

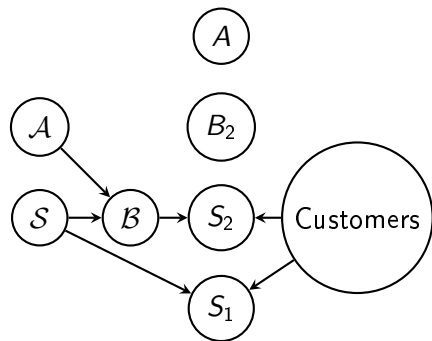
# System goods, tying and vertical foreclosure

Eric Avenel

UNIV RENNES, CNRS, CREM - UMR 6211

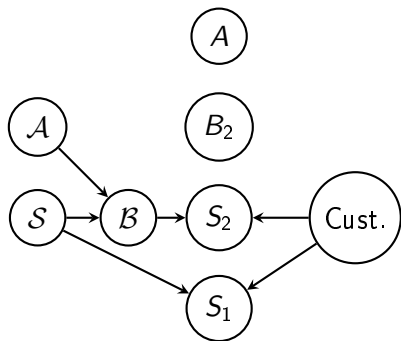
June 2023

## Firms and markets in OSS (1990)



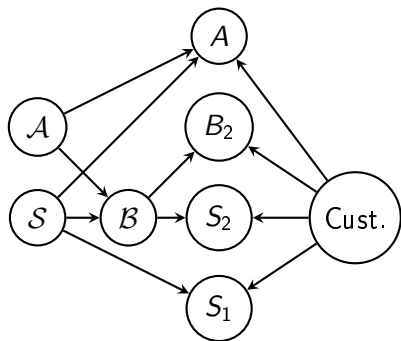
- Upstream firm  $\mathcal{A}$  supplies good  $A$  to downstream firm  $\mathcal{B}$ .
- $\mathcal{B}$  combines  $A$  with  $B_2$  and offers the system good  $S_2$  to customers.
- Vertically integrated firm  $\mathcal{S}$  offers system good  $S_1 = A + B_1$  to customers.
- $S_1$  and  $S_2$  are differentiated.
- $\mathcal{S}$  may offer  $A$  to  $\mathcal{B}$  (or not = vertical foreclosure).

## Firms and markets in OSS (1990)



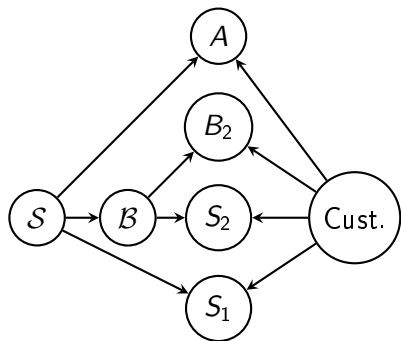
- Assumption A1: Upstream firms choose prices before downstream firms.
- Assumption A2:  $A$  (intermediate good) cannot be sold directly to customers.
- This paper maintains A1 and relaxes A2.

## Selling good $A$ on the BtoC market



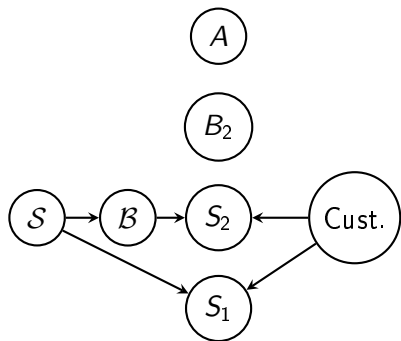
- Should  $S$  sell  $A$  on the BtoB market?
  - ▶ vertical foreclosure?
- Should  $S$  sell  $A$  on the BtoC market?
  - ▶ tying?
- How should  $S$  combine vertical foreclosure and tying?
- Depends of course on what  $A$  does: BtoB, BtoC, BtoB & BtoC, none.

## No competitor producing good $A$



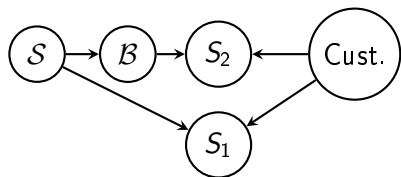
- $A$  is not there!
- $S$  can eliminate  $B$  (tying + vertical foreclosure).
- Let's assume it is not profitable
- Choice between selling on BtoB, BtoC or both markets

## No competitor producing good A



- In equilibrium : Tying without vertical foreclosure
- Leadership advantage: prices set first on BtoB market

# No competitor producing good A



- In equilibrium : Tying without vertical foreclosure
- Leadership advantage: prices set first on BtoB market

- BtoC FOCs wrt  $m_1$ ,  $m_2$  and  $w_1$

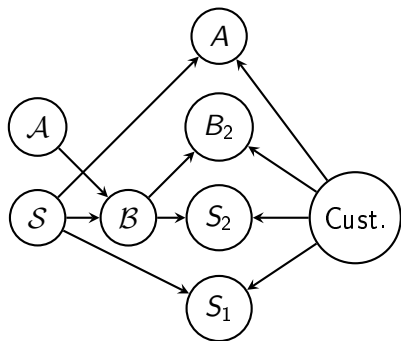
- ▶  $Q^1 + (m_1 - v_1'(Q^1))Q_1^1 + (w_1 - c)Q_1^2 = 0$
- ▶  $Q^2 + (m_2 - v_2'(Q^2))Q_2^2 = 0$
- ▶  $(m_1 - v_1'(Q^1))Q_2^1 + Q^2 + (w_1 - c)Q_2^2 = 0$

- BtoB FOC wrt  $w_1$

- ▶  $(m_1^* - v_1'(Q^1))Q_2^1 + Q^2 + (w_1 - c)Q_2^2 + m_2^*(w_1)[(m_1^* - v_1'(Q^1))Q_2^1 + (w_1 - c)Q_2^2] = 0$

- $w_1^{BB} > w_1^{BC}$  if and only if  $m_2'(w_1^{BC}) < 0$

## $A$ on BtoB market, but not on BtoC market

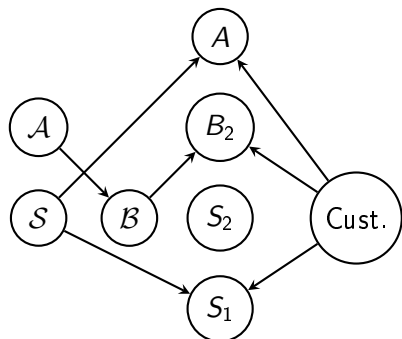


- $S$  keeps away from BtoB market (vertical foreclosure)
- Selling on BtoC market,  $S$  can undercut  $A$ .
- But price of  $A$  on BtoC market may be set significantly lower than the price on the BtoB market (tying?)

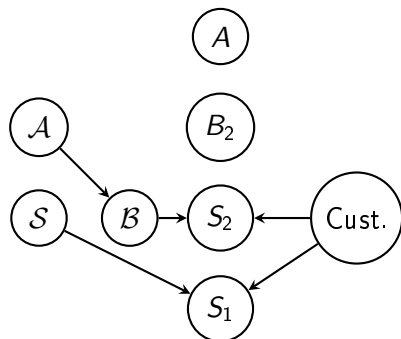


## A on BtoB market, but not on BtoC market

In equilibrium, two possibilities: vertical foreclosure without tying & vertical foreclosure with tying

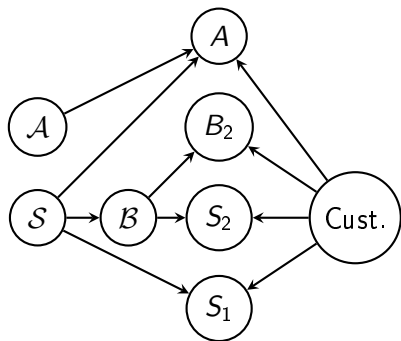


No tying:  $S$  undercuts  $A$  on BtoC market



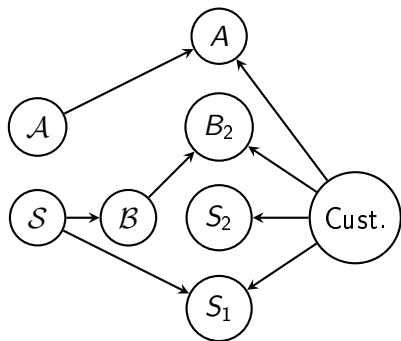
Tying:  $S$  prefers to keep out of the BtoC market

## A on BtoC market, but not on BtoB market



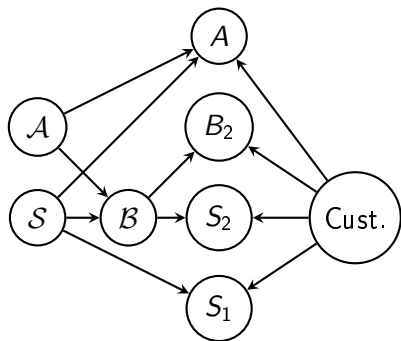
- If  $S$  enters the BtoB market,  $A$  will undercut it.
- Assume that with proba  $\epsilon$ ,  $A$  may not be on the BtoC market.
- Incentive for  $S$  to charge a high price on the BtoB market, namely  $w_1 = \text{Max}(w_1^{BB}, w_2^{BC})$

## $\mathcal{A}$ on BtoC market, but not on BtoB market



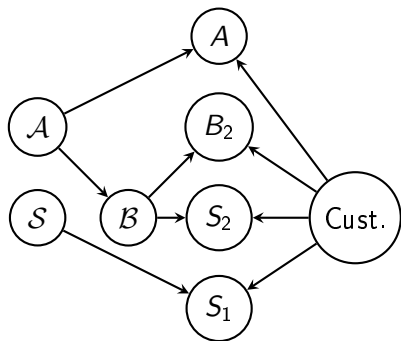
- In equilibrium, tying without vertical foreclosure
- $S$  offers  $A$  on BtoB market but is undercut by  $\mathcal{A}$ .
- Reminiscent of OSS (1990)'s commitment story

# A on BtoB and BtoC market



- In equilibrium: Vertical foreclosure with tying
- Entering either market leads to head-to-head competition and drives the price of  $A$  to the marginal cost.

## A on BtoB and BtoC market



- A first sets a price on the BtoB market.
- Then sets a price on the BtoC market.
- Price on BtoC market may be lower or higher than price on BtoB market.
- Depending on this, B is offering either B<sub>2</sub> or S<sub>2</sub>.

# A on BtoB and BtoC market

- How do  $w_2^{BB}$  and  $w_2^{BC}$  compare?
- BtoC FOCs wrt  $m_1$ ,  $m_2$  and  $w_2$ 
  - ▶  $Q^1 + (m_1 - v_1'(Q^1))Q_1^1 = 0$
  - ▶  $Q^2 + (m_2 - v_2'(Q^2))Q_2^2 = 0$
  - ▶  $(w_2 - c)Q_2^2 + Q^2 = 0$
- BtoB FOC wrt  $w_2$ 
  - ▶  $(w_2 - c)[Q^2(c + m_1^{\$}(w_2), w_2 + m_2^{\$}(w_2))$
- $w_2^{BB} > w_2^{BC}$  if and only if
  - ▶  $(w_2^{BC} - c)m_2^{\$}(w_2^{BC})Q_2^2 + (w_2^{BC} - c)m_1^{\$}(w_2^{BC})Q_1^2 > 0$
- True in the linear case (see appendix)

# Conclusion

- Most (all?) of the literature on vertical integration/foreclosure assumes tying, i.e., integrated firms don't sell the "intermediate" good on the Bto C market.
- I find however that, while the combination of vertical foreclosure and tying indeed emerges as an optimal strategy in some cases, a vertically integrated firm may also use the BtoC market to undercut its rival and capture the demand for good *A* without triggering a price war on the BtoB market, on which it doesn't operate. This is vertical foreclosure without tying.