Alexandre de Cornière (Toulouse School of Economics)
and Greg Taylor (Oxford Internet Institute)

DATA AND COMPETITION: DATA-DRIVEN MERGERS

Data-driven mergers

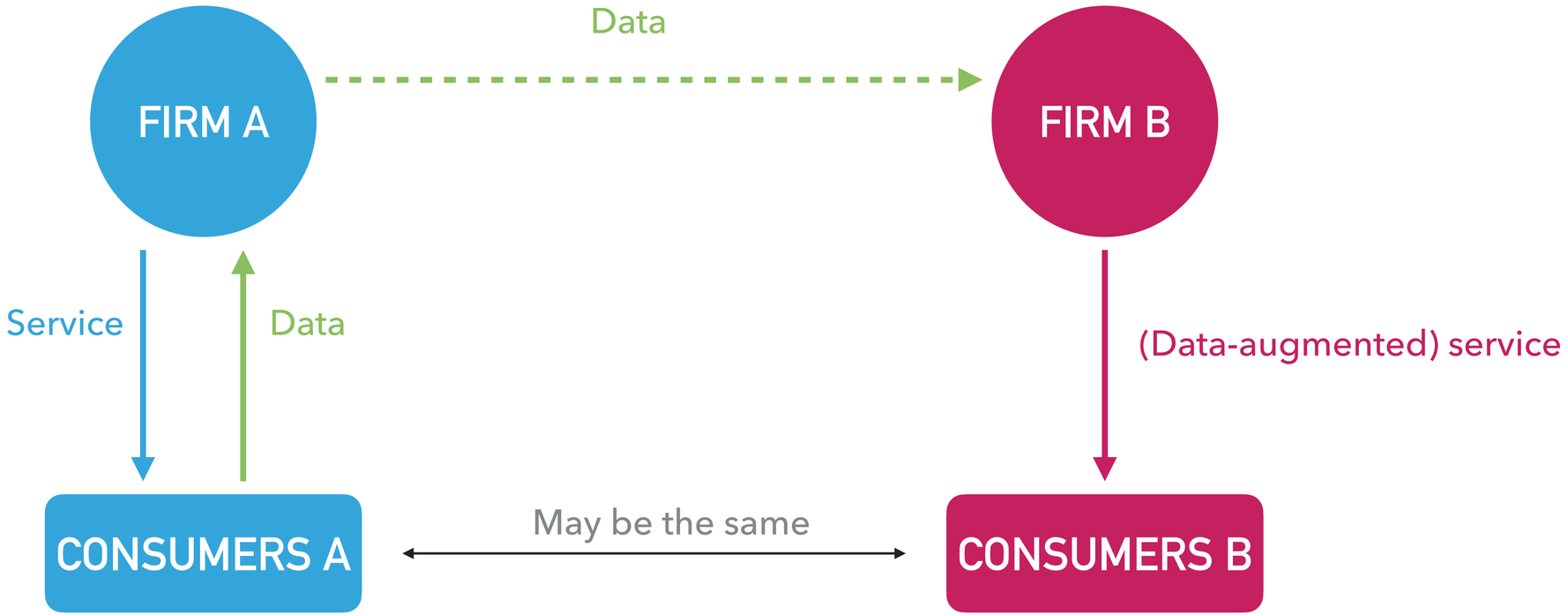
Mergers (partially) motivated by acquisition of data

Examples:

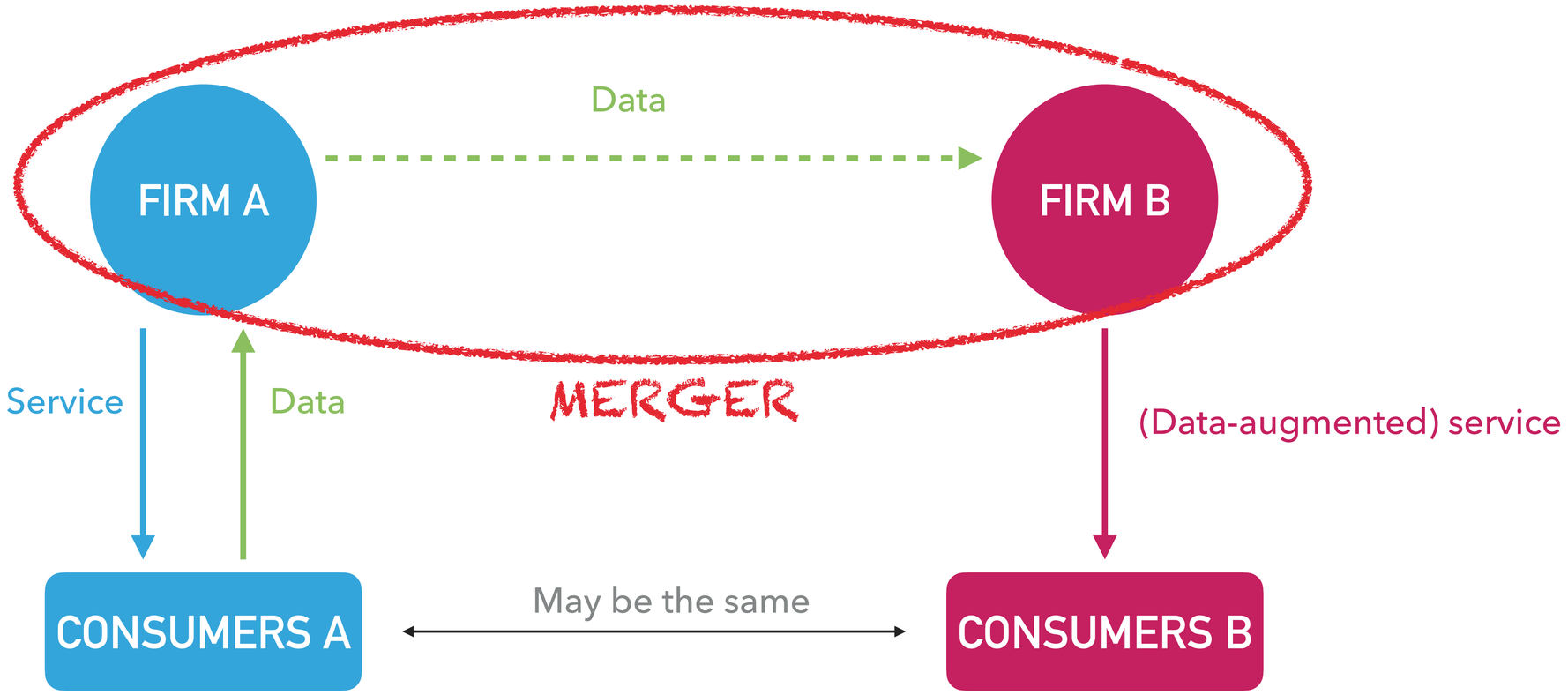
- Microsoft - LinkedIn, Google - Fitbit

Neither horizontal nor (purely) vertical.

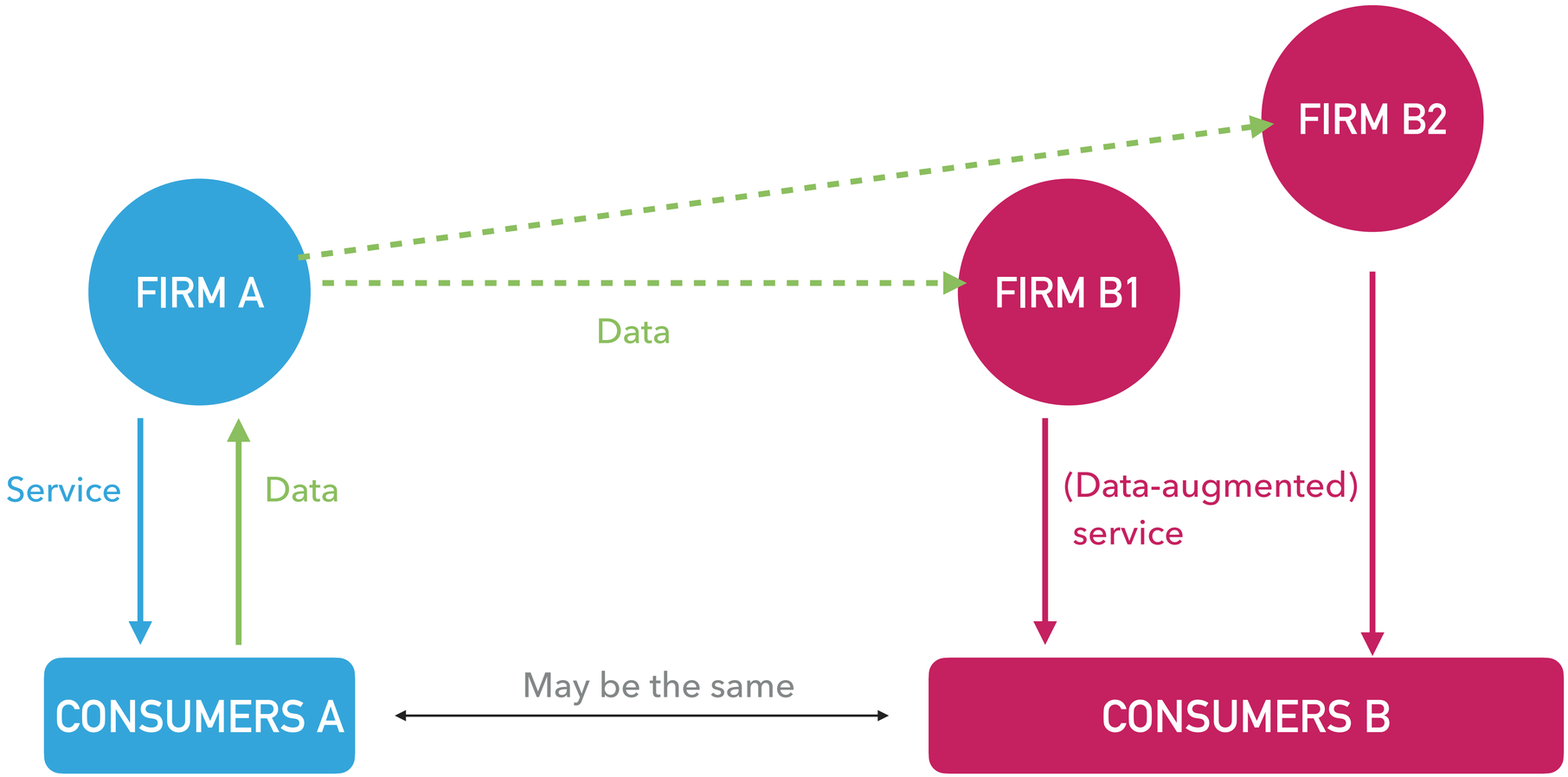
Data-driven merger



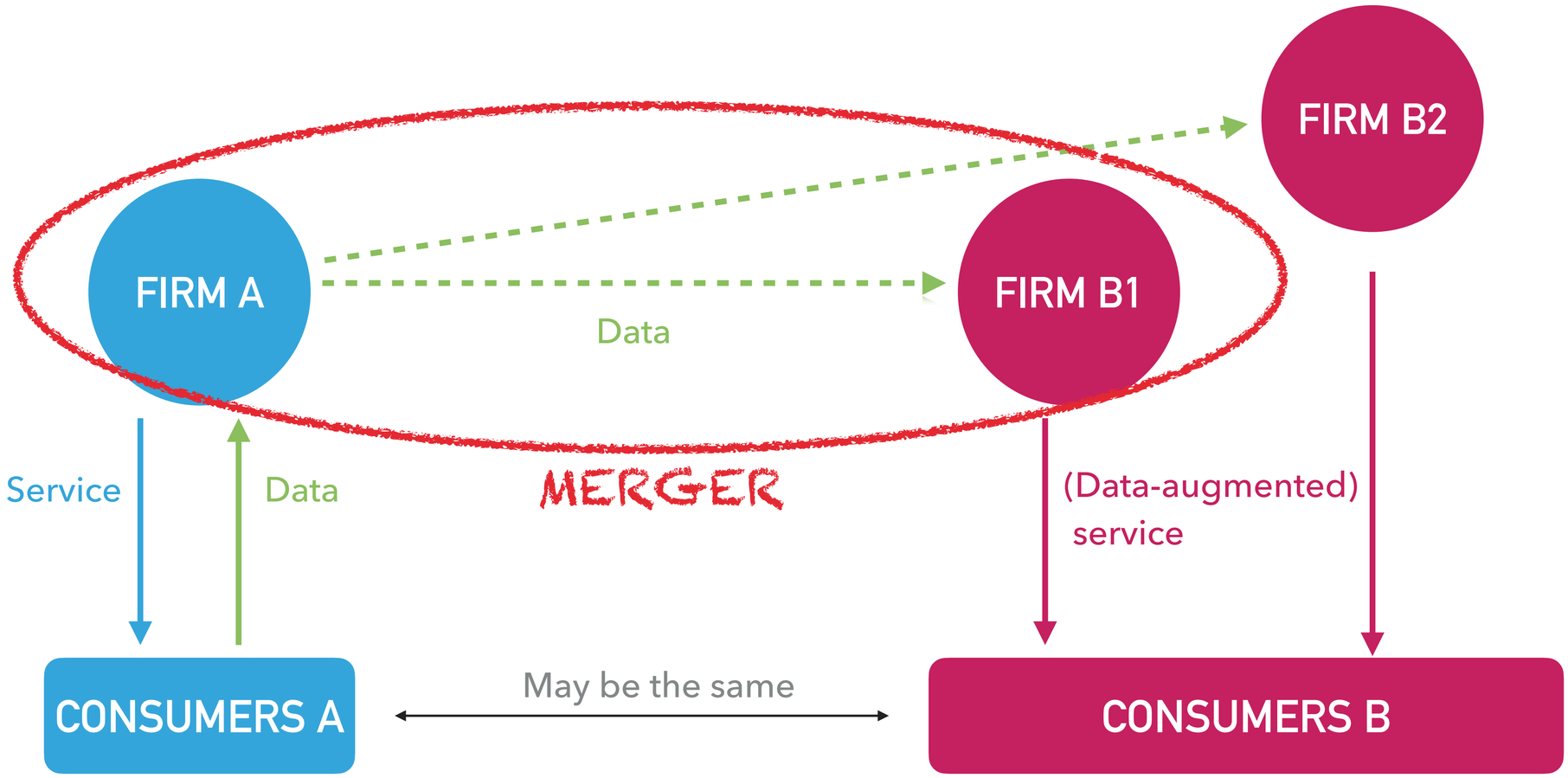
Data-driven merger



Data-driven merger



Data-driven merger



Standard concerns of competition authorities

Standard concerns of competition authorities

1. Input foreclosure

Standard concerns of competition authorities

1. Input foreclosure

- A stops supplying data to B2

Standard concerns of competition authorities

1. Input foreclosure

- A stops supplying data to B2
- Ability / incentive to exclude B2?

Standard concerns of competition authorities

1. Input foreclosure

- A stops supplying data to B2
- Ability / incentive to exclude B2?
- No different than vertical merger

Standard concerns of competition authorities

1. Input foreclosure

- A stops supplying data to B2
- Ability / incentive to exclude B2?
- No different than vertical merger

2. « Efficiency offence » concern

Standard concerns of competition authorities

1. Input foreclosure

- A stops supplying data to B2
- Ability / incentive to exclude B2?
- No different than vertical merger

2. « Efficiency offence » concern

- Pre-merger, B firms don’t use data

Standard concerns of competition authorities

1. Input foreclosure

- A stops supplying data to B2
- Ability / incentive to exclude B2?
- No different than vertical merger

2. « Efficiency offence » concern

- Pre-merger, B firms don’t use data
- Post-merger, B1 can use A’s data $\Longrightarrow$ marginalization of B2

Standard concerns of competition authorities

1. **Input foreclosure**
2. **« Efficiency offence » concern**

Two sides of the same coin: B1 will use data, B2 will not

Difference: is data shared pre-merger?

These foreclosure stories are not our focus here.

Specific features of data

Specific features of data

1. Pro- or anti-competitive uses of data

- Efficiency / surplus extraction.
- We take it as given.

Specific features of data

1. Pro- or anti-competitive uses of data

- Efficiency / surplus extraction.
- We take it as given.

2. Data as byproduct of economic activity

- Dual objective of A: product sales and data

Specific features of data

1. Pro- or anti-competitive uses of data

- Efficiency / surplus extraction.
- We take it as given.

2. Data as byproduct of economic activity

- Dual objective of A: product sales and data

3. Potential frictions around trade

- Regulation, reputational concerns…

2 & 3: $\neq$ pure vertical merger

The Model

Market A

The Model

Market A

- 1 or 2 firms, A_1 and A_2, located on Hotelling segment

The Model

Market A

- 1 or 2 firms, A_1 and A_2, located on Hotelling segment
- Choice of quality q_i, cost $C(q_i)$ increasing and convex

The Model

Market A

- 1 or 2 firms, A_1 and A_2, located on Hotelling segment
- Choice of quality q_i, cost $C(q_i)$ increasing and convex
- Utility $q_i - t\,|\,x - x_i\,|$

The Model

Market A

- 1 or 2 firms, A_1 and A_2, located on Hotelling segment
- Choice of quality q_i, cost $C(q_i)$ increasing and convex
- Utility $q_i - t\,|\,x - x_i\,|$
- Exogenous revenue of α per-consumer

The Model

Market A

- 1 or 2 firms, A_1 and A_2, located on Hotelling segment
- Choice of quality q_i, cost $C(q_i)$ increasing and convex
- Utility $q_i - t\,|\,x - x_i\,|$
- Exogenous revenue of α per-consumer
- Data collected: δ_{A_i}, increasing in users of A_i

The Model

Market A

- 1 or 2 firms, A_1 and A_2, located on Hotelling segment
- Choice of quality q_i, cost $C(q_i)$ increasing and convex
- Utility $q_i - t\,|\,x - x_i\,|$
- Exogenous revenue of α per-consumer
- Data collected: δ_{A_i}, increasing in users of A_i
  - $\delta_{A_i} = n_{A_i}$

The Model

Market B

The Model

Market B

- 2 firms, B_1 and B_2

The Model

Market B

- 2 firms, B_1 and B_2
- Firm B_i has access to data δ_{B_i} from market A
  - (normalize other data to zero)

The Model

Market B

- 2 firms, B_1 and B_2
- Firm B_i has access to data δ_{B_i} from market A
  - (normalize other data to zero)
- B_i chooses utility u_i (Armstrong & Vickers 2001)

The Model

Market B

- 2 firms, B_1 and B_2
- Firm B_i has access to data δ_{B_i} from market A
  - (normalize other data to zero)
- B_i chooses utility u_i (Armstrong & Vickers 2001)
- Demand $D(u_i, u_j)$; Profit $\Pi(u_i, u_j, \delta_{B_i})$

The Model

Market B

- If $\frac{\partial^2 \Pi(u_i, u_j, \delta_{B_i})}{\partial u_i \partial \delta_{B_i}} > 0$, more data leads B_i to offer more utility
  - We then say that data is **unilaterally pro-competitive (UPC)**
  - E.g. product improvement

The Model

Market B

- If $\frac{\partial^2 \Pi(u_i, u_j, \delta_{B_i})}{\partial u_i \partial \delta_{B_i}} < 0$, more data leads B_i to offer less utility
  - We then say that data is **unilaterally anti-competitive (UAC)**
  - Data makes firms better at surplus extraction

The Model

Is data UPC or UAC ?

- In companion paper, we provide conditions for UAC/UPC and discuss examples
- Today, take it as primitive

The Model

Market B

- Firms observe each other's quantity of data
- Given their data, each firm maximizes $\Pi(u_i, u_j, \delta_{B_i})$
- Let $u_i^*(\delta_{B_i}, \delta_{B_j})$ be the equilibrium of subgame
- Let $\pi_i(\delta_{B_i}, \delta_{B_j})$ be the subgame's equilibrium profit

The Model

Market B- extra assumptions

- u_1 and u_2 are strategic complements
- $\dfrac{\partial \pi_i(\delta_{B_i}, \delta_{B_j})}{\partial \delta_{B_i}} > 0$: data is valuable in equilibrium

The Model

Timing

The Model

Timing

1. Merger takes place or not

The Model

Timing

1. Merger takes place or not
2. Firms in market A choose quality

The Model

Timing

1. Merger takes place or not
2. Firms in market A choose quality
3. Consumers in market A decide whether to use product

The Model

Timing

1. Merger takes place or not
2. Firms in market A choose quality
3. Consumers in market A decide whether to use product
4. Firms in market A collect data as byproduct of activity

The Model

Timing

1. Merger takes place or not
2. Firms in market A choose quality
3. Consumers in market A decide whether to use product
4. Firms in market A collect data as byproduct of activity
5. Data trade takes place, if possible

The Model

Timing

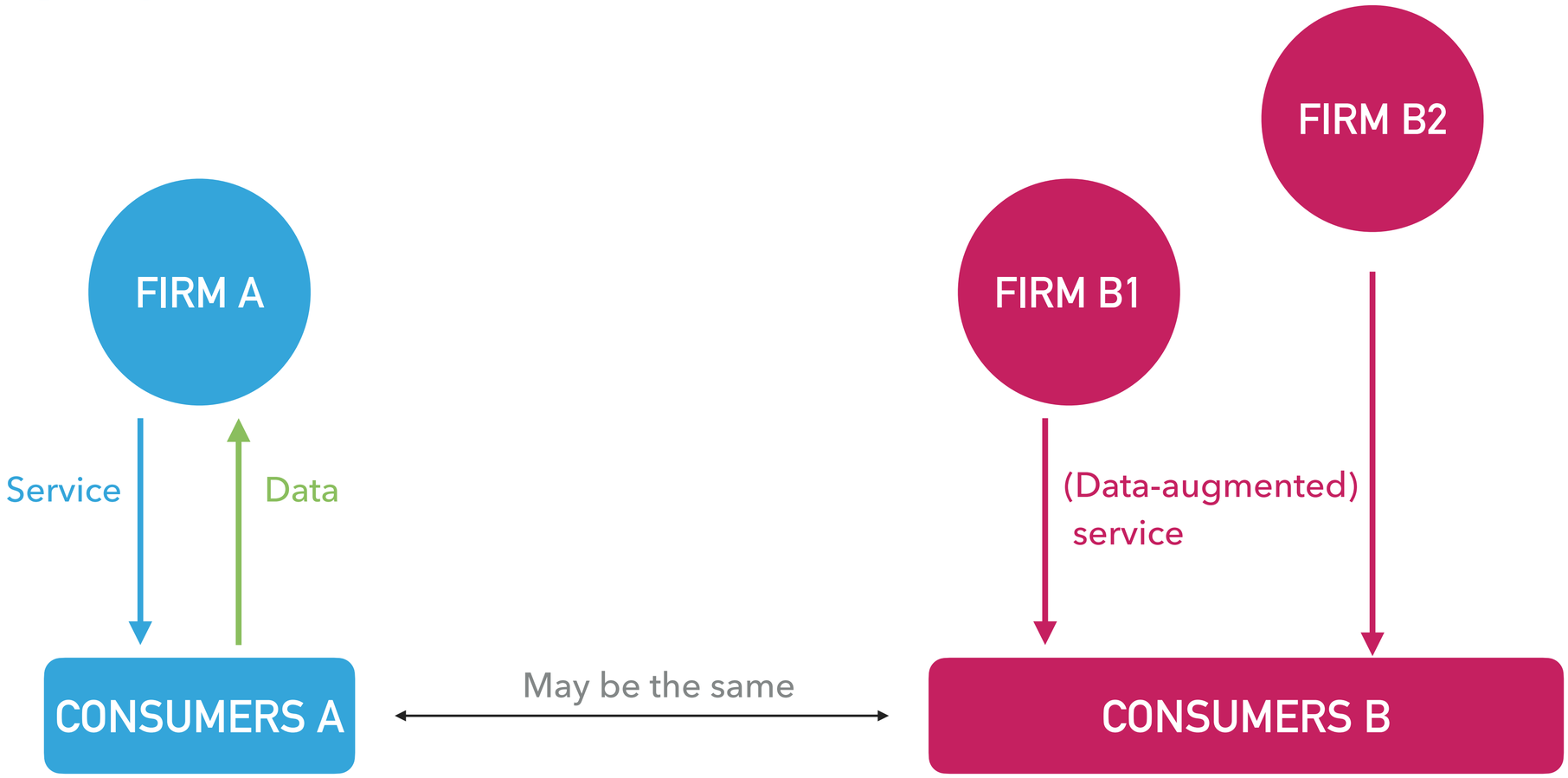
1. Merger takes place or not
2. Firms in market A choose quality
3. Consumers in market A decide whether to use product
4. Firms in market A collect data as byproduct of activity
5. Data trade takes place, if possible
6. Firms in market B choose utility levels

The Model

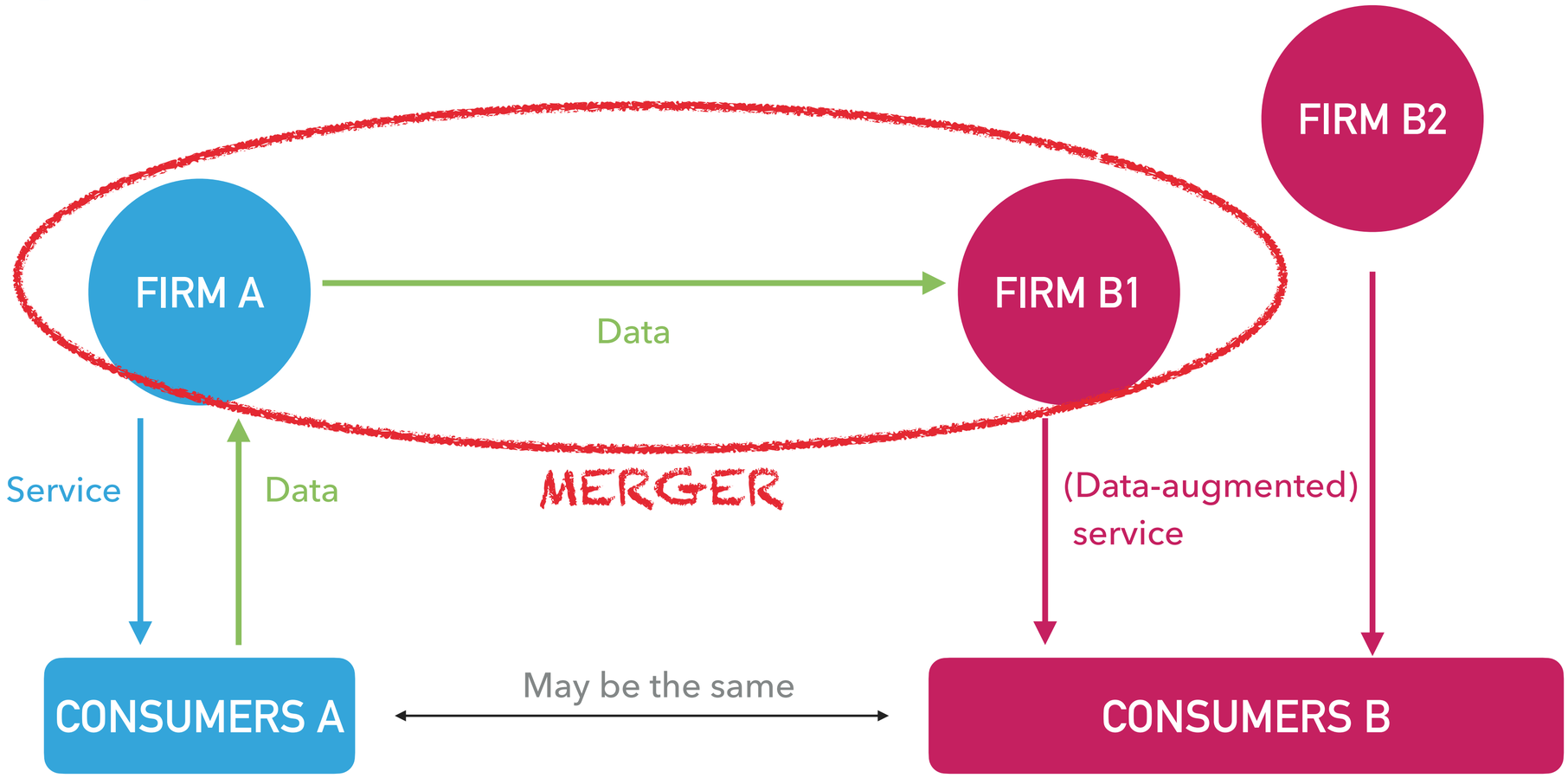
Timing

1. Merger takes place or not
2. Firms in market A choose quality
3. Consumers in market A decide whether to use product
4. Firms in market A collect data as byproduct of activity
5. Data trade takes place, if possible
6. Firms in market B choose utility levels
7. Consumers in market B choose a product

Case I: Monopoly on A - no data trade



Case I: Monopoly on A - no data trade



Case I: Monopoly on A - no data trade (UPC data)

Pre-merger

- Firm A maximizes $\alpha \times \underbrace{q/t}_{\text{demand}} - C(q) \Longrightarrow C'(q^*) = \alpha/t$

- On B market, firms don't use data: utility $u^*(0,0)$

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

- Firm A internalizes B_1's profit

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

- Firm A internalizes B_1's profit
- Firm A maximizes $\alpha q/t - C(q) + \pi_{B_1}(\underbrace{\delta}_{=q/t}, 0)$

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

- Firm A internalizes B_1's profit
- Firm A maximizes $\alpha q/t - C(q) + \pi_{B_1}(\underbrace{\delta}_{=q/t}, 0)$
  - Higher incentive to collect data

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

- Firm A internalizes B_1's profit
- Firm A maximizes $\alpha q/t - C(q) + \pi_{B_1}(\underbrace{\delta}_{=q/t}, 0)$
  - Higher incentive to collect data
  - Higher quality on market A

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

- On B market, B1 uses data: B1 offers utility $u^*(\delta,0)$ and B2 offers $u^*(0,\delta)$

Case I: Monopoly on A - no data trade (UPC data)

Post-merger

- On B market, B1 uses data: B1 offers utility $u^*(\delta,0)$ and B2 offers $u^*(0,\delta)$
- If data UPC, both utilities are larger than $u(0,0)$: consumers better-off

Case I: Monopoly on A - no data trade (UPC data)

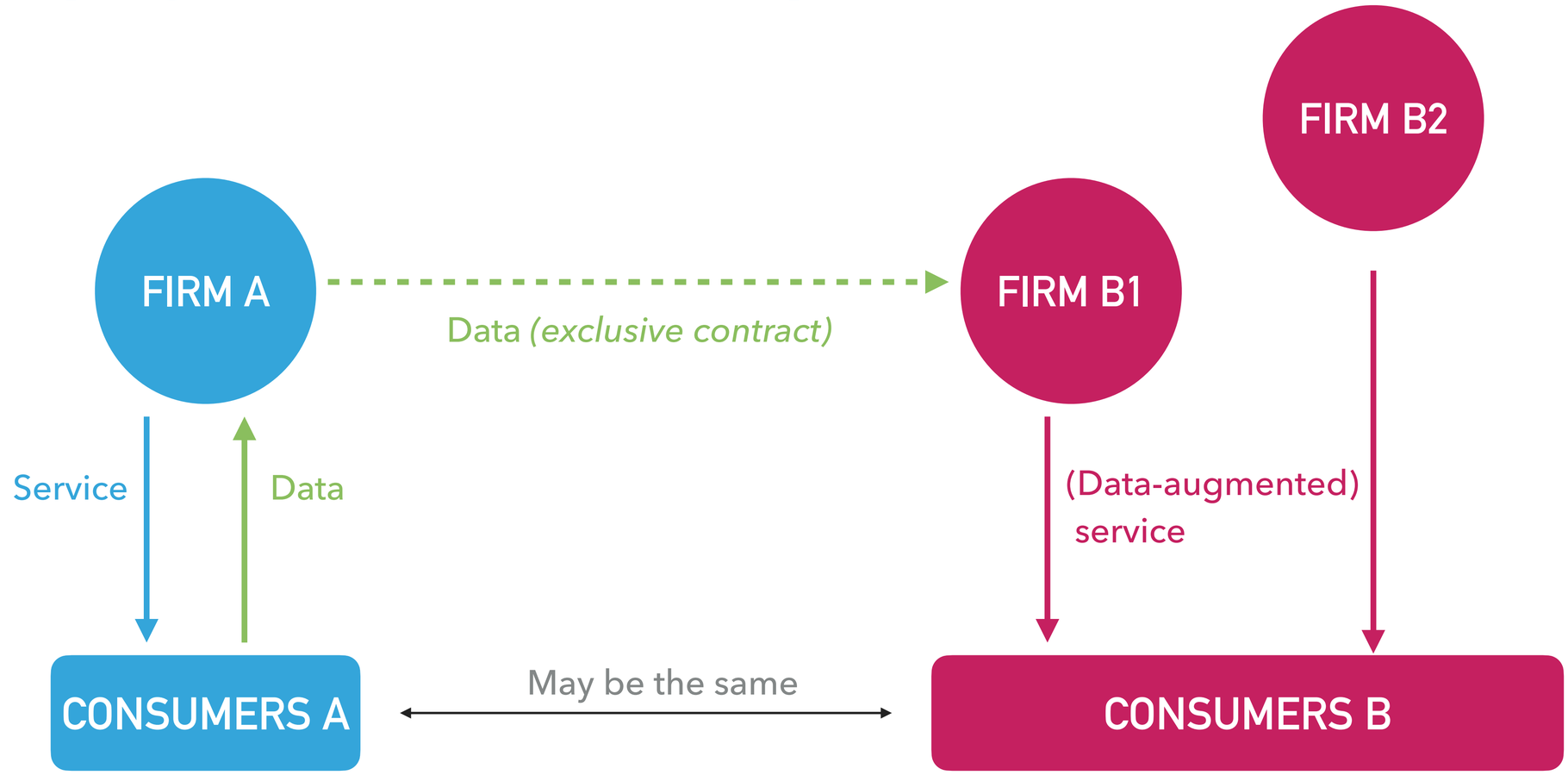
Post-merger

- On B market, B1 uses data: B1 offers utility $u^*(\delta,0)$ and B2 offers $u^*(0,\delta)$
- If data UPC, both utilities are larger than $u(0,0)$: consumers better-off
- If data UAC, both utilities are smaller than $u(0,0)$: consumers worse-off

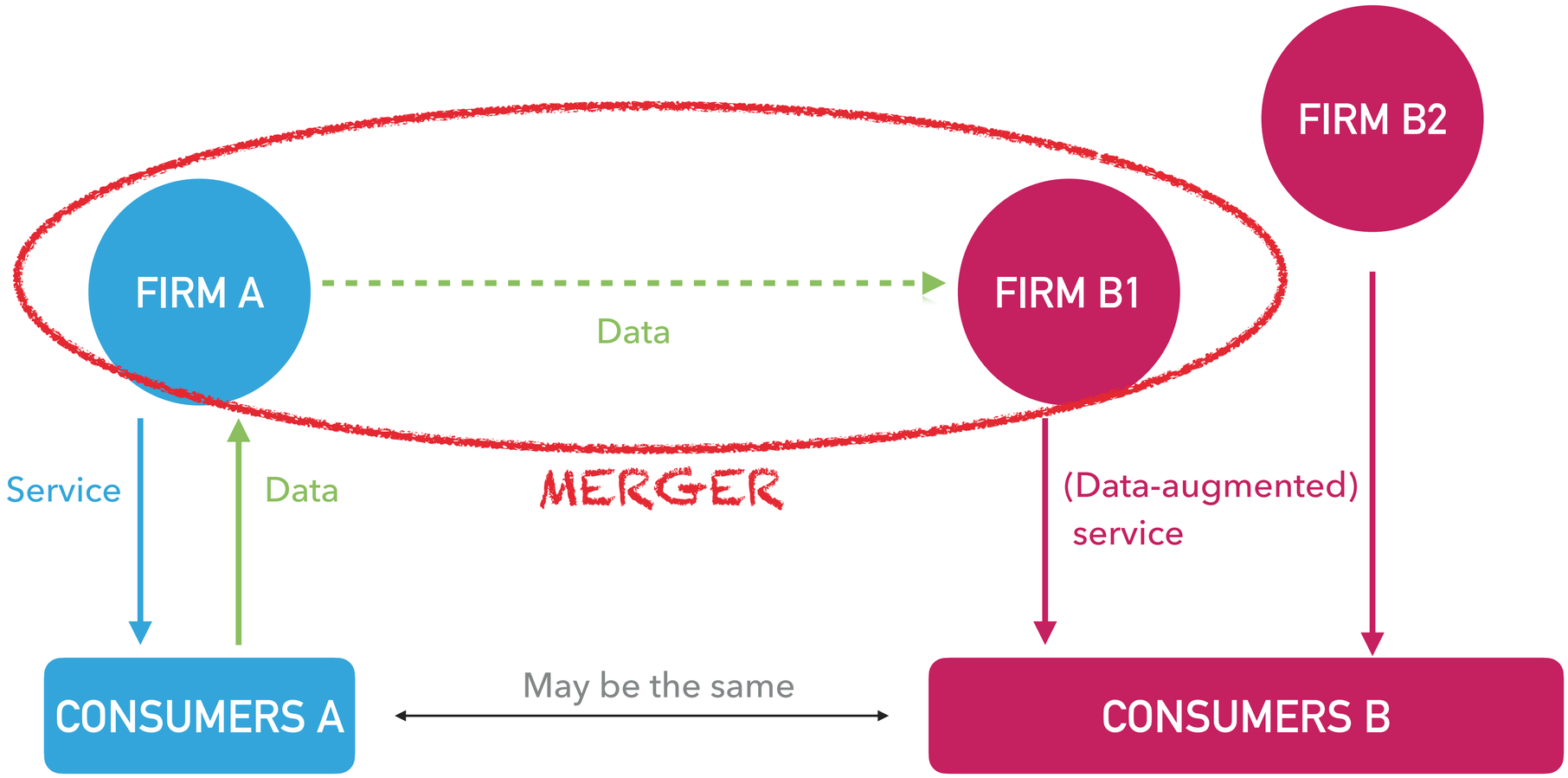
Summary

Effect of merger	UPC data	UAC data
No data trade	$u_A \uparrow \quad u_B \uparrow$	$u_A \uparrow \quad u_B \downarrow$
Data trade		

Case II: Monopoly on A - data trade possible



Case II: Monopoly on A - data trade possible



Case II: Monopoly on A - data trade possible

Pre-merger

Case II: Monopoly on A - data trade possible

Pre-merger

Assumption (for presentation only): Optimal to sell data exclusively (auction)

Case II: Monopoly on A - data trade possible

Pre-merger

Assumption (for presentation only): Optimal to sell data exclusively (auction)

Price of data: $T(\delta) = \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Case II: Monopoly on A - data trade possible

Pre-merger

Assumption (for presentation only): Optimal to sell data exclusively (auction)

Price of data: $T(\delta) = \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Profit of A: $\alpha q/t - C(q) + T(\underbrace{\delta}_{=q/t}) = \alpha\delta - C(t\delta) + \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Case II: Monopoly on A - data trade possible

Pre-merger

Assumption (for presentation only): Optimal to sell data exclusively (auction)

Price of data: $T(\delta) = \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Profit of A: $\alpha q/t - C(q) + T(\underbrace{\delta}_{=q/t}) = \alpha\delta - C(t\delta) + \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Post-merger

Case II: Monopoly on A - data trade possible

Pre-merger

Assumption (for presentation only): Optimal to sell data exclusively (auction)

Price of data: $T(\delta) = \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Profit of A: $\alpha q/t - C(q) + T(\underbrace{\delta}_{=q/t}) = \alpha\delta - C(t\delta) + \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Post-merger

Profit of A: $= \alpha\delta - C(t\delta) + \pi_{B_1}(\delta,0)$

Case II: Monopoly on A - data trade possible

Pre-merger

Assumption (for presentation only): Optimal to sell data exclusively (auction)

Price of data: $T(\delta) = \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Profit of A: $\alpha q/t - C(q) + T(\underbrace{\delta}_{=q/t}) = \alpha\delta - C(t\delta) + \pi_{B_i}(\delta,0) - \pi_{B_i}(0,\delta)$

Post-merger

Profit of A: $= \alpha\delta - C(t\delta) + \pi_{B_1}(\delta,0)$

Case II: Monopoly on A - data trade possible

Comparison

Case II: Monopoly on A - data trade possible

Comparison

$$\frac{d\pi_A}{d\delta}\Big|_{merger} - \frac{d\pi_A}{d\delta}\Big|_{indep} = \frac{\partial \pi_{B_1}(0,\delta)}{\partial \delta_{B_2}}$$

Case II: Monopoly on A - data trade possible

Comparison

$$\frac{d\pi_A}{d\delta}\Big|_{merger} - \frac{d\pi_A}{d\delta}\Big|_{indep} = \frac{\partial \pi_{B_1}(0,\delta)}{\partial \delta_{B_2}}$$

When A and B1 are independent, incentive to reduce payoff of auction loser

Case II: Monopoly on A - data trade possible

Comparison

$$\frac{d\pi_A}{d\delta}\Big|_{merger} - \frac{d\pi_A}{d\delta}\Big|_{indep} = \frac{\partial \pi_{B_1}(0,\delta)}{\partial \delta_{B_2}}$$

When A and B1 are independent, incentive to reduce payoff of auction loser

- If data is UPC: $\partial \pi_{B_1} / \partial \delta_{B_2} < 0$. Data makes rival « tough ».

Case II: Monopoly on A - data trade possible

Comparison

$$\frac{d\pi_A}{d\delta}\Big|_{merger} - \frac{d\pi_A}{d\delta}\Big|_{indep} = \frac{\partial \pi_{B_1}(0,\delta)}{\partial \delta_{B_2}}$$

When A and B1 are independent, incentive to reduce payoff of auction loser

- If data is UPC: $\partial \pi_{B_1} / \partial \delta_{B_2} < 0$. Data makes rival « tough ».
  - Merger reduces incentives to collect data: $u_A^* \downarrow$, $u_B^* \downarrow$

Case II: Monopoly on A - data trade possible

Comparison

$$\frac{d\pi_A}{d\delta}\Big|_{merger} - \frac{d\pi_A}{d\delta}\Big|_{indep} = \frac{\partial \pi_{B_1}(0,\delta)}{\partial \delta_{B_2}}$$

When A and B1 are independent, incentive to reduce payoff of auction loser

- If data is UPC: $\partial \pi_{B_1} / \partial \delta_{B_2} < 0$. Data makes rival « tough ».
  - Merger reduces incentives to collect data: $u_A^* \downarrow$, $u_B^* \downarrow$
- If data is UAC: $\partial \pi_{B_1} / \partial \delta_{B_2} > 0$. Data makes rival « soft ».

Case II: Monopoly on A - data trade possible

Comparison

$$\frac{d\pi_A}{d\delta}\Big|_{merger} - \frac{d\pi_A}{d\delta}\Big|_{indep} = \frac{\partial \pi_{B_1}(0,\delta)}{\partial \delta_{B_2}}$$

When A and B1 are independent, incentive to reduce payoff of auction loser

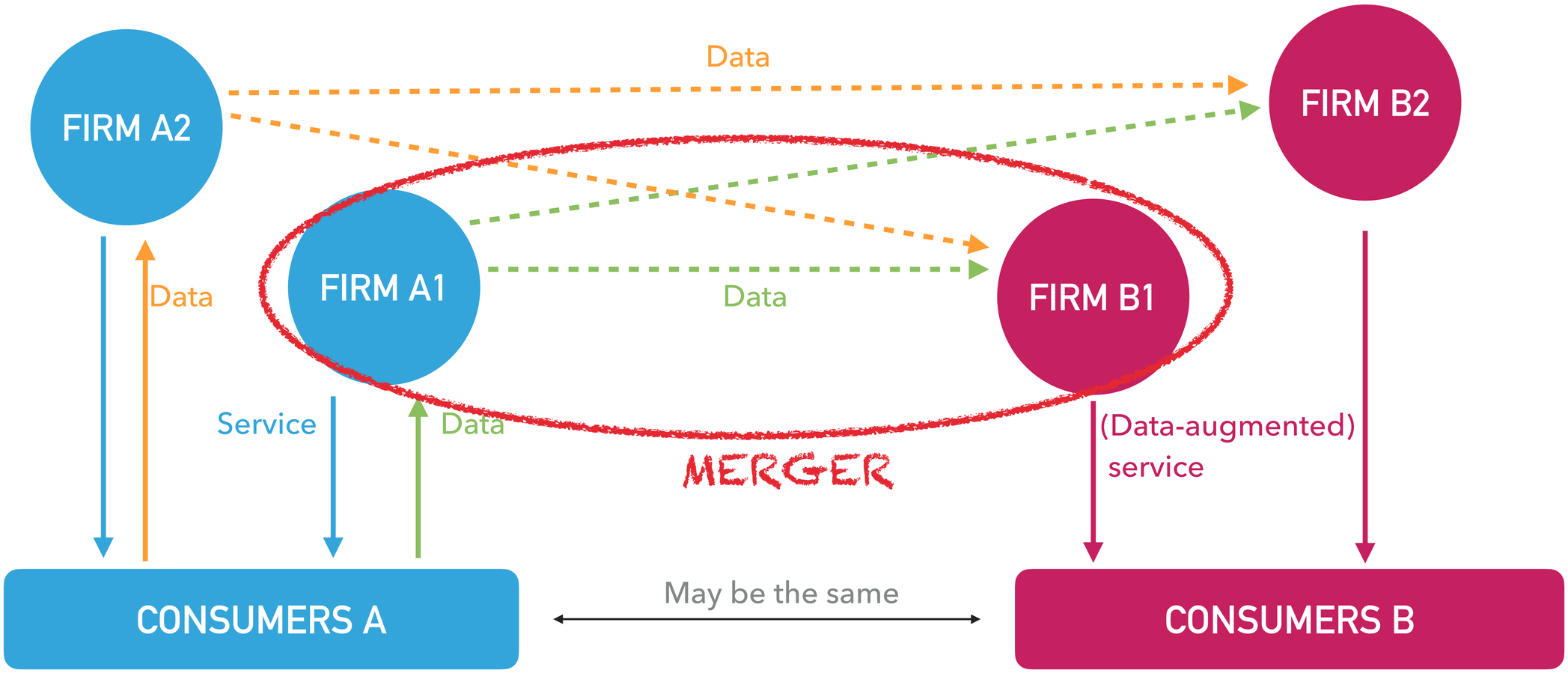
- If data is UPC: $\partial \pi_{B_1} / \partial \delta_{B_2} < 0$. Data makes rival « tough ».
  - Merger reduces incentives to collect data: $u_A^* \downarrow , u_B^* \downarrow$
- If data is UAC: $\partial \pi_{B_1} / \partial \delta_{B_2} > 0$. Data makes rival « soft ».
  - Merger increases incentives to collect data: $u_A^* \uparrow , u_B^* \downarrow$

Summary

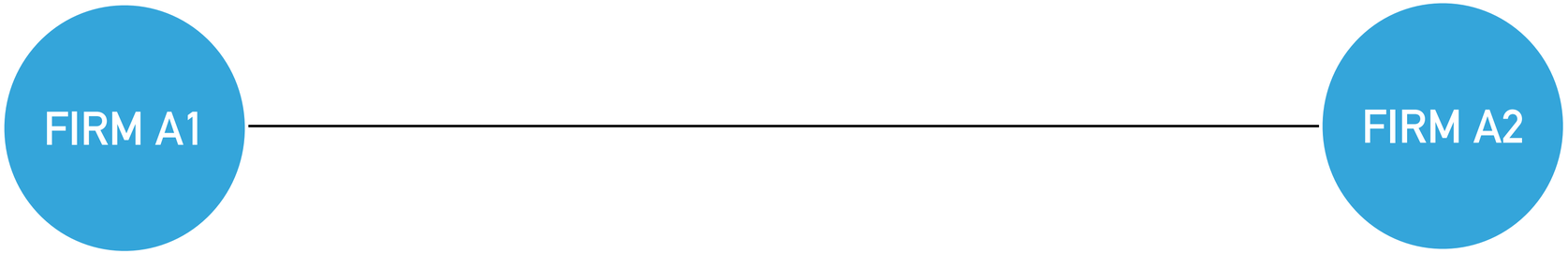
Effect of merger	UPC data	UAC data
No data trade	$u_A \uparrow \quad u_B \uparrow$	$u_A \uparrow \quad u_B \downarrow$
Data trade*	$u_A \downarrow \quad u_B \downarrow$	$u_A \uparrow \quad u_B \downarrow$

*Holds also under non-exclusive data trade, for similar reasons

Competition on A (Preliminary)



Competition on A



Competition on A

If data trade is impossible without merger: same analysis as monopoly.

Competition on A

If data trade is impossible without merger: same analysis as monopoly.

Things are different with data trade.

Competition on A

If data trade is impossible without merger: same analysis as monopoly.

Things are different with data trade.

We assume decreasing returns to data.

Competition on A

If data trade is impossible without merger: same analysis as monopoly.

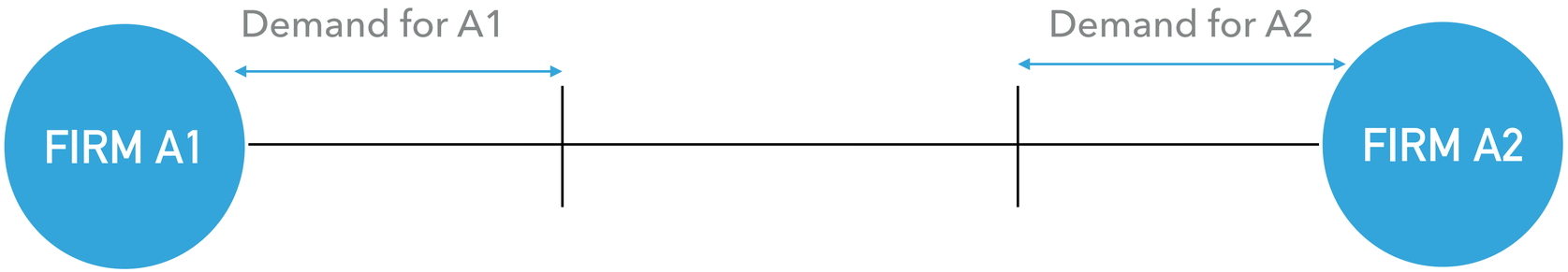
Things are different with data trade.

We assume decreasing returns to data.

Focus on non-exclusive data trade.

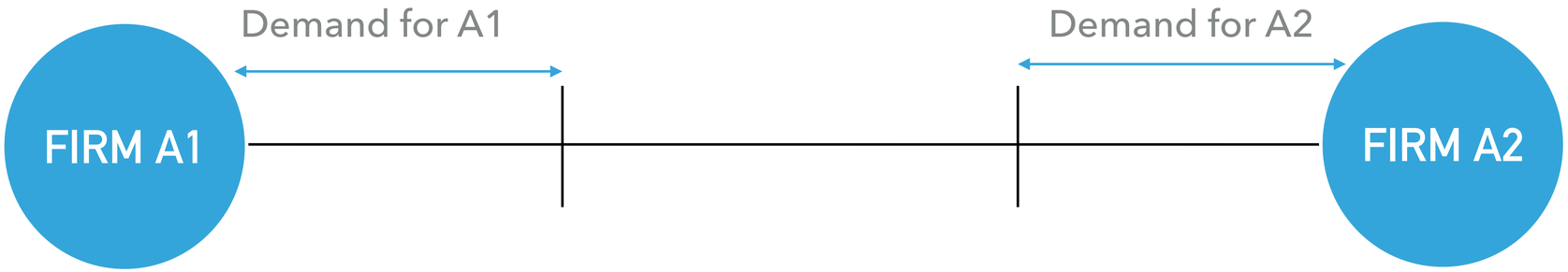
Competition on A

Case 1: Single-homing, non-covered market



Competition on A

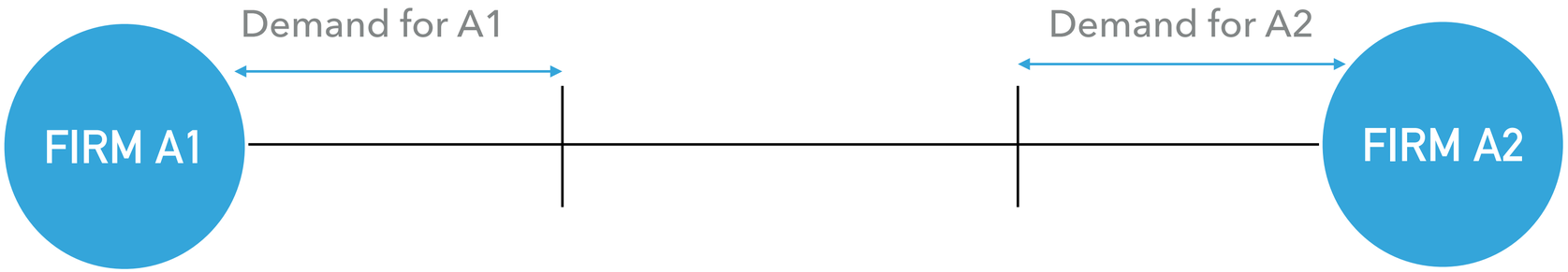
Case 1: Single-homing, non-covered market



Effects of the merger:

Competition on A

Case 1: Single-homing, non-covered market

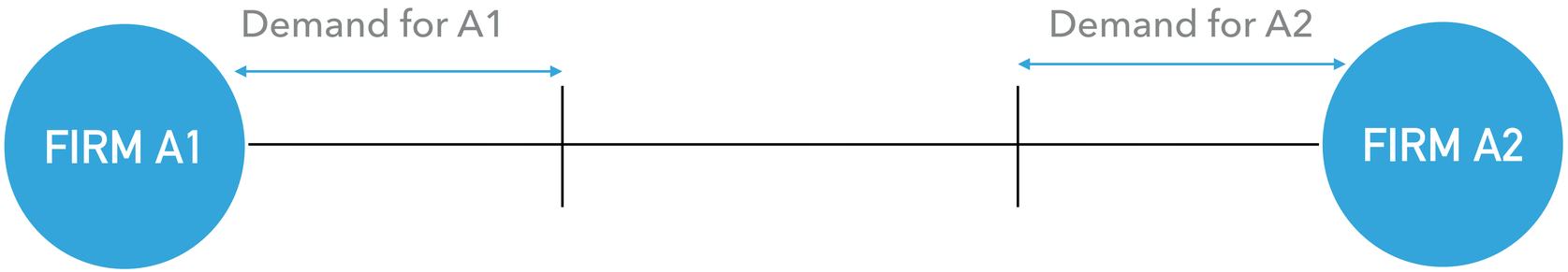


Effects of the merger:

- $u_A^* \uparrow$: collect more data to reduce price paid to A2

Competition on A

Case 1: Single-homing, non-covered market

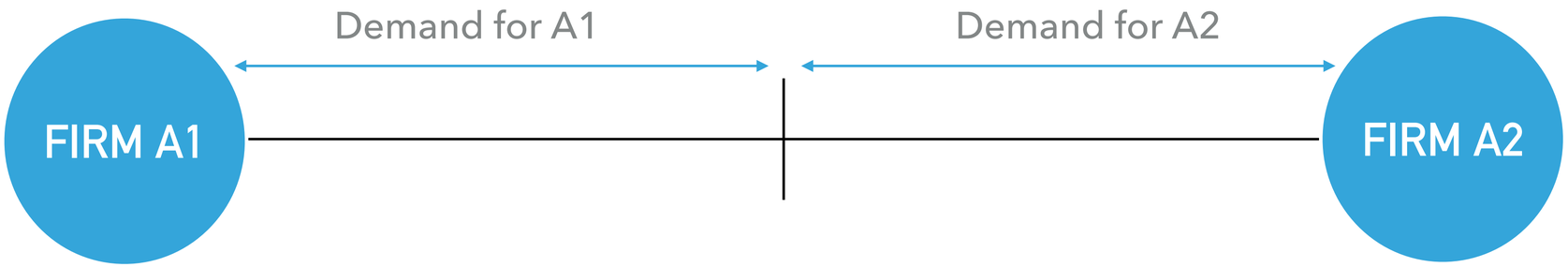


Effects of the merger:

- $u_A^* \uparrow$: collect more data to reduce price paid to A2
- $u_B^* \uparrow$ if data is UPC, $u_B^* \downarrow$ if data is UAC

Competition on A

Case 2: Single homing, covered market

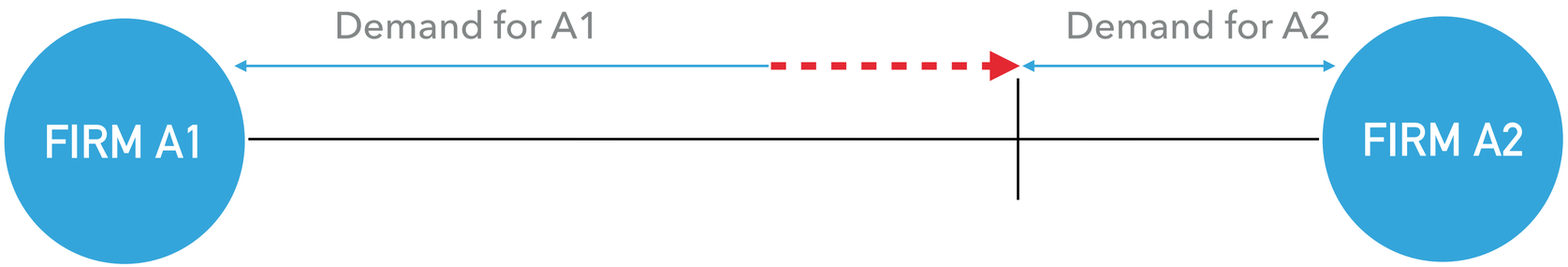


When differentiation is low (i.e. competition more intense)

Firms compete for marginal consumers

Competition on A

Case 2: Single homing, covered market



Main difference: if A_1 invests more then δ_{A_2} goes down

If A_1 and A_2 are symmetric, **merger is neutral**

Competition on A - tentative takeaway

Case 2: Single homing, covered market

Intuition:

For A_1 the change in profit post-merger is

$$\underbrace{\pi_{B_1} - T_{A_2}^{B_1}}_{\text{internalisation of B1's profit}} - \underbrace{T_{A_1}^{B_1}}_{\text{"lost" data sales}}$$

Competition on A - tentative takeaway

Case 2: Single homing, covered market

Intuition:

For A_1 the change in profit post-merger is

$$\underbrace{\pi_{B_1} - T_{A_2}^{B_1}}_{\text{internalisation of B1's profit}} - \underbrace{T_{A_1}^{B_1}}_{\text{"lost" data sales}}$$

If q_{A_1} increases, $T_{A_1}^{B_1}$ increases and $T_{A_2}^{B_1}$ decreases

Competition on A - tentative takeaway

Case 2: Single homing, covered market

Intuition:

For A_1 the change in profit post-merger is

$$\underbrace{\pi_{B_1} - T_{A_2}^{B_1}}_{\text{internalisation of B1's profit}} - \underbrace{T_{A_1}^{B_1}}_{\text{"lost" data sales}}$$

If q_{A_1} increases, $T_{A_1}^{B_1}$ increases and $T_{A_2}^{B_1}$ decreases

(by the same amount in symmetric situation)

Competition on A - tentative takeaway

Case 2: Single homing, covered market

Intuition:

For A_1 the change in profit post-merger is

$$\underbrace{\pi_{B_1} - T_{A_2}^{B_1}}_{\text{internalisation of B1's profit}} - \underbrace{T_{A_1}^{B_1}}_{\text{"lost" data sales}}$$

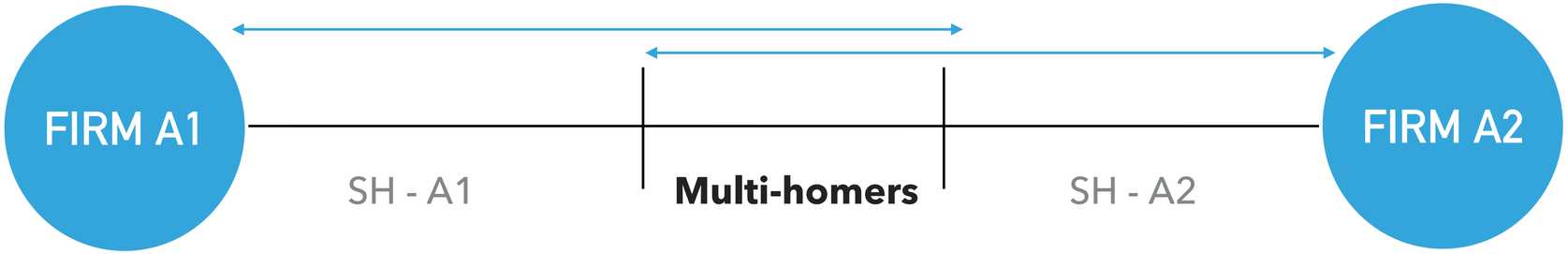
If q_{A_1} increases, $T_{A_1}^{B_1}$ increases and $T_{A_2}^{B_1}$ decreases

(by the same amount in symmetric situation)

(If A_1 has a quality advantage, quality goes down on A, u_B^* remains the same)

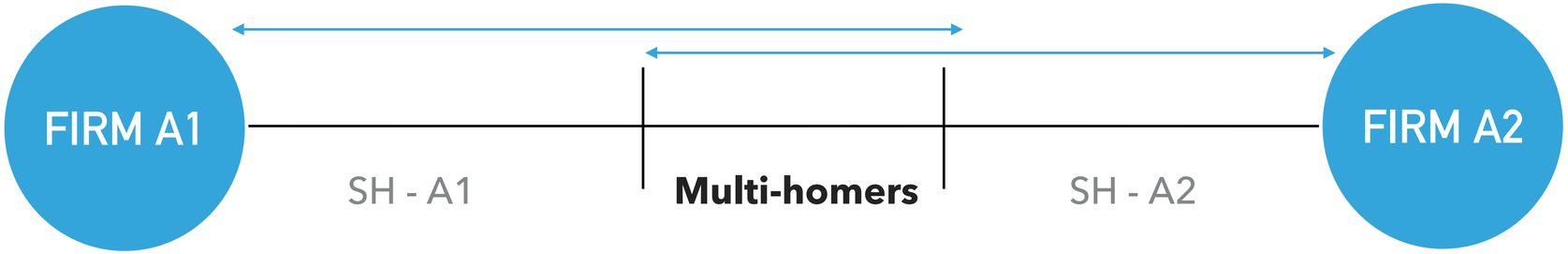
Competition on A

Case 3: Multi-homing



Competition on A

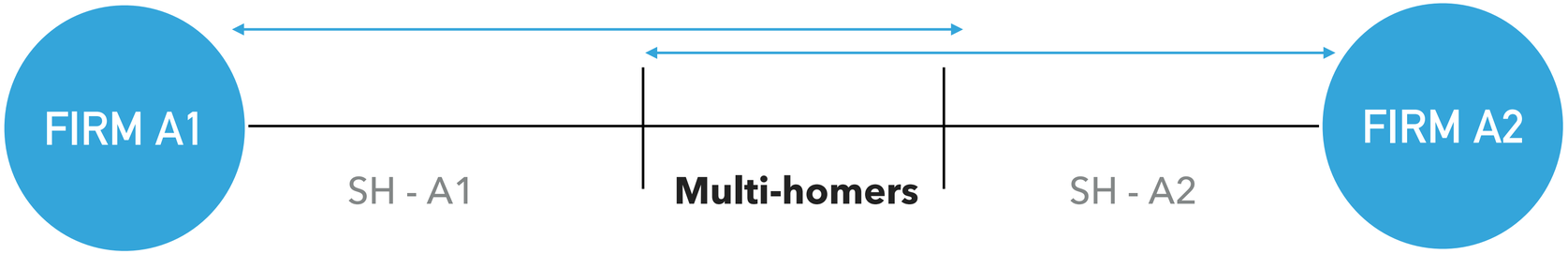
Case 3: Multi-homing



Effects of the merger:

Competition on A

Case 3: Multi-homing

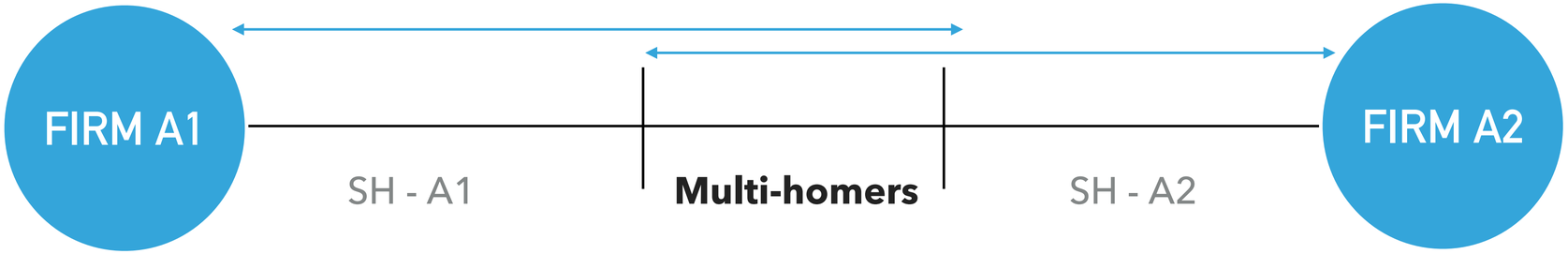


Effects of the merger:

- $u_A^* \uparrow$ (lower price paid to A_2)

Competition on A

Case 3: Multi-homing



Effects of the merger:

- $u_A^* \uparrow$ (lower price paid to A_2)
- $u_B^* \uparrow$ if data is UPC, $u_B^* \downarrow$ if data is UAC

Competition on A - Summary

Effect of merger	UPC data	UAC data
No data trade	$u_A \uparrow \quad u_B \uparrow$	$u_A \uparrow \quad u_B \downarrow$
Data trade*	$u_A \uparrow \quad u_B \uparrow$	$u_A \uparrow \quad u_B \downarrow$

*Except if SH and covered market: merger is neutral

Competition on A - Summary

Effect of merger	UPC data	UAC data
No data trade	$u_A \uparrow \quad u_B \uparrow$	$u_A \uparrow \quad u_B \downarrow$
Data trade*	$u_A \uparrow \quad u_B \uparrow$	$u_A \uparrow \quad u_B \downarrow$

Opposite of monopoly case

*Except if SH and covered market: merger is neutral

Discussion

When data is UPC

Our paper provides:

- An efficiency argument
  - Data use and higher quality on A in presence of large trade frictions
- A theory of harm
  - Trade btw independent firms lead to more collection and use of data

The key is whether trade is possible or not

Discussion

Other conditions

- Market power on A
- High value of data
  - Significant impact on profits of B firms
  - Value high enough to affect decisions on A
- Data collection associated with higher utility on A
  - In the model, quality (could be price)
  - Important assumption: privacy concerns on A not too strong

Discussion - UPC data

If data is UPC and there is no trade:

- Is there perspective of trading in near future?
  - If yes, that's the relevant counterfactual
  - If not, what is the friction?
    - If regulatory (e.g. privacy), allowing merger might run counter to other policy objectives
    - If contractual frictions, merger more likely to be desirable.

Discussion - UAC data

If data is UAC, opposite effects on markets A and B

- Separate effects or net effects analysis?
- If separate effects, harm on one market cannot be compensated on another
- If net effects, theory provides little guidance

Conclusion

Simple model of data-driven mergers

Focus on incentives to collect data through quality investment

Effects of merger depend on:

- Whether data is pro- or anti-competitive
- Frictions on data trading
- Intensity of competition on A market

We assume away foreclosure concerns: also important in practice (standard)

Conclusion

Paper also presents a framework to think about data and competition

Competition in utility (Armstrong & Vickers 2001)

- Allows flexibility to study various business models

Data as a revenue-shifter

- Given utility, more data ⇒ more revenues

We provide conditions for data to be UPC/UAC

We discuss applications

Implications for data sharing policies, dynamics

Thank you for your attention