first agent in* LCC_m *with* $r_i^* \neq r_i$.

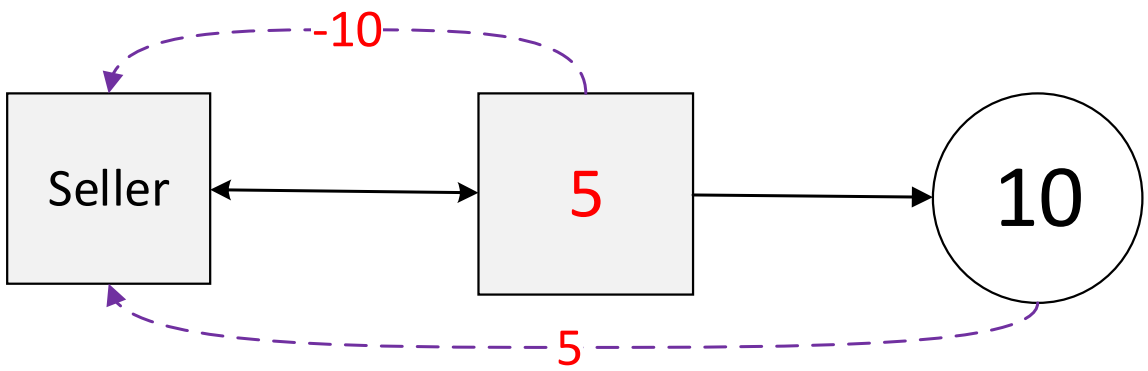
Future Work

- What if intermediate nodes also have valuations on the commodity?
- Characterize all truthful customer sharing mechanisms.
- Revenue maximization problem in economic networks.

Q & A

Thank you for listening!

When Costs are Private



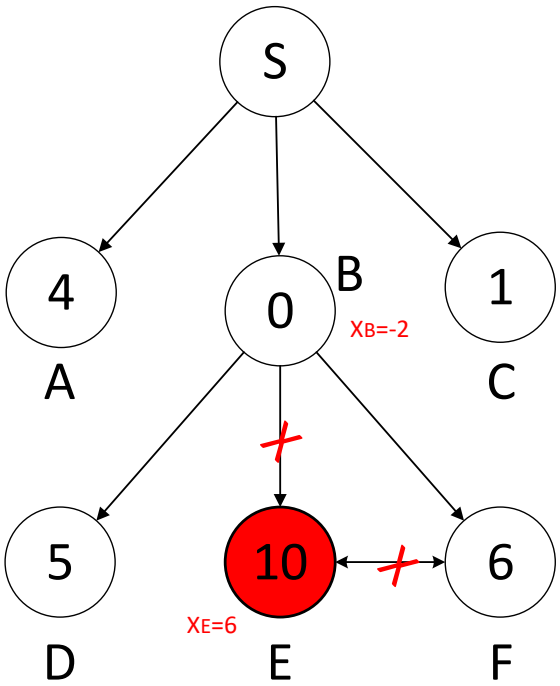
Myerson et al. 1983

There is no bilateral trade mechanism which satisfies the four properties mentioned above, i.e., IR, WBB, BNIC and EE.

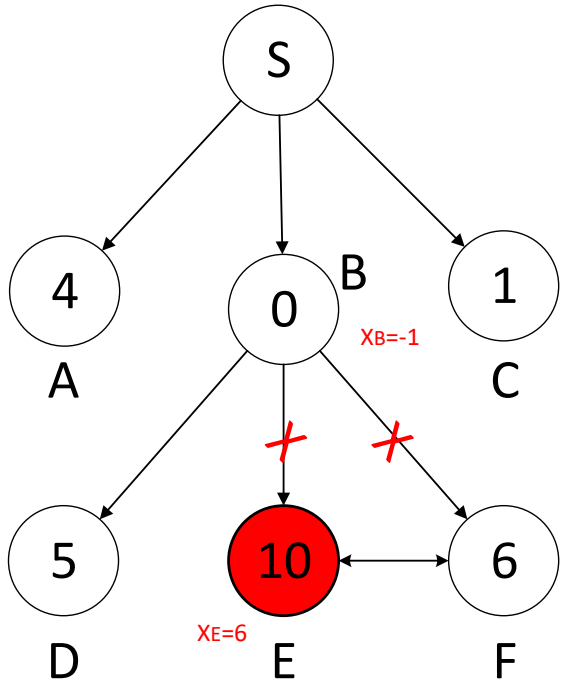
Other Issues: When Costs Disappear

Claim.

When costs are disappear, IDM with $-r_i*$ instead of $-d_i$ achieves a higher revenue for the seller because of $-r_i* \subseteq -d_i$.



Original IDM with -d_i



New IDM with -r_i*

Simulations

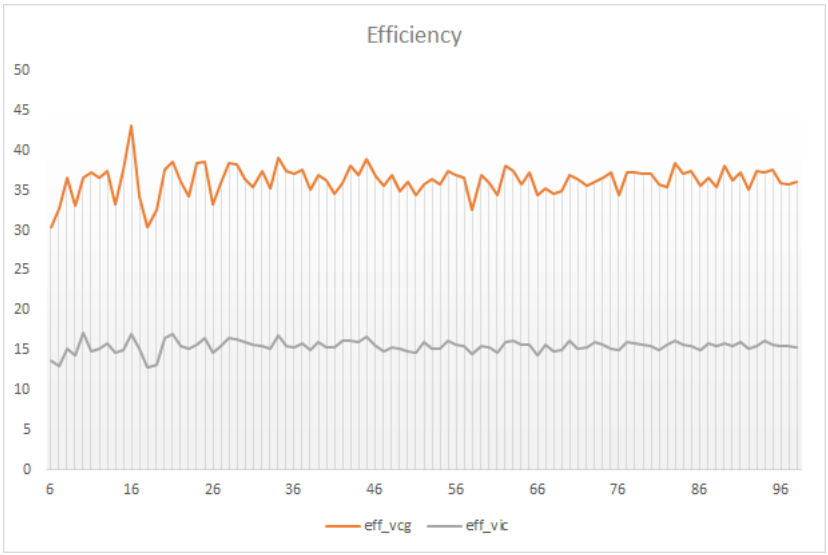


Figure: Efficiency comparison of three mechanisms

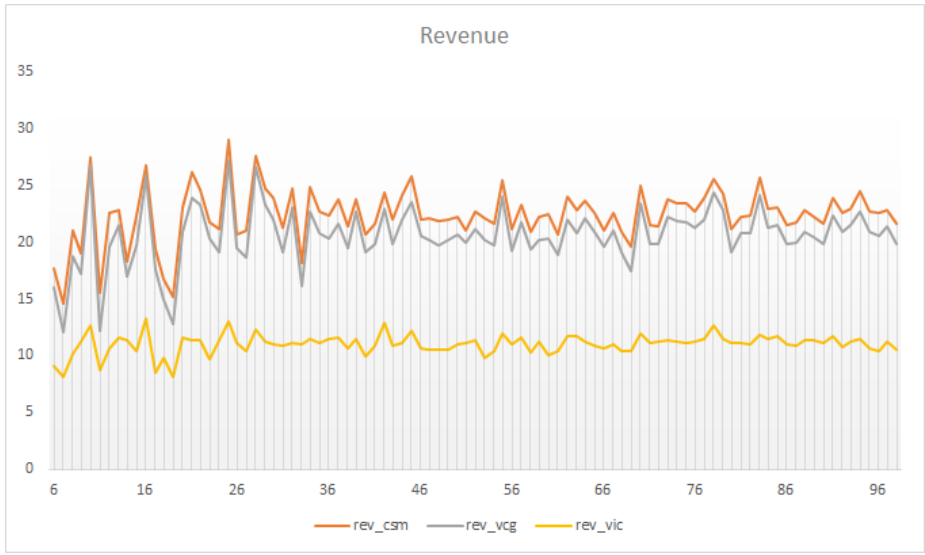


Figure: Revenue comparison of three mechanisms