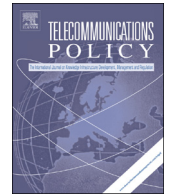




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# Exclusionary strategies and the rise of winner-takes-it-all markets on the Internet

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## ABSTRACT

The success of late entrants in many digital markets suggests network and lock-in effects, albeit important market forces in most digital markets, do not confer sustainable first-mover advantages. In our analysis we suggest exclusionary practices may play a major role explaining the rise of “winner-takes-it-all” markets on the Internet. The entry deterrence literature has extensively analyzed incumbents’ strategic moves in order to make market entry unprofitable or, at least, to minimize the harm that entry causes. In our paper we propose a richer theoretical framework allowing both the incumbent as well as a new entrant to carry out strategic investments. Those allow the incumbent to deter market entry, but also the new entrant to squeeze the incumbent out of the market. We find that competitive advantage and strategic interaction determine a “winner-takes-it all” or a duopoly market outcome. If neither player enjoys a clear-cut cost or demand advantage, a duopoly market outcome will emerge. However, for both incumbent and new entrant there is a strong incentive to complement a possible competitive advantage with exclusionary practices in order to monopolize a market and increase profits. This result suggests “winner-takes-it-all” market results on the Internet may result from exclusionary practices, nourishing antitrust concerns with today’s major Internet players’ market dominance.

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## 1. Introduction

The rise of winner-take-almost-all markets on the Internet has attracted closed scrutiny from regulators and major attention in the public debate. Prominent examples are Google “owning” search; Facebook, social networking, eBay ruling auctions, Apple dominating online content delivery, Amazon, retail (e.g. [Wu, 2010](#)). Economic arguments trying to explain the monopoly-enabling aspects of Internet businesses are typically centered around the presence of direct and indirect network effects in markets with two-sided platforms. Whereas most major Internet success stories have relied on network effects, the question whether network effects may constitute an insurmountable barrier to entry remains controversial. [Evans and Schmalensee \(2007\)](#) argue that indirect network effects are bound to lead two-sides platforms to compete for the market. All things being equal, first movers would have an advantage: As a result of positive feedback effects, the firm that obtains a lead tends to widen that lead and therefore wins the race for the market ([Shapiro & Varian,](#)

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1999). First-mover advantages have been observed in telecommunications markets (Eggers, Grajek, & Kretschmer, 2011; Whalley & Curwen, 2012).

However, evidence in Internet markets seems to contradict the hypothesis that network effects confer a first mover advantage, constituting an insurmountable barrier to entry. The history of digital markets supports the thesis that companies that create radically new markets are not necessarily the ones that scale them up into big mass markets (Markides & Geroski, 2005). Online bookstores were already in place when Amazon entered the market in 1995. When Google entered the market in 1998, Altavista was the leading search engine (Haucap & Heimeshoff, 2014). However, today, Amazon dominates online-retail and e-book markets, Google is the global leader in search and online advertising, and Facebook, another late entrant, enjoys a quasi-monopoly in the social networking arena.

Obviously there is no guarantee that the benefits of network effects and lock-in, albeit important market forces in most digital markets, will go to the first mover (Rangan & Adner, 2001). If scale and network effects were a major barrier to entry, incumbents would find it easy to maintain market dominance. The fact that new entrants were able to surpass incumbents suggests scale and network effects do not confer sustainable first-mover advantages (Bork & Sidak, 2012). Practitioners such as Silicon Valley entrepreneur Thiel highlight the advantages of late mover tactics, suggesting late entrants outperforming incumbents might “enjoy years or even decades of monopoly profits” (Thiel, 2014, p. 58), an argument strongly rooted in Schumpeterian competition economics. Schumpeter's dynamic theory of competition focuses on the “creative destruction” of old incumbents by new entrants, who are rewarded with dominant market positions until being replaced by the next round of insurgents (Schumpeter, 1942).

From a competition economics point of view, a dominant market position based on innovation and a superior value proposal to consumers is widely accepted (Shapiro, 2012). However, a major concern is that substantial market power lays consumers and competitors open to all sorts of abuse. One ramification are exclusionary practices, i.e. practices carried out with the aim of deterring entry or forcing the exit of rivals. Entry deterrence is not a new phenomenon and has been extensively analyzed by the industrial organization literature (e.g. Neven, 1989; Wilson, 1992). However, scholars such as Motta point out that exclusionary practices should receive fresh attention, as network and lock-in effects, the hallmark of most digital markets, create strong incentives for exclusionary behavior (Motta, 2004, p. 411). Competition in digital markets is indeed sometimes described as a “battlefield” between rivaling firms, suggesting industry players strategically invest trying to protect their home markets or to gain control of adjacent markets.<sup>1</sup>

Our model of competition between incumbent and new entrant aims at analyzing economic incentives to adopt accommodating and exclusionary strategies and explaining the rise of “winner-takes-it-all” markets in the digital economy. We capture market dynamics and demand effects, two meaningful distinguishing characteristics of digital markets (Eisenach & Gotts, 2014). Our analytical framework allows *both* the incumbent as well as the new entrant to carry out strategic investments to execute exclusionary strategies – an important extension of the entry deterrence literature, which unilaterally contemplates exclusionary strategies carried out by an incumbent, disregarding possible exclusionary strategies carried out by a new entrant.

Anecdotal evidence suggests major Internet players heavily invest to gain scale and to keep competition at bay. For almost two decades, Amazon has been reporting very modest profits despite of steep rising revenues – the result of the online retailer's continued heavy investments in expanding its business operations. Amazon has built up an infrastructure, in terms of data centers and infrastructure, that a rival would be very hard put to match (e.g. Clark & Young, 2013). Google, a company whose revenues and profits largely stem from its advertising business, has entered markets as diverse as self-driving-cars, smart homes, robotics and health care, aiming at extending its lead in the ‘data exhaust business’ (Mayer-Schönberger & Cukier, 2013). Facebook invested \$19bn to purchase the mobile messaging service WhatsApp, a move widely seen as Facebook's attempt to secure its lead in personal communications, jeopardized by users increasingly moving to mobile and younger users cooling on its service (Rushe, 2014).

The remainder of this paper is organized as follows: in the following section, we introduce our model of competition between incumbent and new entrant. We then discuss the incumbent's and the new entrant's optimal strategies in more detail (Section 3). In Section 4 we show how the comparative competitive advantage determines both firms' optimal strategies. In Section 5, we briefly review major Internet players' investment strategies. Finally, Section 6 presents the concluding remarks.

## 2. The model

### 2.1. Basic assumptions

Competition between incumbent and new entrant is modeled as a four-stage game extending over three periods. In the first period, the initial monopoly period, the incumbent is the sole firm in the market. The second firm's market entry marks the beginning of the second period, the “market entry period”. In the second period, first the new entrant decides on output

<sup>1</sup> “The battlefield on which the big four [Apple, Google, Facebook, Amazon] are fighting are, like most battlefields, messy and confusing. They are also numerous. Apple and Google are crossing swords in operating systems for smartphones and tablet computers; both firms and Amazon are butting heads in hardware; Google and Facebook have become sworn enemies in social networking ... They also have territories to defend. Take Google. Its search engine gives a rich heartland ... It has reinforced its defenses by annexing other services that help find things ...” (Economist, 2012, p. 26).

or capacity and marketing budget, and then the incumbent does. In the third period, the “competition period”, incumbent and new entrant decide simultaneously on marketing budgets and output. Table 1 illustrates the model structure with four stages extending over three periods.

## 2.2. Incumbent's and new entrant's strategic choices

Both incumbent as well as new entrant have the choice between accommodating and belligerent strategies. At the beginning of the first period, the incumbent knows that he is facing potential market entry in period two. The new entrant has three options:

- he can choose an accommodating strategy, maximizing his duopoly profits taking the incumbent's actions into account,
- or he can choose a marketing budget (marketing budget/output combination) that reduces the incumbent's profits to zero, thereby squeezing the incumbent out of the market,
- finally, he can refrain from entering the market at all, if neither an accommodating nor a squeeze-out strategy allows for profitable market entry.

Obviously, the new entrant will choose the profit maximizing strategy.

The incumbent knows the new entrant's options and will take them into account in his decision making. The incumbent has the following options: he can

- choose an accommodating strategy, maximizing duopoly profits;
- choose an entry deterrence strategy, preempting market entry;
- avert squeeze-out: in case the incumbent faces being squeezed-out by the new entrant, he can take preemptive measures changing the entrant's profit scheme, inducing the new entrant to adopt an accommodating instead of a squeeze-out strategy;
- opt for a “static (hit and run)” strategy, i.e. static profit maximization in the initial monopoly period, and then withdrawal.

## 2.3. Functional forms

Our model can be described by general profit functions and by specific demand and cost-functions. We use the general profit functions to derive the first-order conditions which determine firm  $i$ 's optimal output and marketing budget in each stage of the game.

Specific demand and cost-functions allow describing the incumbent's and new entrant's optimal strategies in more detail. Incumbent's and new entrant's inverse demand functions are given by

$$p_{1,t} = G_{1,t} - b_1 x_{1,t} - \gamma x_{2,t}$$

$$p_{2,t} = G_{2,t} - b_2 x_{2,t} - \gamma x_{1,t}$$

Commodities are substitutes if  $\gamma > 0$ ,  $\gamma$  measuring cross-price effects.

The incumbent's goodwill in the monopoly period, the market entry period and the competitive period is given by

$$G_{1,t} = \alpha_1 + a_{1,1},$$

$$G_{1,2} = \alpha_1 + d a_{1,1} + a_{1,2},$$

$$G_{1,3} = \alpha_1 + d^2 a_{1,1} + d a_{1,2} + a_{1,3}$$

In the market entry period, the incumbent's goodwill is determined by his demand parameter  $\alpha_1$  and his marketing budget  $a_{1,1}$ . The marketing budget  $a_{1,1}$  does not only affect the incumbent's goodwill in the first period, but also his goodwill in the second and third period. Through the decay parameter (or goodwill transfer rate)  $d$ ,  $0 < d < 1$ , the first period's marketing budget's goodwill effect will progressively decline over the second and third period.

The new entrant's goodwill is given by

$$G_{2,2} = \alpha_2 + a_{2,2}$$

$$G_{2,3} = \alpha_2 + d a_{2,2} + a_{2,3}$$

Note that an absolute advantage in demand enjoyed by one of the firms will be reflected by a higher  $\alpha$ .

Firm  $i$ 's costs in period  $t$  are determined by the variable costs  $c_i x_{i,t}$ , fixed costs  $F_i$  and marketing costs  $m_i a_{i,t}^2$ :

$$K_{i,t} = F_i + c_i x_{i,t} + m_i a_{i,t}^2$$

This approach takes into account the declining marginal demand effect of increasing marketing expenditures through quadratically increasing advertising costs with linear demand effect.

Write  $\theta_i = \alpha_i - c_i$  reflecting the net absolute advantage (or competitive advantage) for firm  $i$ .

For a general discussion of our model and to determine optimal outputs and marketing budgets we do not need to recur to specific cost and demand functions. In this case, profits  $\pi_{i,t}$  are a function of output  $x_{i,t}$  and marketing budget  $a_{i,t}$ . We assume the profit function  $\pi_{i,t}$  is concave in  $x_{i,t}$  and  $a_{i,t}$ .

**Table 1**  
The 3-period 4-stage model.

Period	Stage	Decision maker	Decision variables
1 ("monopoly period")	1	Incumbent	Marketing budget $a_{1,1}$ Output $x_{1,1}$
2 ("market entry period")	2	New entrant	Marketing budget $a_{2,2}$ Output $x_{2,2}$
	3	Incumbent	Marketing budget $a_{1,2}$ Output $x_{1,2}$
3 ("competition period")	4	Incumbent/new entrant	Marketing budget $a_{1,3}, a_{2,3}$ Output $x_{1,3}, x_{2,3}$

In period 1, the incumbent's profits are a function of his marketing budget  $a_{1,1}$  and his output  $x_{1,1}$ , i.e.

$$\pi_{1,1} = \pi_{1,1}(a_{1,1}, x_{1,1})$$

The new entrant's profits in period 2 depend on his marketing budget and his output, furthermore on the incumbent's output in period 2:

$$\pi_{2,2} = \pi_{2,2}(a_{2,2}, x_{1,2}, x_{2,2})$$

The incumbent's profits in period 2 depend on its marketing budget and its output, but also on the new entrant's output and the pioneer's marketing budget in the first period:

$$\pi_{1,2} = \pi_{1,2}(a_{1,1}, a_{1,2}, x_{1,2}, x_{2,2}).$$

In the third period, profits of incumbent and new entrant depend on each firm's marketing budgets in the current and previous periods and on each firm's output in the current period:

$$\pi_{1,3} = \pi_{1,3}(a_{1,1}, a_{1,2}, a_{1,3}, x_{1,3}, x_{2,3})$$

$$\pi_{2,3} = \pi_{2,3}(a_{2,2}, a_{2,3}, x_{1,3}, x_{2,3})$$

With this approach we capture duopolistic interdependence between incumbent and new entrant as well as dynamic goodwill transfer. We use Selten's concept of subgame perfect equilibrium (e.g. Belleflamme & Peitz 2010) for analyzing dynamic strategic interaction and for deriving optimal strategies.

### 3. Incumbent's and new entrant's optimal strategies

In this section, we first analyze the duopoly case with both firms choosing entry accommodating strategies. The first-order conditions show that dynamic and strategic effects play an important role. We then discuss the entrant's squeeze-out strategy. Finally, we identify five generic strategies available to the incumbent: skimming first period monopoly profits, preventing squeeze-out, entry accommodation, entry deterrence and realizing the dynamic monopoly solution.

#### 3.1. Accommodating strategies: the duopoly case

In the duopoly case, each firm maximizes its discounted total profits considering the other firm's optimal decisions. Dynamic and strategic effects play an important role: for example, a foresighted incumbent will take into account that his marketing budget in the initial monopoly period will not only affect his profits in the first period, but also his profits in future periods. Positive goodwill-transfer from one period to the next creates an incentive to spend higher marketing budgets as compared to the static optimum, as marketing expenditures do not only stimulate output in the current period but also in consecutive periods (the *dynamic-direct effect*). In the following, we will present the first-order conditions of the three periods of the game and discuss economic interpretations.

##### 3.1.1. First period

In the first period, the initial monopoly period, a foresighted incumbent will take into account that his first period's marketing budget will not only affect his profits in the current period, but also in future periods. Maximizing discounted profits yields

$$\frac{\partial \pi_{1,1}}{\partial a_{1,1}} + (1+i)^{-1} \left[ \frac{\partial \pi_{1,2}}{\partial a_{1,1}} + \frac{\partial \pi_{1,2}}{\partial x_{2,2}} \left( \frac{\partial x_{2,2}^*}{\partial a_{1,1}} + \frac{\partial x_{2,2}^*}{\partial a_{2,2}} \frac{\partial a_{2,2}^*}{\partial a_{1,1}} \right) \right] + (1+i)^{-2} \left\{ \frac{\partial \pi_{1,3}}{\partial a_{1,1}} + \frac{\partial \pi_{1,3}}{\partial x_{2,3}} \left[ \frac{\partial x_{2,3}^*}{\partial a_{1,1}} + \frac{\partial x_{2,3}^*}{\partial a_{2,2}} \frac{\partial a_{2,2}^*}{\partial a_{1,1}} + \frac{\partial x_{2,3}^*}{\partial a_{2,3}} \left( \frac{\partial a_{2,3}^*}{\partial a_{1,1}} + \frac{\partial a_{2,3}^*}{\partial a_{2,2}} \frac{\partial a_{2,2}^*}{\partial a_{1,1}} \right) \right] \right\} = 0 \tag{1}$$

Eq. (1) comprises three effects: the *static-direct effect*  $\partial \pi_{1,1} / \partial a_{1,1}$ , the *dynamic-direct effect*  $(1+i)^{-1} (\partial \pi_{1,2} / \partial a_{1,1})$  and the *dynamic-strategic effect* (composed of the remaining terms). The static direct effect captures

the direct effect of the incumbent's marketing budget on his first period's profits; the dynamic-direct effect captures the direct effect on profits in the second and third period. The dynamic-strategic effect takes into account that the incumbent's marketing budget  $a_{1,1}$  directly and indirectly affects the new entrant's output in the following periods, which in turn affects the incumbent's profits in the respective period.

Determining the partial derivatives based on specific demand and cost-functions as specified above, we can show both the dynamic-direct effect as well as the dynamic-indirect effect are positive. Therefore, the static-direct effect must be negative, as the sum of the three effects must equal zero. As  $\pi_{1,1}$  is concave in  $a_{1,1}$ , the optimal marketing budget  $a_{1,1}^*$  taking into account dynamic and strategic effects is larger than the static optimal marketing budget  $a_{1,1}^{sm}$ . A foresighted incumbent will sacrifice profits in the first period in favor of higher discounted total profits.

### 3.1.2. Second period

The new entrant's market entry marks the beginning of the second period. The new entrant's optimal marketing budget  $a_{2,2}^*$  is given by

$$\frac{\partial \pi_{2,2}}{\partial a_{2,2}} + \frac{\partial \pi_{2,2}}{\partial x_{1,2}} \frac{\partial x_{1,2}^*}{\partial a_{2,2}} + (1+i)^{-1} \left\{ \frac{\partial \pi_{2,3}}{\partial a_{2,2}} + \frac{\partial \pi_{2,3}}{\partial x_{1,3}} \left[ \left( \frac{\partial x_{1,3}^*}{\partial a_{1,2}} + \frac{\partial x_{1,3}^*}{\partial a_{1,3}} \frac{\partial a_{1,3}^*}{\partial a_{1,2}} \right) \frac{\partial a_{1,2}^*}{\partial a_{2,2}} + \frac{\partial x_{1,3}^*}{\partial a_{1,3}} \frac{\partial a_{1,3}^*}{\partial a_{2,2}} + \frac{\partial x_{1,3}^*}{\partial a_{2,2,1}} \right] \right\} = 0$$

The entrant's optimal output  $x_{2,2}^*$  is given by

$$\frac{\partial \pi_{2,2}}{\partial x_{2,2}} + \frac{\partial \pi_{2,2}}{\partial x_{1,2}} \left( \frac{\partial x_{1,2}^*}{\partial x_{2,2}} + \frac{\partial x_{1,2}^*}{\partial a_{1,2}} \frac{\partial a_{1,2}^*}{\partial x_{2,2}} \right) + (1+i)^{-1} \frac{\partial \pi_{2,3}}{\partial x_{1,3}} \left( \frac{\partial x_{1,3}^*}{\partial a_{1,2}} + \frac{\partial x_{1,3}^*}{\partial a_{1,3}} \frac{\partial a_{1,3}^*}{\partial a_{1,2}} \right) \frac{\partial a_{1,2}^*}{\partial x_{2,2}} = 0.$$

There are four effects the new entrant has to take into account when determining his marketing budget: the *static-direct* effect ( $\partial \pi_{2,2} / \partial a_{2,2}$ ), the *static-strategic* effect ( $\partial \pi_{2,2} / \partial x_{1,2}$ ) ( $\partial x_{1,2}^* / \partial a_{1,2}$ )  $\partial a_{1,2}^* / \partial a_{2,2}$ , the *dynamic-direct* effect  $(1+i)^{-1} (\partial \pi_{2,3} / \partial a_{2,2})$  and the *dynamic-strategic effect* (remaining terms). Again, with specific demand and cost-functions the static-strategic, the dynamic-direct and the dynamic-strategic effect are positive. Therefore, strategic and dynamic effects require the new entrant to set a higher marketing budget compared to a static optimum.

In the next stage, the incumbent determines his marketing budget and output. The incumbent's optimal marketing budget is given by

$$\frac{\partial \pi_{1,2}}{\partial a_{1,2}} + (1+i)^{-1} \left[ \frac{\partial \pi_{1,3}}{\partial a_{1,2}} + \frac{\partial \pi_{1,3}}{\partial x_{2,3}} \left( \frac{\partial x_{2,3}^*}{\partial a_{1,2}} + \frac{\partial x_{2,3}^*}{\partial a_{2,3}} \frac{\partial a_{2,3}^*}{\partial a_{1,2}} \right) \right] = 0,$$

comprising a *static direct*, *dynamic direct* and a *dynamic strategic* effect. The incumbent's optimal output in period two is simply given by  $\partial \pi_{1,2} / \partial x_{1,2} = 0$ . Strategic and dynamic effects do not play a role, as the entrant has already determined his marketing budget and output, and the incumbent's output in the second period does not affect third period's profits.

### 3.1.3. Third period

In the third period, the "competition period", incumbent and new entrant simultaneously determine their marketing budgets and output. Optimal marketing budgets are given by  $(\partial \pi_{1,3} / \partial a_{1,3}) + (\partial \pi_{1,3} / \partial x_{2,3}) \partial x_{2,3}^* / \partial a_{1,3} = 0$  and  $(\partial \pi_{2,3} / \partial a_{2,3}) + (\partial \pi_{2,3} / \partial x_{1,3}) \partial x_{1,3}^* / \partial a_{2,3} = 0$ .  $\partial \pi_{1,3} / \partial x_{1,3} = 0$  and  $\partial \pi_{2,3} / \partial x_{2,3} = 0$  yield the incumbent's and the entrant's reaction functions in the third period and optimal outputs  $x_{1,3}^*$  and  $x_{2,3}^*$ .

## 3.2. The new entrant's squeeze-out strategy

When entering the market, the new entrant can opt for a squeeze-out strategy by choosing an output-marketing budget combination that drives the incumbent's profits to zero. As both the entrant's marketing budget  $a_{2,2}$  and his output  $x_{2,2}$  affect the incumbent's profits, he can choose both decision variables to drive the incumbent out of the market. The reduced profit functions  $\pi_{1,2}^*(a_{1,1}, a_{2,2}, x_{2,2})$  and  $\pi_{1,3}^*(a_{1,1}, a_{2,2}, x_{2,2})$  show the dependency of the incumbent's profits in the second and third period on marketing budgets  $a_{1,1}$ ,  $a_{1,2}$  and output  $x_{2,2}$ .

Differentiating the reduced profit functions by  $x_{2,2}$  and  $a_{2,2}$  yields

$$\frac{d\pi_{1,2+3}^*}{dx_{2,2}} = \frac{\partial \pi_{1,2}}{\partial x_{2,2}}$$

$$\frac{d\pi_{1,2+3}^*}{da_{2,2}} = \frac{\partial \pi_{1,2}}{\partial x_{2,2}} \frac{\partial x_{2,2}^*}{\partial a_{2,2}} + (1+i)^{-1} \frac{\partial \pi_{1,3}}{\partial x_{2,3}} \left( \frac{\partial x_{2,3}^*}{\partial a_{2,2}} + \frac{\partial x_{2,3}^*}{\partial a_{2,3}} \frac{\partial a_{2,3}^*}{\partial a_{2,2}} \right)$$

with  $\pi_{1,2+3}^*$  defined as the sum of the incumbent's profits in period 2 and 3.

Thus, the entrant can affect the incumbent's profits directly by his output  $x_{2,2}$  and indirectly by his marketing budget  $a_{2,2}$ . In order to squeeze the incumbent out of the market, the entrant needs to choose a  $(a_{2,2}, x_{2,2})$  combination that reduces the incumbent's duopoly profits in period 2 and 3 to zero.

Fig. 1 illustrates the new entrant's decision problem.  $M$  denotes the new entrant's monopoly solution. In the economically more relevant case, the entrant's squeeze-out marketing budget  $a_{2,2}^d$  and output  $x_{2,2}^d$  is larger than  $M$  (otherwise, entry would be blocked). The further northeast from  $M$  the isoprofit lines lie, the lesser the entrant's profits. Therefore, the entrant's isoprofit line tangent to the incumbent's zero-profit isoprofit line defines the optimal squeeze-out marketing budget  $a_{2,2}^d$  and output  $x_{2,2}^d$ .

Formally, the entrant has to maximize  $\pi_{2,2}(a_{2,2}, x_{2,2}) + (1+i)^{-1} \pi_{2,3}^m(a_{2,2})$  subject to the constraint  $\pi_{1,2}^*(a_{1,1}, a_{2,2}, x_{2,2}) + (1+i)^{-1} \pi_{1,3}^*(a_{1,1}, a_{2,2}, x_{2,2}) = 0$ . Using Lagrange multipliers we obtain the first-order condition that yields  $a_{2,2}^d(a_{1,1})$  and  $x_{2,2}^d(a_{1,1})$ , i.e. marketing budget and output that squeeze the incumbent out of the market and maximize the entrant's profits when choosing the squeeze-out strategy:

$$\frac{\frac{\partial \pi_{2,2}^m}{\partial a_{2,2}}}{\frac{\partial \pi_{1,2+3}^*}{\partial a_{2,2}}} = \frac{\frac{\partial \pi_{2,2}^m}{\partial x_{2,2}}}{\frac{\partial \pi_{1,2+3}^*}{\partial x_{2,2}}}$$

Note the new entrant's optimized squeeze-out marketing budget  $a_{2,2}^d(a_{1,1})$  and output  $x_{2,2}^d(a_{1,1})$  depend on  $a_{1,1}$ . The incumbent's first period marketing budget affects marketing budget and output the entrant has to set in order to squeeze the incumbent out of the market. As both variables affect the entrant's squeeze-out profits, the incumbent can “manipulate” the entrant's squeeze-out profits with his first-period marketing budget  $a_{1,1}$ . More specifically, the incumbent can take advantage of being first in the market by choosing an appropriate first-period marketing budget  $a_{1,1}$  and prevent impending squeeze-out. As we will discuss in the following section, in some constellations preventing squeeze-out is the most profitable strategy for the incumbent.

3.3. Determining the incumbent's optimal strategy

In order to determine his optimal strategy, the incumbent needs to consider three profit functions: first,  $\pi_1^*(a_{1,1})$  determines the incumbent's total discounted duopoly profits as a function of  $a_{1,1}$ . Second, if the incumbent chooses an entry deterring marketing budget  $a_{1,1}^d$ , his profits are given by  $\pi_1^m(a_{1,1}^d)$ , the monopoly profits as a function of  $a_{1,1}$ . If the incumbent decides to exit the market after the first period, his profits are given by  $\pi_{1,1}^m(a_{1,1})$ , the monopoly profits in the first period as a function of  $a_{1,1}$ .

The incumbent's optimal strategy depends on cost and demand parameters, the degree of substitutability and the dynamic goodwill transfer rate, which determine both the incumbent's and the entrant's profits. The incumbent will adopt the most profitable strategy, choosing one of the following options:

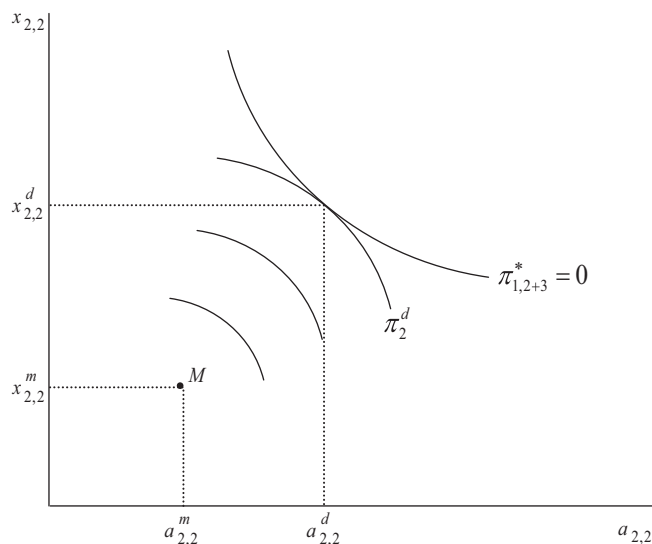


Fig. 1. Incumbent's and new entrant's isoprofit curves in the  $(a_{2,2}, x_{2,2})$  space.

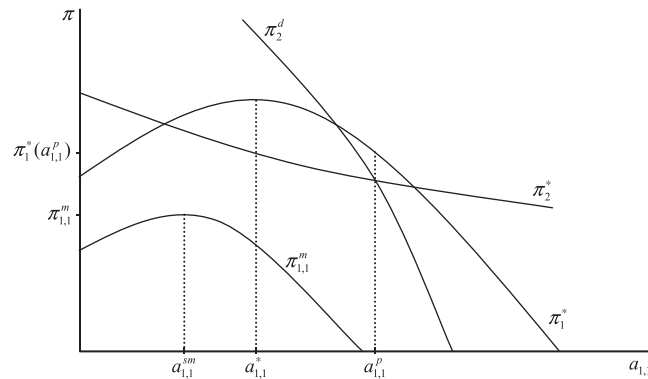


Fig. 2. Squeeze-out preemption.

### 3.3.1. Skimming monopoly profits

If the new entrant's squeeze-out profits are well above his accommodating profits, and it is not efficient for the incumbent to prevent squeeze-out with high marketing budgets  $a_{1,1}$  in the monopoly period, then the incumbent cannot profitably compete with the entrant. In this case, the incumbent's best strategy is to skim monopoly profits in the first period and exit the market at the end of the first period. He will choose the static monopoly solution.

### 3.3.2. Preventing squeeze-out

The higher the incumbent's marketing budget  $a_{1,1}$  in the first period, the more goodwill is created. Goodwill creation in the first period is an irreversible investment that credibly commits the incumbent to higher output levels in the second and third period, thereby reducing the entrant's profits. With increasing  $a_{1,1}$ , the entrant's entry deterrence profits  $\pi_2^d$  decrease faster than the entry accommodating profits  $\pi_2^*$ . The intersection between profit functions  $\pi_2^*$  and  $\pi_2^d$  defines the threshold  $a_{1,1}^p$ .

Fig. 2 illustrates a constellation where it pays off for the incumbent to opt for a squeeze-out preventing strategy. For the incumbent's entry accommodating profit maximizing marketing budget  $a_{1,1}^*$ , the entrant's squeeze-out profits  $\pi_2^d$  are higher than his accommodating profits  $\pi_2^*$ , i.e. the entrant would drive the incumbent out of the market. If the entrant exits the market after the first period, his profits are  $\pi_{1,1}^m$ . However, the incumbent can increase his marketing budget up to  $a_{1,1}^p$  where the entrant's squeeze-out profits  $\pi_2^d$  no longer exceed his duopoly profits  $\pi_2^*$ . The incumbent's total duopoly profits associated with  $a_{1,1}^p$ ,  $\pi_1^*(a_{1,1}^p)$ , are higher than first period monopoly profits. Therefore, the incumbent will choose a high marketing budget  $a_{1,1}^p$  that prevents squeeze-out and allows the incumbent to stay in the market.

### 3.3.3. Accommodating behavior

In case neither entry deterrence nor a squeeze-out strategy is efficient, both firms will choose accommodating strategies. In this case, the incumbent will maximize duopoly profits.

### 3.3.4. Entry deterrence

If the incumbent chooses an entry-deterrence marketing budget  $a_{1,1}^d$ , the marketing budget that drives the entrant's profits down to zero, his profits are given by  $\pi_1^m(a_{1,1}^d)$ . If  $\pi_1^m(a_{1,1}^d)$  exceeds duopoly profits, the incumbent will impede market entry.

### 3.3.5. Blocked entry

If the incumbent's dynamic monopoly solution does not allow the entrant to profitably enter the market, then entry is blocked.

## 4. Competitive advantage and competitive strategy

Competitive advantage determines not only profits but also both firms' competitive strategies. Fig. 3 shows the incumbent's and the new entrant's profits as a function the incumbent's competitive advantage  $\theta_1$ . Note  $\theta_1$  is the difference between absolute demand advantage  $\alpha_1$  and variable cost  $c_1$ . For small  $\theta_1$  the entrant's profits  $\pi_2^d$  associated with a squeeze-out strategy are higher than the profits  $\pi_2^*$  he achieves with an accommodating strategy. Above a critical  $\theta_1$ -threshold, squeeze-out preemption is the incumbent's optimal strategy.<sup>2</sup> At A, the entrant's accommodating and squeeze-out profit

<sup>2</sup> Note the incumbent's profits associated with a squeeze-out preventing strategy are not shown in Fig. 3.

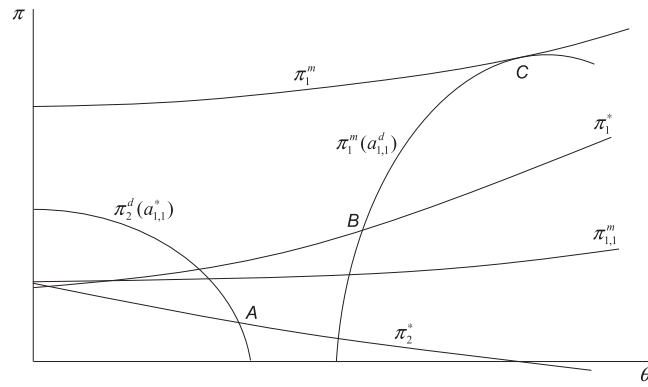


Fig. 3. Profits as a function of the incumbent's competitive advantage.

curves intersect. For a sufficiently high competitive advantage  $\theta_1$ , the incumbent does no longer face the threat of being squeezed out of the market.

In *B*, the incumbent's entry accommodating profit curve  $\pi_1^*$  intersects with his entry deterring profit curve  $\pi_1^m(a_{1,1}^d)$ . From a critical threshold  $\theta_1$  onwards, entry deterrence is more profitable than entry accommodation. The next critical threshold is reached when the entrant's duopoly profits are driven down to zero. At this point, the incumbent's entry deterring profit curve  $\pi_1^m(a_{1,1}^d)$  is tangent to the dynamic monopoly profit curve  $\pi_1^m$  (point *C* in Fig. 3). From that threshold onwards, market entry is blockaded.

In a numerical example, we analyze incumbent's profits in a constellation where the incumbent's competitive advantage is slightly above the critical threshold  $\theta_1$  where entry accommodating profits  $\pi_1^*$  and entry deterring profits  $\pi_1^m(a_{1,1}^d)$  intersect. Fig. 4 shows the incumbent's profits associated with the entry deterring and the entry accommodation strategy in the initial monopoly period, the market entry and the competition period. In this example, discounted entry deterring profits are slightly higher than the entry accommodating profits. Fig. 4 illustrates that the incumbent will have to bear substantial starting losses in the first period due to heavy first period market entry deterring investments. These losses are compensated by high profits the incumbent achieves in the second and third period. On the other hand, if in our example the incumbent chose the accommodation strategy, he would realize high profits in the initial monopoly period (the Schumpeterian monopoly rent). The incumbent's profits would then substantially decline after the second firm's market entry.

Table 2 summarizes the incumbent's and the new entrant's optimal strategies depending on comparative competitive advantage. If incumbent and new entrant's demand and cost-structure are on par, both firms will choose an accommodating strategy. If the incumbent enjoys a clear-cut cost and/or demand advantage, he will opt for an entry deterring strategy. However, if the new entrant enjoys a substantial competitive advantage, the incumbent faces the threat of being squeezed out of the market. If the incumbent's competitive advantage is sufficiently large, he will preempt being squeezed out by overinvesting in the initial monopoly period. If not, he will realize the static monopoly solution in the first period and then withdraw from the market.

## 5. Strategic investment in digital markets: stylized facts

In practice, the identification of exclusionary behavior is one of the most difficult issues in competition policy, as more often than not exclusionary practices cannot be easily distinguished from competitive actions that benefit consumers (Motta, 2004). This applies both to predatory pricing as well as to preemptive investment. However, anecdotic evidence suggests that dominant Internet firms acquire promising firms before they become a threat (Economist, 2012). In an abstract sense, acquiring promising firms with attractive complementing product offerings can be viewed as investing in strategic assets, potentially foreclosing market entry (Van Gorp & Batura, 2015). Google's and Facebook's business policies might be a case in point. Amazon, on the other hand, has predominantly relied on organic growth, reinvesting its substantial cash flows to continuously extend its market leadership.

### 5.1. Google

Since its launch in 1998, Google has acquired more than 180 companies, with its largest acquisition being Motorola for US\$12.5 billion (D'Onfro, 2015). Other major acquisitions were smart thermostat and smoke detector maker NestLabs, extending Google's presence in consumer homes, DoubleClick, further strengthening Google's position in online advertising, and YouTube, today the second biggest search engine in the world (behind Google itself). By acquiring DoubleClick, Google gained access to DoubleClick's advertisement software and, more importantly, its relationships with Web publishers,



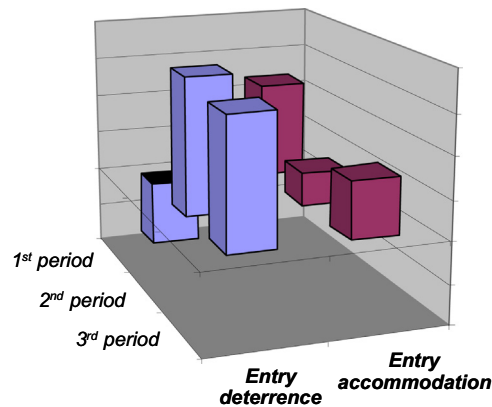


Fig. 4. Incumbent's deterrence vs. accommodation profits (numerical example).

Table 2

Competitive advantage and optimal strategies.

Incumbent's relative competitive advantage	Profits compared	Incumbent's optimal strategy	New entrant's optimal strategy	Market outcome
<b>Very minor</b>	New entrant realizes higher profits with squeeze-out strategy (compared to profits realized with accommodating strategy)	Skim monopoly profits in the monopoly period; then withdrawal	Dynamic monopoly solution, alternatively squeeze-out strategy	"winner takes it all"
<b>Minor</b>	For both firms, accommodating behavior is the profit maximizing strategy	Preemption of new entrant's squeeze-out strategy	Accommodating behavior	Duopoly
<b>Balanced</b>	For both firms, accommodating behavior is the profit maximizing strategy	Market entry accommodation		
<b>Major</b>	Incumbent realizes higher profits with entry deterrence strategy	Entry deterrence	Market entry renouncement	"winner takes it all"
<b>Very major</b>	Blockaded entry	Dynamic monopoly solution		

advertisers and advertising agencies. Further on, it prevented Microsoft, a rival bidder, from gaining access to the online advertising business. According to industry observers "keeping Microsoft away from DoubleClick was worth billions to Google" (Story & Helft, 2007).

In its most active years Google acquired, on average, more than one company per week (Rusli, 2011). Many Google products originated as services provided by companies that Google acquired. Further lowering the hurdles to acquiring companies is seen as one of the motives of Google's decision to create its new umbrella organization Alphabet (Reeves, 2015).

### 5.2. Facebook

Facebook has acquired more than 50 companies. Its acquisition of mobile messaging service WhatsApp for US\$19 billion in 2014 was one of the largest high-tech acquisitions of all times. In 2013, Facebook made an unsuccessful \$3bn bid for SnapChat, a service that sends messages that erase after a short period. In 2012, Facebook acquired Instagram, an online mobile photo-sharing service that enables its users to take pictures and videos, and conveniently share them on a variety of social networking platforms. According to industry observers, the rationale of these acquisitions is Facebook's goal to secure its lead in personal communications, jeopardized by users increasingly moving to mobile and younger users cooling on Facebook's social network site (Rushe, 2014). The results of Facebook's efforts are impressive: today, the company owns four of the five largest brands in social media and messaging worldwide (Kim, 2015).

### 5.3. Amazon

Despite of substantial revenues and cash flows, online retailer Amazon has never paid a dividend to its shareholders. Instead, the company has aggressively invested in expanding capacity (notably warehouses) and cloud infrastructure (Amazon Web Services, AWS), keeping competition at bay. Amazon outlined its investment strategy back in 1998: "We will continue to make investment decisions in light of long-term market leadership considerations rather than short-term profitability considerations or short-term Wall Street reactions ... We will make bold rather than timid investment decisions where we see a sufficient probability of gaining market leadership advantages." (Amazon 1998).

Amazon is not only the leading Internet-based retailer in many parts of the world, but also the world's largest provider of cloud infrastructure services. When the company built a cloud-computing infrastructure to support its vast retailing and logistical operation, it designed that system to be dual-purpose: it supports the company's core business, but it can also be rented to outside users. If Amazon were to spin off AWS, it would be valued at somewhere between \$70bn and \$160bn, according to analysts' estimates – but “Bezos won't do that, of course, for one simple reason: he can see a winner-takes-all goalpost ahead” (Naughton, 2015).

To summarize, anecdotal evidence suggests that successful Internet companies heavily invest in order to gain market leadership advantages, and to some extent this investment is directed at discouraging market entry.

## 6. Concluding remarks

In this paper, we have analyzed the impact of new entrant's strategic investments in a dynamic duopoly with sequential entry. Competitive advantage and strategic interaction determine a “winner-takes-it all” or a duopoly market outcome. With marketing expenditures as a strategic investment, both incumbent and new entrant can commit to exclusionary strategies: the incumbent may deter entry, or the new entrant may squeeze the incumbent out of the market. We find that clear-cut cost and/or demand advantages favor a “winner-takes-it-all” market outcome. Further on, strategic investment is a powerful instrument to influence market outcome: Strategic investment allows a strong incumbent to deter market entry, and vice versa it allows a strong new entrant to squeeze the incumbent out of the market. Depending on relative cost and demand advantages, the incumbent will choose one of five generic strategies: early withdrawal, squeeze-out prevention, entry accommodation, entry deterrence, dynamic monopoly solution.

Our model confirms the empirical observation in new markets created through innovation that incumbents will struggle to survive competing against a new entrant who enjoys a major cost or demand advantage. In this case, an early withdrawal from the market is the best strategy. Alternatively, the incumbent might take advantage of his lead in order to prevent being squeezed out of the market. Such a strategy implies overinvesting in strategic assets. Otherwise, if the incumbent has a major cost or demand advantage, market entry might not occur as entry deterrence is the incumbent's superior strategy. Without a clear-cut comparative advantage, entry accommodation is the most profitable strategy for both firms.

Our results show that a duopoly market outcome cannot be taken for granted – competitive advantage and strategic interaction may easily lead to a “winner-takes-it-all” market outcome, leaving the market either to the incumbent or to the new entrant. From an antitrust point of view, more efficient firms displacing less efficient firms should not be a concern. However, our analysis shows that there are strong incentives to complement competitive advantage with exclusionary practices in order to monopolize a market and increase profits. While in general new market development may require substantial investment (e.g. to achieve scale or to develop strong brands), *strategic* investment is a powerful tool to force rivals to exit the market, inducing a “winner-takes-it-all” market outcome. These findings suggest antitrust concerns with today's leading Internet players' business practices and market dominance may be well-deserved.

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