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Do New Competitors, New Customers, New Suppliers, ... Sustain, Destroy or Create Competitive Advantage?

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Do new competitors, new customers, new suppliers,... sustain, destroy or create guaranteed profitability?[1]

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Abstract

We examine the effect of entry on the value appropriated by an incumbent. By "entrant we mean at any level of the value chain from raw material suppliers to buyers. Our specific concern is whether competition guarantees the incumbent some positive minimum level of profit. We demonstrate that the net effect of entry is subtle even when the entrant is a perfect imitator. On the one hand, entry typically results in greater value creation. This tends to soften competition and, thereby, lower the incumbents minimum level of appropriation. At the same time, however, entry also creates new competitive alternatives for the existing agents, which tends to have the opposite effect. We contribute to a growing stream of strategy theory based upon coalitional game theory.

Introduction

Many of the subjects of interest in strategy involve new entrants into an existing economic activity, modeled as an increase in the number of agents in a game. Some examples: a firm entering an industry with a new substitute or complementary product or service, or a new technology, or simply more capacity to produce an identical product; a firm developing the capability to imitate an incumbent's activities, and contemplating entry; a new customer or segment changing demand for some product or service; an entrepreneurial venture altering the game incumbents are playing; a spin-off or divestiture creating a newly independent entity; a new source of supply for inputs; an individual joining a social network, or a firm joining an information exchange; a firm entering a perfectly competitive market; a country starting to compete globally; or new firms entering in response to a patent expiration or change in regulation, etc. Other applications can be thought of as reversing the process of adding agents, e.g., industry consolidation, a merger, firm exit, employees acting in unison through a union or professional association,...

Coalitional game theory has proven to be a flexible, tractable and powerful tool with which to model a wide variety of strategy topics.[1] One of the central insights arising from this line of work is that competition places upper and lower bounds on the value an agent can appropriate given the various joint opportunities to create value among the agents in the game. The theory draws conclusions based on either the structure of equilibria – e.g., are there equilibria in which firms might earn zero profits, must earn zero profits, or must earn profits that are always positive? – or the impact of parameter changes on equilibria –

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[1]The coalitional approach to strategy was first suggested by Brandenburger and Stuart (1996) who, in particular, discussed the utility of the "value-added" concept in analyzing business strategy; also see Brandenburger and Stuart (2006) and MacDonald and Ryall (2004). Lippman and Rumelt (2003) discuss the benefits of coalitional game theory for strategy research and compare various well-known equilibrium concepts for coalitional games. Gans, Adner and Zemsky (2006) use value-added concepts to analyze sustained profitability. De Fontenay and Gans (2004) analyze the strategic implications of outsourcing. Ryall and Sorenson (2006) use these methods to analyze positional advantage in productive networks. More recently, Montez et al. (2013) introduce a formal definition of competitive intensity for an agent and demonstrate its effects on appropriation. Also, a new line of empirical work is developing in strategy which is designed to examine the claims of the theoretical results. Papers in this group include Chatain (2011, 2013), Grennan (2013), Bennett (2013), and Obloj & Sengul (2012), and Obloj & Zemsky (2014).

e.g., if demand increases, must a firm's minimum and/or maximum equilibrium profits rise? In this paper we examine the impact of entry on the minimum profits of incumbent agents (e.g., firms, consumers, suppliers,...).

Specifically, we study the class of general, coalitional games within which any of the aforementioned examples can be described as special cases. Our research question is: how does adding an agent change an incumbent agent's minimum equilibrium payoff? We focus on the minimum – specifically whether the minimum payoff is zero (i.e., equivalent to the incumbent agent's next best alternative). This focus on the minimum payoff and whether it is zero is not dictated by our methodology: similar reasoning can be applied to whether the minimum takes on some other value, or whether the maximum does so, etc. Instead, as argued elsewhere (MacDonald and Ryall, 2004b), whether the minimum is positive is a question of special interest since it describes whether the forces of competition alone guarantee the incumbent an economic profit. We are thus able to provide a complete answer to questions such as: if competition guarantees a firm profit, does entry remove this guarantee?[2]

MacDonald and Ryall (2004) provide a complete characterization of an agent's having guaranteed profit in a coalitional game, i.e., an agent's minimum equilibrium payoff is positive if and only if certain conditions are satisfied. Loosely, the basic result is that there are exactly two opposing entities that shape how value must be distributed in equilibrium: (i) how much economic value is produced in aggregate from the economic activities in which the agents actually engage; and (ii) how much value could be generated via the alternative opportunities available to the various groups of agents were those groups to transact independently. The value produced must ultimately be distributed among agents. The more there is to distribute, the more ways there are to distribute it while still dominating agents' alternative opportunities. Thus, other things equal, more value to distribute widens the

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[2]In earlier papers we used the term "competitive advantage" to describe "supra-normal profit guaranteed by competition." However, this term has conflicting meanings and, more importantly, it obscures a key distinction in that it lumps competitive reasons for profitability together with others – such as luck, connections to regulators, negotiating skill, etc. Thus, we will say "guaranteed profit" to refer to games in which the structure of competition guarantees an agent a strictly positive level of value appropriation (supra-normal profit).

range of payoffs an agent can earn in equilibrium, including lowering (at least weakly) the minimum. On the other hand, agents' alternatives constrain the ways in which the value produced can be distributed while dominating those alternatives. More/better alternatives make this effect more powerful, thereby narrowing the range of equilibrium payoffs for an agent, including increasing (at least weakly) the minimum. In what follows we will refer to the impact of agents' alternatives as "competition."

The novelty in this paper is that it provides a complete description of how entry affects incumbent guaranteed profitability, e.g., if competition guarantees profits pre-entry, does entry affect this guarantee? The general economic tensions – arising from (i) and (ii) above – must continue to operate. Thus, the question becomes: how does entry simultaneously influence value ultimately produced and the values of alternative activities available to the agents?

Our first collection of propositions are of the following form: an incumbent has guaranteed profits pre-entry, but not post entry, if and only if condition X is satisfied in the pre-entry game but not in the post-entry game; i.e., a complete description of the features of the pre-and post-entry games that lead to entry *destroying* guaranteed profits. Next, we show that condition X always includes bounds on the added value (defined formally below) of the entering agent. We go on to provide similar complete descriptions of the conditions under which entry creates guaranteed profits, or sustains them, or neither creates nor destroys them, and then show these conditions include bounds on the added value of the entering agent.

We illustrate all of these Propositions using variations on a simple market example in which an incumbent has limited capacity and consumers have demands for multiple goods that form a system, e.g., various components making up a video system. The example illustrates how the analysis operates, but is of independent interest for the following reason. In each version, the entrant has all the capability of the incumbent – it could replace the incumbent in any economic interaction with no loss in value to the participants. However,

depending on the nature of compatibility between the incumbent's and entrant's products, entry can have many different effects on the incumbent: eliminating any prospect of guaranteed profit, stimulating competition that ensures positive guaranteed profit, or even guaranteeing the incumbent profit that exceeds its maximum pre-entry profit. The differences among these outcomes are a consequence of the various ways entry affects competition. Simply knowing that an entrant can do anything the incumbent can do is not nearly enough to know how entry will affect the incumbent because entry may have many effects beyond simply replicating its capabilities.

A simple, but important, insight that underlies our analysis is that the pre- and post-entry situations have much in common. That is, the two situations are not simply a pair of games with differing numbers of agents. Instead, adding an agent brings new value creation opportunities while leaving pre-existing opportunities unchanged. It follows that entry's impact on an incumbent's minimum payoff comes via exactly three avenues. First, the value created by all agents in the pre-entry market is exactly the value that they share. Post-entry, obtaining this value becomes one of the alternatives available to the original collection of agents; i.e., the entrant cannot force them to interact with it, so they can always continue to do what they were already doing before entry. Second, entry opens up a specific alternative for the incumbent, i.e., to create value by interacting only with the entrant. Third, entry creates new opportunities for the other groups (that may or may not include the incumbent) containing some but not all of the agents to produce value with the entrant. New alternatives of each of the three varieties have different effects. Our second set of results extends our understanding of how entry impacts guaranteed profits by exploring the operation of these three effects one at a time. For example, how does entry impact guaranteed profits if the sole effect of entry is to increase total value created?

In what follows we provide and discuss the coalitional game formalism employed for our analysis; readers familiar with MacDonald and Ryall (2004) may wish to go directly to Section . We then present the characterizations of entry destroying, sustaining, creating, or

neither creating nor destroying guaranteed profits. In this section, we also introduce and discuss the market example. Finally we present the just-described second set of results.

Setup and a Key Preliminary Result

This section describes the coalitional model and how value creation opportunities constrain the ways in which value can be appropriated. We highlight three assumptions that are important for interpretation of the model and out results. Finally, we describe how competition can guarantee an incumbent strictly positive economic profit.

The model

We model any situation in which agents create and appropriate economic value as a coalitional game. Such games consist of two components. First, there is a set of agents, $N = \{1, ..., n\}$, $1 \leq n < \infty$. These agents act independently and are assumed to be self-interested; i.e., any transactions between/among agents are "arms length." Any group of agents including at least one agent from N, but not every agent in N, is denoted G. Second, the agents in N ultimately create some amount of value, V, via their economic interactions. For example, some firms might purchase inputs from suppliers, turn them into products or employ them to deliver services, with other firms or consumers making use of the goods or services. In this instance V represents the total value to whoever ultimately enjoys the good or service, less the total resource cost of producing it. But any group of agents, G, always has the option to produce value by limiting themselves to activities involving only the agents in G; the total value available to G, were it to act on this alternative, is denoted v_G. For example, each individual always has the option of not participating at all, engaging instead in their next best alternative. Any group of two agents always has the option of each engaging in their individual next best alternative, or the pair acting on some alternative involving both agents. In this case v_G would be the larger of the sum of the individual alternatives and

5

the value created by the agents working together; likewise for any group G. It is important to be clear that V is the value that N ultimately creates. The role of the v_G values is to constrain how V is distributed; more on this point shortly.

Summing up, a coalitional game includes a list of agents, N, an aggregate amount of value created via the economic activity, V, and, for every group G, an amount of value the agents in G could produce on their own, v_G.[3]

Given an economic activity described by N, V and the v_G values, what determines feasible range of value appropriation for each agent? There are two conditions, referred to as *feasibility* and *stability*. Since V is the aggregate value produced, it must also be the aggregate value appropriated. Let π_i denote the value appropriated by agent i. This feasibility condition is

$$\sum_{i \in N} \pi_i = V. \tag{1}$$

Second, if agents willingly create V, it must be that the agents in any group G cannot all be made strictly better off by engaging in the other alternative activities avalable to the group. This implies the stability condition:

$$\text{for all } G, \sum_{i \in G} \pi_i \geq v_G. \tag{2}$$

If value is appropriated in a way that satisfies (2), appropriation is immune from competition from alternatives, viz. it is "stable".

Typically, there are many ways V can be distributed – i.e., many values for $\pi_1, ..., \pi_n$ that satisfy (1) and (2). Thus, feasibility and competition alone do not completely determine how value is appropriated. However, since the impact of the competing alternatives is entirely summarized by the stability condition, to understand the role of competition, we need go no further than studying feasible and stable distributions of value. The novelty in this paper is

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[3]In order to avoid trivial cases, assume that adding a player to a group never reduces the value the group can create. The added agent can always do nothing, thereby leaving value creation possibilities for the group unchanged; this implies $V \geq v_G$. Also, we normalize so that for every agent i, $v_{\{i\}} = 0$.

exactly its results on how feasible and stable distributions change when an agent is added to the market. To put it differently, V determines how much value will be appropriated, (2) determines how competition restricts the pattern of appropriation. The determination of precisely which of the feasible and stable patterns of appropriation ultimately occurs is the result of other activities – essentially, all the ways agents are induced to part with value beyond the constraints imposed by stability – traditionally lumped together and referred to as "bargaining."

Below we make use of the notion of an agent's added value. Specifically, agent i's *added value* is

$$av_i \equiv V - V_{-i},$$

where V_{-i} is defined to be the value that can be created by the group of all agents *other than* i, i.e., $v_{N\setminus\{i\}}$. No feasible and stable distribution can involve $\pi_i > av_i$ since this implies less than V_{-i} is left for the other agents, who can always obtain V_{-i} without i. Note that $av_i > 0$ is necessary for $\pi_i > 0$.

The coalitional model makes three important assumptions that deserve discussion. First, all agents measure value in the same units (typically, monetary). When this is the case, it is possible to talk about the "total value created" or the "total received" by some group of agents. This assumption does not mean agents attach the same value to some item or activity, just that the different values are denominated in the same units. Thus, for example, if a consumer values a service provided by some firm at \$5, and the cost to the firm of providing this service is \$3, then providing the service generates \$2 in value. Second, agents engage in economic activities voluntarily. With this assumption, an agent engages in an activity because it is best for the agent among all that are available, not because it is a requirement. This is important because competition has a great deal to do with the alternatives available to agents, which matter little if agents cannot freely select among them. Finally, agents agree on the value created by any activity. Under this assumption, it is possible to discuss how created value is to be distributed (e.g., the firm and the consumer in the first part of

7

this paragraph agree that their transaction creates \$2 in value).

These three assumptions focus our analysis squarely on competition. Agents can transact with one another easily since they measure value in the same units; they can act on whatever alternatives are available; and they agree on the amount of value that can be generated by their various alternatives. When this is the case, agents choose an activity over the competing alternatives because the value they obtain by doing so dominates what they can obtain by making a different choice. Finally, if aggregate value is not maximized, then: i) there is some other set of activities that produces more value; ii) all the agents know and agree on this; and iii) since all measure value the same way, every agent can be made better off by pursuing the more valuable activities. Thus V is always equal to the maximum value the agents in N can create.

When does competition guarantee profits?

Our focus is on the way entry impacts the incumbent's minimum profitability guaranteed by competition. That is, the value an incumbent $f \in N$ can appropriate – consistent with competition, as described by feasibility and stability – is always at least as large as some number, $\pi_f^{\min}$, no greater than another number, $\pi_f^{\max}$, where $\pi_f^{\min} \leq \pi_f^{\max}$, and may be anything between $\pi_f^{\min}$ and $\pi_f^{\max}$. Formally, we focus on whether $\pi_f^{\min} > 0$, where $\pi_f^{\min}$ is the value of the following linear program: choose $\pi_1, ..., \pi_n$ to minimize π_f subject to (1) and (2). An analogous calculation yields $\pi_f^{\max}$.

MacDonald and Ryall(2004) describe an economic tension that is necessary and sufficient for competition to guarantee an agent in a coalitional game positive profit, i.e., $\pi_f^{\min} > 0$. To see how this tension operates, suppose that $\pi_f = 0$. Inspecting (1) and (2) *with $\pi_f = 0$ imposed*, the answer is affirmative if and only if V is sufficiently large. That is, if V is large enough, one can always find $\pi_1, ...\pi_n$ such that (2) can be satisfied with $\pi_f = 0$. Intuitively, if $\pi_f = 0$, it is easier for the incumbent to make acting on some alternative involving itself attractive to other agents; i.e., the incumbent can offer to accept some small share of the

8

value produced by the alternative. If such overtures are to fail, so that $\pi_f^{\min} > 0$, it must be that the other agents are appropriating enough that acting on an alternative involving the incumbent is unattractive despite its being willing to be involved in some alternative for a small share of the resulting value. If V is large enough, then there is always a way that it can be distributed among the other agents so as to accomplish this. Indeed, there is a critical value of V, which MacDonald and Ryall (2004) call the incumbent's *minimum value*, denoted mv_f, such that

$$\pi_f^{\min} = 0 \text{ if and only if } V \geq mv_f, \tag{3}$$

or, equivalently, since $\pi_f^{\min}$ cannot be negative,

$$\pi_f^{\min} > 0 \text{ if and only if } V < mv_f. \tag{4}$$

Simple as (3) and (4) are, they describe all the economic forces that determine whether competition guarantees the incumbent positive appropriation. That is, if $V < mv_f$, the forces of competition – i.e., the possibility of acting on alternatives involving the incumbent – are too powerful to permit the incumbent zero appropriation. When this is the case, competition guarantees that when the most valuable activities (i.e., those which generate V) actually occur, the incumbent *must* have positive appropriation. When $V \geq mv_f$, the incumbent *might* appropriate positive value (i.e., provided $\pi_f^{\max} > 0$), but the reason will not be the result of competitive forces – the most competition actually guarantees is zero.

Example: the tension that guarantees appropriation

Suppose there is one incumbent firm, and two buyers. The incumbent has one unit of capacity and can produce one component of a two-component system at zero cost. For example, the two components might be a streaming media player and a high definition TV. Buyer 1 values a complete system at $30, but also has a use for one component on a standalone basis, valuing

9

it at $10; e.g., he might connect the media player to his laptop, or use a game console to provide input to his HDTV. Similarly, buyer 2 values a complete system at $30, but values a single component of either type at just $5.

Let π_f and π_i denote appropriation by the incumbent and buyer i, respectively, with $i = 1, 2$. The greatest amount of economic value is generated by the incumbent employing its sole unit of capacity to produce a component buyer 1 values, and selling it to buyer 1. This results in $10 in value being created, i.e., $V = 10$. The *feasibility* condition is, therefore,

$$\pi_f + \pi_1 + \pi_2 = 10.$$

Feasibility is consistent with buyer 2 appropriating; i.e., $\pi_2 > 0$. However, the incumbent and buyer 1 can always generate $10 without buyer 2. The stability conditions take account of the fact that groups of agents have such alternatives:

$$\pi_f + \pi_1 \geq 10, \pi_f + \pi_2 \geq 5, \text{ and } \pi_1 + \pi_2 \geq 0.$$

The first inequality says that the incumbent and buyer 1 can create $10 on their own. Thus, buyer 2's added value is zero, and the incumbent and buyer 1 together must appropriate the entire $10. The second says that the incumbent and buyer 2 must share at least $5; given that buyer 2 does not appropriate, the incumbent must appropriate at least $5. The final inequality says that the buyers cannot create any value absent the incumbent. Overall, the incumbent and buyer 1 must split $10, with the incumbent obtaining at least $5.

Despite $av_2 = 0$, the presence of buyer 2 matters from the perspective of competition. To see this, consider the minimum value condition: How much value is required to satisfy the stability inequalities if $\pi_f = 0$? Imposing $\pi_f = 0$ in the preceding inequalities yields

$$\pi_1 \geq 10, \pi_2 \geq 5, \text{ and } \pi_1 \geq 0.$$

Satisfying these conditions requires at least \$15, i.e., $mv_f = 15$. Since $V = 10$, it is immediate that $V < mv_f$ which, according to (4), means $\pi_f^{\min} > 0$. That is, the tension between the value created and the alternatives available to the various parties is such that the incumbent *must* appropriate a strictly positive share of V.

Intuitively, since buyer 2 cannot appropriate, if the incumbent also fails to appropriate, the whole \$10 must go to buyer 1. But then buyer 2 can compete with buyer 1 by offering to share \$5 with the incumbent. Thus the incumbent must appropriate. Indeed, competition from buyer 2 will arise whenever the incumbent appropriates less than \$5. There is simply not enough value available to neutralize this competition.

Results

In this section we present our general results on the impact of entry on guaranteed profits; i.e., how entry affects $\pi_f^{\min}$. We will use a "¯" to indicate post-entry variables. That is, $\pi_f^{\min}$ represents the incumbent's minimum appropriation pre-entry, and $\bar{\pi}_f^{\min}$ the minimum appropriation post entry. Likewise, we refer to the pre-entry game as (N, V, v_G) and the post-entry game as $(\bar{N}, \bar{V}, \bar{v}_G)$. Entry *destroys* guaranteed profits if $\pi_f^{\min} > 0$ and $\bar{\pi}_f^{\min} = 0$; entry *creates* guaranteed profits if $\pi_f^{\min} = 0$ and $\bar{\pi}_f^{\min} > 0$; entry *sustains* guaranteed profits if $\pi_f^{\min} > 0$ and $\bar{\pi}_f^{\min} > 0$; and otherwise there are no guaranteed profits.[4]

The forces summarized by (4) allow us to derive three kinds of results. The first can be developed with no extra exploration of exactly what determines either mv_f or $\overline{mv}_f$ These results follow simply from asking whether entry disturbs the general forces determining whether the incumbent is guaranteed profit as a result of competition. The second collection explores the connection between the impact of entry on guaranteed profits and the entrant's added value:

$$av_e \equiv \bar{V} - V.$$

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[4]Note that these definitions do not preclude $\pi_f^{\max} > 0$ or $\bar{\pi}_f^{\max} > 0$, in which case it is possible that the incumbent might appropriate due to bargaining; however, unless $\pi_f^{\min} > 0$ or $\bar{\pi}_f^{\min} > 0$, there is no guaranteed appropriation.

The final collection of results follow from more detailed exploration of exactly what determines minimum value and how entry affects these determinants.

The assumption that adding an agent to any group never reduces the value that group might produce has two useful implications for understanding the impact of entry. First, $V \leq \overline{V}$, i.e, including the entrant in the existing collection of agents does not reduce their overall value creation possibilities, and may increase them.[5] Second, $mv_f \leq \overline{mv}_f$, i.e., the addition of the entrant never reduces minimum value, and might increase it. The reason minimum value cannot fall with entry is simply that minimum value is determined by the alternatives available to the other agents, and the inclusion of the entrant creates even more alternatives. (The various ways this might occur are the source of some of the more specific results we explore below.)

The general effects of entry on guaranteed profits

We begin with a general proposition that follows immediately from (4). We then discuss the interpretation and importance of each of the items separately.

Proposition 1. *Given pre-entry game* (N, V, v_G) *and post entry game* $(\overline{N}, \overline{V}, \overline{v}_G)$:

1. *Entry destroys guaranteed profits for the incumbent if and only if*

$$V < mv_f \text{ and } \overline{V} \geq \overline{mv}_f;$$

2. *Entry creates guaranteed profits for the incumbent if and only if*

$$V \geq mv_f \text{ and } \overline{V} < \overline{mv}_f;$$

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[5] *Within* the pre- and post-entry games, normalizing agents' individual outside option to zero is without loss of generality. Comparing across games the interpretation of $\overline{V} \geq V$ is that the new resources entry brings are measured net of their outside option.

3. Entry sustains guaranteed profits for the incumbent if and only if

$$V < mv_f \text{ and } \overline{V} < \overline{mv}_f; and$$

4. Otherwise, the incumbent has no guaranteed profits pre- or post-entry.

According to Proposition 1, in order to determine entry's impact on guaranteed profits one needs to know exactly four things: $V, \overline{V}, mv_f$, and $\overline{mv}_f$, In Figure 1, below, total value created is measured on the horizontal axis, and minimum value on the vertical. According to (4), the (V, mv_f) values consistent with the incumbent lacking guaranteed profits (i.e., $\pi_f^{\min} = 0$), are those in the shaded area, including the dashed line corresponding to $V = mv_f$. Likewise, the points "northwest" of the shaded area are those generating guaranteed profits. The impact of entry is indicated by the arrows, where the lower left point identifies the pre-entry values, (V, mv_f), and the upper right corresponds to post-entry, i.e., $(\overline{V}, \overline{mv}_f)$. Since $V \leq \overline{V}$ and $mv_f \leq \overline{mv}_f$, the arrows must slope upward and to the right. Thus, entry destroys a guaranteed profit when the the arrow enters the shaded area; creates them when the arrow departs the shaded area; sustains them when the arrow never touches the shaded area, and there are no guaranteed profits if the arrow remains inside the shaded area.

[INSERT FIGURE 1 HERE]

Proposition 1 and Figure 1 offer interesting and general insights about the impact of entry on guaranteed profits. First, entry generally increases the relevant sources of competition, and thus mv_f, as well as the overall value creation as measured by V. Since entry both stimulates competition by bringing new alternatives for agents, and blunts it by allowing more value to be created, simply knowing that entry has occurred, or might, says very little about the affect of competition on profitability. That is, all of the kinds of effects of entry – i.e., creating guaranteed profits, destroying them, etc. – are consistent with both value

creation and competition increasing as a result of entry. Determining the impact of entry necessarily requires more detailed exploration of how both value creation and competition are changed by entry. There is no general presumption that entry is necessarily good or bad from the standpoint of competition. Furthermore, since exit is simply entry in reverse, the same comment applies to exit. This is not to say that one cannot determine the impact of entry in specific circumstances – we do this repeatedly below. The point is that assessing how entry changes the competitive balance one way or the other requires exploration of entry's consequences for both overall value creation and the relevant sources of competition.

Entry destroys guaranteed profits

If the incumbent has guaranteed profits pre-entry – that is, (V, mv_f) is not in the shaded region in Figure 1 – for entry to be detrimental to guaranteed profits, it is necessary that entry results in strictly more value ultimately being created, i.e., $V < \overline{V}$ (so that the arrow in Figure 1 is not vertical, and thus might enter the shaded region). Entry opens up new opportunities involving agents other than the incumbent. But the competing alternatives that originally caused the incumbent to have positive minimum appropriation are still there, and if $V = \overline{V}$, there is still not enough value created post-entry to blunt the competition these alternatives imply, despite the existence of new opportunities.[6]

That entry must create value if it is to threaten guaranteed profits has some surprising implications. For example, suppose an incumbent operating at less than full capacity loses patent protection, with the result that an entrant can do essentially anything the incumbent can do. Intense competition to appropriate value would be expected. But all such an entrant can do is attract customers from the incumbent (who is already serving all buyers with whom value can be created). Extra value is not created. Thus, the model tells us that entry must not destroy the incumbent's guaranteed profits – a result which at first appears

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[6]This is not to say that entry has no effect on incumbent profitability. It may, e.g., effect the incumbent's maximum appropriation or induce some relation between the incumbent's profits and the entrant's, such as making them equal.

counterintuitive. The explanation is that in this situation there were no guaranteed profits in the first place, i.e. $\pi_f^{\min} = 0$. That is, suppose the incumbent sells its good or service at cost, so that its customers appropriate all value. There is no competing alternative that any agent would strictly prefer, so this way of distributing value is both feasible and stable. Likewise, if the incumbent sells the good or service at a customer-specific price equal to each customer's willingness to pay, once again there is no competing alternative that any agent would strictly prefer, so this way of distributing value is both feasible and stable. In fact, whatever the incumbent appropriates pre-entry is due to some successful bargaining by the incumbent, not competition among buyers.

The curated music streaming service Rhapsody provides a nice example of this reasoning. Once entry by Pandora, Spotify and others occurred, Pandora's difficulty in achieving significant profitability was cemented due to its having close to zero added value. But even earlier, Rhapsody, due to employing low pricing to attract customers who had few *curated* music alternatives, was unsuccessful in turning its close-to-monopoly into profits. Thus entry replaced low profits due to unsuccessful bargaining with listeners, with low profits guaranteed by competition.

Another implication of Proposition 1 and Figure 1 is that, unless entry stimulates competition, as measured by $\overline{mv}_f$ exceeding mv_f, if the entrant adds enough value – i.e., $\overline{V}$ is sufficiently greater than V – the incumbent's guaranteed profit is *always* destroyed. For example, suppose that the entrant brings a new technology whose use is voluntary but all agents must use it for it to be effective for any. A secure transaction system, for example, may be ineffective if only a small subset of the transactions consumers engage in employ it.[7] If the technology is valuable enough, the incumbent's guaranteed profit is destroyed. Intuitively, the technology makes the competing alternatives – which do not use the new technology – an ineffective source of competition. Indeed, value appropriation is entirely determined by bargaining, not by competition. This example provides another way to think

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[7]In this case, $\overline{V}$ is the aggregate value created through the new technology, and the $\overline{v}_G$ values are what groups can achieve via opting out of it.

about the oft-discussed notion of a "disruptive" technology. If use of the new technology creates a sufficient increase in aggregate value creation, competition based on the old technology that once delivered guaranteed profits is no longer effective in doing so. This way of looking at technology emphasizes that the critical issue is not whether the new technology is similar to or different from the old technology. The key point is that, similar or different, the new technology allows a lot more value to be created relative to the old.

The entrant's added value is $av_e \equiv \bar{V} - V$. Since Proposition 1 implies $\overline{mv}_f \geq mv_f$, the inequalities in Part 1 can be combined to yield

$$\bar{V} \geq \overline{mv}_f \geq mv_f > V.$$

Subtracting V throughout, then applying the definition of av_e, yields the following proposition.

Proposition 2. *Given the pre- and post-entry games, entry destroys guaranteed profit if and only if*

$$av_e \geq \overline{mv}_f - V \geq mv_f - V > 0.$$

Two observations follow immediately. First, an entrant whose added value is sufficiently large always destroys the incumbent's guaranteed profit. The intuition is straightforward. Entry provides both agents new alternatives – which, as discussed earlier, tends to increase $\pi_f^{\min}$ – along with more value, which has the opposite effect. If av_e is large enough, the latter effect always outweighs the former. Second, if the entrant is to destroy guaranteed profits, a strictly positive av_e is necessary (the theoretically smallest possible value for av_e is zero). The argument is easy. If the incumbent has a guaranteed profits in the pre-entry game, the reason is that, assuming it does not appropriate, the alternatives available to agents are too valuable to be dominated with the available resources. Entry produces even more alternatives. So the competitive forces that gave the incumbent guaranteed profits pre-entry are augmented by entry. If the entrant brings no new value to the game, i.e., $av_e = 0$, the

resources available to oppose these forces are no greater. Thus the incumbent must continue to appropriate post-entry.

Earlier we argued that $\bar{V} > V$ is necessary for entry to threaten guaranteed profits, and gave an example in which the loss of intellectual property did not threaten guaranteed profits absent the incumbent being capacity-constrained. Since $av_e > 0$ is equivalent to $\bar{V} > V$, the earlier discussion and example apply here as well.

0.0.1 Example: entry destroys guaranteed profits

Returning to the one incumbent, two buyer example, recall that $V = 10$, $mv_f = 15$ and $\pi_f^{\min} = 5$. Suppose another firm, e, enters the market with the same capabilities as the incumbent. That is, e can produce one unit of a component which buyers agree is indistinguishable from the component available from the incumbent. Assume the components produced by each firm are *incompatible*, i.e., they cannot be combined into a two-component system.

Since neither firm can produce a complete system, and each firm's components are incompatible with the other's, the most value is created by each firm producing one component and selling it to one of the buyers. The value created this way is $\overline{V} = 15$. Suppose $\pi_f = 0 = \pi_e$, $\pi_1 = 10$ and $\pi_2 = 5$. That is, each buyer receives a component and pays its production cost (i.e., \$0). This pattern of appropriation is feasible and stable. That is, each buyer is receiving a component and appropriating all value created by its consumption. The incumbent cannot construct an alternative deal involving either the entrant or the buyers in which: i) it appropriates a positive share of value, and ii) its transaction partner is made strictly better off. The same is true for the entrant. At the same time, it is not possible for either buyer to appropriate any more value unless some agent has negative appropriation, which that agent can always avoid by not participating. Thus, entry destroys guaranteed profits: $\pi_f^{\min} = 5$ and $\bar{\pi}_f^{\min} = 0$.

We just checked that post-entry, with $\bar{V} = 15$, $\bar{\pi}_f = 0$ is possible. The fact that the incumbent and buyer 1 can produce 10 on their own – implying $\bar{\pi}_f + \bar{\pi}_1 \geq 10$ – yields, if

$\bar{\pi}_f = 0$, $\bar{\pi}_1 \geq 10$. Likewise, if $\bar{\pi}_f = 0$, $\bar{\pi}_2 \geq 5$. Thus, 15 is the smallest amount of value consistent with $\bar{\pi}_f = 0$, i.e., $\overline{mv}_f = 15$. Also, $av_e = \overline{V} - V = 5$. Thus the inequalities in Proposition 2 are all satisfied, i.e., $av_e = \overline{mv}_f - V = mv_f - V = 5 > 0$, and entry destroys guaranteed profits. Pre-entry, the incumbent had guaranteed profits due to competition between buyers to receive a component produced by the sole unit of available capacity. Post-entry the additional capacity brought in by the entrant eliminates that competition, and with it any guarantee of positive profits.

Entry creates guaranteed profits

The inequalities in part 2 of Proposition 1 can be combined to yield

$$\overline{mv}_f > \overline{V} \geq V \geq mv_f.$$

Subtracting V throughout and applying the definition of av_e yields our next result.

Proposition 3. *Given the pre- and post-entry games, entry creates guaranteed profits if and only if*

$$\overline{mv}_f - V > av_e \geq 0 \geq mv_f - V.$$

Pre-entry, the available resources are great enough to deny the incumbent guaranteed profits, i.e., $V \geq mv_f$. Post-entry, one of the options available to the group of *all* the original agents is simply to do what they were doing pre-entry, thus earning V as a group with the incumbent appropriating $\pi_f = 0$. Thus $\overline{mv}_f$ cannot be less than V; i.e., at least V is required to keep the original agents from simply doing what they were doing pre entry. Thus, $\overline{mv}_f - V$ is $\overline{mv}_f$ measured relative to its theoretically smallest value. The first inequality in Proposition 3 says that for entry to create positive profits, the new alternatives entry brings must be too attractive, given $\pi_f = 0$, to be dominated with just the new resources available post-entry, i.e., av_e. In particular, even if $av_e = 0$, for entry to create guaranteed profits, it must be that $\overline{mv}_f - V > 0$, so that entry must bring some new alternatives involving the

18

entrant that are strictly better than the pre-existing alternatives.

Observe that even an entrant who has $av_e = 0$, and so no possibility of appropriation, can create guaranteed profit for the incumbent. To see how this might occur, suppose that the pre-entry alternatives that are most valuable to groups including the incumbent are those that involve some particular complementary agent. That is, the alternatives available to groups including the incumbent but *not* the complementary agent are less valuable. In this case the incumbent lacks guaranteed profit because, even when it appropriates nothing, the other group members are uninterested in acting on the alternatives involving it. In this situation the incumbent and the complementary agent are valuable only as a pair. Competition may guarantee that the pair must appropriate something in aggregate. However, it is possible that bargaining results in the complementary agent getting all of it and the incumbent nothing.

Suppose the entrant is a clone of the complementary agent and that the groups are just as valuable with *either* the entrant or the complementary agent; i.e., just one of them is needed to increase the value produceable by a group. In this case, post-entry, both the complementary agent and the entrant have zero added value. Moreover, the entrant makes a collection of alternatives – i.e., those involving the incumbent but not the complementary agent – more valuable. Thus the entrant and complementary agent must appropriate zero and the incumbent must earn guaranteed profits to prevent acting on alternatives involving it and either the complementary agent or the entrant becoming attractive. Here, entry creates competition for the complementary agent which guarantees the incumbent appropriation. In the entertainment business, for example, talented but untested artists find themselves in a bargaining situation with any record label they can interest in developing/marketing them. These activities are complementary to music creation and ultimate commercial success. They often appropriate little of the value from their early work. Once successful, however, numerous music companies enter the picture with the resulting competition assuring the artist much greater compensation.

0.0.2 Example: entry creates guaranteed profits

To illustrate the proposition, we must modify the pre-entry game so that the incumbent is no longer guaranteed appropriation (i.e., so that competition can create it in the post-entry game). Suppose buyer 1 values a stand-alone component at \$10 and a complete system at \$30. Buyer 2 values a stand-alone component at \$0 (previously \$5) and a complete system at \$30. Now, in the pre-entry case, $V = 10$, $mv_f = V = 10$, and $\pi_f^{\min} = 0$. Assume that one component from each of the entrant and the incumbent can be combined into a system, i.e., the components are now *compatible*. The incumbent and entrant, as before, each have one unit of capacity.

The most valuable post-entry activity is for one of the buyers to acquire a complete system by combining one component from each of the incumbent and entrant, so that $\overline{V} = 30$. The relevant stability (i.e., if this collection of stability conditions are satisfied, then all the other stability conditions are also satified) and feasibility conditions following entry are:

$$\overline{\pi}_f + \overline{\pi}_1 \geq 10, \overline{\pi}_e + \overline{\pi}_1 \geq 10, \overline{\pi}_f + \overline{\pi}_1 \geq 10, \overline{\pi}_e + \overline{\pi}_1 \geq 10$$

$$\overline{\pi}_f + \overline{\pi}_e + \overline{\pi}_1 \geq 30, \overline{\pi}_f + \pi_e + \overline{\pi}_2 \geq 30$$

$$\overline{\pi}_f + \overline{\pi}_e + \overline{\pi}_1 + \overline{\pi}_2 = 30.$$

Suppose buyer 1 appropriates, i.e., $\overline{\pi}_1 > 0$. Then less than \$30 is left for the incumbent, the entrant and buyer 2. But this group can produce \$30 independently of buyer 1 because the components are compatible and valued by buyer 2 at \$30. Thus, buyer 1 cannot appropriate; a parallel argument shows that buyer 2 cannot appropriate either. In other words, $av_1 = av_2 = 0$. This implies that all \$30 in value must be shared between the incumbent and entrant. Setting $\overline{\pi}_1 = \overline{\pi}_2 = 0$, the relevant stability and feasibility conditions become:

$$\overline{\pi}_f \geq 10, \overline{\pi}_e \geq 10$$

and

$$\overline{\pi}_f + \pi_e = 30.$$

That is, the incumbent and the entrant must share \$30 in a way that makes neither interested in the alternative of creating \$10 in value by selling a single component to buyer 1.

Pre-entry, the incumbent's appropriation lay between \$0 and \$10. Post-entry, it lies between \$10 and \$20. Entry not only guaranteed the incumbent positive profit, but actually shifted its *entire range* of appropriation possibilities for the better. The intuition for this shift is as follows. Pre-entry, there is no competition between the buyers – the incumbent and buyer 1 are in a pure bargaining situation. Post-entry, there is sufficient capacity to produce a complete system. Both buyers value the system at \$30 – much more than the value either places on a single component. Still, the industry is such that only one such system can be created, so the buyers compete to obtain the system, and the whole \$30 is appropriated by the incumbent and entrant. The sole constraint is that neither incumbent nor entrant can improve by selling their component as a stand-alone unit to buyer 1 instead of as part of a complete system.

As in all versions of this example, the entrant is identical to the incumbent. It can replace incumbent in every bilateral transaction with no loss in value. Even so, entry has the effect of stimulating competition between the buyers for a complete system, thereby guaranteeing both firms minimum appropriation of \$10. It is important that the incumbent's and entrant's components, being compatible, are complementary in that they form a system valued by both buyers, and that just one system is available. If the capacity of each firm is at least two, the tension guaranteeing them positive appropriation is removed. Entry affects competition on different dimensions. Simply knowing that an entrant can do anything an incumbent can do is not enough to know how entry will affect the incumbent.

Entry sustains guaranteed profits

Since $\bar{V} \geq V$, the second inequality in part 3 of Proposition **??** gives

$$\overline{mv}_f > \bar{V} \geq V.$$

Subtracting V throughout, then applying the definition of av_e, gives

$$\overline{mv}_f - V > av_e \geq 0.$$

This inequality, together with the first inequality in part 3 of Proposition **??** yields the following result.

Proposition 4. *Given the pre- and post-entry games, entry sustains guaranteed profit if and only if*

$$\overline{mv}_f - V > av_e \geq 0 > V - mv_f.$$

The intuition for Proposition 4 is as follows. Pre-entry, competition is strong enough to guarantee the incumbent positive appropriation. Post-entry, the aggregate amount of value increases. However, the existing and new alternatives involving the incumbent remain too attractive relative to even this new level of value to create a feasible and stable distribution in which it appropriates nothing.

Switching costs and network effects are standard examples consistent with this proposition. An entrant often can obtain the capabilities of existing firms. There is nothing special about Facebook's software or Google's search engine or eBay's auctions. But these firms continue to appropriate because individuals see little to gain from switching to an entrant, and the costs of organizing switching en masse are prohibitive. Thus, the forces that deliver guaranteed profits pre-entry are just as powerful post-entry.

0.0.3 Example: entry maintains positive profit

To see an example in which guaranteed profits exist and are actually augmented by entry, assume the firms' components are compatible as a system, and return to the original situatiom: buyer 1 values a stand-alone component at $10 and a complete system at $30; and buyer 2 values a stand-alone component at $5 and a complete system at $30. In the pre-entry situation, competition guarantees the incumbent appropriation of at least $5. The post-entry outcome is as it was in the previous example: the most value is created by each firm producing one component, both of which are acquired by one buyer to form a complete system valued at $30; each buyer has zero added value, so the incumbent and entrant split the $30 between them; and the alternative to sell to buyer 1 independently assures each firm at least $10.

Note that when the entrant entered with an *in*compatible component, the impact on the incumbent was to destroy the competition between buyers to obtain a single component and to eliminate guaranteed profits for the incumbent. When the entrant entered with a compatible component, it created a new and more powerful competition between buyers to acquire a complete system, which actually raises the incumbent's minimum possible appropriation.

Summary Proposition

Finally, we present a proposition demonstrating that the two opposing forces emphasized earleir throughout are indeed all the forces determining entry's impact on guaranteed profits. If entry affects guaranteed profit, it either creates it or destroys it. In the former, both

$$mv_f \leq V \text{ and } \overline{mv}_f > \bar{V},$$

or

$$\overline{mv}_f - mv_f > av_e.$$

In the latter, both

$$mv_f > V \text{ and } \overline{mv}_f \leq \bar{V},$$

or

$$\overline{mv}_f - mv_f < av_e.$$

Proposition 5. *Given the pre- and post-entry games, if entry affects guaranteed profit, it creates it if and only if*

$$\overline{mv}_f - mv_f > av_e,$$

and destroys it if and only if

$$\overline{mv}_f - mv_f < av_e.$$

The left hand side of each inequality measures the impact of increased competition to create value with the incumbent that entry brings, and the right hand side describes the additional resources that might be used to resolve this competition.

Impact of the new alternatives entry brings

The nature of the impact of entry on guaranteed profit depends how entry affects two entities: the available resources, V, and the impact of the competition to work with the incumbent should $\pi_f = 0$, as measured by mv_f. There are five distinct ways that the post-entry game $(\overline{N}, \overline{V}, \overline{v}_G)$ can differ from the pre-entry game, (N, V, v_G). We explore these five ways one at a time, emphasizing that *all* ways entry can affect the original game are some combination of these five.

Value Creation Suppose that the sole impact of entry is to increase the available resources – V increases to $\bar{V}$, but adding e to any group G does not increase v_G (formally $\bar{v}_{G \cup \{e\}} =$

$v_G, \bar{v}_{\{e\}} = 0$).[8] An example of entry of this kind is an entrepreneur introducing a technology improvement in an industry where the most attractive alternatives for all groups are in other industries. Since none of the competing alternatives are improved by entry, the competition to work with the incumbent if $\pi_f = 0$ is not changed; thus $\overline{mv}_f = mv_f$. Referring back to Figure 1, entry of this kind merely makes it less harder for the incumbent to have guaranteed appropriation; i.e., the arrow is parallel to the horizontal axis. Thus, such entry can never create guaranteed profits. If the incumbent did not enjoy guaranteed profits pre-entry, neither will it post-entry. On the other hand, entry of this type can sufficiently blunt competition to destroy guaranteed profits. But it might not – especially if the increase in value entry brings is not large (i.e., guaranteed profits might survive post-entry).

Entrant's Outside Option There are situations in which the only effect of entry is the entrant having an attractive outside option (formally, $\bar{v}_{\{e\}} > 0$, $\bar{v}_{G \cup \{e\}} = v_G$, and $\bar{V} = V$). An example is the imposition of a tax on the industry in the amount of $\bar{v}_{\{e\}}$ (the entrant is the government) where the most attractive alternatives for all groups are in other industries. In this case the resources available for distribution to incumbents post-entry fall to $V - \bar{v}_{\{e\}}$, but mv_f is unchanged. It follows that this sort of entry can never destroy guaranteed profits unless it destroys the industry; i.e., $V - \bar{v}_{\{e\}}$ is so small that there are no feasible and stable distributions post-entry. Thus entry of this kind can guarantee appropriation, or sustain it, or neither.

Option for Entrant and Incumbent In a similar vein, entry can provide an attractive alternative for just the incumbent and the entrant. That is, entry has no effect on groups of agents that include any agent(s) besides the incumbent (formally, $\bar{v}_{\{e\}} = 0$, $\bar{v}_{G \cup \{e\}} = v_G, \bar{v}_f = 0, \bar{V} = V, \bar{v}_{\{f\} \cup \{e\}} > 0$, and $\bar{v}_{\{f\} \cup \{e\}} > 0$.) An example is one in which the incumbent lacks a widely available skill and, so, is made more productive when an entrant having such a skill

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[8]The incumbent's outside alternatives pre-entry were normalized to zero; this is without loss of generality. But for *comparing* pre- and post-entry games the entrant's outside alternative cannot be so normalized, so $v_{\{e\}} = 0$ is a material restriction.

partners with it but, at the same time the entrant's skills are merely duplicative when added to other groups. In this case, the entrant and the incumbent together must appropriate $v_{\{f \cup e\}}$. This situation is almost exactly the same as the previous case: resources available for distribution to the incumbents post-entry falls to $V - \bar{v}_{\{f\} \cup \{e\}}$ with the same effect as a tax on the industry. Indeed since the entrant has $av_e = 0$, implying the incumbent must appropriate at least $\bar{v}_{\{f\} \cup \{e\}}$ post-entry.

Options with Others, Excluding the Incumbent Next, the entrant can have a skill very similar to the incumbent and so improve the value of alternatives excluding the incumbent, yet leave alternatives including the incumbent unchanged (formally, $\bar{v}_{\{e\}} = 0$, $\bar{v}_{G \cup \{e\}} \geq v_G$ with equality if the incumbent is in G, $\bar{v}_f = 0$, and $\bar{V} = V$.) In this case entry has no effect on the incumbent's guaranteed appropriation. To see why, note that the extra resources available to distribute are not affected by entry. Also, the alternatives that allow or prohibit the incumbent having guaranteed profit – i.e., the alternatives that matter for mv_f– involve some agents working with the incumbent and the incumbent receiving $\pi_f = 0$. Thus $\overline{mv}_f = mv_f$. If these alternatives are attractive enough to allow guaranteed profit for the incumbent pre-entry, i.e., $mv_f > V$, then they have the same effect post entry; the other improved alternatives might raise $\pi_f^{\min}$ if it is positive pre-entry, but they cannot make it positive if it is not so pre-entry. On the other hand, if these alternatives are not attractive enough to allow guaranteed profit for the incumbent pre-entry, i.e., $mv_f \leq V$, then they are not more powerful post-entry. Thus, this type of entry neither increases resources available for appropriation nor stimulates competition to transact with the incumbent.

Options Including Entrant, Incumbent and Others Finally, the entrant might have a skill very complementary to the incumbent and so improve the value of alternatives where it is present, while leaving alternatives without it unchanged (formally $\bar{v}_{\{e\}} = 0$, $\bar{v}_{G \cup \{e\}} \geq v_G$ with equality if the incumbent is not in G, $\bar{v}_f = 0, \bar{V} = V$.).) In this case entry does not augment resources available for distribution, i.e., $\bar{V} = V$. However, with the alternatives

involving the incumbent and the entrant becoming more attractive, $\overline{mv}_f \geq mv_f$. It follows that this sort of entry can never destroy guaranteed profits, and may sustain them, create them, or or leave them absent, the last occurring when $\bar{V} = V \geq \overline{mv}_f \geq mv_f$.

1   Conclusion

The preceding results contribute to a growing body of work in strategy that emplys coalitional game theory to gain a deeper understanding of how competitive and extra-competitive factors interact to determine how value is appropriated by agents in some econommi activity, e.g., a market. Specifically, they provide a characterization of the effect of an arbitrary entrant on whether competition guarantees an incumbent firm positive appropriation. The the effect of entry on appropriation is quite subtle. The reason for this is that every entrant induces two kinds of changes that have opposing effects on an incumbent's guaranteed minimum profit. The first is the entrant's added value. The greater the increase in aggregate value induced by entry, other things equal, the weaker the competition for the incumbent – ultimately, to the point of no guaranteed profit whatsoever. However, there is also a second way in which entry changes the market: it is the new set of *alternative* opportunities to create value that entry presents to the set of original agents. These, in turn, can be categorized into four types, each working to increase or soften competition for an incumbent in its own particular way. The net effect of entry on an incumbent's profitability cannot be determined without a full assessment of how the tensions between these various effects balance out.

Although our examples consider an incumbent and an entrant of similar-to-identical capabilities, it must be emphasized that the results are quite general. They pertain to any entrant – be it a new customer, distributor, supplier, employee, etc. Thus, for example, a new buyer entering the market in which the incumbent is capacity constrained (and who, therefore, must buy from another firm) may increase the competitive tension described by the incumbent's minimum value and, consistent with intuition, increase the incumbent's guaranteed profit. On the other hand, a new buyer who becomes a client of the incum-

27

bent – by increasing aggregate value and, as a client, providing no new alternatives for the incumbent – may have no effect on the incumbent's minimum.

Finally, our theoretical results suggest a wide variety of empirical implications about entry and incumbent profitabiilty – specifically, how the impact of entry depends on the characteristics of entrant and all incumbents. Although structural estimation of of coalitional models is difficult, there are several recent advances on this front (Chatain 2011, 2013; Grennan 2013; Bennett 2013; Obloj & Sengul 2012; and Obloj & Zemsky 2014).

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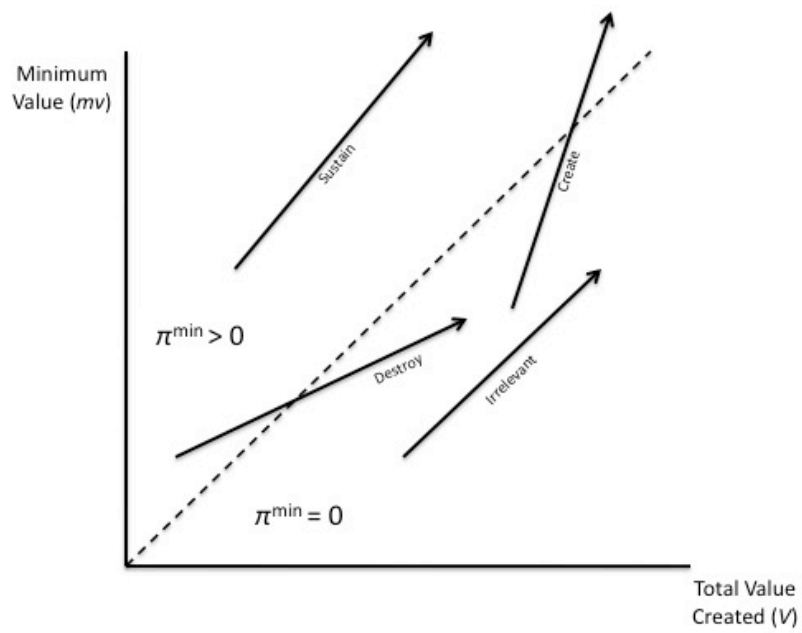[17] Saloner, G., A. Shepard, and J. Podolny (2001), Strategic management. New York: John Wiley & Sons, Inc.

Figure 1: The effect of entry depends upon the balance of its two essential effects.