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A theory of gazelle growth: Competition, venture capital finance and policy[☆]

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ABSTRACT

This paper proposes a theory of gazelle growth in which gazelles can grow either organically or through acquisitions. The model includes three types of firms: incumbent, target, and gazelle. We show that the lower cost of organic growth can increase the incentives for acquisition growth because the incumbent understands that if it acquires the target firm, the gazelle will then invest organically in order to grow, and therefore, the acquisition will not be enough to protect the incumbent's market power. The gazelle could then acquire the target firm at a good price. We also show that financial support for the organic growth of gazelles can increase gazelles' growth through acquisitions because incumbents' preemptive motives are reduced.

1. Introduction

Due to their substantial share in net employment growth and their role in providing society with new products and services, young high-growth firms, or so-called gazelles, have attracted increasing interest from the literature, particularly in terms of understanding and analyzing their development (Birch, 1979; Henrekson & Johansson, 2010).

The starting point of this paper is the observation that gazelles[1] face considerable problems when trying to fully exploit the potential value of an invention or a business idea. Complementary assets such as distribution networks, marketing channels, financial resources, manufacturing know-how and brand names are typically held by large established firms, but these assets are also often needed by gazelles. To obtain these assets, the gazelles could either set up a new plant or warehouse and grow organically or acquire a target firm with these assets in place (Delmar, Davidsson, & Gartner, 2003; McKelvie, Wiklund, & Davidsson, 2006). However, many gazelles have to challenge large incumbent firms that are already market leaders competing in oligopolistic markets and possess market power. These incumbents' profits are diminished by gazelles' growth. The incumbents may have an incentive to acquire these target firms. In doing so, they can block the growth of gazelles and protect their market share.

The purpose of this paper is to propose a theory of gazelle growth that is consistent with these facts and that is tractable for policy analysis. To this end, we construct a model with the following components. There are three firms in a market. One of them is the market leader, which is labeled the incumbent. Another is a firm that has already been in the market as a competitor to the

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[1] Gazelles and high-growth firms are not necessarily the same. Gazelles are often defined as young firms that are growing rapidly. The definition of high-growth firms, on the other hand, tends to be based on all firms (independent of firm age); see, e.g., Coad, Daunfeldt, Hölzl, Johansson, and Nightingale (2014). Our focus here is on gazelles, and a main focus of the analysis is that gazelles need external financing to grow, which is typically the case for young firms.

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incumbent; however, its assets are on sale, and it is going out of business. This firm is labeled the target. Finally, the last firm is a new firm entering the market. It is established by an entrepreneur and labeled the gazelle. The incumbent and gazelle are assumed to compete in an oligopolistic fashion. The entrepreneur has invested in an innovative activity that could lead to the creation of a unique business idea or an invention, which could then be used to start a gazelle and make it grow. At the very beginning, the entrepreneur decides whether to invest in the innovative activity. If the entrepreneur is successful in the first period, the gazelle and the incumbent will compete to acquire the target firm's distribution network. If the gazelle does not acquire the target firm's distribution network, the gazelle could grow organically either on a small scale or on a large scale in the second stage. If it grows organically on a small scale, it will face higher distribution costs. The crucial feature of the model is that the gazelle lacks financial resources and needs to borrow when growing by acquisition or engaging in large-scale organic growth. However, the model assumes that the gazelle will not need any external funding for small-scale organic growth.

We first analyze the gazelle growth model. We show that if the gazelle faces sufficiently large distributional costs when investing on a small scale, the incumbent obtains the target firm's distribution network despite the fact that the gazelle would save considerably on the distribution cost by obtaining the target firm's distribution network. Once the distribution cost becomes sufficiently high, this distribution-cost saving effect is dominated by a preemptive anticompetitive effect because, when obtaining the target firm's distribution network in this situation, the incumbent firm gains greater market power in the product market. It faces a competitor (the gazelle) with high distribution costs. Consequently, the incumbent firm obtains the target firm's assets. Therefore, the gazelle is left with the option of growing organically on a low scale. On the other hand, if the gazelle has a better position when growing on a small scale (it becomes a sufficiently large firm by doing so) or if the gazelle can grow on a large scale at a low cost, then the incumbent can no longer prevent the gazelle from enhancing its competitiveness in the product market. Therefore, the incumbent is not willing to pay a high price for the target firm's distribution network.

Access to financing is often difficult for gazelle firms due to their perceived riskiness and lack of collateral. Banks are usually reluctant to lend to gazelles. Therefore, venture capital (VC) is one of gazelles' primary sources of outside equity financing and support. However, the amounts of money that VC firms allocate for different stages of company development vary considerably. In the US, only approximately 4% of all VC deals are made with companies that are in the seed stage, whereas 50% of all deals are made with companies in the early stage.[2] VC firms prefer to finance early-stage companies that are ready to expand their operations, manufacturing capacities, sales and marketing teams or product development teams. An early-stage gazelle firm that is generating revenue but is not necessarily profitable is not as risky an investment for VC firms as a seed-stage company. Most of the time, gazelle firms have already proven a market need and have already found a good product-market fit. They are ready to increase their market share by enlarging their operations, i.e., acquiring the required assets from another firm for this purpose. Therefore, gazelles are attractive investments for VC firms.

By incorporating VC financing into the model, we show that VC financing indeed leads to higher gazelle growth. Moreover, and perhaps more surprisingly, we show that VC financing increases acquisition growth more than organic growth – by securing VC financing, a gazelle could credibly threaten to invest organically on a large scale if it does not grow by acquisitions. This approach reduces the incumbent's preemptive acquisition motive and decreases the acquisition price for the gazelle when growing by acquisition.

An example of a successful acquisition growth financed by VC is Flipkart, an Indian e-commerce company founded in 2007 by two entrepreneurs. Flipkart experienced high growth by becoming a USD 11 billion market-valued company in February 2016 from a start-up whose equity value was only USD 6000 when it was established. Flipkart managed this rapid growth through several acquisitions financed by VC funds. It was listed number one among the top 10 e-commerce companies in India in terms of funds received. Flipkart obtained USD 542 million by the end of 2014.[3] Interestingly, Flipkart's main competitor, Amazon, has tried to buy Flipkart, but instead, Walmart (an outsider to the market) made a staggering offer of USD 16 billion for a controlling stake of 77% in May 2018. An injection of USD 2 billion in fresh investment in Flipkart was also part of the deal.[4]

We next turn to policy issues. Entrepreneurship has emerged as a key issue in the policy arena in Europe and the US. An important factor in the process of commercialization and the growth of small businesses is these firms' access to financing. In addition to bank loan financing, government policies aim at promoting alternative sources of financing, such as public listings for SMEs and venture capital investments. Recently, there has been a substantial increase in spending on such policies. For example, in 2015, the US Small Business Administration (SBA) approved USD 33 billion in loans, and it also provided more than $6 billion in capital to small businesses through SBICs (Small Business Investment Companies), which are privately owned and managed investment funds that are licensed and regulated by the SBA. These investment funds use their own capital plus funds borrowed with an SBA guarantee to make equity and debt investments in qualifying small businesses.[5] Another government policy to improve SMEs' access to financing is providing tax exemptions and deferments, such as the provision of tax incentives for equity investors and businesses. Countries that provided tax subsidies and deferments targeted at SMEs during the period from 2007 to 2014 included Belgium, Finland, Italy, New Zealand, Norway, Spain, Sweden and Turkey.[6] We start the policy analysis section by examining the effects of financial support for gazelles. We show that financial support, such as a reduction in the interest rate, tends to improve gazelles' opportunity to grow by acquisition rather than by organic growth because a reduced interest rate improves gazelles' outside option (organic growth), which decreases the

[2] Source: Yearbook 2016, National Venture Capital Association.

[3] Online Source: www.businesstoday.in, https://en.wikipedia.org/wiki/Flipkart, www.indianexpress.com.

[4] Walmart is buying India's Flipkart, by Rishi Iyengar and Sherisse Pham @CNNMoneyInvest, May 9, 2018, http://money.cnn.com/2018/05/09/investing/walmart-flipkart-india-softbank/index.html.

[5] Source: Summary of Performance and Financial Information Fiscal Year 2015, the U.S. Small Business Administration, 2015.

[6] Source: Financing SMEs and Entrepreneurs, OECD, 2016.

incumbent's preemptive motive to buy the target, which, in turn, implies that the price of the target firm substantially decreases.

We then show that a subsidy for large-scale organic growth might not increase the incentive for organic growth, which is the objective, but rather may actually decrease it because the subsidy for organic growth reduces the possibility for preemption by the incumbent. The gazelle could credibly threaten the incumbent with large-scale organic growth. A subsidy helps the gazelle decrease the investment cutoff level that determines the profitability and feasibility of large-scale organic growth. In short, by decreasing the investment cutoff level, a subsidy improves the position for the gazelle in the bidding competition against the incumbent while acquiring the target firm.

This paper can be viewed as a contribution to the literature on the growth mode of young, high-growth firms. McCann (1991) notes that young and small firms often do not have sufficient resources to grow aggressively via acquisitions. Several empirical studies provide evidence that organic growth is the dominant mode of growth for young and small firms (e.g., Davidsson & Delmar, 1998; Delmar et al., 2003; Kraemer & Venkataraman, 1997; Levie, 1997). Organic growth is the main mode for non-high-growth firms, while acquisition growth seems more important for high-growth firms (HGFs). Clarysse, Bruneel, and Wright (2011) examine the growth paths of six young technology-based high-growth firms and document that two of them grew mainly via acquisitions. Brown and Mawson (2013) find that HGFs utilize overseas acquisitions to grow more aggressively in their international expansion than non-HGFs. Some firms that grow very quickly and become superstar ventures use acquisitions; e.g., Cisco realized much of its rapid growth via acquisitions (Murmann, Korn, & Worch, 2014). We add to this literature by proposing a model with an endogenous growth mode for young firms. Our model shows that organic growth and acquisition growth are both substitutes and complements for each other. In particular, through this model, we illustrate that if organic growth is very costly, then acquisition growth can be blocked by incumbent firms using preemptive acquisitions.

This paper also contributes to the literature on when entrepreneurs will challenge incumbents or sell their ventures to incumbents. To date, It has been found that a challenge is more likely to happen when entry costs are low, when the entrepreneurial firm has complementary assets, when brokers facilitating trade are not available, when the incumbent's and entrepreneur's assets are substitutes, and when the intensity of product market competition is low (see, for instance, Gans, Hsu, & Stern, 2002; Gans & Stern, 2000; Hellmann, 2002; Henkel, Rønde, & Wagner, 2015; Norbäck & Persson, 2012). We add to this literature by allowing entrepreneurs to challenge leading incumbents not only via organic growth but also through the acquisition of the non-leading incumbent firm's specific assets. This approach enables us to show that a lower cost of organic growth can increase the incentives challenging leading incumbents through acquisition growth. The leading incumbent understands that if it acquired the target firm, the gazelle would then invest organically anyway to grow, and therefore, the acquisition would not be sufficient to protect its market power as a leading incumbent firm from the gazelle. We also show that financial support for the organic growth of gazelles can increase gazelles' growth by acquisitions rather than their organic growth, as incumbents' preemptive motives are reduced.

2. The model

At the outset, an entrepreneur has an idea that has given rise to a viable business model. The entrepreneur will set up a gazelle firm denoted "g", which will bring this novel business model to the market. The gazelle will then compete with an established incumbent firm "i" in an oligopolistic market. There is also a target firm "t" up for sale in the market. The target firm's business is no longer viable due to the emergence of the gazelle, but the target firm owns a distribution network, which may help the gazelle to serve the market. To simplify the analysis, we merely assume that there is a target firm for sale. In a more general setup, we could derive conditions under which the target firm would not be viable and how it would depend on cost asymmetries between the different firms. These cost asymmetries would then stem from different firm-specific assets, such as machinery, patents, management skills, etc.

The interaction between the gazelle and the incumbent occurs in three stages. In the first stage, the target firm sells its assets, denoted k_t. If the gazelle acquires the target firm's assets, it will gain a distribution cost advantage and will be able to distribute its goods (or services) at zero distribution cost, i.e., $d = d_t = 0$; it will also hire L_t^g employees. However, the gazelle lacks financial resources and needs to borrow to be able to pay the acquisition price A. The total acquisition cost is $C_{acq} = A(1 + r)$, where r is the interest rate, i.e., the rate charged by the bank for a loan.

In the second stage, if the gazelle does not acquire the target firm in the first stage, it has the option to grow organically on either a small scale or a large scale. If the gazelle grows organically on a small scale by investing in small-scale assets k_s, it will have a low fixed cost C_s, normalized to zero, but will face a high distribution cost, $d_s > 0$. The gazelle will then hire L_s^g employees. If the gazelle grows organically on a large scale, it will invest in large-scale assets, denoted k_N, at an investment cost of I. This investment, I, will reduce the gazelle's distribution cost to zero, i.e., $d_l = 0$. However, the gazelle needs to borrow to be able to pay the investment cost, I. The total cost of organic growth on a large scale is $C_l = I(1 + r)$. The gazelle will then hire L_l^g employees.

Finally, in the third stage, both the gazelle and the incumbent sell a homogeneous product in the market. The quantities produced and sold by the gazelle and the incumbent are, respectively, q_g and q_i. The gazelle may be exposed to an extra distribution cost d_s, unless it has invested in large-scale assets and has grown organically ($d_l = 0$) or it has acquired the target firm's assets ($d_t = 0$).[7] It

[7] The theoretical model presented here builds on Norbäck and Persson (2004, 2005, 2008). It relies on a similar game structure: an acquisition/entry stage using an auction with externalities and an investment stage with an oligopolistic product market stage. The focus of the analysis by Norbäck and Persson (2004, 2005, 2008) is on how the acquisition-greenfield entry pattern of foreign firms depends on trade and greenfield investment costs. In this paper, the model framework is used to determine how the gazelle acquisition vs. organic growth patterns depend on the distribution cost, the interest rate and any subsidy targeted to a gazelle. A policy analysis for gazelle growth is given in a later section.

should be noted that we do not study startups of small firms but rather young firms that may grow to be large firms. Most of these successful growing firms will then compete in situations where they and their rivals have market power, and thus, oligopolistic interaction seems to be a reasonable assumption.

Note that we assume that the incumbent cannot acquire the gazelle, which could be because monopolization of the market would be blocked by antitrust authorities or because the gazelle's business model would not fit into the incumbent's organization, thus rendering the acquisition unprofitable. A third reason would be that other viable incumbents would expand if the incumbent acquired the gazelle, thereby making the acquisition unprofitable.

It should be noted that for some gazelles, bank financing might not be available because their ventures are characterized by high uncertainty. This should be particularly true for high-tech ventures. If other financing, such as venture capital, is not available, the gazelle would not grow. The case in which venture capital is available is examined in Section 4. It is shown that the main analysis carries over to this case as long as the VC firm's injection of capital covers all the investment costs. If so, the main analysis will hold for zero interest ($r = 0$).

2.1. Period 3: the product market

The game is solved via backward induction. In the last stage, the gazelle and the incumbent compete in the product market in a Cournot fashion. The market demand function is given by $P(Q) = a - bQ$ and $a, b > 0$, where $Q = q_g + q_i$. [8] The incumbent already possesses one unit of distribution assets k_N, but the gazelle initially lacks these assets. Next, depending on which firm acquired the target's assets in period 2, we will have three different ownership structures to consider. To keep track of them, we denote the ownership structure by $M(k_g, L_g, k_i)$, where the gazelle possesses k_g units of assets and L_g numbers of employees and the incumbent possesses k_i units. For example, $M(k_t, L_t, k_N)$ is then the duopoly in which the gazelle owns the target firm's assets k_t and hires L_t employees, whereas the incumbents have their initial assets of k_N, where $k_i = k_N$.

We make some assumptions regarding firms' marginal costs, given different ownerships of the target's assets. A firm possessing at least one unit of large-scale assets is assumed to produce at a zero marginal cost. Thus, the gazelle has a distribution cost disadvantage, d_s, per unit of output while serving the market when it grows organically at a small scale. We assume that the gazelle can avoid this extra cost d_s when it possesses large-scale assets (k_N). Having large-scale assets can be achieved by either acquiring the target firm's assets k_t or growing organically at a large scale k_N. In these two situations, the gazelle will have zero distribution cost as a variable cost, $d = 0$ ($d_t = 0$ or $d_l = 0$).

Let firm $j's$ profit function be defined by $\pi_j(q_g, q_i) = P(q_g + q_i)q_j - TC_j(q_j)$. Then, $\pi_j^D(d_s)$ indicates the duopoly profit for firm $j = g, i$ when the incumbent firm i has a variable cost of zero ($d_i = 0$) and gazelle firm g has a variable cost of d_s. Moreover, $q_g(d_s)$ denotes the corresponding equilibrium quantity of the gazelle, and $d_s^{\max}$ represents d_s, satisfying $q_g(d_s) = 0$, meaning that the gazelle does not produce or serve the goods in the market due to a high distribution cost. In addition, π^M denotes the monopoly profit when the incumbent firm becomes a monopolist and has zero distribution cost. We can make the following observation:

Observation 1: The incumbent will be hurt by the gazelle's acquisition growth or the gazelle's organic large-scale growth since the incumbent will then face tougher competitors. Thus, the incumbent will have an incentive to prevent the gazelle's expansion.

This preemptive motive is important for the growth pattern of the gazelle, as will be shown below.

2.2. Period 2: organic growth: small scale or large scale?

If the gazelle does not acquire the target firm in the first stage, it may grow organically in the second stage. The gazelle might either undertake large-scale organic growth investment at a cost of $C_l = I(1 + r)$, where I is the original investment cost and r is the interest rate (cost of finance), or grow on a small scale and have a zero fixed cost of $C_s = 0$, but it will have a variable distribution cost greater than zero ($d_s > 0$). In the case of large-scale organic growth, the gazelle reduces its distribution costs from d_s to 0.

The gazelle needs to borrow to be able to invest on a large scale. We define $\bar{I}(d_s, r)$ as the value of the investment cost such that the gazelle firm is indifferent between the alternatives of large-scale and small-scale organic growth. Formally, we find that large-scale organic growth occurs when the following holds: $\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0) - \pi_g^D(d_s)}{1+r}$ if $d_s < d_s^{\max}$, and $\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0)}{1+r}$ otherwise. In the above expression, $\pi_g^D(0)$ stands for the gazelle's profit when it has a zero distribution cost, and $\pi_g^D(d_s)$ stands for the gazelle's profit when it has a distribution cost $d_s > 0$.

Because the gazelle's small-scale growth profits $\pi_g^D(d_s)$ decrease monotonically in d_s, the critical investment cost $\bar{I}(d_s, r)$ is increasing in d_s and reaches its maximum at the point at which $d = d_s = d^{\max}$. When $d_s > d^{\max}$, the gazelle does not produce and sell the good unless it invests organically in large-scale assets with a critical investment cost of $\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0)}{1+r}$, where $\pi_g^D(0) = C_l = I(1 + r)$.

We can make the following observation:

Observation 2: If the cost of financing r is too high, large-scale organic growth will not be profitable for the gazelle.

[8] We assume that firms have a strictly concave inverse demand function, such that $P'(Q) < 0$ and $P''(Q) < 0$.

Whether the gazelle will have an incentive for large-scale organic growth is an important factor in determining the outcome of the bidding competition over the target firm acquisition, as will be explained below.

2.3. Period 1: the acquisition game

The acquisition process is depicted as a perfect-information auction in which the two firms simultaneously post bids, and the bidder with the highest bid obtains the target firm.[9,10] To solve the acquisition auction and determine bids, we need to determine the valuations of the bidders for obtaining the target firm's assets. To aid in this process, we introduce the net gain function $N_g(A)$, which defines the net gain for the gazelle if the acquisition price is A. Furthermore, we assume that the acquiring firm borrows to be able to pay the acquisition price and has to pay an interest rate r.

A gazelle will have net gain functions defined as follows:

$$N_g(A) = \underbrace{[\pi_g^D(0) - (1+r)A]}_{\text{Acquire}}\underbrace{[\pi_g^D(0) - (1+r)I]}_{\text{Do not acquire}}, \quad \text{if } I < \bar{I}\left(d_s, r\right) \tag{1}$$

$$N_g(A) = \underbrace{[\pi_g^D(0) - (1+r)A]}_{\text{Acquire}} - \underbrace{[\pi_g^D(d_s)]}_{\text{Do not acquire}}, \quad \text{if } I > \bar{I}\left(d_s, r\right). \tag{2}$$

Let us start with the first line, where the alternative to the acquisition for the gazelle is large-scale organic growth. The first term consists of product market profits net of the acquisition price, including interest payments $\pi_g^D(0) - (1+r)A$. The second term is the product market profits in the case in which the gazelle does not acquire the target firm and instead grows organically on a large scale, net of the investment cost including interest payments $\pi_g^D(0) - (1+r)I$.

We should note that a key insight is that a gazelle's maximum willingness to pay (v_g) for the target firm depends on what happens if it does not acquire the target firm, i.e., it might then invest organically on a large scale or not. The second line describes the valuations when the gazelle instead undergoes small-scale organic growth.

For the gazelle, the maximum willingness to pay, v_g, can be determined to be $v_g = \min A\ ,\ s.\ t\ N_g(A) \geqslant 0$, where A is the acquisition price. Solving for $N_g(A) = 0$, we obtain the maximum willingness to pay for each of the two net gain functions as follows:

$$v_g = I \text{if} I < \bar{I}(d_s, r) \tag{3}$$

$$v_g = \frac{\pi_g^D(0) - \pi_g^D(d_s)}{1+r} \text{if} I > \bar{I}\left(d_s, r\right). \tag{4}$$

Let us now turn to the incumbent's valuation of the target firm's assets. The maximum willingness to pay for the incumbent, v_i, to acquire the target firm can be directly written as

$$v_i = 0 \quad \text{if } I < \bar{I}(d_s, r) \tag{5}$$

$$v_i = \pi_i^D(d_s) - \pi_i^D(0) \quad \text{if } I > \bar{I}(d_s, r) \quad \text{and } d_s < d^{\max} \tag{6}$$

$$v_i = \pi_i^M - \pi_i^D(0) \quad \text{if } I > \bar{I}(d_s, r) \quad \text{and } d_s > d^{\max} \tag{7}$$

We note that the game is solved with the backward induction method. We look for a subgame perfect equilibrium. Let us begin with Eq. (5) where the alternative to the acquisition of the incumbent itself is the large-scale organic growth of the gazelle firm. Then, the incumbent obtains no value from buying the target firm's assets. Its willingness to pay for the acquisition will be zero, $v_i = 0$. The reason is that the intensity of competition is not affected by the incumbent's acquisition of the target firm, and no cost savings occur when $I < \bar{I}(d_s, r)$.

However, Eq. (6) shows that when the alternative to the acquisition of the target firm by the incumbent is the small-scale organic growth of the gazelle, the acquisition by the incumbent will have an effect on the competition in the product market. The incumbent will then ensure that it will face a weaker rival if it acquires the target firm's assets. This is captured by the term $\pi_i^D(d_s) - \pi_i^D(0) > 0 \Rightarrow v_i > 0$. The marginal willingness to pay in the acquisition will be greater than zero for the incumbent.

Finally, Eq. (7) captures the case when the acquisition by the incumbent completely blocks the expansion of the gazelle firm and the incumbent becomes a monopolist. In this case, large-scale organic growth is not feasible for the gazelle due to the high investment cost and production on a small scale is not feasible for the gazelle due to the high distribution cost.

The analysis is straightforward because both firms will bid their maximum willingness to pay, and we can state the following

[9] Thus, we abstract from asymmetric information problems to focus on the competitive effects of the acquisition.

[10] If more than one firm posts such a bid, each firm obtains the assets with equal probability. The winning buyer pays an amount equal to his bid. The auction will be solved for Nash equilibria in undominated pure strategies. There is assumed to be the smallest monetary unit, denoted ε. We assume that ties will be randomly broken and all equalities in valuations will be ruled out. The smallest amount ε is chosen such that all inequalities are preserved if ε is added or subtracted.

result:

Lemma 1. Let firm i be the firm with the highest valuation, v_i. The target firm's assets are then acquired by firm i at a price equal to the other firm's valuation: firm h's valuation of obtaining the target firm's assets instead of the firm i itself, v_h.

3. The gazelle growth pattern

One more definition is required to proceed. To this end, we consider the situation where no large-scale organic growth investment takes place. The only way for the gazelle to decrease the distribution cost to zero, $d = 0$, is an acquisition. We make use of the following definition:

Definition 2. *Preemption condition:* As v_g is the maximum willingness to pay for the gazelle to acquire the target firm and v_i is the maximum willingness to pay for the incumbent firm, let d_s^* be the value of the distribution cost satisfying the following equality when $I > \bar{I}(d_s, r)$: $v_g = \frac{\pi_g^D(0) - \pi_g^D(d_s^*)}{1+r} = \pi_i^D(d_s^*) - \pi_i^D(0) = v_i$.

Therefore, d_s^* is the distribution cost at which the gazelle and the incumbent firms' valuations of the target firm's assets coincide, given that no large-scale organic growth investment takes place. We are now set to derive the equilibrium ownership structure in the gazelle growth model presented above.

The game is solved backwards, and the following proposition identifies the equilibrium ownership structure and the equilibrium auction price.

Proposition 3. The equilibrium ownership structure and the gazelle growth pattern are as follows:

(ii) If $I > \bar{I}(d_s, r)$ and $d_s < d_s^*$, the gazelle grows by acquisition. It obtains the target firm's assets at a price of $A = v_i = \pi_i^D(d_s) - \pi_i^D(0)$. The ownership structure is $M(k_t, L_t^g, k_N)$, where the gazelle owns the asset of the target firm, k_t.

(iii) If $I < \bar{I}(d, r)$, the gazelle grows by acquisition. It obtains the target firm's assets at a price $A = v_i = 0$. The ownership structure is $M(k_t, L_t^g, k_N)$, where the gazelle owns the assets of the target firm, k_t.

Proof. See the Appendix. To understand the logic of Proposition 3, we should note that firms' valuations depend on the gazelle's decision in stage 2, i.e., whether It makes investments and grows organically on a large scale. In the following subsections, we will examine the two separate cases more closely.

High cost of large-scale organic growth, i.e.,$I > \bar{I}(d_s, r)$: Let us now characterize the difference between the valuations of the incumbent and the gazelle, $v_i - v_g$; when the gazelle will not grow on a large scale organically in stage 2, if it loses the auction in stage 1. This is the case when the investment cost is too high, i.e., $I > \bar{I}(d, r)$.

In this case, $v_i - v_g = \pi_i^D(d) - \pi_i^D(0) - \left(\frac{\pi_g^D(0) - \pi_g^D(d)}{1+r}\right)$. It follows directly that $v_i - v_g = 0$ when $d = 0$, i.e., the value of avoiding high distribution costs equals the value of preemption. Let us now analyze how an increase in d affects the difference in valuations. At first glance, one might believe that an increase in d would make the value of avoiding the distribution cost, v_g, increase more than the value of preemption (the value of decreasing competition through target firm acquisition by the incumbent), v_i, because the gazelle has an incentive to avoid these higher distribution costs. However, more effects are involved. Following Norbäck and Persson (2004), we differentiate $v_i - v_g$ with respect to d and use the FOC's yields: [11]

$$\frac{d(v_i - v_g)}{dd} = \frac{dQ(d)}{dd} P' q_i(d) + \frac{dq_i(d)}{dd} d - q_g(d). \tag{8}$$

The first term in Eq. (8) captures the *anticompetitive effect* because the increased distribution cost induces the gazelle to be less aggressive in its market interaction, which softens competition and increases revenues for the incumbent. The second term reflects the decrease in total distribution costs as the incumbent firm steals business from the gazelle. This effect is referred to as the *business-stealing effect*. The first two terms in Eq. (8) increase the incumbent firm's valuation of the target firm's assets relative to that of the gazelle firm. The third term, the *direct distribution cost effect*, decreases the incumbent firm's valuation relative to that of the gazelle, as the gazelle firm faces higher distribution costs.

Let us now analyze how the difference in valuations $v_i - v_g$ depends on d. At $d = 0$, the *distribution cost effect* dominates the *anticompetitive effect*. At higher distribution costs, however, the direct distribution cost effect is weaker because the gazelle's sales are smaller. However, both the anticompetitive and the business-stealing effects are stronger because the incumbent has a larger market share, and each unit shifted from the gazelle to the incumbent implies greater cost savings. Hence, once the distribution costs become sufficiently high, $v_i - v_g$ will rise. When the distribution costs become sufficiently high at $d = d^{\max}$, the incumbent becomes a monopolist, and consequently, v_i is then greater than v_g.

In summary, when the distribution costs are high, the incumbent firm can prevent the gazelle from becoming a tough competitor, and thus, its willingness to pay for the target firm's assets increases. The preemptive value increases. Consequently, the acquisition by the incumbent is more likely to happen.

[11] Please refer to Appendix A.3 for the derivation of Eq. (8).

Low cost of large-scale organic growth, i.e., $I < \bar{I}(d_s, r)$*:* In this case, the gazelle will grow organically on a large scale in stage 2 upon losing the auction in stage 1 because the investment cost is sufficiently low, i.e., $I < \bar{I}(d, r)$. If the incumbent acquires the target firm's assets, the gazelle organically invests on a large scale, and no firm faces any distribution costs in the product market, but the gazelle faces an investment cost, *I*. If the gazelle acquires the target firm's assets, the investment cost is avoided. Consequently, since $v_g - v_i = I$ and $I > 0$, it follows that $v_g > v_i$.

Intuitively, the lower cost of large-scale organic growth decreases the incumbent firm's willingness to pay because the gazelle can credibly threaten to grow organically on a large scale if it does not obtain the target firm's assets. This situation implies that the value of preemption disappears. At the same time, the gazelle is still willing to pay *I* for the target firm's assets.

The above analysis thus contains several noteworthy features.

Observation 3: When the cost of large-scale organic growth is high and the distributional costs are high for small-scale entry, the incumbent firm obtains the target firm's assets despite the fact that the gazelle would save considerably on the distribution cost by obtaining the target firm; when obtaining the target firm's assets, the incumbent firm gains high market power in the product market because it then faces a competitor with high distribution costs.

Observation 4: When the cost of growing organically on a large scale is sufficiently low, the gazelle grows by acquisition and obtains the target firm's assets because the strategic position in the bidding competition in acquiring the target firm is improved for the gazelle since it can credibly threaten to invest organically on a large scale if it does not acquire the target firm.

4. Venture capital

Empirical studies show that venture capitalists mostly concentrate their investment in early-stage entrepreneurial firms that have the potential to grow quickly. For instance, from data on 794 capital-backed ventures, Gompers (1995) finds that VC firms invest their funds mostly in high-technology startup companies, where the informational asymmetries are highest. Gompers also concludes from his data that the duration of VC financing is related to the nature of invested firms' assets: higher industry ratios of tangible assets to total assets, lower market-to-book ratios, and lower R&D intensities are associated with VC firms' longer funding duration. Therefore, as we see in the real-life business case of Flipkart, quickly growing start-ups are more likely to attract more VC funding over longer periods to finance their growth by acquisitions because they increase their tangible assets by acquiring other firms. When there is a specific asset to be acquired, venture capitalists are more eager to deal with information asymmetries in gazelles that naturally exist.

By providing capital funds to entrepreneurial firms, VC firms infuse financial strength and competence into ventures. Furthermore, VC firms improve the overall efficiency of entrepreneurial firms by helping them decrease their production costs and/or increase their sales (Chemmanur, Krishnan, & Nandy, 2011). Next, we focus on how increased financial strength affects the growth pattern of a type of entrepreneurial firm: gazelles.

Let us now incorporate VC financing into our model. Once an entrepreneurial firm makes a deal with a VC firm, it will obtain additional equity in cash, *F*. This VC fund *F* can be used partly or totally to finance the acquisition or large-scale organic growth. We assume that two symmetric VC firms compete to invest in the gazelle. We also assume that the VC firms are perfectly informed about the future profitability of the gazelle. Moreover, the gazelle is indifferent between these two symmetric VC firms. We also simplify the analysis by assuming that the gazelle needs a fixed amount of capital, *F*.

In equilibrium, one of these VC firms invests *F* amounts of funds in the gazelle and obtains an amount of shares valuing the equivalent of the amount *F* of the gazelle's ownership. This process follows from the fact that the VC firms compete and make zero profit on their investments. Therefore, the investor VC firm will receive $\frac{F}{TSHE}$ amounts of shares in the gazelle's ownership, where *TSHE* stands for the gazelle's total shareholder equity after the injection of VC equity. *TSHE* is the net present value of the gazelle's future product market profits, net of investment costs.

We do not focus on any other detailed conditions, such as dividend policy, management, exit of the VC firm, etc., of the contract between the VC firm and the gazelle. We suppose that the level of VC ownership in the gazelle will not affect the gazelle's objective function. The gazelle will always maximize its profits.

We will now examine how the infusion of capital will affect the gazelle's growth pattern. In our analysis, we once more distinguish between the cases when large-scale organic growth is feasible and when it is not feasible.

High cost of large-scale organic growth, i.e., $I > \bar{I}(d_s, r)$*:* Here, we assume that if the gazelle did not acquire the target in the auction in stage 1, it would not grow organically on a large scale in stage 2. From Lemma 1, it follows that a gazelle acquisition takes place if and only if $v_i - v_g < 0$.

Our analysis now concentrates on how the valuations of the target firm for the incumbent and the gazelle are affected by the introduction of VC financing. First, note that the incumbent's valuation is not affected and is still given by expressions (6) and (7). However, the gazelle's valuation will change. To observe this change, we rewrite the gazelle net gain function as follows:

$$N_g(A) = \underbrace{[\pi_g^D(0) - (1+r)(A-F)]}_{\text{Acquire}} - \underbrace{[\pi_g^D(d_s) + F]}_{\text{Do not acquire}}, \quad \text{if } I > \bar{I}\left(d_s, r\right). \tag{9}$$

The VC firm's infusion of capital reduces the acquisition cost, as captured by the term $(1 + r)(A - F)$. Moreover, in the case of no expansion, the infusion of capital will come up as an additional capital *F*, where it is assumed that there is no interest in this capital.[12] Solving for $N_g(A) = 0$, we obtain the maximum willingness to pay for the gazelle:

$$v_g = \frac{\pi_g^D(0) - \pi_g^D(d_s) + rF}{1 + r} \quad \text{if } I > \bar{I}\left(d_s, r\right). \tag{10}$$

As a result, the gazelle's valuation v_g will increase by the amount of $\frac{rF}{1+r}$, which captures the saved interest rate expense associated with the acquisition. Therefore, the difference between the maximum willingness to pay of the incumbent and the entrepreneurial firm, $v_i - v_g$, decreases when the entrepreneurial firm receives venture capital equity, *F*.

Low cost of large-scale organic growth, i.e.,$I < \bar{I}(d_s, r)$: We examine the case in which $I < \bar{I}(d_s, r)$. The entrepreneurial firm can credibly threaten the incumbent with large-scale organic growth, and the value of preemption for the incumbent will be zero. Moreover, the gazelle's valuation will not change. After obtaining VC funds *F*, the gazelle has a net gain function defined as follows:

$$N_g(A) = \underbrace{[\pi_g^D(0) - (1 + r)(A - F)]}_{\text{Acquire}} - \underbrace{[\pi_g^D(0) - (1 + r)(I - F)]}_{\text{Do not acquire}}, \quad \text{if } I < \bar{I}\left(d_s, r\right). \tag{11}$$

Solving for $N_g(A) = 0$, we obtain

$$v_g = I \quad \text{if } I < \bar{I}(d_s, r). \tag{12}$$

Capital infusion can be used to finance either acquisitions or large-scale organic growth; the tradeoff between acquisitions and large-scale growth is not affected.

How is the large-scale organic growth cutoff investment amount,$\bar{I}(d_s, r)$, affected by a capital injection from the VC firm? We evaluate how the incentive to undertake a large-scale organic growth changes after a VC equity injection into the gazelle, given that the gazelle does not acquire the target firm in the first period. Formally, we state that

$$\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0) - \pi_g^D(d_s) + rF}{1 + r} \quad \text{if } d_s < d_s^{\max} \quad \text{and}$$

$$\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0) + rF}{1 + r} \quad \text{otherwise.}$$

As can be observed from the above formulas, there is a positive relationship between the cutoff investment level and the VC funding. The higher the VC financing is, the higher $\bar{I}(d_s, r)$ because the gazelle is willing to pay more for large-scale organic growth investment since the cost of financing is lower.

$$\frac{d\bar{I}(d_s, r)}{dF} = \frac{r}{1 + r} > 0$$

Therefore, the infusion of the VC fund makes investment in large-scale organic growth more feasible and thus the gazelle's threat more credible since the interest cost of financing large-scale organic growth can be reduced by the amount *rF*.

To summarize, we can state the following results:

Proposition 4. A gazelle that receives VC funding is more likely to grow by acquisition for the following reasons:

(ii) The cutoff investment cost of large-scale organic growth for the gazelle increases due to decreased interest payments in financing the investment. This phenomenon improves the gazelle's strategic position and reduces the incumbent's preemptive acquisition motive.

As a final remark, it can also be argued that increasing the level of equity in the gazelle's balance sheet will ease the bargaining conditions of the entrepreneurial firm with banks or other types of debtors. In the case where the VC fund cannot finance the acquisition alone or the acquisition is partly financed via VC equity and partly via bank borrowing, the cost of debt, *r*, may decrease for the gazelle. Having a higher amount of equity and thus a lower leverage ratio will allow the gazelle to face a lower rate of interest when bargaining with debtors. This situation will further strengthen the results derived above.

In practice, the VC also provides assets other than financial assets to the venture, such as knowledge and network assets. Unless these assets are much more useful for organic growth than for acquisition growth, our results will hold. Extending the analysis, allowing for different types of investors with different assets and examining how this will affect the growth pattern seem to be interesting avenues for future research.

Additionally, note that if organic growth can only occur slowly because the needed resources are provided step-by-step by the

[12] This assumption is crucial. When allowing the gazelle to earn the same interest in its bank account as the bank requires for lending, venture capital would have no effect on the valuation.

venture capitalist, an incumbent acquisition may substantially slow the market penetration of the gazelle. Hence, even if venture capital is available, the incumbent may still have a strong incentive to acquire the target.

5. Policy

Policymakers are concerned with gazelle development and growth; they would like to find an efficient means for gazelle development. The endogenous nature of the buyer's identity, the competition from the incumbent and the determination of the auction price in the present analysis, in addition to the different types of growth strategies available for the gazelle, all imply that the optimal policy is very complicated. Therefore, we will make a couple of remarks about policy. These remarks seem to open an interesting avenue of future investigations.

5.1. Reduction in the interest rate

One of the most discussed means of supporting gazelles is to provide them with financial resources under better financial conditions. To capture this phenomenon in our model, we examine how a reduction in the interest rate, r, affects the equilibrium market structure and the gazelle growth pattern.

High cost of large-scale organic growth, i.e., $I > \bar{I}(d_s, r)$*:* Given that large-scale organic growth is not feasible, i.e., $I > \bar{I}(d_s, r)$, it follows that when r decreases, an acquisition by the gazelle becomes more likely. To analyze this possibility, remember that according to Lemma 1, an acquisition by the gazelle takes place if and only if $v_i - v_g < 0$. In this expression, the incumbent's marginal willingness to pay, $v_i = \pi_i^D(d_s) - \pi_i^D(0)$, is independent of r. On the other hand, we show that the gazelle's marginal willingness to pay, $v_g = \frac{\pi_g^D(0) - \pi_g^D(d_s)}{1+r}$, decreases in r since

$$\frac{dv_g}{dr} = -\frac{\pi_g^D(0) - \pi_g^D(d_s)}{(1+r)^2} < 0$$

As a result, by reducing the interest rate, the government lessens the acquisition cost of the gazelle and thus increases the gazelle's marginal willingness to pay, v_g. As a result, a reduction in the interest rate makes an acquisition more likely for the gazelle.

Low cost of large-scale organic growth, i.e., $I < \bar{I}(d_s, r)$*:* We now analyze the situation after the reduction in the interest rate when $I < \bar{I}(d_s, r)$. The entrepreneurial firm can credibly threaten the incumbent with large-scale organic growth. Then, the value of preemption for the incumbent will be zero, as expected. Moreover, the gazelle's valuation will not change after the decrease in the interest rate. The gazelle has a net gain function defined as follows:

$$N_g(A) = \underbrace{[\pi_g^D(0) - (1+r)A]}_{\text{Acquire}} - \underbrace{[\pi_g^D(0) - (1+r)I]}_{\text{Do not acquire}}, \ \text{if } I < \bar{I}\left(d_s, r\right). \tag{13}$$

Solving for $N_g(A) = 0$, we obtain

$$v_g = I \quad \text{if } I < \bar{I}(d_s, r). \tag{14}$$

As can be observed from the above, the gazelle's marginal willingness to pay in an acquisition is independent of the interest rate when large-scale organic growth is already feasible. Because the gazelle can benefit from a lower interest rate in both financing an acquisition and making an investment in large-scale organic growth, the tradeoff between an acquisition and large-scale growth is not influenced by a reduction in the interest rate.

How is the large-scale organic growth cutoff investment amount, $\bar{I}(d_s, r)$*, influenced by a lower interest rate?* Given that the gazelle does not acquire the target firm in the auction, we analyze how its incentive to make a large-scale organic growth investment will be influenced by a drop in the interest rate. The large-scale organic growth investment cutoff level, $\bar{I}(d_s, r)$, will increase as the interest rate r drops. The lower the interest rate is, the higher $\bar{I}(d_s, r)$ because a decreasing interest rate makes the gazelle more willing to make an investment in large-scale organic growth. The financial capacity of the gazelle improves. We can view the negative relation between the cutoff investment level for large-scale organic growth, $\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0) - \pi_g^D(d_s)}{1+r}$, and the interest rate, r, as follows:

$$\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0) - \pi_g^D(d_s)}{1+r}$$

$$\frac{\partial \bar{I}(d_s, r)}{\partial r} = \left[\pi_g^D(0) - \pi_g^D(d_s)\right]\left(-1\right)(1+r)^{-2}$$

Then, we evaluate the sign of the derivative of $\bar{I}$ with respect to r calculated above,

$$\frac{\partial \bar{I}(d_s, r)}{\partial r} = \frac{-[\pi_g^D(0) - \pi_g^D(d_s)]}{(1+r)^2} < 0$$

$\frac{d\bar{I}(d_s, r)}{dr} < 0$ since we know that $\pi_g^D(0) > \pi_g^D(d_s)$.

Increasing financial capacity due to the drop in the interest rate makes the gazelle more likely to undergo large-scale organic growth. However, this also means that the gazelle can credibly threaten the incumbent with a more probable large-scale organic growth scenario and can decrease the incumbent's preemptive motive for acquisition in the first stage.

Furthermore, when the interest rate drops, the financial capacity of the gazelle increases for both large-scale organic growth and acquisitions. However, due to competition, the gazelle is more willing to make an acquisition in the first stage than a large-scale investment in the second stage. Therefore, the gazelle will save time in competition since making a large-scale investment one period later and an investment (e.g., constructing a warehouse from scratch) will take some time. In the first stage, with the drop in the interest rate, the gazelle's willingness to acquire increases more than that of the incumbent because the incumbent does not need to borrow under any circumstances. This situation implies that an acquisition by the gazelle becomes more likely when the interest rate in the economy decreases because the gazelle can also obtain the target firm's assets at a lower borrowing cost. As an interesting result, better financial conditions for organic growth can actually reduce organic growth and can instead increase acquisition growth.

Proposition 5. A gazelle that receives better financial conditions (lower interest rates r) is more likely to grow through acquisitions for the following reasons:

- (i) A decrease in the interest rate will motivate the gazelle to acquire the target firm by increasing the gazelle's marginal willingness to pay: $\frac{dv_g}{dr} < 0$.
- (ii) A decrease in the interest rate will make the gazelle's acquisition more likely because the gazelle will have a greater opportunity to undergo large-scale organic growth in the second stage due to $\frac{d\bar{I}(d_s, r)}{dr} < 0$. This situation enables the gazelle to pose a credible threat to the incumbent in the first stage. The incumbent's preemptive motive decreases with a credible threat.

5.2. Subsidy for organic growth

Another means of providing financial support to gazelles is directly subsidizing the organic growth of these firms. In the US, for example, one of the main programs to promote small businesses is the Technological Innovation Program (TIP), which subsidizes the commercialization of successful prototypes with up to USD 3 million. This support scheme is available only if the SME markets the product itself or is the leading company in a joint venture (OECD, 2010, p. 106). See OECD (2010) for a listing of similar support schemes for SMEs in all OECD member states. To analyze the effects of a subsidy targeted to gazelles in our model, we examine how a subsidy of S targeted at large-scale organic growth affects the equilibrium market structure and the gazelle growth pattern. In our analysis of the effect of a subsidy on the gazelle's growth pattern, we again distinguish between the case in which large-scale organic growth is feasible and the case in which it is not feasible.

High cost of large-scale organic growth, i.e., $I > \bar{I}(d_s, r)$*:* Here, we assume that if the gazelle were not to acquire the target firm in the auction in stage 1, it would not grow organically on a large scale in stage 2. From Lemma 1, it follows that a gazelle acquisition occurs if and only if $v_i - v_g < 0$. Because the subsidy of S affects neither v_i nor v_g, the support for organic growth, a subsidy, has no impact on the growth pattern of the gazelle when large-scale organic growth has already become infeasible.

Low cost of large-scale organic growth, i.e., $I < \bar{I}(d_s, r)$*:* Let us now examine the case in which $I < \bar{I}(d_s, r)$, i.e., large-scale organic growth is feasible. The gazelle firm can credibly threaten the incumbent with large-scale organic growth, and the value of preemption for the incumbent will be zero. However, the gazelle's valuation will change, as can be observed from the gazelle's net gain function:

$$N_g(A) = \underbrace{[\pi_g^D(0) - (1+r)A]}_{\text{Acquire}} - \underbrace{[\pi_g^D(0) - (1+r)(I-S)]}_{\text{Do not acquire}}, \quad \text{if } I < \bar{I}\left(d_s, r\right) \tag{15}$$

Solving for $N_g(A) = 0$, we obtain

$$v_g = I - S \text{ if } I < \bar{I}(d_s, r). \tag{16}$$

Because the subsidy S can only be used to save the financing cost of organic growth, the tradeoff between an acquisition and large-scale organic growth is affected. The gazelle will acquire the target firm. However, this result is valid as long as $I > S$.

How is the large-scale organic growth investment cutoff level, $\bar{I}(d_s, r)$*, affected by a subsidy targeted at organic growth?* Let us analyze how the incentive to undertake large-scale organic growth changes once a subsidy is given under the condition that the gazelle did not acquire the target firm in the first stage. When the gazelle is provided with a subsidy, an investment in large-scale organic growth will be more affordable for the gazelle. Formally, we know that after a subsidy, large- scale organic growth occurs when

$$\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0) - \pi_g^D(d_s) + rS}{1+r} \quad \text{if } d_s < d_s^{\max} \quad \text{and}$$

$$\bar{I}\left(d_s, r\right) = \frac{\pi_g^D(0) + rS}{1+r} \quad \text{otherwise.}$$

The gazelle will save some interest payment at the amount of rS by borrowing less from the debtors by the amount of S. The gazelle's financial capacity for large-scale organic growth improves after receiving a subsidy from the government. Therefore, $\bar{I}(d_s, r)$ increases due to the subsidy given to the gazelle:

$$\frac{\partial \bar{I}(d_s, r)}{\partial S} = \frac{r}{1+r} > 0 \text{ since } r > 0.$$

Because the subsidy gives a greater opportunity for large-scale organic growth to the gazelle, the gazelle could more credibly threaten the incumbent. Therefore, in the first stage, the incumbent will not be interested in acquiring the target firm, and the value of the preemption move will disappear.

In conclusion, a subsidy for large-scale organic growth implies that large-scale organic growth becomes profitable for the gazelle when it has not obtained the target firm's assets. This, in turn, implies that an acquisition by the gazelle could become more likely since the gazelle could then credibly "threaten" the incumbent in the first stage to grow organically on a large scale in the second stage if it does not obtain the target firm's assets. As an interesting result, subsidies targeted to increase gazelles' organic growth can actually reduce their likelihood of organic growth and instead increase their likelihood of acquisition growth.

Proposition 6. A subsidy targeted to increase the gazelle's organic growth can, in fact, lead to an increase in the acquisition growth: (i) A subsidy, S, will make large-scale organic growth more likely for the gazelle in the second stage due to $\frac{\partial \bar{I}(d_s, r)}{\partial S} > 0$, and therefore, the gazelle will pose a more credible threat to the incumbent in the first stage. The incumbent's preemptive motive will decrease.

One might argue that the key to an efficient gazelle subsidy policy is to target these to specific firms. However, gazelles' growth rates tend to be very erratic, i.e., these firms are essentially 'one-hit wonders', unable to repeat their high growth rates.[13] This phenomenon implies that targeting policies to specific firms seems difficult in practice.

6. Extension

6.1. Labor market effects

The effects of gazelle growth on the demand for labor will depend on several characteristics of gazelle growth. First, they will depend on whether the gazelle's labor investment is a substitute or a complement to its capital investment. For instance, if the capital investment requires that many computer programmers or sales personnel need to be hired, then capital and labor are complements. In this case, L_i^g will be large and employment will increase. However, if the capital investment is in machinery and it replaces low-skilled employees, then capital and labor are substitutes. In this case, L_i^g will be small and employment will decrease.

Second, the effects will depend on whether the gazelle growth mostly replaces the incumbent's sale or if it creates new demand. If gazelle growth creates new demand, then aggregate demand for labor will be high, and L_i^g will be large.

Third, the effects will depend on the type of acquisition growth of the gazelle. If the acquisition is mostly associated with using existing capital from the acquired firm and reducing existing employees, then employment will decrease, i.e., L_i^g will be small. However, if there are complementary labor and capital investments associated with the gazelle's acquisition, employee hiring might actually increase, i.e., L_i^g will be large.

6.2. The incumbent's incentive and opportunity to acquire the gazelle

What would be the effects of allowing the incumbent to acquire the gazelle? Such an acquisition would give rise to a stronger market power effect than the acquisition of the target firm, which implies that an acquisition of the gazelle by the incumbent might be the outcome of the game if such an alternative were incorporated into the model. However, there are a couple of reasons why an acquisition of the gazelle by the incumbent may not occur. First, in most jurisdictions, a merger that concentrates the market too much will not be allowed. In fact, it seems as this phenomenon could explain why Amazon could not acquire Flipkart in the example mentioned in the introduction.[14] Second, when more than one incumbent acquires the gazelle, an acquisition might benefit the non-acquiring incumbents most because they will expand their business following the merger (Norbäck & Persson, 2012). Additionally, this aspect seems to be consistent with our example of Flipkart, in which Walmart (an outsider to the e-commerce market) was able to outbid Amazon (an incumbent) and where a large third player (Snapdeal) was present in the market. Thus, our identified mechanism seems to also be at play when the possibility of acquiring the gazelle was included in the model. However, an interesting avenue for future research would be to extend the analysis to the case in which the possibility of acquiring the gazelle is included in the model, to analyze how the incentives to start a gazelle firm are affected by this possibility and to study the timing of such acquisitions.

[13] See, for instance, Daunfeldt and Halvarsson (2015), Hölzl (2014), Parker, Storey, and van Witteloostujin (2010).

[14] An acquisition of Flipkart by Amazon would likely have been scrutinized by the Competition Commission of India (CCI), given the dominant market share these two entities have in the e-commerce space—approximately 70 percent collectively (see Flipkart likely to go with Walmart even as Amazon makes a last-ditch bid: report BusinessToday, May 3, 2018, www.businesstoday.in/current/corporate/flipkart-walmart-amazon-acquire-buy-deal-stake-softbank/story/276148.html).

7. Conclusion

Gazelles can either grow organically by establishing a new facility or acquiring a suitable target firm to grow. We show that the lower cost of organic growth can increase the incentives for acquisition growth. This result seems counterintuitive at first sight but makes sense as soon as one takes into account how the acquisition price of a target firm is determined. When the cost of organic growth is high for the gazelle, the incumbent will benefit considerably from acquiring the target firm because the incumbent will thereby protect its market power in the product market. When the cost of organic growth drops, the incumbent takes into account that if it acquires the target firm, the gazelle will invest organically in order to grow, and therefore, the acquisition will not be sufficient to protect the incumbent's market power. The gazelle can acquire the target firm at a good price and will prefer acquisition growth to organic growth.

One of the major obstacles to gazelle growth is the cost of financing. Receiving equity from a venture capital firm will reduce the gazelle's financing burden for growth. The financial strength gained from the venture capital funds will reduce the incumbent's opportunity and motivation to impede the gazelle's growth by making the acquisition itself. Therefore, venture capital support will induce the gazelle's acquisition.

These results suggest that financial policies supporting the growth of gazelles may, in particular, ignite gazelle growth through acquisitions because these policies not only reduce the financial cost for the gazelles but also reduce the possibility for incumbents to use strategic gazelle growth acquisitions. Policies improving both the financial market for gazelles and the M&A market could then substantially spur gazelle growth. In contrast, the existing policies do, to a large extent, exclusively focus on stimulating the organic growth of small firms, and there is a lack of policies that stimulate ownership transfers.

Policymakers are interested in promoting gazelle development since gazelles create many jobs through organic growth. However, if gazelles grow via acquisition, it is possible that no new jobs are directly created, so policymakers might be less interested in promoting the growth of gazelles via acquisition. In contrast, if there are complementary labor investments associated with the gazelle's acquisition, the hiring of new employees might actually increase. In fact, using panel data on Swedish firms over a 10-year period, Lockett, Davidsson, Wiklund, and Girma (2011) find that previous acquisition growth has a positive effect on current organic growth, which will in turn increase new employment in the future. Thus, policymakers might consider the possibility that acquisition and organic growth by gazelle firms are complements.

The model has several limitations. The first limitation is that there is only one incumbent, one gazelle, and one asset that belongs a target firm and is up for acquisition. If we were to add multiples of any of these three categories, the model would be more complicated. However, the key assumption is that there are sufficiently few of these categories to have the mechanisms identified here in play. If there were many assets (target firms) to acquire, the incumbent would not be able to easily pre-empt the gazelle; if there were many gazelles, the incumbent presumably would not be able to pre-empt them all; and if there were many incumbents, the strategic motive to acquire would be much lower. Thus, the model would not apply to markets with a very low entry cost, small network effects and small values of marketing.

Second, we have assumed that the incumbent has no use of the target's asset to highlight the strategic motive. If the incumbent has use of the target's asset, the analysis will be more involved, but the main insight will be that the value for the incumbent of acquiring the target will increase, and we will predict fewer acquisitions made by the gazelle. However, unless the synergies between the incumbent and target are too large, our analysis above will be valid.

In this study, we have not taken asymmetric information problems into account in detail, such as in the gazelle's venture capital financing. It is likely that the gazelle owner has an informational advantage by knowing the quality of the business idea better than the venture capitalist. In future research, it would be interesting to extend the theoretical model by allowing for asymmetric information.

Moreover, gazelle growth is often characterized by uncertainty both on the demand side and on the technology development side, which might affect the choice of growth mode. In particular, large-scale organic growth might be costly since the time between the onset of the investment and the use of the new plants might be long. Examining these aspects seems to be a fruitful avenue for future research.

Appendix A

A.1. Cournot model

In the Cournot oligopoly model, we consider two firms in an industry: an established market-leading firm, called the incumbent, and an entrepreneurial firm that has recently started up and has the potential to grow quickly, called the gazelle. We characterize each firm with zero total cost except the distribution cost of the gazelle, d, in small-scale organic growth. The firms produce identical goods and are price takers. The market-demand function is given by

$P(Q) = a - bQ$ and $a, b > 0$, $a > d$, where $Q = q_g + q_i$.

In this two-seller game, each firm's action is defined as choosing its production level. First, we assume here that both the incumbent and the gazelle choose their actions simultaneously. Thus, each firm j chooses $q_j \in A_j \equiv [0, \infty)$, $j = 1, 2$. Then, the payoff function of each firm j is its profit function, which is defined by: $\pi_j(q_g, q_i) = P(q_g + q_i)q_j - TC_j(q_j)$, where $TC_j(q_j) = 0$, except that

$TC_g(q_g) = dq_g$ under the condition of small-scale organic growth. Based on the simultaneous move assumption, we first calculate the Cournot-Nash equilibrium. The triplet $\left\{P^c, q_i^c, q_g^c\right\}$ is a Cournot-Nash equilibrium if the following hold:

(1) Given $q_g = q_g^c$, q_i^c solves $max_{q_i}\pi_i\left(q_i, q_g^c\right) = P\left(q_i + q_g^c\right)q_i - TC_i(q_i) = \left[a - b\left(q_i + q_g^c\right)\right]q_i - 0$ Given $q_i = q_i^c$, q_g^c solves $max_{q_g}\pi_g\left(q_i^c, q_g\right) = P\left(q_i^c + q_g\right)q_g - TC_g(q_g) = \left[a - b\left(q_i^c + q_g\right)\right]q_g - dq_g$

(2) $p^c = a - b\left({}_i{}^c + q_g^c\right)$, $P^c, q_i^c, q_g^c \geqslant 0$.

The incumbent firm's profit maximization problem yields the first-order condition, given by $\frac{\partial\pi_i\left(q_i, q_g\right)}{\partial q_i} = a - 2bq_i - bq_g = 0$. The second-order condition guarantees that a global maximum is satisfied because $\frac{\partial^2\pi_i}{\partial(q_i)^2} = -2b < 0$ for every q_i and q_g. If we solve for q_i as a function of q_g, we will obtain the best-response function of the incumbent, denoted as $R_i(q_g)$:

$q_i = R_i(q_g) = \frac{a - bq_g}{2b} = \frac{a}{2b} - \frac{1}{2}q_g$.

Similarly, we can obtain the gazelle's best-response function from the first-order condition $\frac{\partial\pi_g\left(q_i, q_g\right)}{\partial q_g} = a - 2bq_g - bq_i - d = 0$. $R_g(q_i)$ is given by:

$q_g = R_g(q_i) = \frac{a - bq_i - d}{2b} = \frac{a - d}{2b} - \frac{1}{2}q_i$.

Due to the difference in the cost structure between the incumbent and the gazelle, their best-response functions do not look exactly the same. The Cournot equilibrium output levels can be calculated by solving these two best-response functions. The Cournot equilibrium quantity for the incumbent is given by

$$q_i^c = \frac{a}{2b} - \frac{1}{2}\left(\frac{a - d}{2b} - \frac{1}{2}q_i\right)$$

$$q_i^c = \frac{a}{2b} - \frac{a}{4b} + \frac{d}{4b} + \frac{1}{4}q_i$$

$$q_i^c = \frac{a + d}{3b}$$

The Cournot equilibrium quantity for the gazelle is given by

$$q_g^c = \frac{a - d}{2b} - \frac{1}{2}\left(\frac{a}{2b} - \frac{1}{2}q_g\right)$$

$$q_g^c = \frac{a - d}{2b} - \frac{a}{4b} + \frac{1}{4}q_g$$

$$q_g^c = \frac{a - 2d}{3b}$$

Hence, the aggregate industry-output level is $Q^c = q_i^c + q_g^c = \frac{2a - d}{3b}$, and the Cournot equilibrium price is $P^c = a - bQ^c = a - b(\frac{2a - d}{3b}) = \frac{a + d}{3}$.

On the other hand, in our model, the game between the incumbent and the gazelle is a sequential-moves game, called a Stackelberg game in the literature. The incumbent is the leader and moves first, whereas the gazelle is the follower and moves after observing the output level chosen by the incumbent. This game has a continuum of subgames indexed by the output level chosen by the incumbent in the first stage. A finite-horizon dynamic game is generally solved backward. We look for a subgame perfect equilibrium for this game. Therefore, we first analyze the gazelle's action in the last period, assuming that the actions in the previous period are given. Then, we go back one period and analyze the incumbent's action given the strategy of how the gazelle chooses its output level based on the first-period action. In the second period, only the gazelle moves and chooses q_g to maximize its profit, taking the incumbent's quantity produced, q_i, as given. The second-period problem of the gazelle is identical to the problem solved by the gazelle in a Cournot market structure. The maximization gives the same best-response function for the gazelle: $R_g(q_i) = \frac{a - bq_i - d}{2b} = \frac{a - d}{2b} - \frac{1}{2}q_i$. This function $R_g(q_i)$ constitutes the gazelle's strategy for this game. On the other hand, in the first period, the incumbent is able to calculate how the gazelle will best reply to its choice of quantity. The incumbent chooses q_i^s to maximize its payoff function, π_i^s.

$$max_{q_i}\pi_i^s = P(q_i + R_g(q_i))q_i - TC_i(q_i)$$

$$\pi_i^s = \left[a - \left(\frac{a-d-bq_i}{2b} + q_i\right)\right]q_i - 0$$

$$\pi_i^s = aq_i - bq_i^2 - \frac{a}{2}q_i + \frac{d}{2}q_i + \frac{b}{2}q_i^2$$

$$\frac{\partial \pi_i^s}{\partial q_i} = \frac{a}{2} - bq_i^s + \frac{d}{2} = 0$$

$$q_i^s = \frac{a+d}{2b}$$

As expected, the incumbent produces a higher quantity than the Cournot equilibrium quantity: $q_i^s > q_i^c$.
Under the sequential-moves market structure, we calculate the quantity chosen by the gazelle by substituting q_i^s into $R_g(q_i)$:

$$q_g^s = \frac{a-d}{2b} - \frac{1}{2}q_i^s = \frac{a-d}{2b} - \frac{1}{2}\left(\frac{a+d}{2b}\right)$$

$$q_g^s = \frac{a-3d}{4b}$$

On the other hand, the quantity level of the gazelle drops compared to the Cournot equilibrium quantity: $q_g^s < q_g^c$.

A.2. Proof of proposition 3

Lemma 1 implies that the firm i with the highest valuation obtains the assets at a price of v_i.

(i) If $I > \bar{I}(d_s, r)$ and $d_s > d^*$: In this interval, the gazelle g will not undertake large-scale organic growth. It will grow organically on a small scale. On the other hand, it then follows from Lemma 1 that the incumbent i acquires the target firm and its distribution network at a price of $\frac{\pi_g^D(0)}{1+r}$ when $d_s \geqslant d^{\max}$ and at a price of $\frac{\pi_g^D(0)-\pi_g^D(d_s)}{1+r}$ when $d_s < d^{\max}$.
(ii) If $I > \bar{I}(d_s, r)$ and $d_s < d^*$: In this interval, the gazelle g will not be able to undertake large-scale organic growth. However, it then follows from Lemma 1 that the gazelle g will obtain the target firm's assets at a price $[\pi_i^D(d_s) - \pi_i^D(0)]$ when it makes the acquisition.
(iii) If $I < \bar{I}(d_s, r)$: In this interval, the gazelle g will grow by acquisition, although it could also choose to grow organically at a large scale. It then follows from Lemma 1 that the gazelle g obtains the assets at a price of 0 in the case of the acquisition.

A.3. Derivation of equation 8

First, note the following:

$$v_i(d) - v_g(d) = \pi_i^D(d) - \pi_i^D(0) - \left(\frac{\pi_g^D(0) - \pi_g^D(d)}{1+r}\right) \tag{A.1}$$

$$= \pi_i^D(d) + \frac{\pi_g^D(d)}{1+r} - \left(\pi_i^D(0) + \frac{\pi_g^D(0)}{1+r}\right)$$

$$= \Pi_i(d) - \Pi_g(0)$$

where $\Pi_i(d) = \pi_i^D(d) + \frac{\pi_g^D(d)}{1+r}$ is the aggregate profit under the incumbent's ownership of the assets and $\Pi_g(0) = \pi_i^D(0) + \frac{\pi_g^D(0)}{1+r}$ is the aggregate profit under the gazelle's ownership of the assets. Hence, distribution costs d affect only profits under the incumbent's ownership. To study how $v_i - v_g$ reacts to changes in d, we can simply explore aggregate profit $\Pi_i(d)$ when the incumbent buys the target firm. The firm's profits under an incumbent's acquisition of the target firm are as follows:

$$\Pi_i(d) = \pi_i^D(d) + \frac{1}{1+r}(\pi_g^D(d))$$

$$\pi_i^D(d) = P(q_i + q_g)q_i \tag{A.2}$$

$$\frac{1}{1+r}(\pi_g^D(d)) = \frac{1}{1+r}[P(q_i + q_g)q_g - dq_g]. \tag{A.3}$$

The FOCs are as follows:

$$\frac{\partial \pi_i^D}{\partial q_i} = P + P'q_i = 0 \tag{A.4}$$

$$\frac{\partial \pi_g^D}{\partial q_g} = \frac{1}{1+r}\left(P + P'q_g - d\right) = 0 \qquad \text{(A.5)}$$

$$\Rightarrow P + P'q_g - d = 0.$$

We know that $Q = q_i + q_g$ and $\frac{dQ}{dd} = \frac{dq_i}{dd} + \frac{dq_g}{dd}$. Differentiating (A.4) with respect to q_i, q_g, and d and solving for $\frac{dq_i}{dd}$, $\frac{dq_g}{dd}$ and $\frac{dQ}{dd}$ implies the following:

$$\frac{d}{dd}\left(P + P'q_i\right) = 0\frac{dP}{dQ}\frac{dQ}{dd} + \frac{dP'}{dQ}\frac{dQ}{dd}q_i + P'\frac{dq_i}{dd} = 0$$

$$P'\left(\frac{dq_i}{dd} + \frac{dq_g}{dd}\right) + P''q_i\left(\frac{dq_i}{dd} + \frac{dq_g}{dd}\right) + P'\frac{dq_i}{dd} = 0$$

$$\left(P' + P''q_i + P'\right)\frac{dq_i}{dd} + \left(P' + P''q_i\right)\frac{dq_g}{dd} = 0$$

$$(P' + P' + P''q_i)dq_i + (P' + P''q_i)dq_g = 0$$

$$\Rightarrow dq_g = \frac{-(2P' + P''q_i)dq_i}{(P' + P''q_i)} \qquad \text{(A.6)}$$

Differentiating (A.5) with respect to q_i, q_g, and d and solving for $\frac{dq_i}{dd}$, $\frac{dq_g}{dd}$ and $\frac{dQ}{dd}$ implies the following:

$$\frac{d}{dd}(P + P'q_g - d) = 0$$

$$\frac{dP}{dQ}\frac{dQ}{dd} + \frac{dP'}{dQ}\frac{dQ}{dd}q_g + P'\frac{dq_g}{dd} - 1\frac{dd}{dd} = 0$$

$$P'\left(\frac{dq_i}{dd} + \frac{dq_g}{dd}\right) + P''q_g\left(\frac{dq_i}{dd} + \frac{dq_g}{dd}\right) + P'\frac{dq_g}{dd} - 1\frac{dd}{dd} = 0$$

$$(P' + P''q_g)\frac{dq_i}{dd} + (P' + P''q_g + P')\frac{dq_g}{dd} - 1\frac{dd}{dd} = 0$$

$$(P' + P''q_g)dq_i + (P' + P' + P''q_g)dq_g - 1dd = 0$$

$$\Rightarrow (P' + P''q_g)dq_i + (P' + P' + P''q_g)dq_g = dd \qquad \text{(A.7)}$$

Inserting (A.6) into (A.7), we obtain the following:

$$\left(P' + P''q_g\right)dq_i + \left(2P' + P''q_g\right)\frac{-(2P' + P''q_i)dq_i}{(P' + P''q_i)} = dd$$

$$(P' + P''q_i)(P' + P''q_g)dq_i + (2P' + P''q_g)[-(2P' + P''q_i)]dq_i = (P' + P''q_i)dd$$

$$([(P')^2 + P''P'q_g + P''P'q_i + (P'')^2q_iq_g] - [4(P')^2 + 2P'P''q_i + 2P''q_gP' + (P'')^2q_iq_g])dq_i$$

$$= (P' + P''q_i)dd$$

$$(-3(P')^2 - P''P'q_g - P''P'q_i)dq_i = (P' + P''q_i)dd$$

$$\frac{dq_i}{dd} = \frac{(P' + P''q_i)}{-3(P')^2 - P''P'q_g - P''P'q_i}$$

$$\frac{dq_i}{dd} = \left(-1\right)\frac{(P' + P''q_i)}{P'\left[3(P') + P''q_g + P''q_i\right]} = \left(-1\right)\frac{(P' + P''q_i)}{P'\left[3P' + P''\left(q_g + q_i\right)\right]} = \left(-1\right)\frac{(P' + P''q_i)}{P'[3P' + P''Q]}$$

$$\Rightarrow \frac{dq_i}{dd} = -\frac{(P' + P''q_i)}{D} > 0 \quad \text{since we know that } P' < 0 \text{ and } P'' < 0$$

and $D = P'[3P' + P''Q] > 0$.

In summary, when we solve for $\frac{dq_i}{dd}$, $\frac{dq_g}{dd}$ and $\frac{dQ}{dd}$, we obtain the following inequalities:

$$\frac{dq_i}{dd} = -\frac{P' + P''q_i}{D} > 0, \quad \frac{dq_g}{dd} = \frac{2P' + P''q_i}{D} < 0, \qquad \text{(A.8)}$$

$$\frac{dQ}{dd} = \frac{P'}{D} < 0,$$

where $D = P'[3P' + P''Q] > 0$ and $Q = q_i + q_g$. We can then define the (reduced-form) aggregate profits under incumbent ownership of the assets as a function of d:

$$\Pi_i(d) = \pi_i^D(q_i(d), q_g(d), d) + \pi_g^D(q_i(d), q_g(d), d) \tag{A.9}$$

Taking the total derivative in d and using (A.2), (A.3), (A.4) and (A.5), (A.9) can be written as follows:

$$\frac{d\Pi_i}{dd} = P'q_i\frac{dq_g}{dd} + P'q_g\frac{dq_i}{dd} - q_g \tag{A.10}$$

Using the first-order conditions (A.4) and (A.5) and that $\frac{dQ}{dd} = \frac{dq_i}{dd} + \frac{dq_g}{dd}$ must hold, (A.10) can be rewritten as follows:

$$\frac{d\Pi_i}{dd} = P'q_i\left(\frac{dQ}{dd} - \frac{dq_i}{dd}\right) + \underbrace{[P'q_g]}_{d-P}\frac{dq_i}{dd} - q_g$$

$$\frac{d\Pi_i}{dd} = P'q_i\frac{dQ}{dd} - \underbrace{[P'q_i]}_{-P}\frac{dq_i}{dd} + d\frac{dq_i}{dd} - P\frac{dq_i}{dd} - q_g$$

$$\frac{d\Pi_i}{dd} = P'q_i\frac{dQ}{dd} + P\frac{dq_i}{dd} - P\frac{dq_i}{dd} + d\frac{dq_i}{dd} - q_g$$

$$\Rightarrow \frac{d\Pi_i}{dd} = P'q_i\frac{dQ}{dd} + d\frac{dq_i}{dd} - q_g. \tag{A.11}$$

Finally, from (A.1), $v_i(d) - v_g(d) = \Pi_i(d) - \Pi_g(0)$. It then follows that

$$\frac{d(v_i - v_g)}{dd} = P'q_i\frac{dQ}{dd} + d\frac{dq_i}{dd} - q_g$$

$$\frac{d(v_i - v_g)}{dd} = \frac{dQ(d)}{dd}P'q_i(d) + \frac{dq_i(d)}{dd}d - q_g(d).$$

This equation is Eq. (8) in Section 3.

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