Regulating platform competition in markets with network externalities: Will predatory pricing restrictions increase social welfare?

Ohad Atad
Coller School of Management - Tel Aviv University

Yaron Yehezkel
Coller School of Management - Tel Aviv University

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Motivation: Excessive prices

- Platforms sometimes charge below cost (negative) prices

- Such prices might be interpreted as predatory pricing: an incumbent may charge a negative price in order to eliminate a potentially more efficient entrant

- Research question: **How will predatory pricing restrictions affect the efficiency of entry in a market with network effects?**

Motivation: Predatory pricing by platforms

A classic Silicon Valley tactic — losing money to crush rivals — comes in for scrutiny

By **Will Oremus** Washington Post, Updated July 6, 2021, 6:43 p.m.

In 2015, Google launched Google Photos with the promise of unlimited, free storage and no ads — a money-losing proposition that no stand-alone photo-storage company could compete with. By the time Google started charging for storage in 2020, the innovative startups that once dotted the competitive landscape were mostly defunct.

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Motivation: Predatory pricing by platforms

A classic Silicon Valley tactic — losing money to crush rivals — comes in for scrutiny

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(Snapchat), or social audio (Clubhouse) — Facebook is sure to follow. So it was no surprise when the company announced last week a near-clone of Substack, the fast-growing newsletter platform that connects notable writers directly with subscribers.

The answer, it turns out, is by offering them financial terms that Substack can't match. Substack makes money by taking a 10 percent cut of writers' revenue. Facebook's cut of subscriptions on its newsletter platform, Bulletin, will be a tidy 0 percent, at least for now. And it paid best-selling authors such as Malcolm Gladwell

Motivation: Predatory pricing by platforms

INVESTIGATION OF COMPETITION IN DIGITAL MARKETS

MAJORITY STAFF REPORT AND RECOMMENDATIONS

SUBCOMMITTEE ON ANTITRUST, COMMERCIAL AND ADMINISTRATIVE LAW OF THE COMMITTEE ON THE JUDICIARY

Jerrold Nadler, Chairman, Committee on the Judiciary

David N. Cicilline, Chairman, Subcommittee on Antitrust, Commercial and Administrative Law

UNITED STATES
2020

About a year later, Amazon acquired Quidsi, the parent company of Diapers.com and Soap.com, for about $540 million.[1612] Prior to buying it, Amazon identified Diapers.com as its "largest and fastest growing compe baby care space,"[1613] and its "#1 short term competitor."[1614] Amazon's Diapers.com "keep[s] the pressure on pricing on us" and provided extre vels, which—prior to the merger—had forced Amazon to up its game.[161 ft and predatory action in response to this competitive threat. As Rep n (D-PA) summarized at the Subcommittee's sixth hearing, Amazon's i Amazon employees began strategizing about ways to weaken this comp tched a plot to go after Diapers.com and take it out."[1616] Specifically, Ama e firm entered into an aggressive price war, in which Amazon was willing to bleed over $200 million in losses on diapers in one month.[1617]

In 2017, Amazon shut down Diapers.com, citing profitability issues, though some industry experts questioned the legitimacy of this rationale.[1619] In shutting down the company, Amazon eliminated a differentiated online retailer that consumers loved[1620] ... reducing the number of online

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Overview

- Dynamic, infinitely repeated competition between two platforms:
  - An incumbent platform that benefits from a ***focal*** position: Users expect other users to join the incumbent
  - An entrant platform that suffers from a ***non-focal*** position but may offer a superior base quality
- The winner of each period becomes the focal incumbent in the next
- In each period, the market is stochastic in two dimensions:
  1. The quality gap between the platforms (both platforms contentiously innovate, quality advantage may "change sides" over-time)
  2. The Market size in each period can be high or low

Overview

- In each period, platforms compete not only for winning the current period, but also for gaining focality in the next

- Therefore, platforms may charge negative prices in order to secure the dominant position in future periods

- Our research question is how predatory price restrictions affects the efficiency of entry:
  - *Inefficient incumbency*
  - *Inefficient entry*

Main results

Unregulated market:

- An incumbent can benefit from ***inefficient incumbency*** - wins the market with an inferior quality
- In some cases, **both** platforms may choose below cost prices

Regulated market: Two types of regulation

1. Symmetric regulation decreases users' surplus, yet has no effect on efficiency
   - Soften price competition, users pay more
   - Threshold quality gap remain unchanged

2. Asymmetric regulation: Market size over-time determine policy outcomes
   - **Stable market**: Incumbent restriction weakly improves market outcome
   - **Unstable market**: A tradeoff between *inefficient incumbency* and *inefficient entry*

Literature: Excessive prices and competition law

Legal

- ***Bork (1978), Edlin (2002), Evans and Padilla (2005), Hamphill and Weiser (2018), O'Donoghue and Padilla (2019)***
  - Legal discussions on the competitive effects of predatory price restrictions.
  - Our contribution: A formal model, welfare analysis

Economic

Gilo and Spiegel (2018), Rey Spiegel and Stahl (2022)

- Our contribution: Study the competitive effects of predatory price restrictions in markets with network externalities

Literature: Platforms and coordination problem

- How markets with network externalities contribute to the analysis?
  - Users seek other consumers; coordination problem
  - Low prices are applied in order to secure a dominant position

Caillaud and Jullien (2001,2003), Hagiu (2006), Jullien (2011), Biglaiser and C´remer (2020)

- Predation in markets with network effects

***Farrel and Katz (2005)*:** Study predatory pricing restrictions in the context of a two-period game when the market size is constant over time.

Our contribution: 1. Stochastic market size determines the efficiency of a regulatory intervention

2. Evaluate the long-term effect of price restrictions (Infinite horizon, entrant internalizes that winning today results in price restrictions in the future)

The Model

- User's utility: $U_{it} = q_{it} + \beta \cdot N_{it} - p_{it}$
  - p_{it} - Platform's price ; q_{it} - Platform's quality (in period *t*)
  - N_{it} : The mass of consumers that join the platform (in period *t*)
  - Assumption: Network effects, $\beta > 0$
- Two competing platforms, *A* and *B*
- Homogeneous user population of a mass of *N*
- In each period (timing):
  1. Platforms set p_A, p_B
  2. Users decide simultaneously and non-cooperatively, to join one of the platforms for the current period (and re-join one of the platforms in each period)
- Platforms discount future profits by $\delta \in (0,1)$
- The winning platform in the current period becomes focal in the next
  - Platforms may charge negative prices (cost functions are normalized to 0)
  - Focality in future periods leads to additional profits

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Focality

Benchmark in a static game (HYJ 2020)

- Platforms set p_A and p_B, and all users decide which platform to join:
  - If: $q_A + \beta \cdot N - p_A > q_B - p_B$ → All users join *A*
  - If: $q_B + \beta \cdot N - p_B > q_A - p_A$ → All users join *B*
  - If: $(q_B - q_A) - \beta \cdot N < \boldsymbol{p_B} - \boldsymbol{p_A} < (q_B - q_A) + \beta \cdot N$ → Two possible allocations:
    1. All users join *A*, or
    2. All users join *B*

- Suppose that Platform *A* is *focal*: If both allocations are possible, all users join *A*

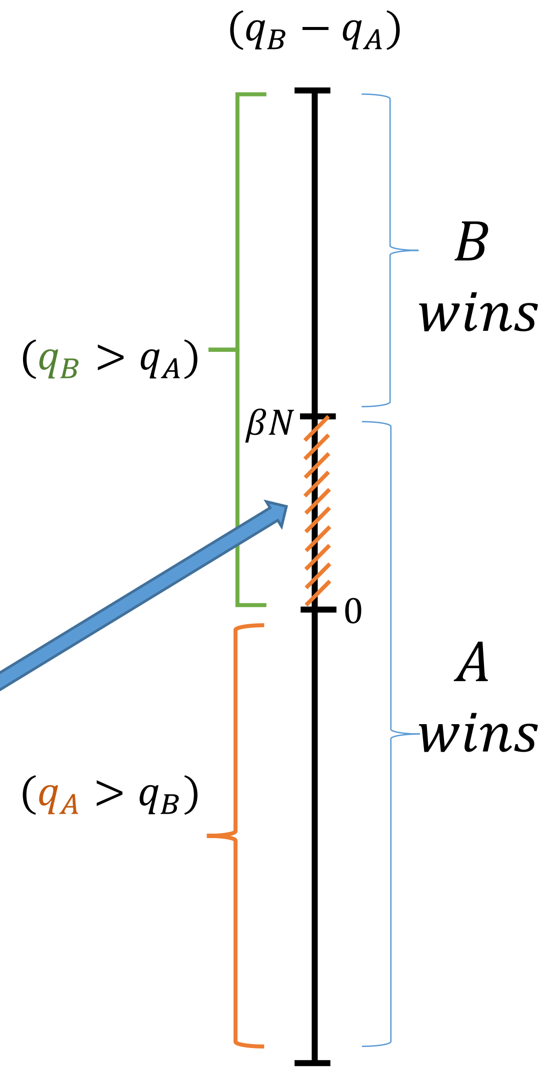
Focality

Benchmark in a static game (HJY 2020)

Lemma: *Consider a static game. Then, if platform A holds the focal position:*

- *The losing platform charges a price of 0*
- *The winning platform charges a positive price*
- *Platform A wins the market if* $(q_b - q_a) \leq \beta \cdot N$

<u>Inefficient incumbency</u>: The focal platform may win the market with an inferior quality, due to its focal position



Infinitely repeated game – Stochastic Markov Perfect Equilibrium

- Market size is stochastic in each period: $\mathrm{N} = \{1, n\}, n > 1$

  N =1 with a probability of $(1 - \rho)$, N =n with a probability of ρ

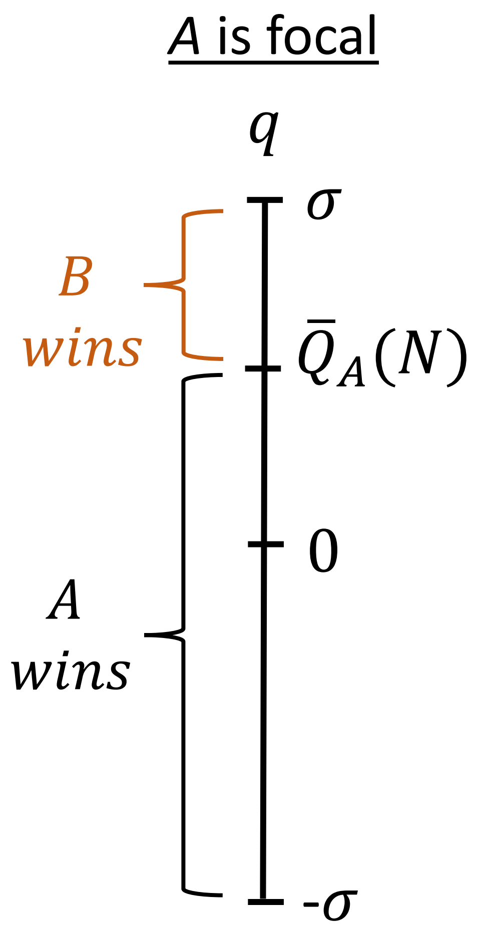
- Platforms are contentiously innovative:

  Quality gap is stochastic in each period: $q \equiv q_B - q_A$

  q is independently drawn between periods: $q \sim U[-\sigma, \sigma]$

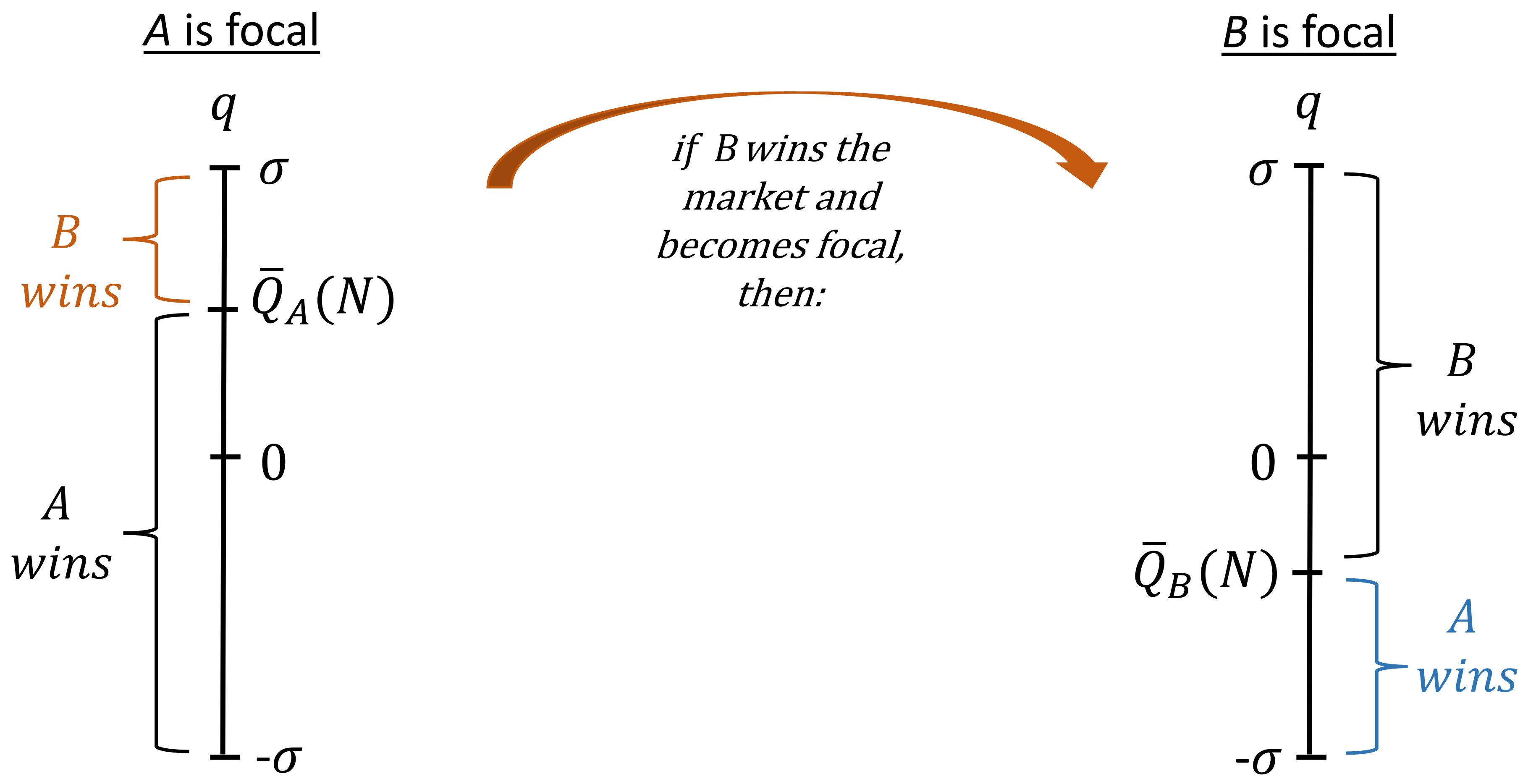
Infinitely repeated game – Stochastic Markov Perfect Equilibrium

- In equilibrium, the *focal* platform *A* wins the current period and continues to win the market as long as the quality gap in favor of *B* is below the equilibrium threshold: $q \leq \overline{Q}_A(N)$



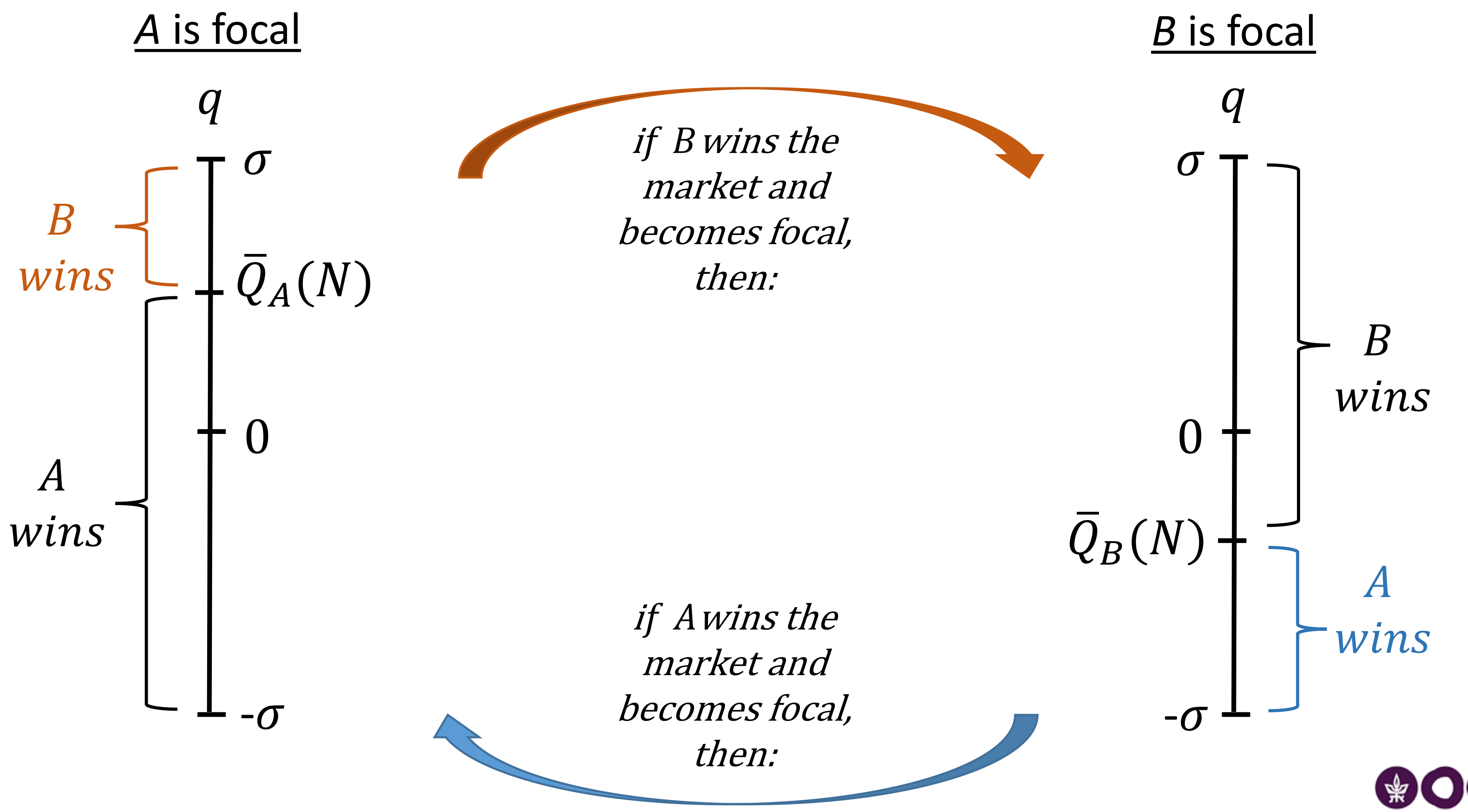
Infinitely repeated game – Stochastic Markov Perfect Equilibrium

- Eventually, a high realization of *q* occurs: $q > \overline{Q}_A(N)$. *B* 'attacks' the market, win all users, and become *focal*



Infinitely repeated game – Stochastic Markov Perfect Equilibrium

- The equilibrium threshold changes: the *focal* platform *B* wins the market as long as the realization of *q* is higher than $q \geq \overline{Q}_B(N)$, and loses the focal position otherwise.



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Infinitely repeated game – Stochastic Markov Perfect Equilibrium

- $V_i^j(N)$: the discounted sum of expected profits of platform *i* when platform *j* currently holds the dominant position *(focal),* and the current market size is N
- The Stochastic Markov Perfect Equilibrium is defined by the vector of 8 value functions $V_i^j(N)$, and 4 thresholds $\overline{Q_i}(N)$, for $i = \{A, B\}$ and $N = \{1, n\}$
- $p_i^j(N)$ is the price charged by platform i when platform j is focal, given a market size of N
- $EV_i^j = (1-\rho)V_i^j(1) + \rho V_i^j(n)$ is the expected value function, given that in the next period, the market size can be $N = \{1, n\}$

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Infinitely repeated game – Unregulated market

- The value function of *A*, for $N = \{1, n\}$, when *A* is *focal*:
  - *N=1* ⟶
$$V_A^A(1) = \int_{-\sigma}^{\overline{Q}_A(1)} \left[(\beta \cdot 1 - q - \delta(EV_B^B - EV_B^A)) \cdot 1 + \delta EV_A^A\right] \cdot \frac{1}{2\sigma} dq + \int_{\overline{Q}_A(1)}^{\sigma} \delta EV_A^B \cdot \frac{1}{2\sigma} dq.$$
  - *N=n* ⟶
$$V_A^A(n) = \int_{-\sigma}^{\overline{Q}_A(n)} \left[\left(n\beta - q - \frac{\delta}{n}\left(EV_B^B - EV_B^A\right)\right) n + \delta EV_A^A\right] \cdot \frac{1}{2\sigma} dq + \int_{\overline{Q}_A(n)}^{\sigma} \delta EV_A^B \cdot \frac{1}{2\sigma} dq$$

Infinitely repeated game – Unregulated market

- The value function of *A*, for $N = \{1, n\}$, when *B* is *focal*:
  - *N=1* ⟶ $$V_A^B(1) = \int_{-\sigma}^{\overline{Q}_B(1)} [(-q - \beta \cdot 1 - \delta(EV_B^B - EV_B^A)) \cdot 1 + \delta EV_A^A] \cdot \frac{1}{2\sigma} dq + \int_{\overline{Q}_B(1)}^{\sigma} \delta EV_A^B \cdot \frac{1}{2\sigma} dq$$
  - *N=n* ⟶ $$V_A^B(n) = \int_{-\sigma}^{\overline{Q}_B(n)} \left[\left(-q - \beta n - \frac{\delta}{n}(EV_B^B - EV_B^A)\right) n + \delta EV_A^A\right] \cdot \frac{1}{2\sigma} dq + \int_{\overline{Q}_B(n)}^{\sigma} \delta EV_A^B \cdot \frac{1}{2\sigma} dq$$

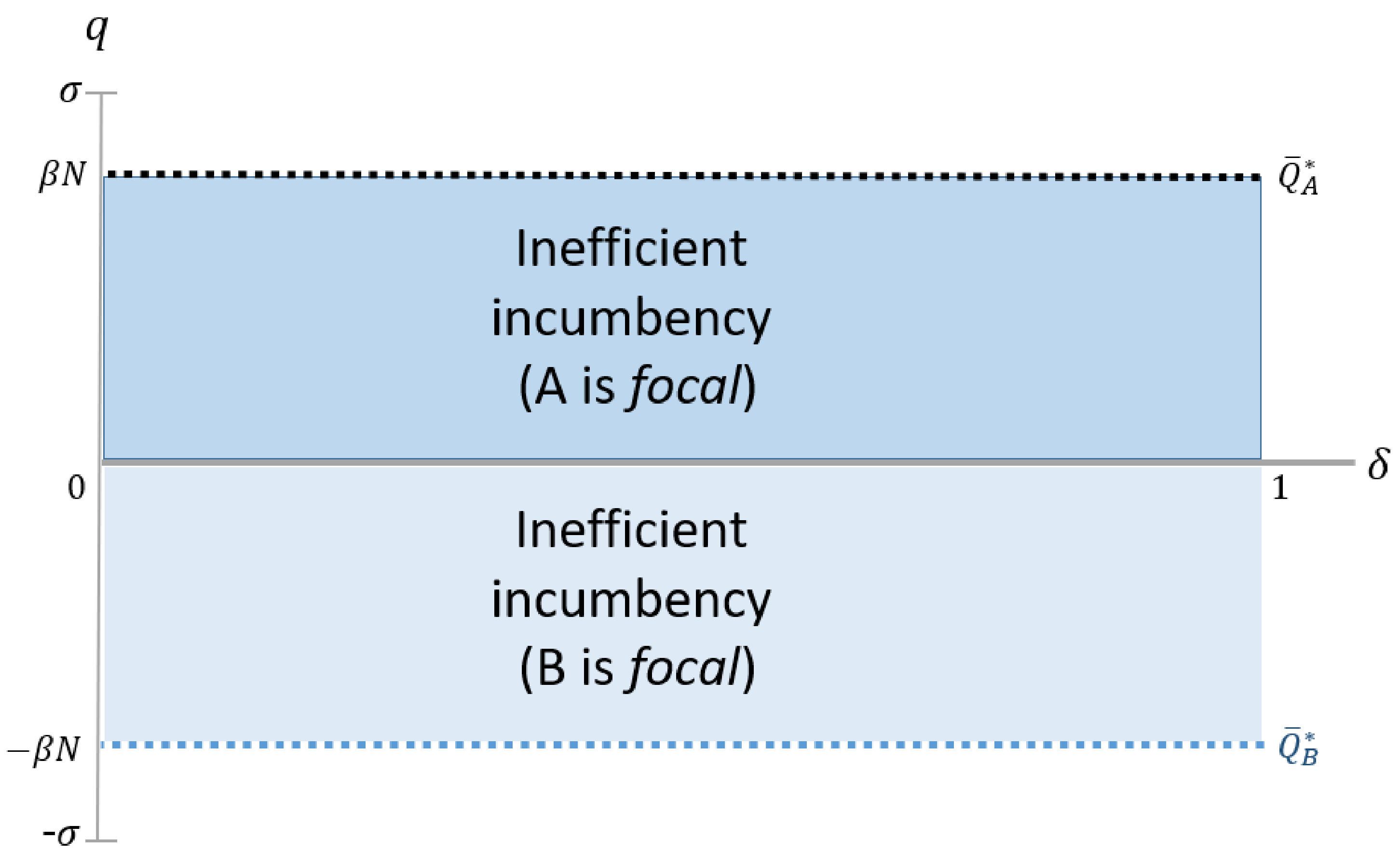
Benchmark: Unregulated market

- When both platforms can charge negative prices:

  I. In an unregulated market *Focality* may lead to inefficient incumbency:

  $$\bar{Q}_A^* = \beta N \quad \bar{Q}_B^* = -\beta N$$

  II. Evaluated at $q = \bar{Q}_i^*(N)$, <u>both</u> the *focal* and the *non-focal* platform charge a negative price



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Symmetric regulation

Both platforms are prohibited from charging negative prices:

- The threshold quality gap is identical to that in the unregulated market:

$$\bar{Q}_A^{sym} = \beta N \qquad \bar{Q}_B^{sym} = -\beta N$$

- Prices are higher, yet market efficiency remain unchanged

Users' surplus decreases

Platforms' profits increase

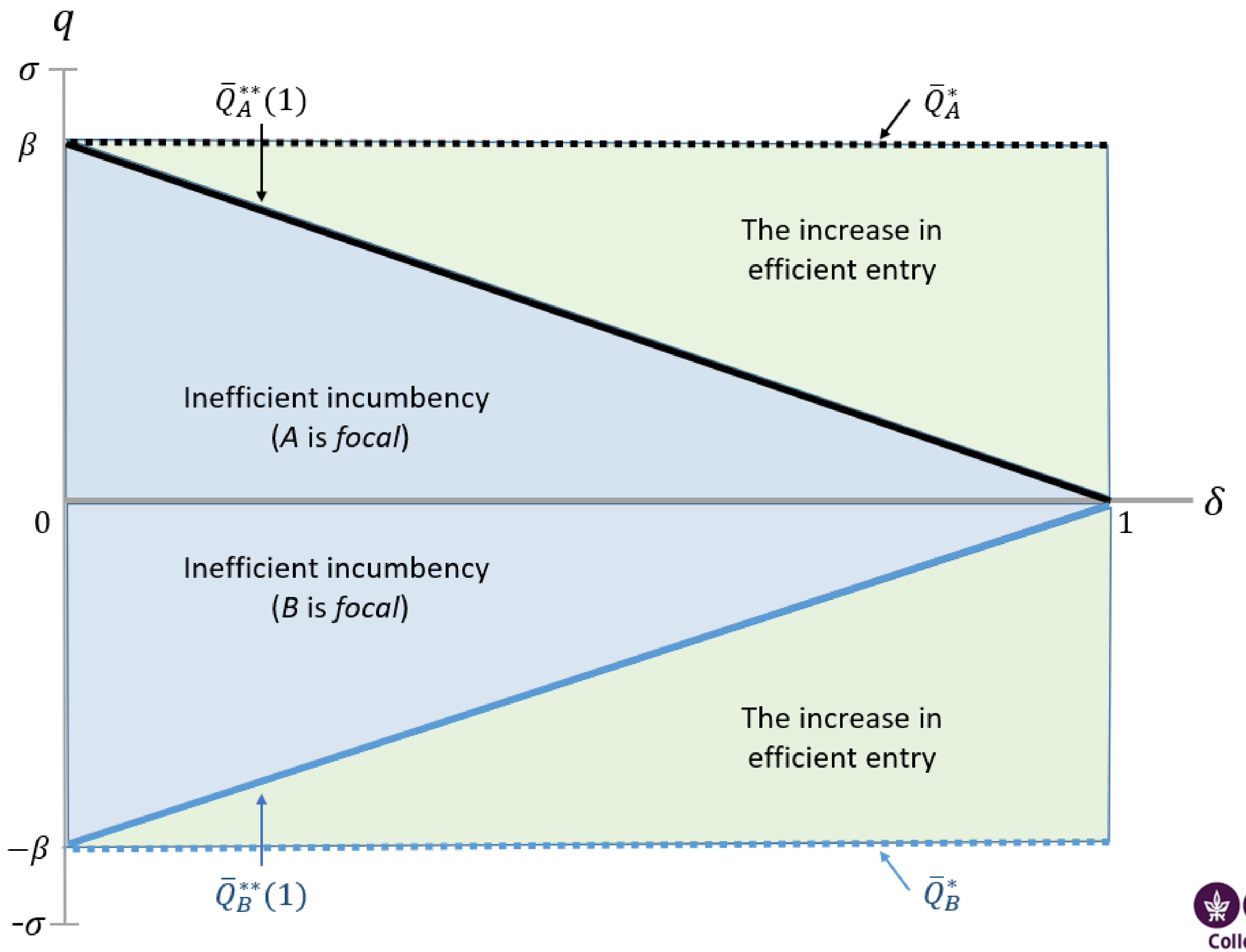
Asymmetric regulation- Stable market size

Proposition 1:

When the market size is stable overtime:

(i) Inefficient incumbency decreases with δ

(ii) The entrant is <u>unable</u> to win the market with an inferior product

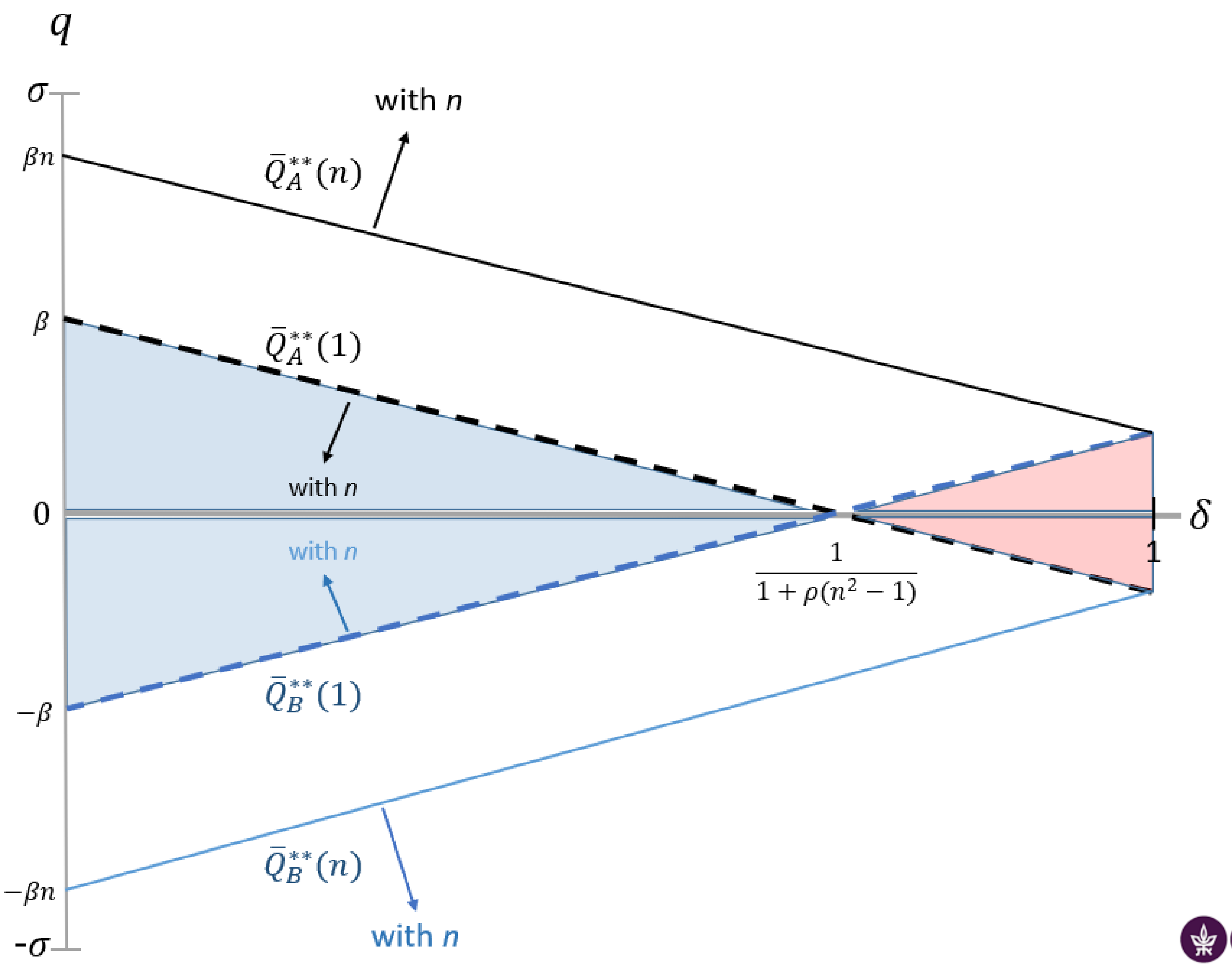


Asymmetric regulation – Unstable market size

Proposition 2:

When the market size is unstable over time:

Market size realization today determines policy outcomes (a trade-off between inefficient incumbency and inefficient entry)

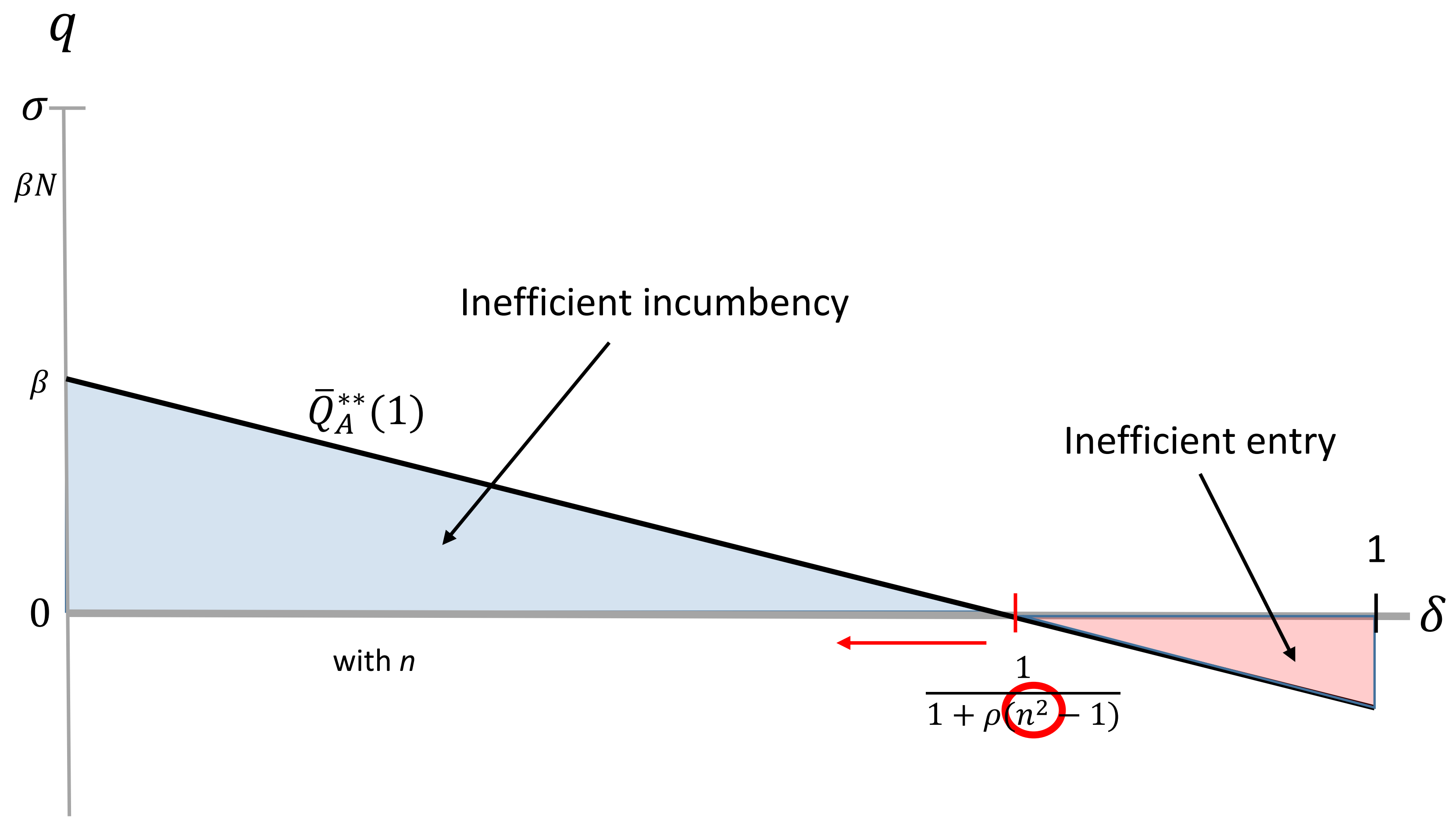


Unstable market: Periods of low realization, 1

Proposition 2:

(i a) *Inefficient entry is feasible, increases with n*

(i b) *Inefficient incumbency decreases with n*



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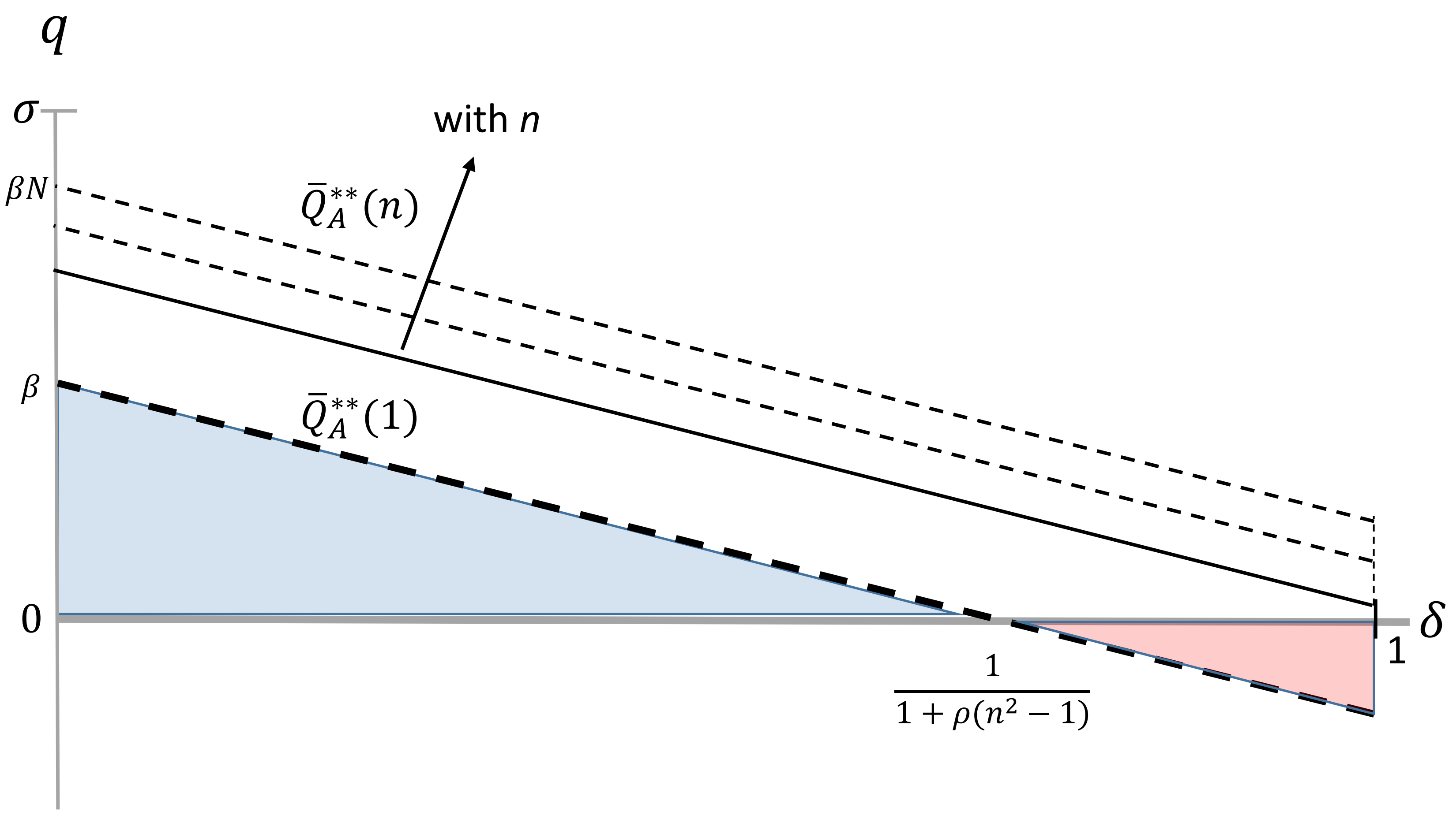
Unstable market: Periods of high realization, n

Proposition 2:

(ii) *The problem of inefficient incumbency in periods of high market size realizations aggravates with n*



Welfare - Unregulated and Regulated market

$$W^i = \rho\left(\int_{-\sigma}^{\overline{Q}_i(n)}((n\beta+q_0)n+\delta W^i)\frac{1}{2\sigma}dq+\int_{\overline{Q}_i(n)}^{\sigma}(n(n\beta+q_0+q)+\delta W^j)\frac{1}{2\sigma}dq\right)$$

$$+(1-\rho)\left(\int_{-\sigma}^{\overline{Q}_i(1)}((\beta+q_0)+\delta W^i)\frac{1}{2\sigma}dq+\int_{\overline{Q}_j(1)}^{\sigma}((\beta+q_0+q)+\delta W^j)\frac{1}{2\sigma}dq\right)$$

W^{i*} *(Unregulated):*

- W^i *evaluated at* $\bar{Q}_i^*$
- $W^{A*} = W^{B*} = W^*$
- $w^* = (1-\delta)W^*$

w^* is the one-period expected welfare in an unregulated market

W^{i**} *(Asymmetrically regulated):*

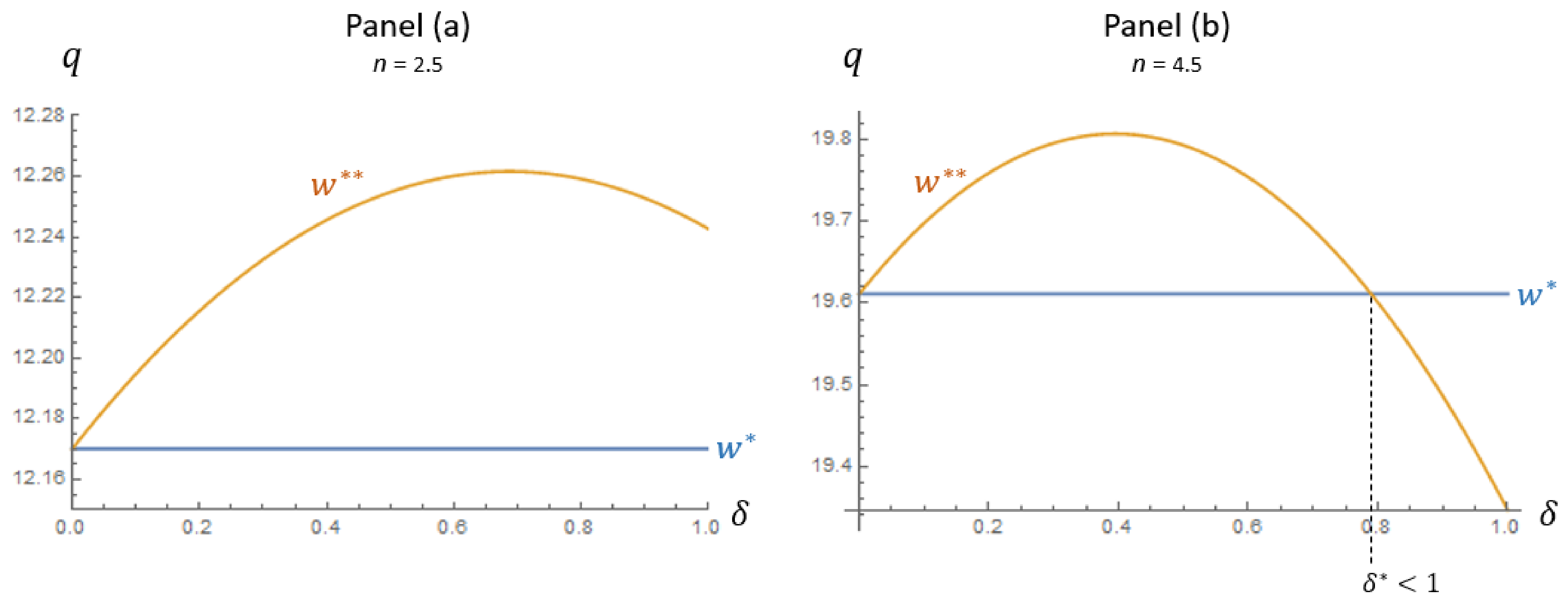
- W^i *evaluated at* $\bar{Q}_i^{**}$
- $W^{A**} = W^{B**} = W^{**}$
- $w^{**} = (1-\delta)W^{**}$

w^{**} is the one-period expected welfare in an asymmetrically regulated market

Asymmetric regulation – Stable/Unstable market size

Welfare:

The effect of asymmetric regulation on welfare depends on the potential of variations in the size of the market



w^{*} = *Unregulated* w^{**} = *Asymetrically regulated*

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Conclusion

- The paper considers a market for platforms when consumers expect other consumers to join the incumbent platform (*focality*)
- Symmetric restriction is not recommended
- Variations in the size of the market determine the efficiency of an asymmetric restriction:
  I. Asymmetric regulation always increase consumer surplus.
  II. Asymmetric regulation always decrease platforms' profits.
  III. Asymmetric regulation is suitable for a **stable market size**, in which it is always welfare enhancing, and is more efficient as the discount factor increases (low interest rates)
  IV. Asymmetric regulation may create the problem of *inefficient entry* in an **unstable market size**, and decreases welfare when the potential variations are higher

Thank you!

ohadatad@yahoo.co.uk