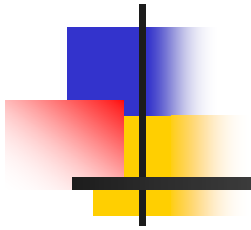


Kill Zone

Sai Krishna Kamepalli

Raghuram Rajan Luigi Zingales

CHICAGO BOOTH

The University of Chicago Booth School of Business

Motivation

- Kill Zone: Venture capitalists are reluctant to fund investments in a space that is proximate to large digital platforms.

- "The Kill Zone is a real thing. The scale of these companies [digital platforms] and their impact on what can be funded, and what can succeed, is massive": Albert Wenger, VC

- "Venture capitalists are now hesitant to fund new startups to compete with these big tech companies because it's so easy for the big companies to either snap up growing competitors or drive them out of business." : Senator Elizabeth Warren.

- Wait a minute! The prospect of being acquired should spur, not stifle, innovation and investment.
- What do the data say?
- Is there even suggestive evidence that a liberal acquisition environment may deter entry?

Nature of the Test

- Ideally, we would like to study the impact on start-up investments of a decision by antitrust authorities to strike down a big acquisition by a major digital platform.
- Unfortunately, we have not observed any such decision
- Therefore, we resort to a different strategy
- We consider the announcements of major acquisitions by platforms as a signal that the FTC and DoJ will let these, and similar, acquisitions go through.
- We then examine the impact on investment decisions by related companies.

Empirical Strategy

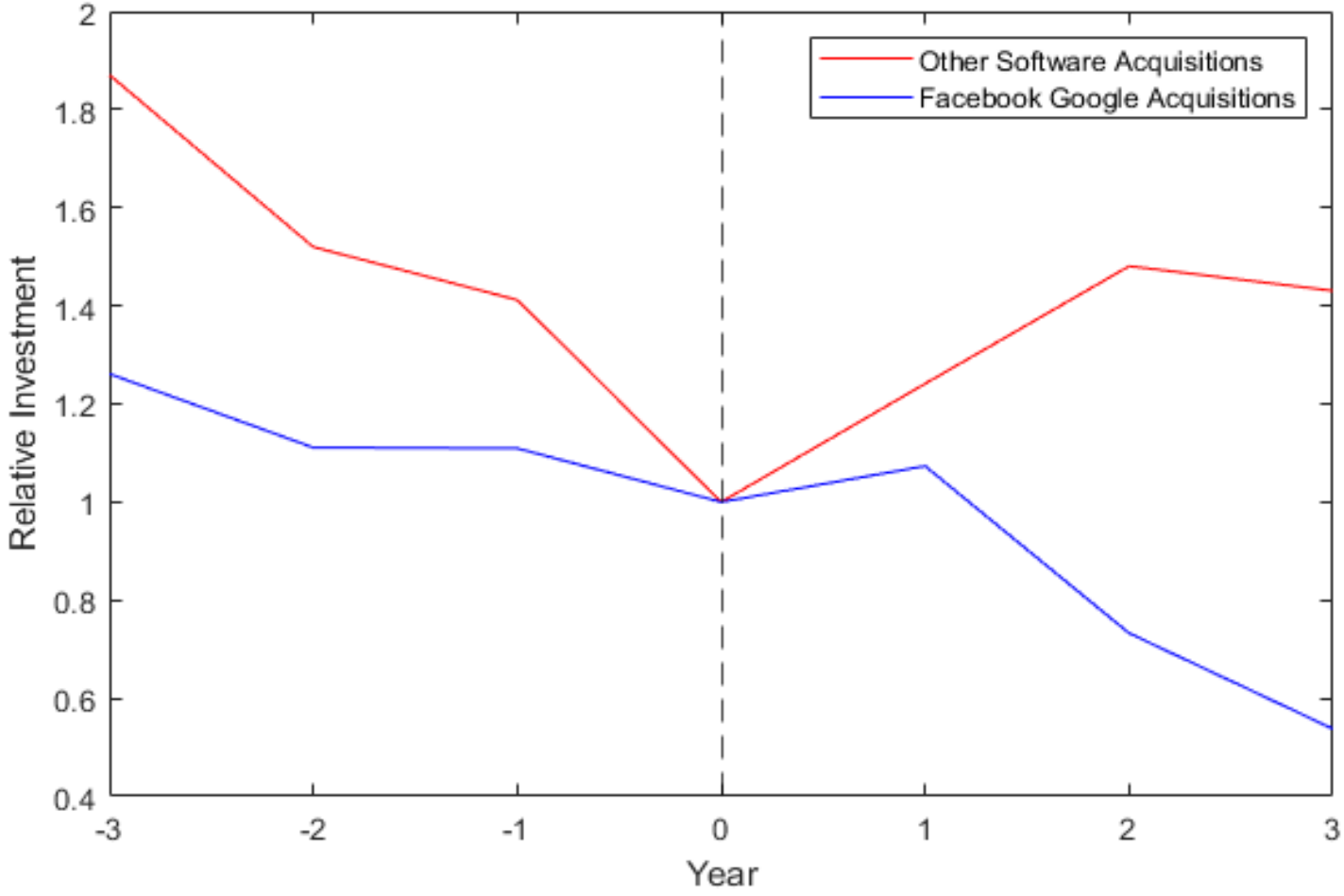
- Identify which acquisitions are big enough to matter
  - All Google and Facebook acquisitions > $ 500 million in the period 2006-2016
- Identify a set of “treated firms”
  - Similar to the one acquired (possibly not too similar)
- Define a “cycle-adjusted” measure of investments
  - We standardize the amount by all the amount VCs invest in all software companies (all early deals) from Pitchbook.
  - We normalize by this ratio in the year of the acquisition.
- Compute this cycle-adjusted normalized measure around the year of acquisition (+/- 3 years)
- Aggregate them in an event study across acquisitions

Events

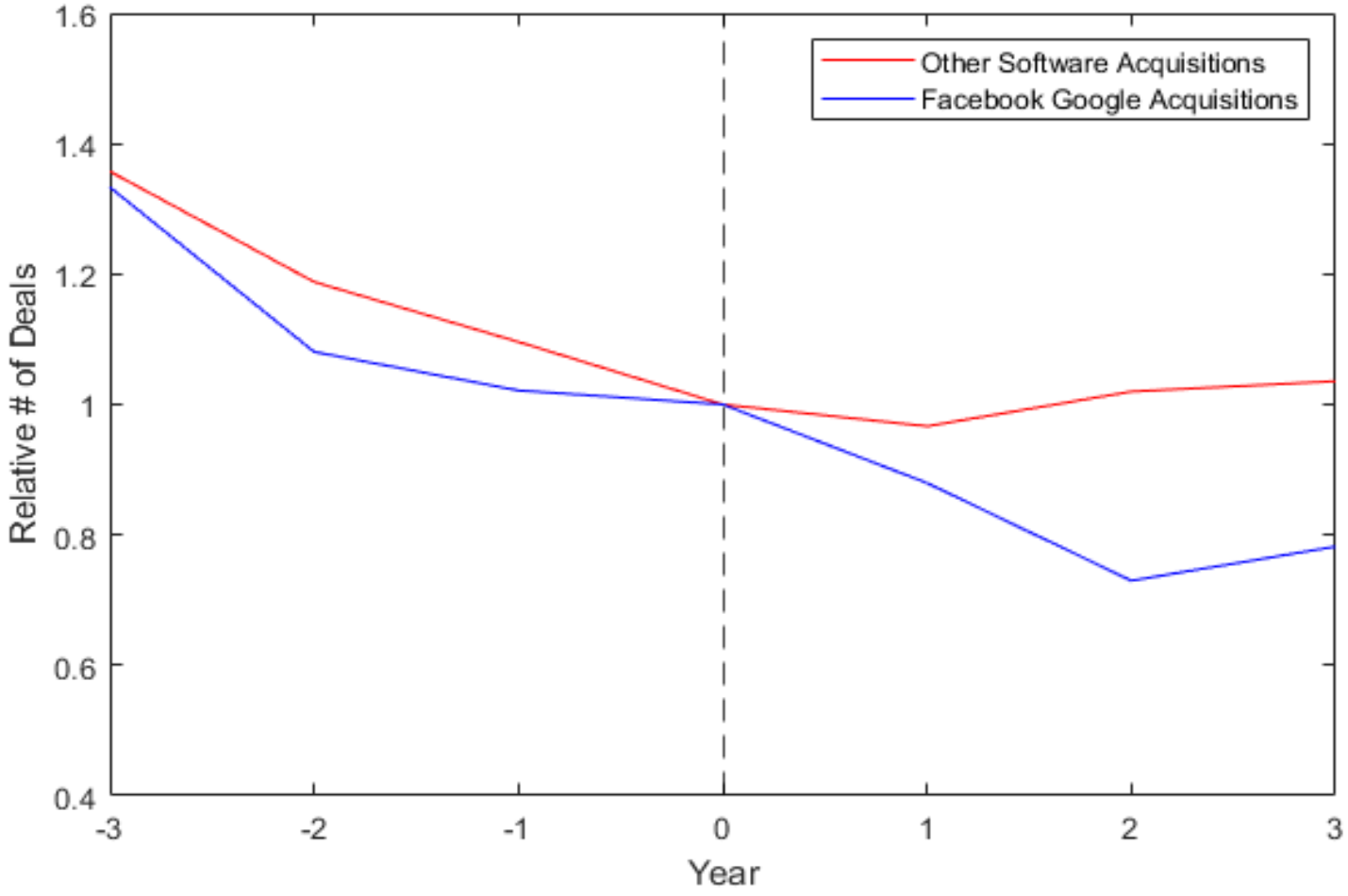
All software companies acquired by Facebook or Google for more than 500 M between the beginning of 2006 and the end of 2018.

Year	Acquirer	Target	Price	Software Sector	Complementarity
2006	Google	Youtube	1,650	Multimedia and Design	Substitute
2007	Google	DoubleClick	3,100	Internet	Complement
2009	Google	AdMob	750	Vertical Market	Complement
2009	Google	Postini	625	Network Management	Complement
2011	Google	ITA Software	676	Vertical Market	Substitute
2012	Facebook	Instagram	1,000	Social Platform	Substitute
2013	Google	Waze	966	Communication	Substitute
2014	Facebook	WhatsApp	19,000	Communication	Substitute
2016	Google	Apigee	625	Development Applications	Complement

Normalized relative investment before and after an acquisition



Normalized relative number of deals before and after an acquisition



Do acquisitions encourage entry in a digital platform world?

- A world characterized by:
  1. One dominant incumbent
  2. Network externalities
     - the more the apps on a platform, the more each customer benefits
  3. Multi sided platforms
     - The price charged on the customer side of the platform equals zero
  4. Switching costs
     - Adaptation cost for app designers
     - No costless multi-homing for customers
- Perhaps not!

Intuition 1: Dominant incumbent

- Acquisition price of entrant depends upon:
  - Competition among bidders
  - Entrant's outside option to go it alone (even if mergers are always efficient)
- If only one large incumbent platform, there is no competition -> go-it-alone value

Intuition 2: Network externalities

- Go-it-alone value depends upon
  - the entrant's quality
  - the number of customers the new entrant can attract

Intuition 3: Multisided platform

- Customer decisions swayed by decisions of app designers who choose whether to adapt their app to the entrant platform.

Intuition 4: Switching costs

- In a world where app designers have switching costs entrant is already at a disadvantage because app designers start with incumbent.
- Willingness of designers to incur costs and adopt a new platform depends upon length of independent life of new platform.
- Lengthy merger authorizations lead to longer independent life

Intuition 5

- Acquirer is expected to make seamless the adaptation of apps to the merged platform.
- Anticipating this, few app designers will pay cost to adapt to entrant if merger expected soon
- Seeing few app designers adapt, few customers will switch.
- This depresses stand-alone valuations, hence acquisition prices.
- Depresses investments in potential entrants.
- No overt anti-competitive behavior! Incumbent platform can be entirely passive (apart from acquisition).

Model Setup

Problem in modeling

- Network externalities lead to multiple equilibria
  - If I think many designers will adapt, I too will adapt, while if I think no one will adapt, I will not adapt.
  - No relationship to fundamentals (sun spots)
  - Similar to the modeling of bank runs
- Technique of global games helps us get a unique equilibrium.
  - Equilibrium related to fundamentals.
  - Allows us to do comparative statics.

Model

- Consider an incumbent platform I, which is threatened by a new entrant platform E.
- Without loss of generality, we will assume the quality of the incumbent is normalized to zero.
- The quality increment of the new entrant is θ, with the technology lasting *n* periods.
- There are two sets of agents:
  - App designers with measure λ
  - Ordinary customers with measure 1.
  - All agents are risk neutral

App designers: Early adopters

- At date 0 (the beginning of the first period), everyone observes a common signal such that their posterior on θ is distributed

$$N(q, \frac{1}{\alpha})$$

- Each app designer also sees a private signal of incremental quality $x_i = \theta + \eta_i$

where

$$\eta_i \sim N(0, \frac{1}{\beta})$$

- App designers already have their app on the incumbent platform, the question is do they adapt to the new platform.
- If they do so, they incur an one time adaptation cost *s*.
- App designers multi-home (we also analyze single-homing).

Ordinary Customers

- At date ½ , ordinary customers choose whether to switch to the new platform.
- Ordinary customers have a switching cost c_i distributed uniformly [0,c̄].
- Their value of being on a platform is:

expected platform quality + total measure of app designers on platform

- Value of being on Entrant = $\theta+\lambda p$

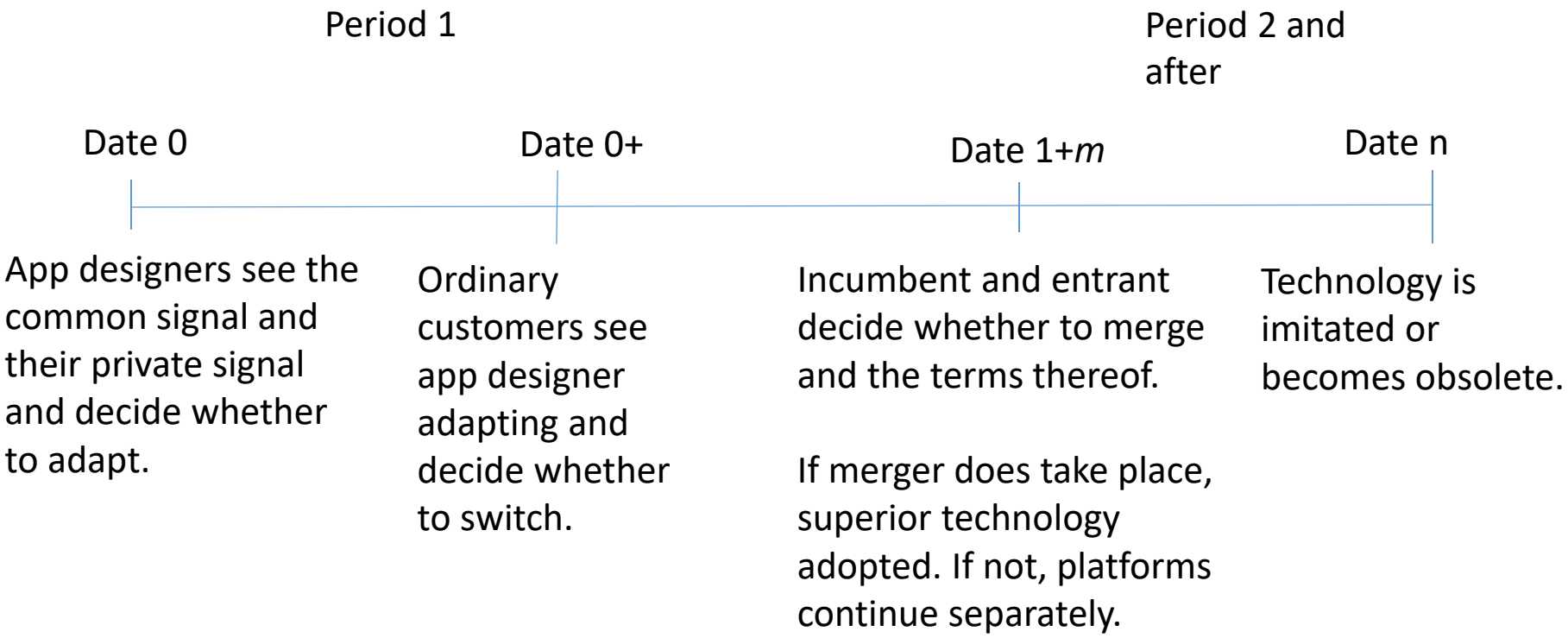
  where p is the measure of app designers who opt for it.

- Value of being on Incumbent =λ
- App designers see the commercial value of a platform as the measure of customers who switch to it.

The Merger Game

- At date 1, the two companies announce a merger
- After *m* periods the merger is authorized
- The shorter is *m*, the laxer is antirust enforcement
- The share of the merged value each party gets is determined through bargaining
- If they do merge, the superior technology will be adopted by the merged entity and all the customers will enjoy it.
- The acquirer in the merger ensures a seamless interface for all apps, regardless of whether they adapted earlier or not, so adaptation costs are zero at that point
- If the two companies do not merge, they will survive *n-(1+m)* more periods independently.

Timing


Period 1
Period 2 and after
Date 0
Date 0+
Date 1+*m*
Date n
App designers see the common signal and their private signal and decide whether to adapt.
Ordinary customers see app designer adapting and decide whether to switch.
Incumbent and entrant decide whether to merge and the terms thereof.
If merger does take place, superior technology adopted. If not, platforms continue separately.
Technology is imitated or becomes obsolete.

Value of platform revenues (from advertisers)

- Platforms make money by advertising
- The value of a platform to advertisers depends on the number of customers a platform has:
  - more customers on the platform means more eyeballs that will see the advertisement
  - more customers also mean more platform data and thus better targeted advertising.

Solving for customer decisions and app designer behavior

Analysis of customer behavior

- The customer expects the merger to take place in (1+m) periods.
  - m=0 if the merger takes place at date 1
    - liberal antitrust regime
  - m=n-1 if it never takes place
    - Tough antitrust regime

Analysis of customer behavior -2

- He will switch iff

$$\left[(\theta + \lambda p) - \lambda\right](1+m) > c_i$$

- Given the cost is uniformly distributed and assuming an interior solution, the mass of customers switching is

$$\frac{\left[(\theta + \lambda p) - \lambda\right](1+m)}{\overline{c}}$$

- Importantly, this increases in the time before merger, *m*, and the share of app developers who adapt to the entrant, *p*.

Analysis of app designer behavior

- Combining the public signal with the private signal, each app designer has a posterior belief of the quality differential

$$\rho_i = \frac{\alpha q + \beta x_i}{\alpha + \beta}$$

  with a precision α+β

- The designer's valuation is driven by the measure of customers she expects will switch

$$\frac{\left[\rho_i + \lambda p(\rho_i) - \lambda\right](1+m)}{\overline{c}}$$

- The designer adapts her app iff

$$\left(\frac{\left[\rho^i + \lambda p(\rho^i) - \lambda\right](1+m)}{\overline{c}}\right)(1+m) \geq s$$

- Simplifying, designer adapts if

$$\rho^i + \lambda p(\rho^i) - \left(\lambda + \frac{s\overline{c}}{(1+m)^2} \right) \geq 0$$

Adaptation Game

- Typical global game (see, for example, Morris and Shin, 2000, 2003).
- To solve it, we first conjecture that designers will follow a adaptation strategy where they adapt if their posterior of quality exceeds a threshold.
- When a designer is the marginal adapter, she has to believe that a fraction *p* of designers will adapt as well.
- Thus, a fraction *p* should have a posterior at least as high as hers.
- So calculating *p* at the switching point ρ^*, and substituting

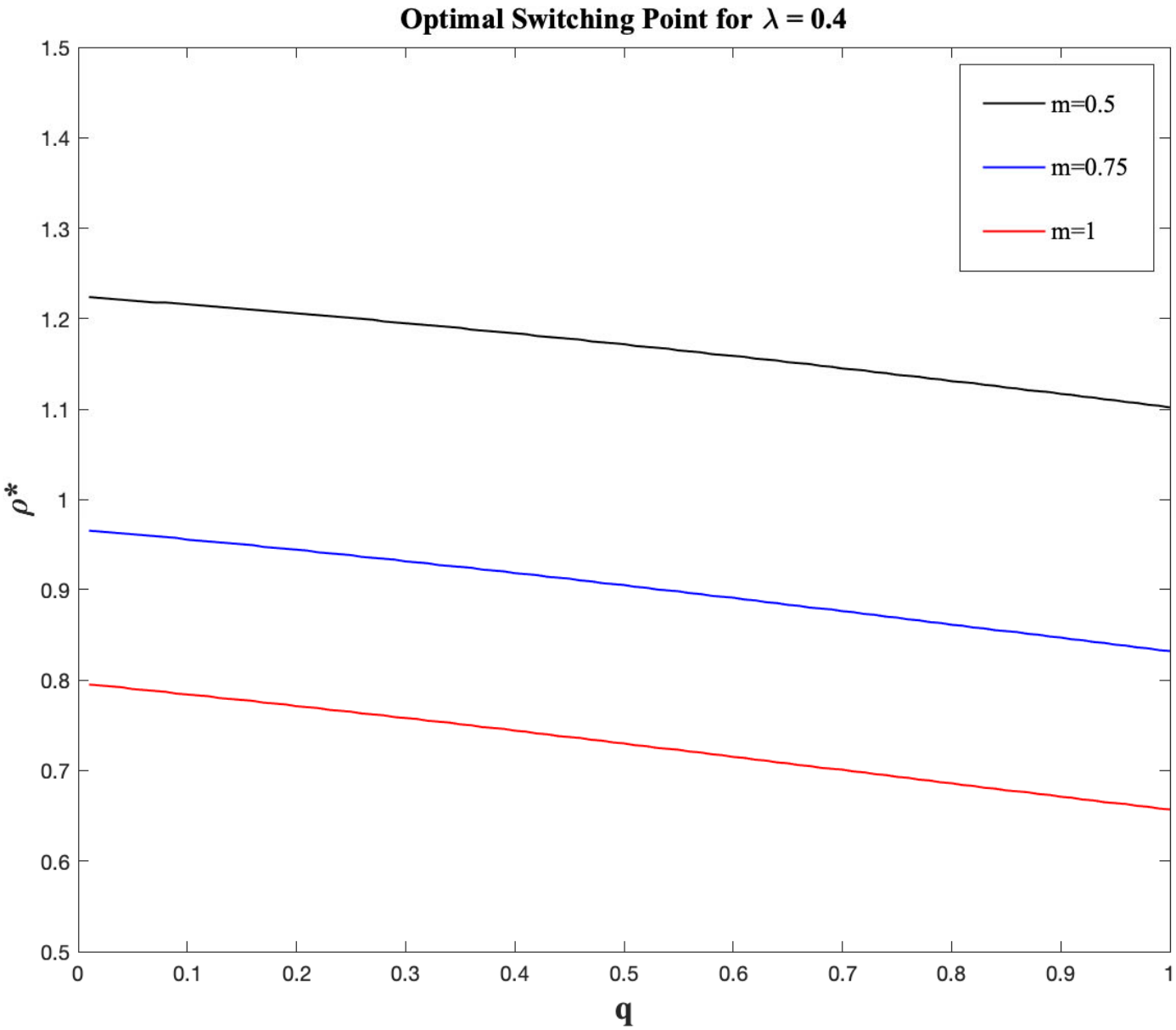
- At the adaptation point we must have

$$\rho^* + \lambda p(\rho^*) - \left(\lambda + \frac{s\bar{c}}{(1+m)^2} \right) \geq 0$$

- Let

$$S(\rho) = \rho - \lambda \Phi\left(\gamma(\rho - q)\right) - \frac{s\bar{c}}{(1+m)^2}$$

Theorem 1: For $\gamma < \frac{\sqrt{2\pi}}{\lambda}$ the function *S*() is always increasing in ρ and there is a unique adaptation equilibrium.

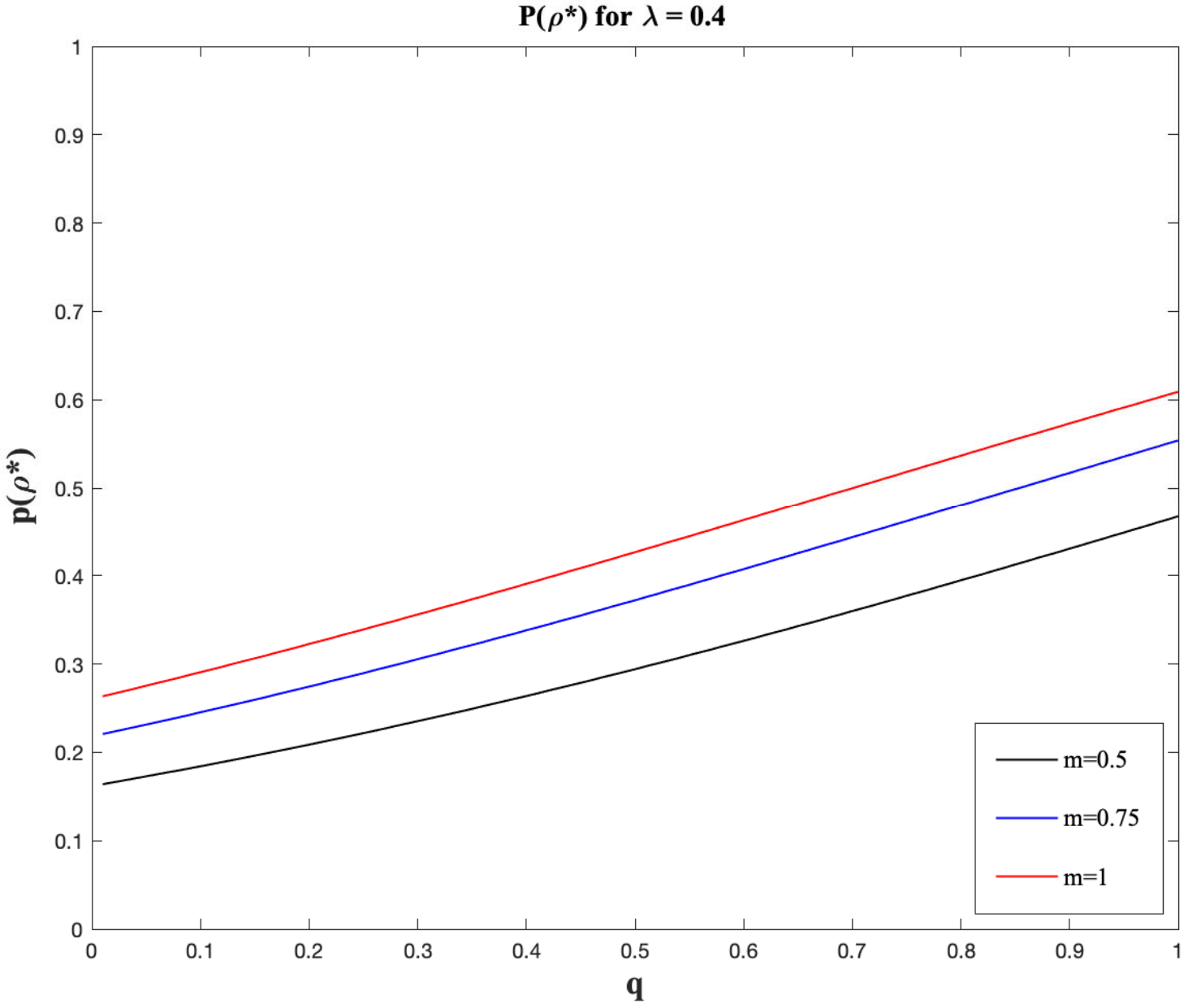

Optimal Switching Point for λ = 0.4
m=0.5
m=0.75
m=1
ρ*
q
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Corollary 1:

The optimal adaptation point decreases and the fraction of app designers adapting to the entrant increases in the number of periods *(1+m)* that everyone expects the entrant to remain independent.

Intuition:

- The longer the expected period of independence, the more customers will switch to the entrant for a given quality differential and share of designers adapting.
  - Amortizing switching costs
- The longer the expected period of independence, the more app designers will switch to the entrant, ceteris paribus.
  - Expectation of more customers.
  - Amortizing adaptation costs.
- In turn, greater adaptation will enhance the number of customers that switch, and enhances the expected value of the entrant as a stand-alone entity.
- Note – price not a factor: platforms price services at zero on one side.


P(ρ*) for λ = 0.4
p(ρ*)
q
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
m=0.5
m=0.75
m=1

Merger Game

Mergers will always take place if allowed

- Let *V(1)* be the discounted sum of profits that a merged platform with all the customers and the superior technology extract in the advertising market after a merger at date 1.
- The share of ordinary customers who switch to E is proportional to the share of app designers who adapt, *p.*
- Let $V^I(p)$ and $V^E(p)$ be the value respectively of the incumbent and of the entrant, operating for the remaining n-1 periods as stand-alone platforms, where $\frac{dV^I(p)}{dp} < 0$ and $\frac{dV^E(p)}{dp}$>0.

Merger game contd.

- Since a monopolist's profit is greater than the sum of the profit of the two duopolists

$$V(1) > V^I(p) + V^E(p)$$

- With bargaining under symmetric information, the merger will always take place if allowed. The only question is at what price.

Transaction price

- If a merger takes place, we assume that with probability μ the incumbent makes a take-it-or-leave-it offer to the entrant.
- With probability1- μ the entrant does so.
- The entrant gets

$$\Pi^E(p^M) = \mu V^E(p^M) + (1-\mu)[V(1) - V^I(p^M)]$$

- If mergers are prohibited, she gets

$$\Pi^E(p^{NM}) = V^E(p^{NM})$$

- Note that

$$E_0\left[V^E(p^{NM})\right] \geq E_0\left[V^E(p^M)\right]$$

- Hence if mergers are prohibited (*m*=n-1), and the entrant's bargaining power is small (e.g., μ=1), she gets more ex post when mergers are prohibited.
- This depends critically on the stand alone value
  - The stand-alone value increases in the number of customers the entrant has attracted.
  - Ceteris paribus, the number of customers it attracts increases in the expected time before a merger.

Note

- Importance of incumbent's bargaining power. Why likely to be high?
  - Lower cost of capital, lower impatience.
  - Incumbent ownership structure less concentrated, less risk averse.
  - Incumbent can replicate entrant's technology over time, shortens latter's horizon.
- Importance of entrant's outside option or stand alone valuation.
  - Rent-seeking behavior

Ex ante investment by potential entrant

Ex ante investment

- Potential entrant faces a cost of R&D equal to C^E
- On paying this cost, she can draw a technology of quality θ
- Before she decides whether to invest, E will compare her expected profit with her known cost of R&D and invest if and only if

$$E_\theta[\Pi^E(\theta)] > C^E$$

- Delaying/prohibiting acquisitions by incumbent platforms can have the effect of increasing the expected profit of new entrants
- This will increase the range of C^E that are viable, and increase the probability of investment in R&D and thus entry.

Critical assumptions

- Network externalities associated with app designers
- App designers can only single-home?
- Platform can pay to attract designers?
  - App designers carry a signal
  - If you pay them, you destroy their signal value

Key result

Theorem 2:

So long as the expected measure of app designers switching with a prohibition on mergers is positive, there is a $\mu^* \in [0,1]$ such that for incumbent bargaining power $\mu > \mu^*$, the probability a new platform enters the market is higher when mergers are prohibited than when they are not.

Implications

- What Wenger and Warren say is not inconsistent with theory
- The data suggest it might even be plausible
- Different history of digital platforms in the United States, China, and the EU.
  - EU entrants had to contend from the beginning with US incumbents, who built extensive networks in Europe early on.
  - By contrast, Chinese entrants did not have the same problem.
- India and Tik Tok

Policy?

- New technology could bring new sources of concern for anti-trust.
  - No overt anti-competitive action
- Prohibiting mergers has problems both in theory and in practice
  - **Theory**: it prevents the industry from realizing ex post efficiencies.
  - **Practice:** how you define the boundaries of the prohibition
    - A case-by-case approach will inevitably lead to approving all acquisitions
- However, the regulatory authorities can affect switching costs.
  - Mandate a common standard and interoperability.
  - All competitors realize common network externalities.
- Data should not be the sole privilege of incumbents

Conclusions

- We construct a simple model that rationalizes the existence of “kill zones” without obvious anti-competitive actions by the incumbent.
- It depends upon the interaction of 3 frictions
  - network externalities
  - switching costs
  - lack of price competition
- Mandated interoperability could help alleviate the problem.