Information Disclosure by Informed Intermediary in Double Auction

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May 26, 2023
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Motivation

- Role of intermediaries has been extensively studied in economics
  - Dealers: Rubinstein and Wolinsky (1987), Biglaiser (1993), Gehrig (1993), Spulber (1996), Rust and Hall (2003), etc.
  - Brokers: Yinger (1981), Yavas (1994)
- Intermediaries acquire information
  - More knowledgeable than typical buyers and sellers
- Can act as advisors or information providers
- Intermediaries' communications with buyers and sellers received relatively less attention

This paper...

- Studies intermediary (broker)'s communication and impact on market outcomes
  - Based on double auction setting
  - Introduce partially informed intermediary
  - Intermediary disclose information to
    - Both buyer and seller / either buyer or seller / none
- Compare two most common incentives
  - Maximize expected transaction price: percentage-fee intermediaries
    - Ex. real estate agents, financial brokers, online market platforms, etc.
  - Maximize trade probability: fixed-fee intermediaries
    - Ex. mediators, travel agents, matchmaking platforms, etc.

Preview of results

- Maximizing trade probability is superior to maximizing expected transaction price
  - Intermediary discloses information truthfully w/ former incentive
  - Intermediary may deceive buyer w/ latter incentive
  - Former incentive leads to higher trade probability and higher expected transaction price
- More information better
  - Buyer & seller mostly prefer intermediary disclosing information to both
  - Buyer & seller prefer exclusive information if intermediary discloses information to one party
  - Buyer & seller may prefer intermediary disclosing information to the other party than no disclosure

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Literature review

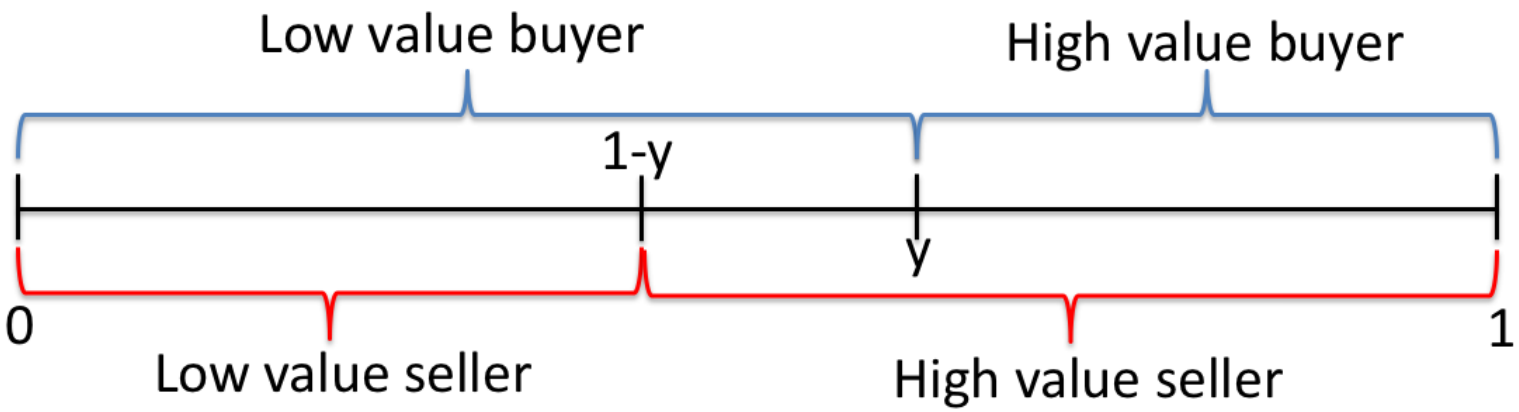
- **Inefficiency in double auction:** Chatterjee and Samuelson (1983), Myerson and Satterthwaite(1983)
- **Inefficiency dissipates with many buyers & sellers:** Gresik and Satterthwaite (1989), Satterthwaite and Williams (1989), Williams (1991), Rustichini et al. (1994), Cripps and Swinkels (2006), Reny and Perry (2006), Fudenberg et al. (2007)
- **Communication in double auction:** Farrell and Gibbons (1989), Suvorov and Tsybuleva (2010)
- **Intermediary as advisor:** Inderst and Ottaviani (2009, 2012), Mullainathan et al. (2012), Jiang et al. (2012), Anagol et al. (2017), Robles-Garcia (2020), Larsen et al. (2021)

Model setting

- Three players: buyer, seller, informed intermediary
- Seller owns indivisible object; buyer wants to acquire
  - Buyer's valuation: $v^b \sim U_{[0,1]}$
  - Seller's valuation: $v^s \sim U_{[0,1]}$
- Risk neutral
- Additively separable utility (object & money)
  - Buyer's utility: $v^b - p$
  - Seller's utility: $p - v^s$
- No trade: utilities are normalized to 0

Model setting: Informed intermediary

- Informed intermediary has partial information
  - $y \in (0, 1)$
  - $v^b \in [0, y]$ (Low) or $v^b \in [y, 1]$ (High)
  - $v^s \in [0, 1-y]$ (Low) or $v^s \in [1-y, 1]$ (High)



Model setting: Timeline

- Nature selects v^b from $U_{[0,1]}$ & v^s from $U_{[0,1]}$
- Buyer learns v^b & seller learns v^s
- Intermediary observes signals about v^b & v^s
- Intermediary delivers private messages
- Buyer & seller simultaneously make offer b & s
- If $b \geq s$, trade object at $\frac{b+s}{2}$

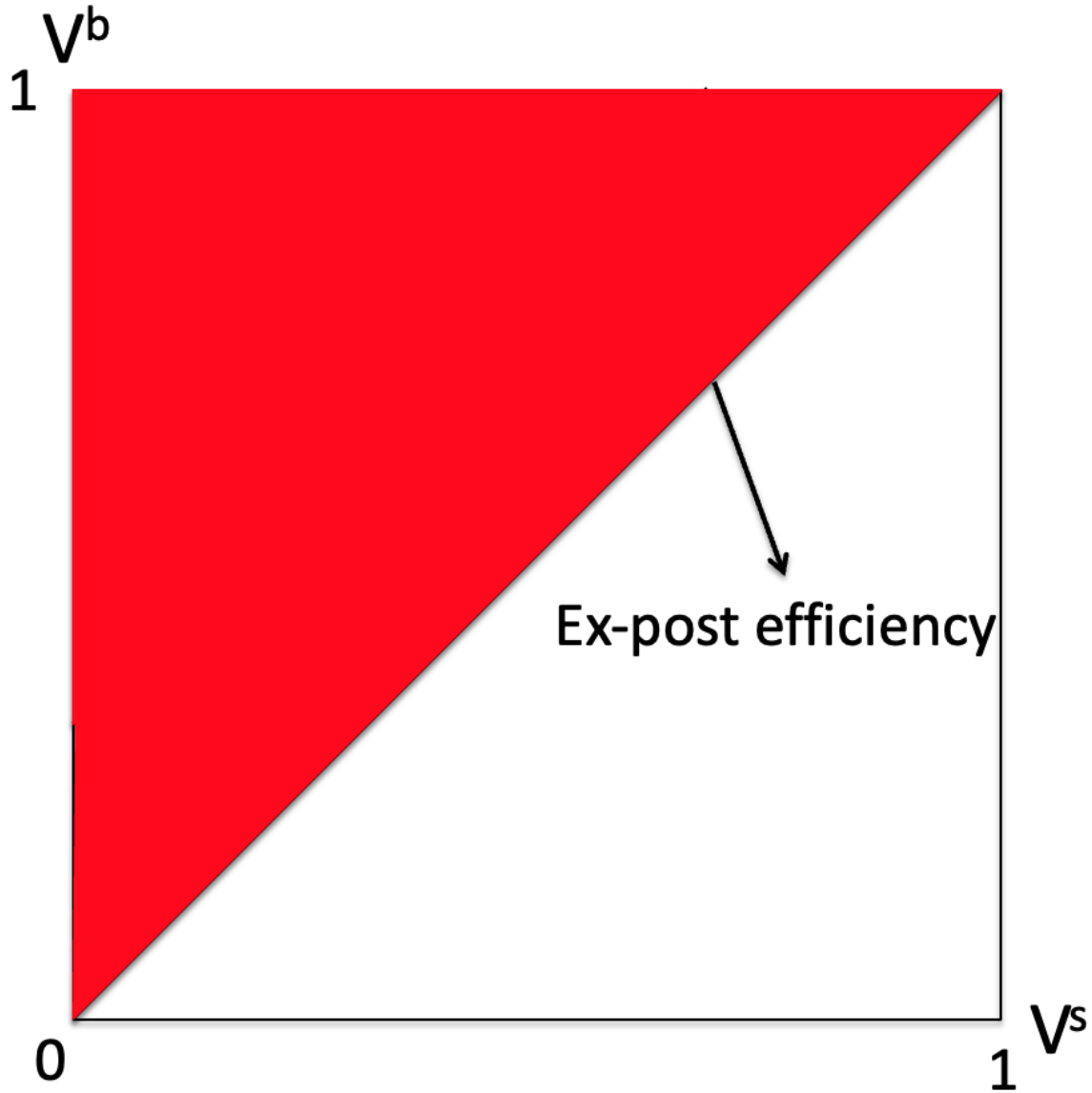
Definitions of candidate equilibria

- Intermediary discloses information to:
  - Both buyer & seller
  - Buyer only
  - Seller only
  - None (Babbling)
- After intermediary's messages, buyer & seller do double auction

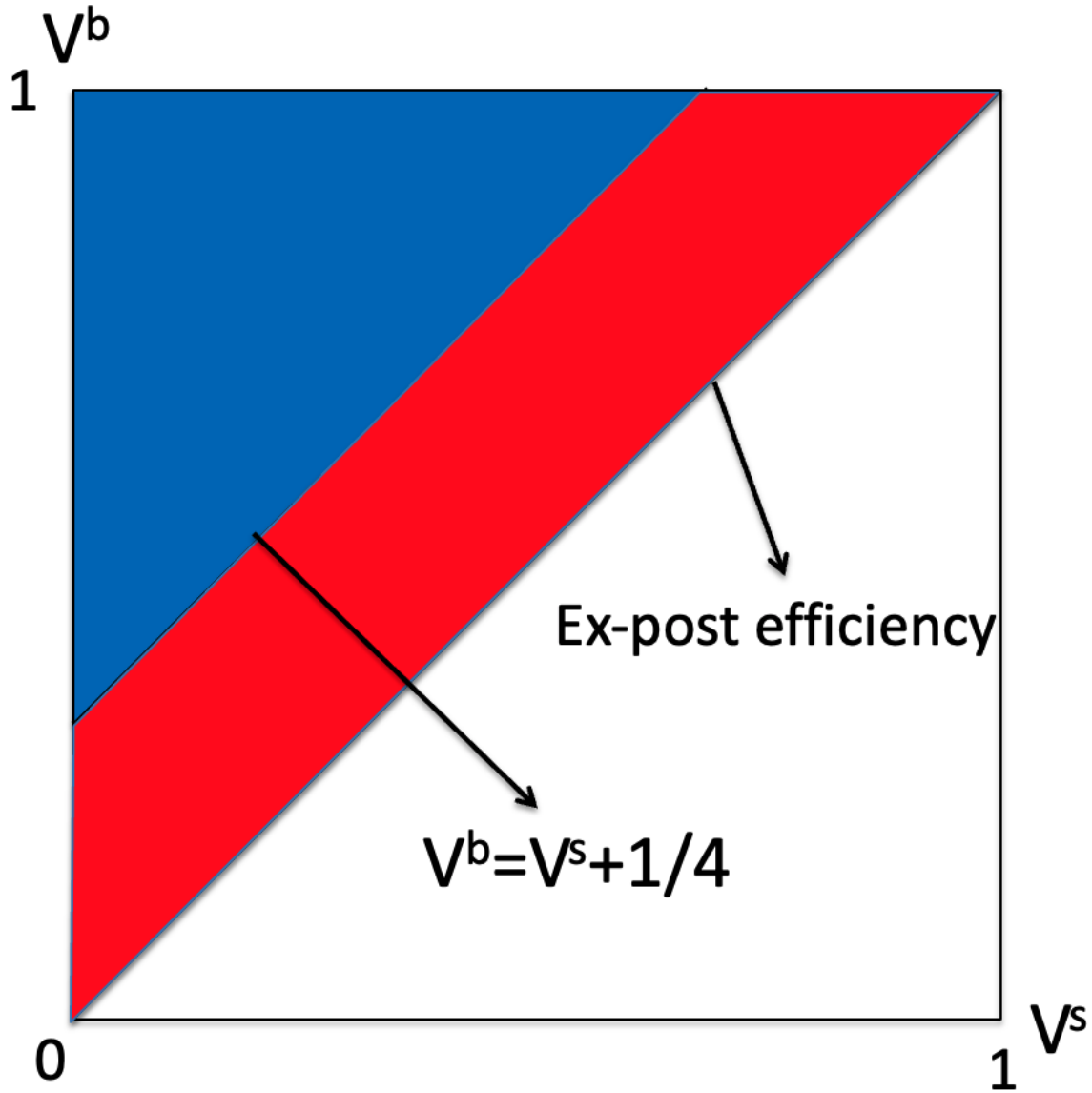
Babbling equilibrium

- Intermediary does not discloses information at all: equivalent to Chatterjee and Samuelson (1983)
  - Buyer understates valuation: $b_0 \leq v^b$
  - Seller overstates valuation: $s_0 \geq v^s$
  - Even if $v^b \geq v^s$, no trade with positive probability
    $\Rightarrow$ Ex-post inefficient

Babbling: Chatterjee & Samuelson (1983)



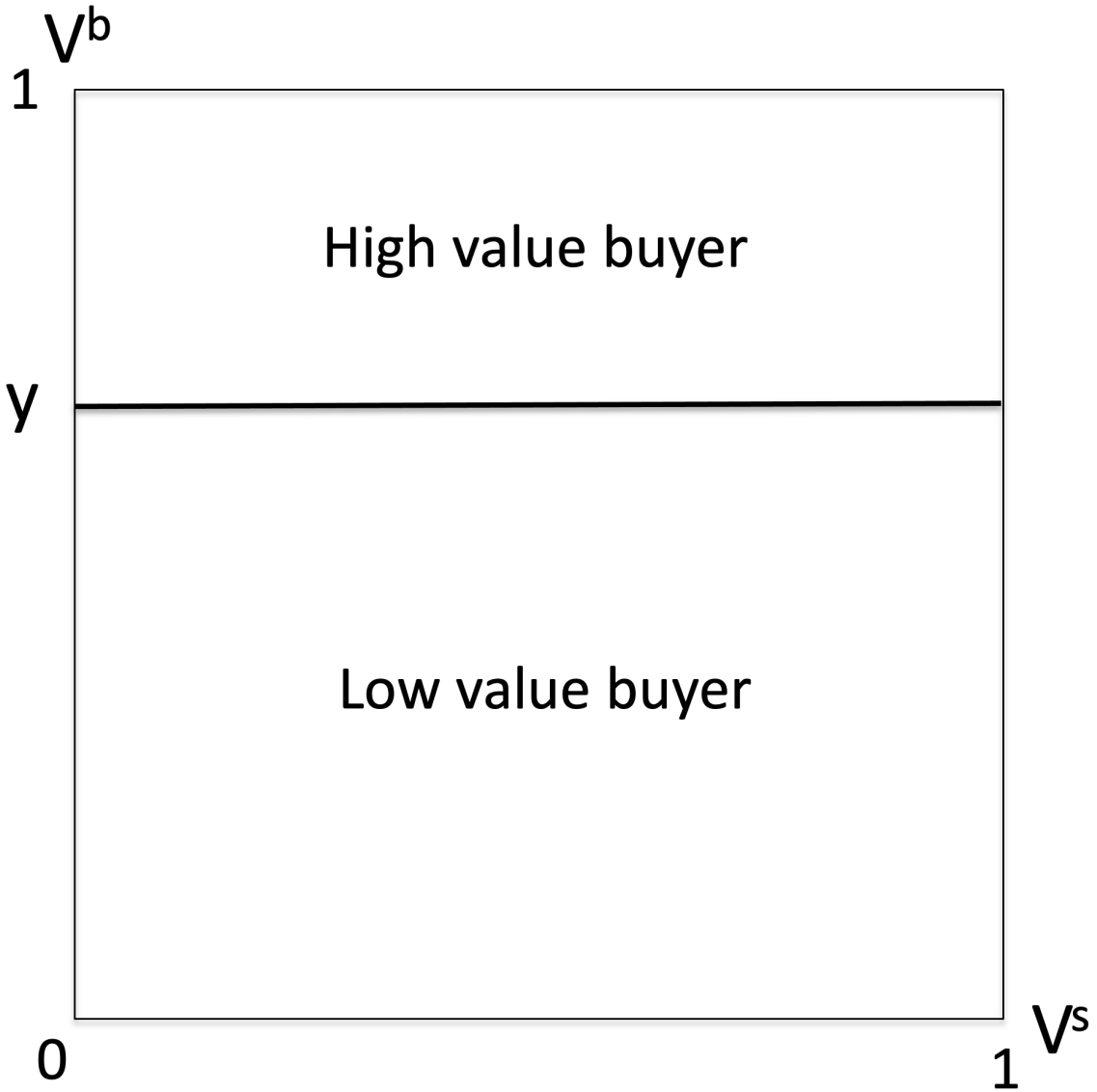
Babbling: Chatterjee & Samuelson (1983)



Seller receives information

- Intermediary discloses information only to seller
  - Seller knows whether buyer's valuation is low ($\leq y$) or high ($\geq y$)
  - Seller less overstates if buyer's value is low: $v^s \leq s_{s1} \leq s_0$

Seller receives information



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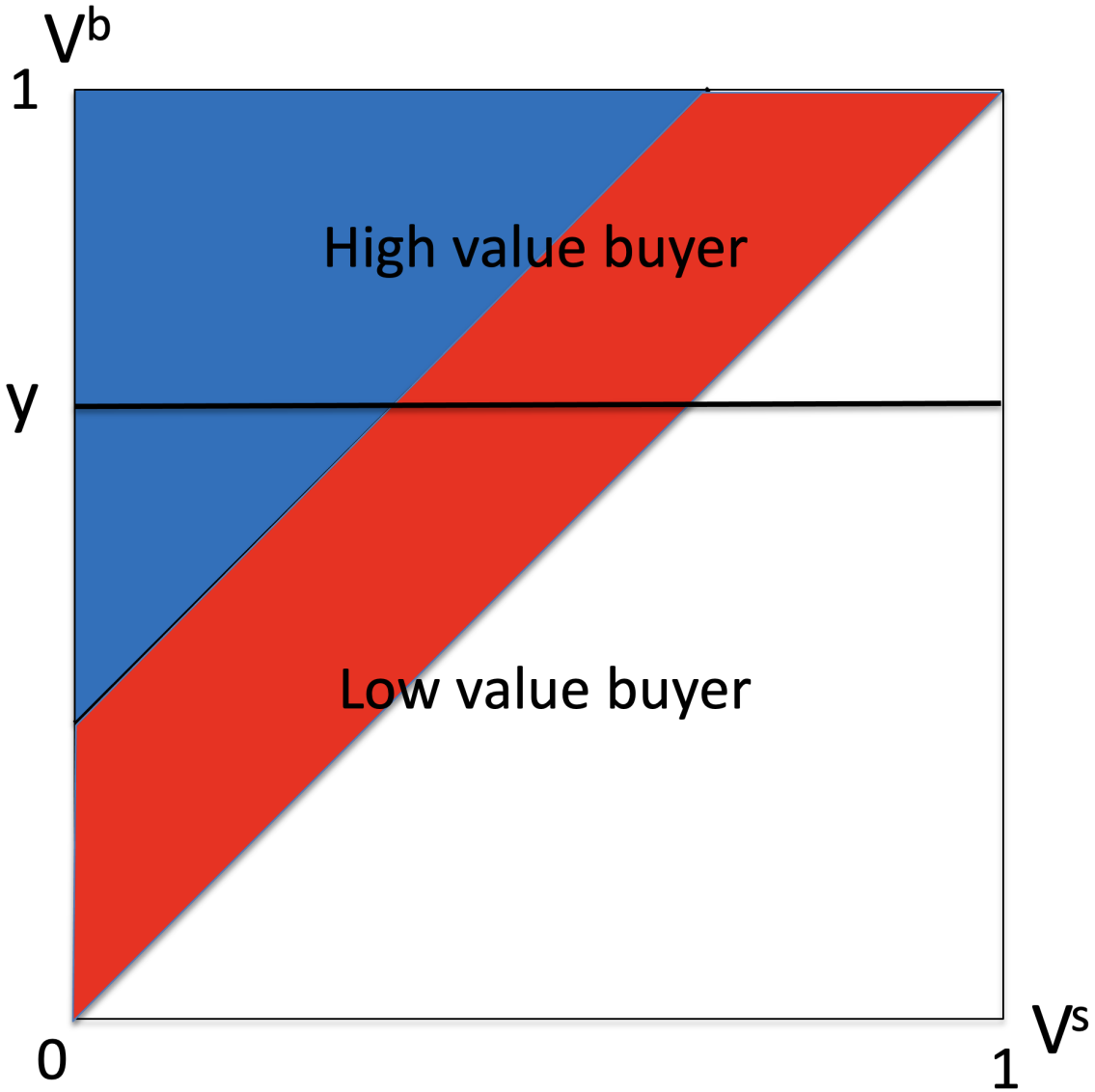

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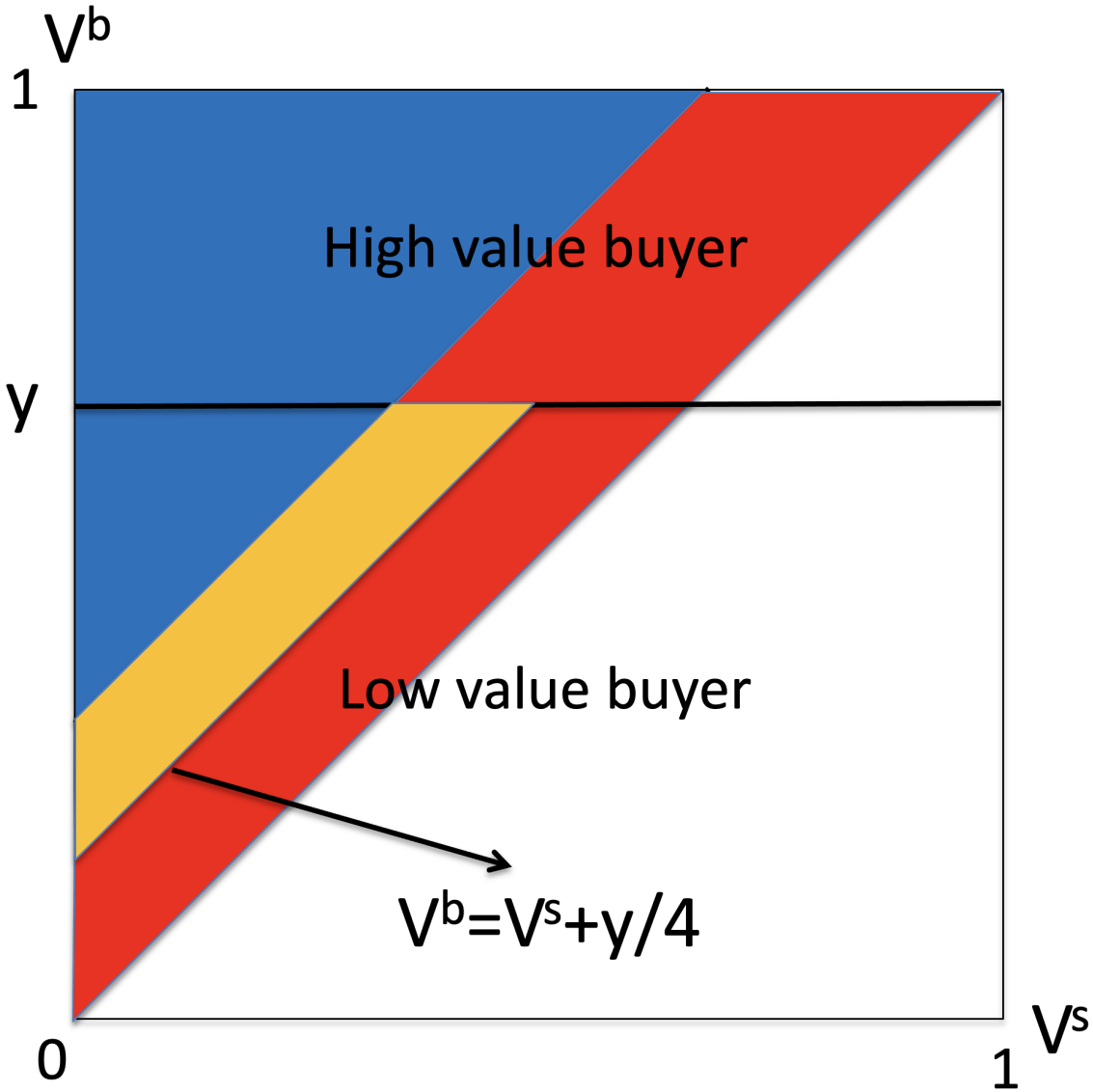


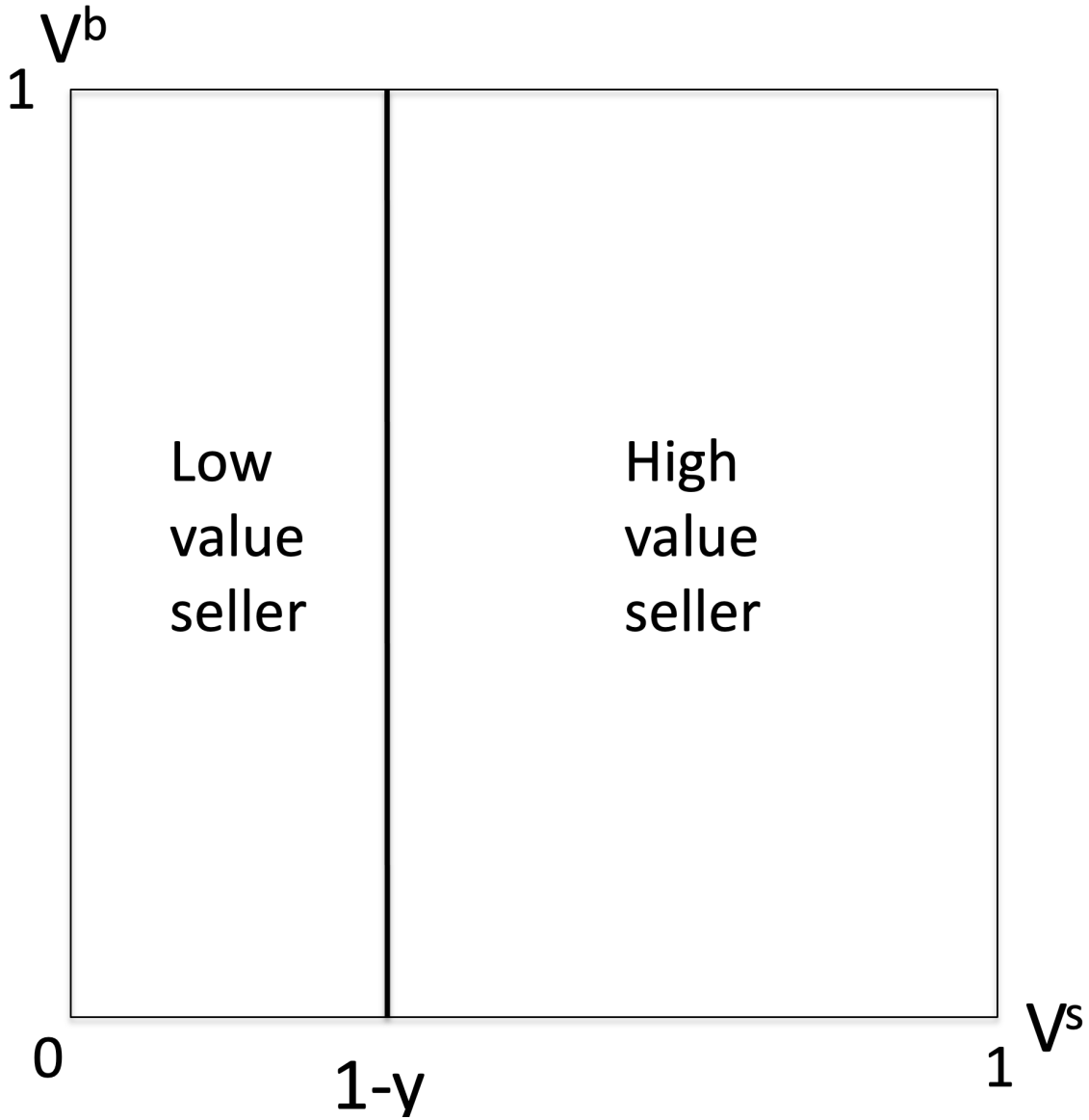
Seller receives information

- Trade probability & expected price are higher than in babbling equilibrium
- Seller's expected payoff is greater than in babbling equilibrium
- Buyer's expected payoff is greater than in babbling equilibrium for lower y values (≤ 0.5892)
  - Seller has informational advantage (cost for buyer)
  - Lower y, lower seller's offer with low-value buyer (benefit for buyer)
    $\Rightarrow$ Benefit decreases with y values
- Intermediary has no incentive to lie regardless of incentives (max probability or max expected price)

Buyer receives information

- Intermediary discloses information only to buyer
  - Buyer knows whether seller's valuation is low ($\leq 1-y$) or high ($\geq 1-y$)
  - Buyer less understates if seller's value is high: $b_0 \leq b_{b1} \leq v^b$

Buyer receives information



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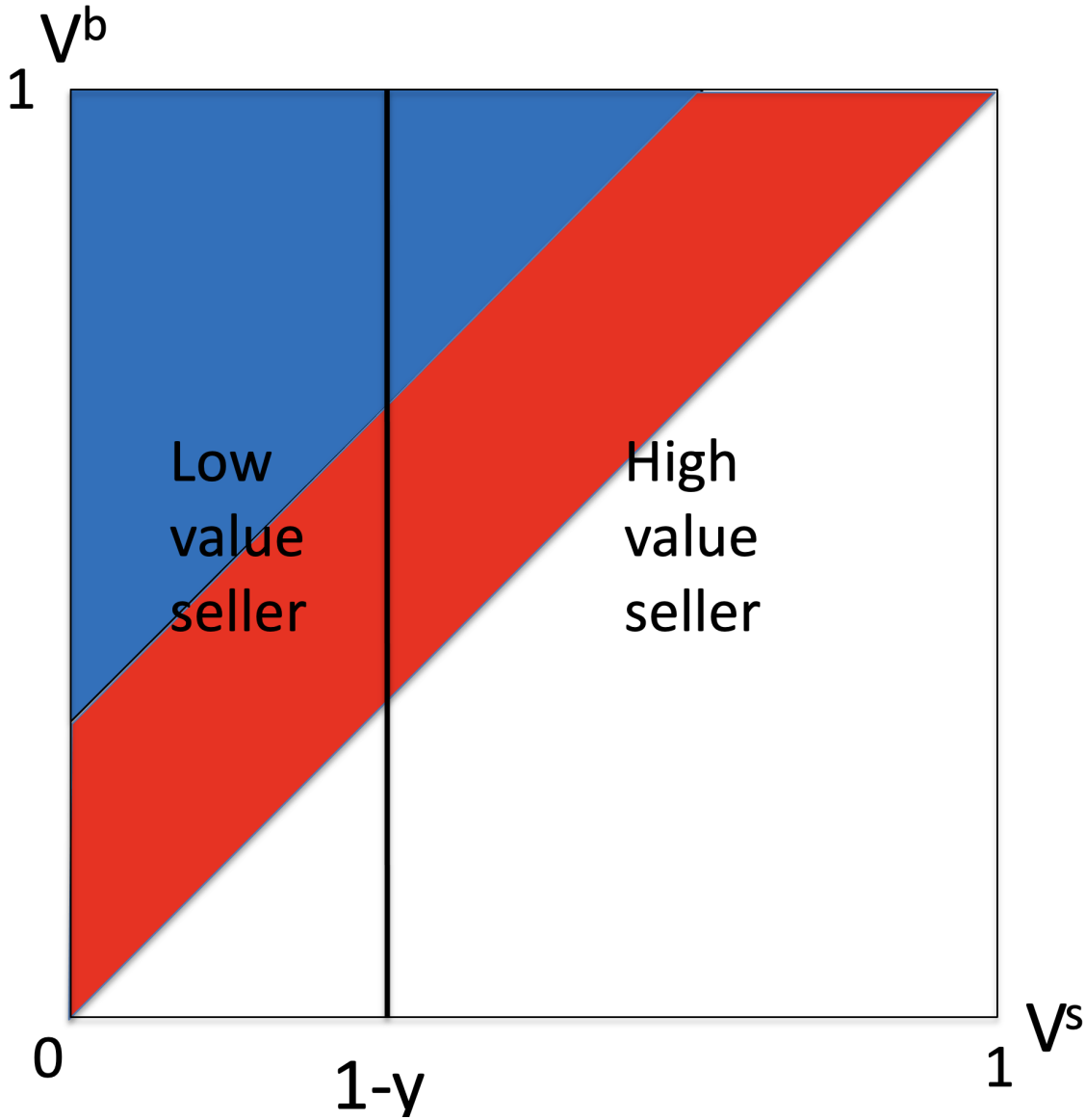
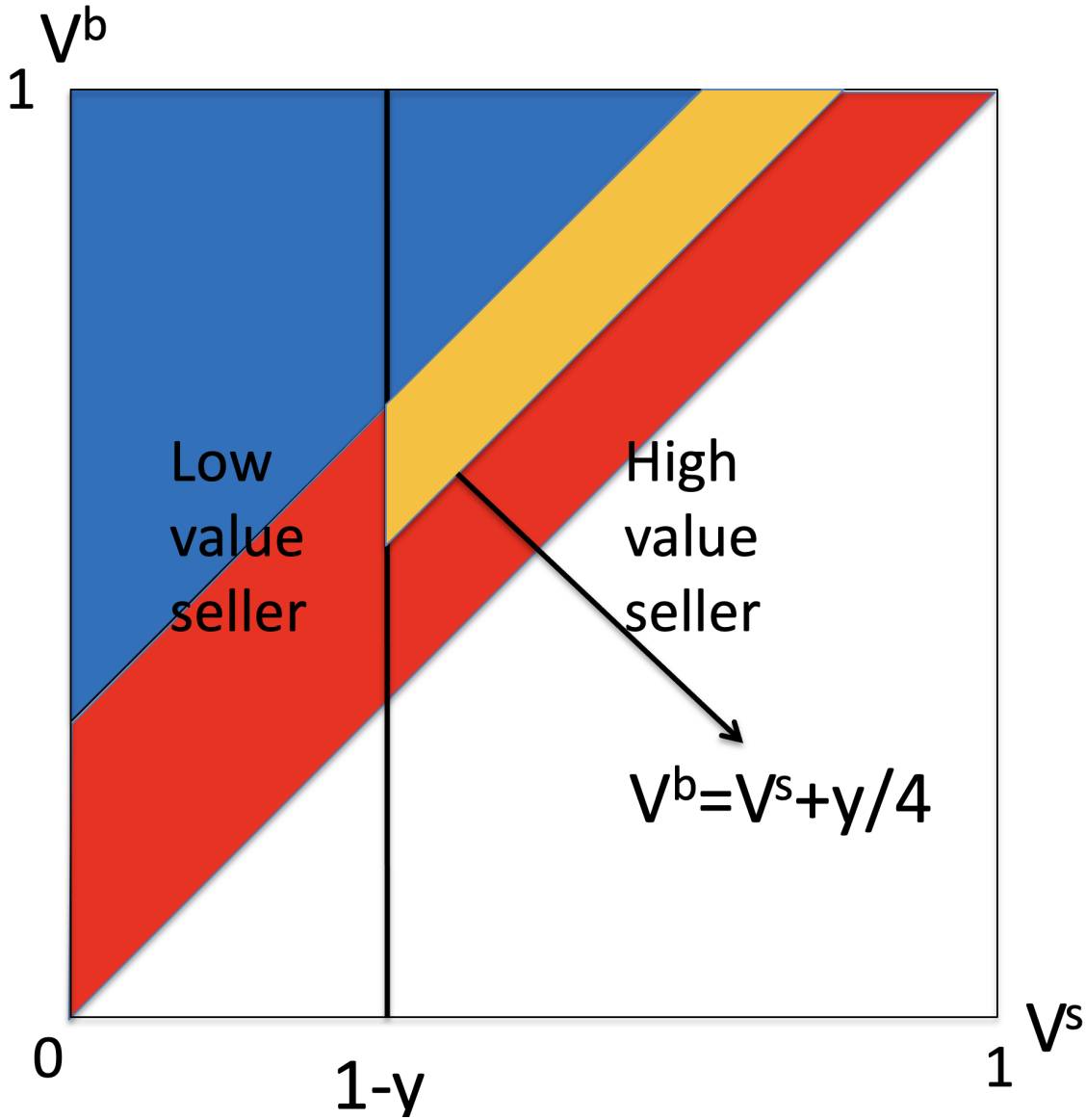


Buyer receives information



Buyer receives information

- Trade probability & expected price are higher than in babbling equilibrium
- Buyer's expected payoff is greater than in babbling equilibrium
- Seller's expected payoff is greater than in babbling equilibrium for lower y values (≤ 0.5892)
  - Buyer has informational advantage (cost for seller)
  - Higher $1 - y$, higher buyer's offer with high-value seller (benefit for seller)
    $\Rightarrow$ Benefit increases with $1 - y$ values

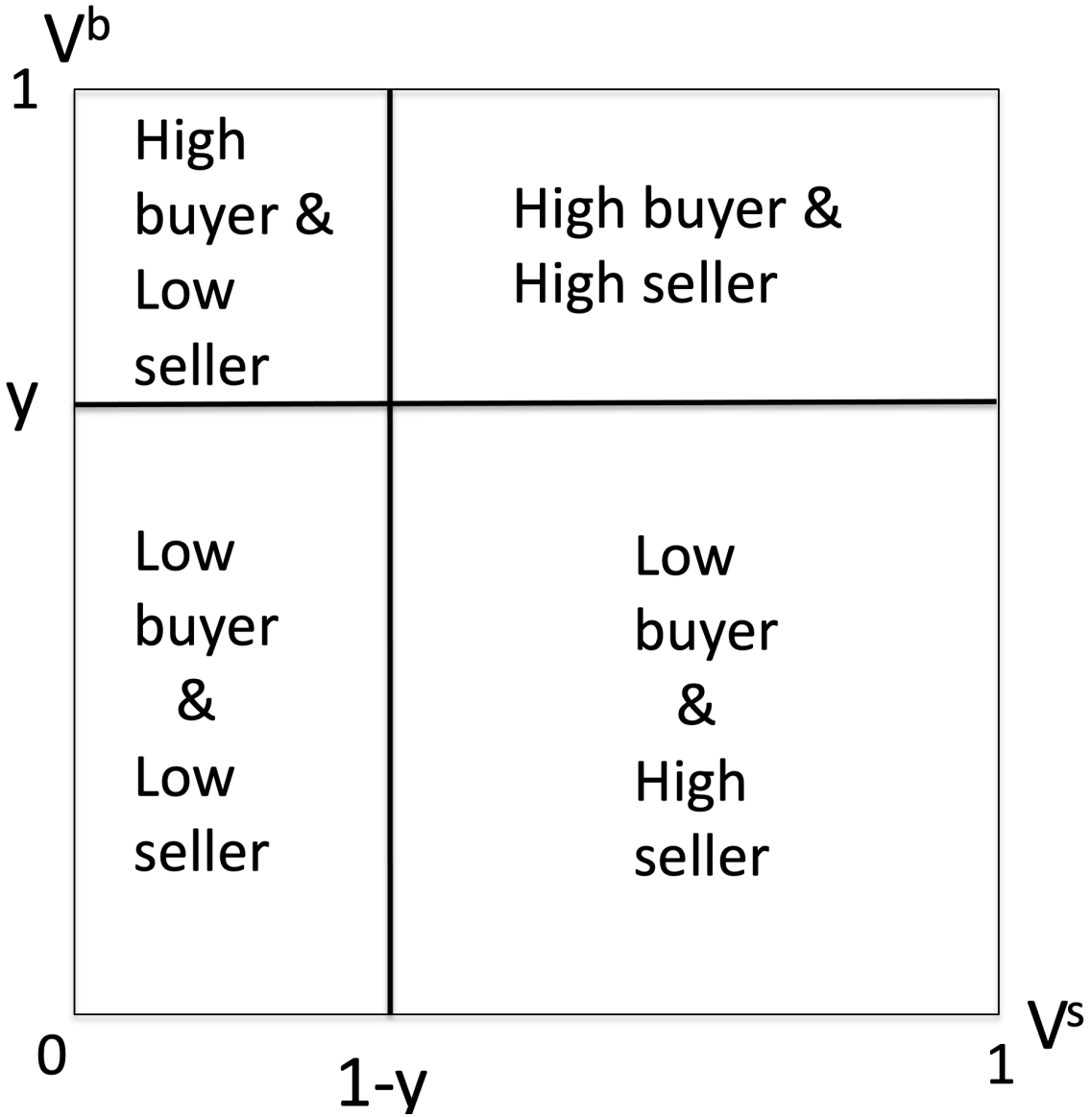
Buyer receives information

- Intermediary has no incentive to lie if max probability
- Incentive to deceive buyer into believing seller has high value if max expected price for higher y (≥ 0.5523)
  - Lie leads to higher buyer's offer, higher price if trade (benefit for intermediary)
  - Deceived buyer could walk away (cost)
    $\Rightarrow$ Cost increases with $1 - y$
    $\Rightarrow$ Cost exceeds benefit for smaller y
  - For higher y, goes back to babbling equilibrium
- Max probability incentive leads to higher probability & higher expected price than max expected price incentive

Both buyer & seller receive information

- Intermediary discloses information to both buyer & seller
  - Seller knows whether buyer's valuation is low ($\leq y$) or high ($\geq y$)
    $\Rightarrow$ less overstates: $v^s \leq s_2 \leq s_{s1} \leq s_0$
  - Buyer knows whether seller's valuation is low ($\leq 1-y$) or high ($\geq 1-y$)
    $\Rightarrow$ less understates: $b_0 \leq b_{b1} \leq b_2 \leq v^b$

Both buyer & seller receive information



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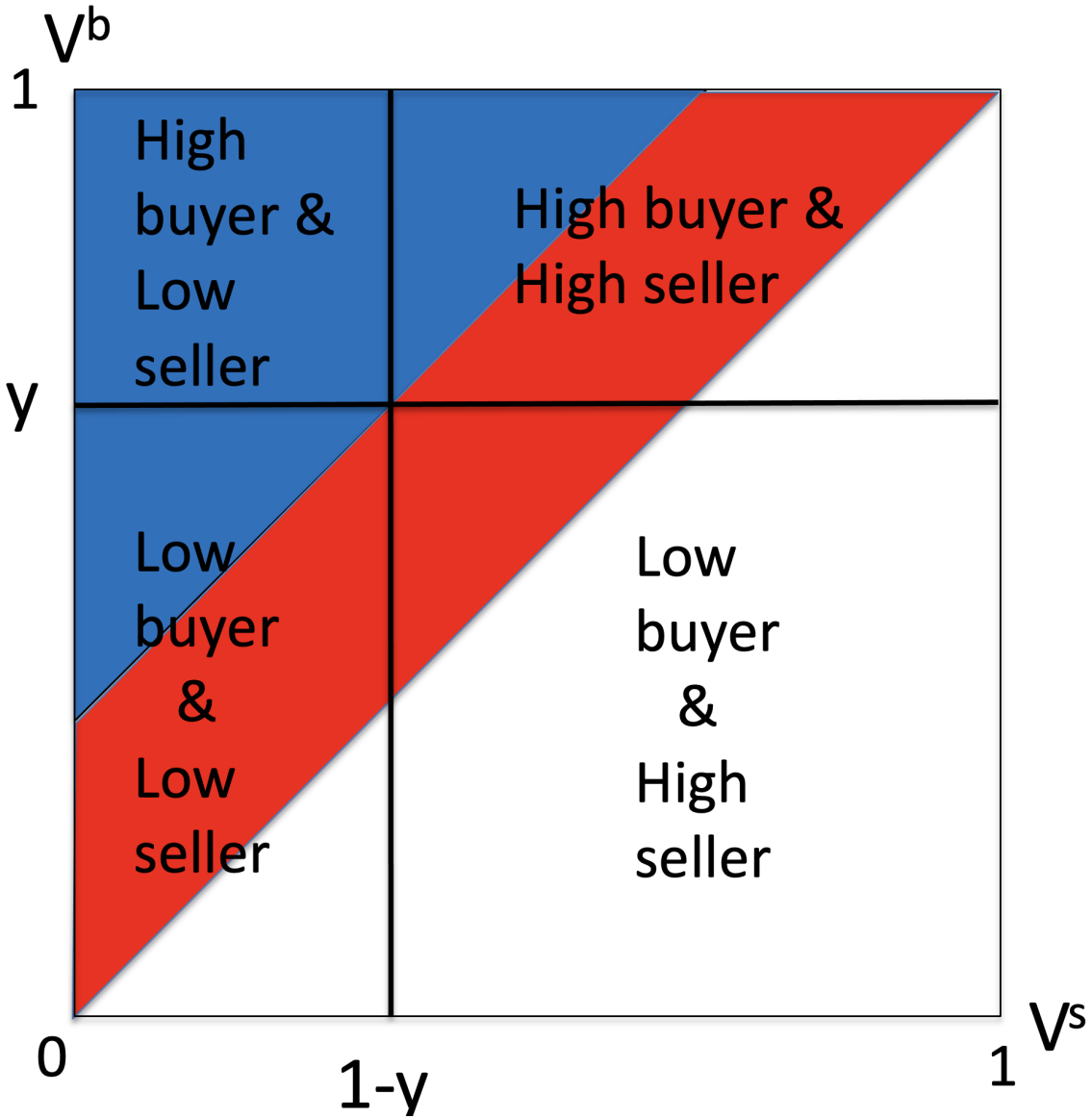

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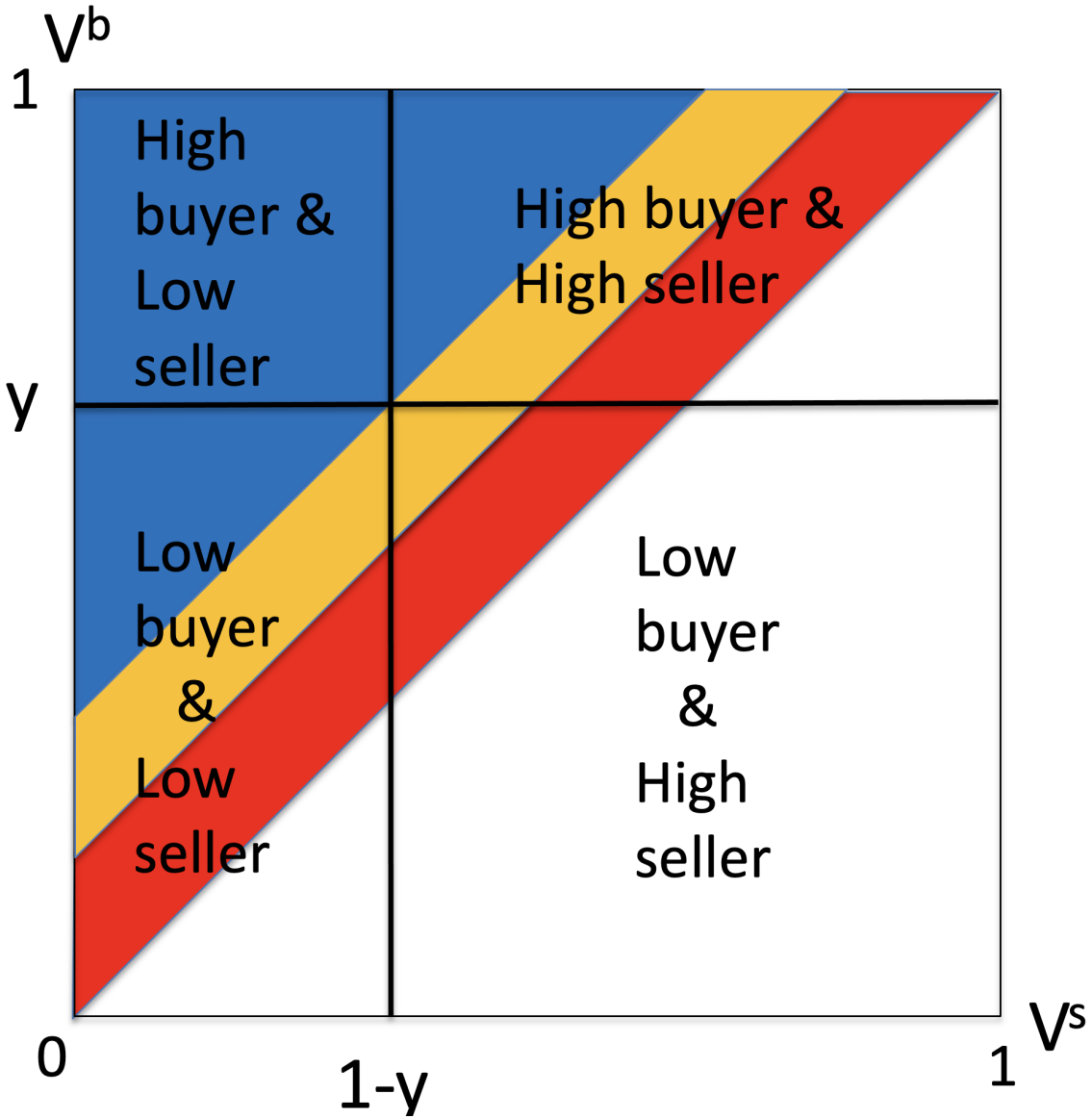

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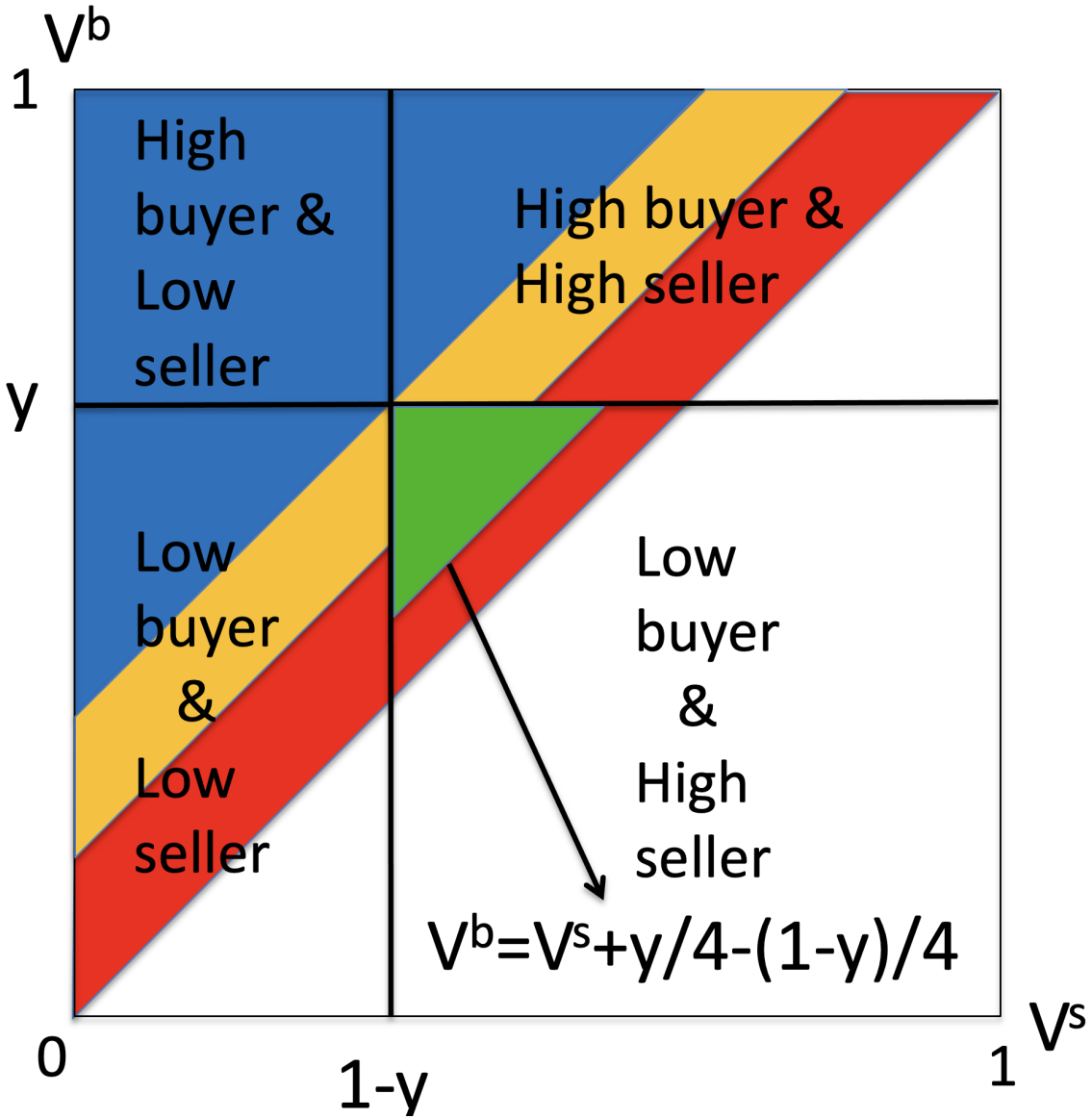

Both buyer & seller receive information

- Trade probability & expected price are higher than all other equilibria
- Buyer's & seller's expected payoffs are greater than all other equilibria for lower y (≤ 0.618)
  - Exclusive information provides advantage
  - Low-value buyer & high-value seller prefer revealing their types for lower y
    $\Rightarrow$ Recall one-sided information disclosure cases

Both buyer & seller receive information

- Intermediary has no incentive to lie if max probability
- Incentive to deceive buyer into believing seller has high value if max expected price for higher y
  $\Rightarrow$ Same reason as previous case
- Max probability incentive leads to higher probability & higher expected price than max expected price incentive

Existence & Comparison of equilibria

- Intermediary maximizes trade probability: all four equilibria exist for all $y \in (0, 1)$
- Intermediary maximizes expected price:

y value	**Existence of equilibria**
$0 < y \leq 0.4819$	babbling, seller, buyer, both
$0.4819 < y < 0.5$	babbling, seller, buyer
$0.5 \leq y \leq 0.5179$	babbling, seller, buyer, both
$0.5179 < y \leq 0.5523$	babbling, seller, buyer
$0.5523 < y < 1$	babbling, seller

Comparison of equilibria

- Trade probability: babbling $<$ seller $=$ buyer $<$ both
- Expected price:

$0 < y \leq 0.7133$	babbling $<$ seller $<$ buyer $<$ both
$0.7133 < y < 1$	babbling $<$ buyer $<$ seller $<$ both

- Buyer's and seller's expected payoff:

$0 < y \leq 0.25$	babbling $<$ other $=$ me $<$ both
$0.25 < y \leq 0.5892$	babbling $<$ other $<$ me $<$ both
$0.5892 < y \leq 0.618$	other $<$ babbling $<$ me $<$ both
$0.618 < y < 1$	other $<$ babbling $<$ both $<$ me

Equilibrium selection

- Intermediary maximizes trade probability: **both**
- Intermediary maximizes expected price:

y value	**Existence of equilibria**
$0 < y \leq 0.4819$	babbling, seller, buyer, **both**
$0.4819 < y < 0.5$	babbling, seller, **buyer**
$0.5 \leq y \leq 0.5179$	babbling, seller, buyer, **both**
$0.5179 < y \leq 0.5523$	babbling, seller, **buyer**
$0.5523 < y < 1$	babbling, **seller**

- Max probability incentive leads to higher probability & higher expected price than max expected price incentive

Conclusion

- Intermediary can improve efficiency by disclosing information
- Buyer & seller prefer more information
- Intermediary maximizing trade probability is superior to other maximizing expected transaction price
- Provide important policy implications for designing compensation schemes for intermediaries

Thank you

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