Do new competitors, new customers, new suppliers,... sustain, destroy or create sustained profitability?

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Abstract

A new player, e.g., an entrant, joining an existing game generally allows more value to be created, but also creates new alternatives for existing players. Greater value expands the range of equilibrium appropriation levels for an existing player, in particular, lowering the minimum equilibrium appropriation. The emergence of new alternatives has the opposite effect.

We say a player has competitive advantage if the player’s minimum equilibrium appropriation is strictly greater than the player’s outside alternative. That is, the forces of competition alone, as embodied in the conditions defining equilibrium, suffice to guarantee a player appropriates more than the best alternative to being in the game, i.e., a sustainable performance advantage.

When a player has competitive advantage pre-entry, but not post-entry, we say entry destroys competitive advantage; likewise for creating and sustaining competitive advantage. Our results provide complete characterizations (i.e., if and only if statements) of the features of a game that cause the addition of a new player to destroy, create or sustain competitive advantage in a general coalitional game.

These results are of importance for strategy issues since – as argued by proponents of value-based business strategy, e.g., Brandenburger and Stuart (1996) – many of the economic interactions of interest in strategy are well-described as coalitional games.

*Comments from seminars at Emory, Yale and HBS are greatly appreciated.*
1 Introduction

Many of the subjects of interest in strategy and industrial organization involve augmenting the agents in a game. Some examples: (i) a firm entering an industry with a new substitute or complementary product, or a new technology, or simply more capacity; (ii) a firm developing the capability to imitate an incumbent’s activities, and contemplating entry; (iii) a new customer or segment changing demand for some product; (iv) an entrepreneurial venture altering the game incumbents are playing; (v) a spin-off or divestiture; (vi) a new source of supply for inputs; (vii) the transition from profitable short run to zero profit long run in a competitive market; (viii) a patent expiring and allowing others to produce; etc.

This paper explores how increasing the number of agents in a game affects the equilibrium payoffs of existing agents. Specifically, we study a general coalitional game (within which any of the examples just mentioned can be described), and ask how adding an agent changes an existing agent’s minimum equilibrium payoff. We focus primarily on whether that minimum payoff is zero, or more generally, equal to the agent’s next best alternative to being in the game. There is nothing about our methodology that requires this focus on the minimum and whether it is zero; indeed, the same sort of reasoning can be applied to whether the minimum takes on some other value, or whether the maximum does so, etc. Instead, as we 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 suffice to guarantee supra-normal profit, an outcome we equate with the familiar term competitive advantage.

In our earlier work (MacDonald and Ryall (2004a) and (2204b)), we provided a complete characterization of an agent’s having a competitive advantage in a general coalitional game, i.e., a firm’s minimum equilibrium payoff is positive if and only if certain conditions involving agents’ alternatives are satisfied. Loosely, the basic result from that work (formally restated below) was that there are precisely two opposing entities that shape how value must be distributed in equilibrium: (i) the value ultimately produced by the agents; and (ii) the value that could be generated via alternative activities available to agents. The value produced must ultimately be distributed among agents, and the more there is to distribute, the more ways there are

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1Our results cover decreasing the number of agents by, e.g., firm exit, simply by treating the game with the larger number of agents as the initial condition.

2“Competitive advantage” is traditionally synonymous with “profitable”. In our view, this definition obscures an important distinction in that it lumps competitive reasons for profitability together with others such as luck, connections to regulators, negotiating skill, etc. Thus we restrict the term competitive advantage to a narrower meaning, viz. profitable as a consequence of competitive alternatives.
to distribute it and still dominate agents’ alternative opportunities (i.e., alternatives the agents must be
dissuaded from pursuing if they are to participate in the contemplated value generating activities). Thus,
more value to distribute widens the range of payoffs an agent can earn in equilibrium, including lowering the
minimum. On the other hand, agents’ alternatives constrain the ways in which the value produced can be
distributed so as to dominate those alternatives. More/better alternatives make this effect more powerful,
thereby narrowing the range of equilibrium payoffs for an agent, including increasing the minimum. \(^3\)

We focus on comparing a firm’s (generally, any agent’s) pre- and post-entry competitive advantage. The
result described above suggests that one way to proceed is to analyze the agent’s appropriation in a pre-entry
game, and then compare this to appropriation in the corresponding post-entry game, including the entrant of
interest. This approach, which we adopt, allows us to develop propositions of the following form: a firm has
competitive advantage 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 competitive advantage. The features of the game that lead to the firm
not having competitive advantage pre-entry, but having competitive advantage post-entry, are described in
an analogous fashion; i.e., entry creates competitive advantage. Entry sustaining competitive advantage is
developed and characterized similarly.

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 games are not simply a pair of games with differing numbers of
agents. Instead, adding an agent brings new value creation opportunities while leaving others unchanged.
By specifying the post-entry game fully, then, to analyze the pre-entry game, suppressing all value creation
involving the entrant, we are able to provide a complete description of the features of the pre- and post-entry
environments that result in entry destroying, creating, or sustaining competitive advantage; see Proposition
??. (The remaining case, in which the firm lacks competitive advantage pre- and post-entry, is described
by “none of the above conditions”.) Loosely, an entrant generally brings additional value to the economic
activities in which agents ultimately engage, tending to widen the range of possible equilibrium payoffs for
agents, including lowering their minimum payoffs. But the entrant also creates new alternatives in which
agents might engage, which has the opposite effect. Whether entry creates, destroys or sustains competitive
advantage depends on the interplay of these forces. Propositions ??-?? provide more perspective on entry’s
impact on competitive advantage by stating these conditions in terms of the entrant’s “added value”.

\(^3\)In what follows we will refer to the impact of agents’ alternatives as “competition”. That is, an agent’s having alternatives
means there are groups competing to engage the agent in other activities.
Entry’s impact on an incumbent’s minimum payoff comes via exactly three avenues. First, pre-entry, the aggregate value that all agents could create without the entrant is exactly the value that can be distributed in the pre-entry game. Post-entry, obtaining this value becomes one of the alternatives that the set of all agents other than the entrant might act upon. Second, entry opens up a specific alternative for the incumbent; i.e., to create value by interacting with just the entrant. Third, entry creates new opportunities for groups of agents that may or may not include the incumbent; i.e., to create value by interacting with the entrant. Alternatives of each variety have different effects. Our second set of results, Propositions ??-??, extends our understanding of how entry impacts competitive advantage by exploring the operation of these three effects one at a time.

One specific form of entry that has received much attention in strategy is imitation. Indeed, if there is one idea that is not controversial, it is that to enjoy a sustained performance advantage, a firm must possess value-producing resources that are difficult to imitate. For example, Saloner et. al. (2001, page 49) say, “If a firm’s competitive advantage is based on its capabilities, a sustainable advantage requires either that imitation is difficult or that the firm can improve its capabilities (learn) before its rivals catch up.” The intuition is as follows. Imitation permits a competitor to provide new, equally attractive alternatives to customers. In order to persuade those customers not to act on those alternatives, the incumbent firm must allow its customers to keep a greater share of the gains from trading with it than they had previously enjoyed. As a result, its payoff is diminished and possibly eliminated altogether. In MacDonald and Ryall (2004b), we formalized and explored two versions of this idea, and found that the impact of imitation varies greatly with what one has in mind by “ability to imitate.” One version is what we called capability imitation: the imitator can do anything the incumbent can do, viz., a clone of the incumbent. More precisely, the entrant is a capability imitator if in every economic interaction involving the firm, replacing the firm with the imitator results in the same value created. We showed that (i) capability imitation might or might not eliminate competitive advantage, and (ii) entry forces both the firm and the entrant to earn the same range of payoffs (not necessarily zero). Our second version of imitation, unlimited product imitation describes the situation in which the firm and its imitator can supply an identical product at the same constant marginal cost, i.e., no capacity constraints, no diminishing returns to scale, no limited managerial talent,... Unlimited product imitation invariably both eliminates competitive advantage and forces both the firm and entrant to earn zero payoff. These are special cases of the more general phenomenon of entry studied in this paper.

The use of coalitional game theory to study issues in strategy is growing rapidly. The coalitional approach to strategy was first suggested by Brandenburger and Stuart (1996) who, in particular, discussed the utility

We begin with examples illustrating the basics of the methodology and some of our results, then develop the formal notation, review the basic characterization result, and discuss the new results.
2 Preliminaries and examples

In our 2004 paper we reviewed the formalism of coalitional game theory and employed that framework to provide a variety of results about competition and its impact on sustained profitability. In our 2008 paper with Gans, we carefully explained the assumptions underlying the coalitional model and provided an extensive discussion of how to interpret it. To keep this paper self-contained, we next précis some of this material. We then give a series of very simple examples that show why the economic tensions created and relaxed by the entry of a new player – a competing firm in the examples – can have a wide variety of effects on the possibility of sustained profits.

2.1 Assumptions and definitions

The coalitional model makes three important assumptions. First, all agents value their transactions in the same units (typically, money). In this case, it is possible to talk about “total value created,” or the “total received by some group of agents,” and so on. This assumption does not mean agents attach the same value to some item or activity, just that the different values are 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, 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 most preferred among all that are available, not because it is a requirement. This is important because, for example, competition has a great deal to do with the alternatives available to agents, which matter little if agents cannot select among their alternatives. Finally, agents agree on the value expected to be created by any activity. Under this assumption, it is possible to discuss how created value is to be distributed. Moreover, it is much more straightforward to study the competitive impact of the alternatives available to agents, i.e., competition, when agents agree on the value of the alternatives to those who might pursue them.

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 value of the 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 do by making a different choice. (We make this more formal shortly.)

One key implication of these three assumptions is that the value that will ultimately be created is the largest aggregate value the agents can create, i.e., no money is ever “left on the table.” If value were not
maximized: there is some other activity that is more valuable; all the players know and agree on this; and, since all measure value the same way, value can be rearranged to make every agent better off via pursuing the more valuable activity.

More formally, a coalitional game has two components. First, there is a finite set of agents, i.e., all the players in the game, \( N = \{1, \ldots, n\} \); nonempty subsets of \( N \) — i.e., groups of players including at least one, but not all players — will be denoted by \( G \). Second, the maximum value all players together can create is denoted by \( V \). The activities generating \( V \) are those value maximizing activities the theory predicts will actually be observed. For each group, \( G \), there is an associated value \( v_G \), interpreted as the total value that \( G \) could generate by engaging in some other activity. The theory predicts that none of these alternative activities will actually occur. However, the fact that agents have these competing alternatives plays an essential role in determining how value will be distributed, since agents in each group must prefer their actual appropriation to what they could obtain by pursuing their competing alternative. Altogether, a coalitional game specifies the list, \( N \), and the numbers \( V \) and \( v_G \) (for every group \( G \)).

In order to avoid considering trivial cases, we assume that the addition of a player to any group never reduces the value the group can create. The idea is that the incremental agent can always choose to do nothing, thereby leaving value creation possibilities for the group unchanged.

How is value to be distributed? There are two key requirements. First, the activities that are predicted to occur generate value \( V \), so this is the amount of value that can be distributed. Letting \( \pi_i \) be the value player \( i \) appropriates, the feasibility condition is

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

Second, if players are actually going to engage in the predicted activities, it must be that no group of players could do strictly better by engaging in one of the competing alternatives instead. That is, if they could do so, they would. Thus, the stability condition is

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

The theory predicts that activities leading to value creation \( V \) will happen, and that value will be distributed in a way that is both feasible and stable. Of course, there may be many ways to distribute value that are both feasible and stable. However, the forces of competition do not determine which of these will actually occur. The full impact of the competing alternatives is entirely captured by the stability condition. So to understand the role of competition, we need go no further than studying feasible and stable
distributions of value. Indeed, the novelty in this paper is exactly its results on how feasible and stable distributions change when a player is added to the game.

To fix ideas and get some feeling for how the results work, we now present some very simple examples.

## 2.2 Example of firm entry

### 2.2.1 Pre-entry situation

Pre-entry there is one firm, $f$, and two buyers. The firm has just one unit of production capacity, and can costlessly produce exactly one of two goods, which we can think of as components of a system. For example, the goods might be a high definition media player and a plasma TV. Buyer 1 has some use for one of the goods, and values it at $10; e.g., he might connect the media player to a laptop, or use a portable DVD player to provide input to the plasma TV. Buyer 1 would also value a complete system at $30, were it possible to acquire one. Buyer 2 has no usable video equipment, and so has no use for either good on its own, but would value a complete system at $30.

Let $\pi_f$ and $\pi_i$ ($i = 1, 2$) denote appropriation by the firm and buyer $i$, respectively. In all that follows, to simplify notation, we assume both $\pi_f$ and $\pi_i$ are nonnegative; that is, both the firm and buyers have “outside alternatives” they can pursue on their own, and we normalize the value of those alternatives to zero.

Maximum value in this example is achieved by the firm employing its sole unit of capacity to produce something buyer 1 values, resulting in $10 in appropriable value being created by the parties, i.e., $V = 10$. The feasibility condition is therefore

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

Observe that the feasibility condition is consistent with buyer 2 appropriating, i.e., $\pi_2 > 0$. One might, however, wonder how buyer 2 could appropriate given that he/she does not have any role in maximum value creation. Or to put it slightly differently, the firm and player 1 can always generate $10 without buyer 2.

The stability condition takes account of the fact that groups of players have such alternatives:

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

That is, the firm and buyer 1 can create $10 on their own, and so must appropriate at least $10 between them; the firm an buyer 2 cannot create any value, since the firm has just one unit of capacity, but buyer 2 only values both goods together; finally, the buyers cannot create any value without the firm.
So what appropriation levels are feasible and stable pre entry? Since there is just $10 to distribute, and the firm and buyer 1 can always appropriate that much on their own, it follows that buyer 2 cannot appropriate at all, i.e., $\pi_2 = 0$. Given this conclusion, the situation is as if buyer 2 were not present, in which case any division of $10 between the firm and buyer 1 is feasible and stable, and so, specifically, the firm’s minimum profit guaranteed by competition is zero. Intuitively, although buyer 1 must compete with buyer 2 to enjoy what can be produced with the firm’s capacity, that buyer 2 only values a system which is beyond the firm’s capabilities makes buyer 2 an ineffective competitor for buyer 1. Thus, the competition between buyers is too weak to guarantee the firm any profit.

2.2.2 Entry guarantees zero profit

Now assume an entrant, $e$, enters the market, and that the entrant has exactly the same capabilities as the firm in the sense that buyers do not care whether they purchase from the firm or entrant, and the entrant, like the firm, has one unit of capacity. In this version of the example, we assume that the components produced by each firm are incompatible.

As in the pre-entry case, since there is no value created by buyer 2 acquiring any of the system components, value is maximized by either the firm or entrant, but (due to the incompatibility) not both, producing something buyer 1 values. The feasibility condition is

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

The firm and buyer 1 can always appropriate $10 on their own; in this example the same is true for the entrant and buyer 1. Thus, again, buyer 2 cannot appropriate, i.e., $\pi_2 = 0$. The feasibility conditions reduce to

$$\pi_f + \pi_1 \geq 10, \pi_e + \pi_1 \geq 10$$

and

$$\pi_f + \pi_e + \pi_1 \geq 10.$$  

The unique feasible and stable appropriations are $\pi_f = \pi_e = 0$, and $\pi_1 = 10$. To see this, suppose $\pi_f > 0$. Then, there is strictly less than $10 left to be shared among the entrant and buyer 1. But the entrant and buyer 1 always have the option of generating $10 in value on their own, i.e., they can improve on any distribution of value that leaves them appropriating less than $10. Thus, entry guarantees the firm cannot
appropriate. A parallel argument yields \( \pi_e = 0 \), in which case buyer 1 appropriates all created value, i.e., \( \pi_1 = 10 \).

In this example, entry had a very special impact. First, although entry brought more capacity to the market, it did so (as a result of component incompatibility) in a way that did not allow more value to be realized. Moreover, entry did not create new alternatives for any group including the firm. In fact, entry created just one new alternative, namely another source of a single component for buyer 1. Thus, entry merely created intense competition between the firm and entrant to provide that component to buyer 1, driving the firm’s maximum possible appropriation to zero.

This example, while very special, typifies the kind of outcome that motivates much concern about entry. That is, entry merely creates new opportunities for participants other than the firm, thereby creating competition that restricts or eliminates the possibility of the firm appropriating. The next examples show that the situation need not be much different for entry to have a very different impact.

### 2.2.3 Entry guarantees positive profit

In this example we continue to assume the entrant’s product is incompatible with the firm’s, but in a less extreme manner. That is, buyer 2 continues to value the incompatible products at $0, but buyer 1 can achieve $11 in value from both goods, and $10 from just one. That is, an incompatible system is a small improvement over having just one component. We also suppose that an incompatible system, but neither good individually, has some alternative use that the firm and entrant can act on, say in a different application entirely, valued at $2. The most valuable activity is now for both the firm and entrant to produce, and buyer 1 to acquire the incompatible system; value created is $11.

Since buyer 2 continues to add nothing to any economic activity, buyer 2 still cannot appropriate, i.e., \( \pi_2 = 0 \). The stability and feasibility conditions become

\[
\pi_e + \pi_f \geq 2, \pi_f + \pi_1 \geq 10, \pi_e + \pi_1 \geq 10,
\]

\[
\pi_f + \pi_e + \pi_1 \geq 11,
\]

and

\[
\pi_f + \pi_e + \pi_1 = 11.
\]

The unique feasible and stable appropriations are \( \pi_f = \pi_e = 1 \) and \( \pi_1 = 9 \). To see why, note that in this example, as in the previous one, entry opened up new opportunities for buyer 1, in this case to acquire one
component from the entrant and none from the firm, or one from each, and did nothing for buyer 2. It also allowed more value to be achieved, since the incompatible system does offer buyer 1 some improvement over a single component. But it also created a new opportunity for the firm, i.e., to produce a system with the entrant and act on whatever alternative use generates $2.

Given these new opportunities, it is possible for the firm to appropriate some positive amount. This occurs because the incompatible system is more valuable to buyer 1 in comparison to acquiring a single component from the entrant. The entrant can appropriate for essentially the same reason. However, the firm can appropriate no more than $1 without making the option of acquiring a single component from the entrant attractive to buyer 1; for the same reason, the entrant can appropriate no more than $1. Finally, since the firm and entrant can always obtain $2 between them, they must appropriate exactly $1 each, leaving $9 for the buyer. Overall, the tension between entry creating extra value to be distributed, but also creating better alternatives for the firm, resulted in the firm being guaranteed positive profit post entry, but having no such guarantee pre entry.

2.2.4 Entry guarantees abundant profit

Finally, consider the case in which the components have no use outside the interaction with the buyers, but that they are fully compatible. The most valuable activity is for one of the buyers to acquire a complete system by obtaining one component from each of the firm and entrant. The stability and feasibility conditions therefore reduce to:4

\[ \pi_f + \pi_1 \geq 10, \pi_e + \pi_1 \geq 10, \]
\[ \pi_f + \pi_e + \pi_1 \geq 30, \pi_f + \pi_e + \pi_2 \geq 30 \]

and

\[ \pi_f + \pi_e + \pi_1 + \pi_2 = 30. \]

Suppose buyer 1 appropriates, i.e., \( \pi_1 > 0 \). Then less than $30 is left for the firm, entrant and buyer 2. But this group, since the components are compatible, and therefore of use to buyer 2, can always share $30. Thus, buyer 1 cannot appropriate; a parallel argument shows that buyer 2 cannot appropriate either.

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4Here we have suppressed some of the stability conditions that do not influence the feasible and stable appropriations, e.g., \( \pi_1 + \pi_2 \geq 0 \).
Thus, all value is appropriated by the firm and entrant. Incorporating these conclusions, the stability and feasibility conditions are simply
\[ \pi_f \geq 10, \pi_e \geq 10 \]
and
\[ \pi_f + \pi_e = 30. \]

That is, the firm and 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 firm’s appropriation lay between 0 and $10. Post-entry, the firm’s appropriation lies between $10 and $20, i.e., entry not only guaranteed the firm positive profit, but actually shifted the incumbent’s entire range of appropriation for the better. The intuition for the difference in the situations is as follows. Pre-entry, there is not enough capacity to produce anything buyer 2 values, so the firm and buyer 1 are effectively in a pure bargaining situation. Thus, whatever the firm appropriates is not a consequence of competition. Post-entry, there is sufficient capacity to produce the system, which both buyers value at $30. Buyers have become intense competitors, and so the $30 must be shared between firm and entrant. The sole constraint is that this sharing is such that neither the firm nor entrant can improve by selling one good to buyer 1 instead of being part of the production of a system.

In all these examples, the entrant has all the capability of the firm, and could replace the firm in any economic interaction with no loss in value. However, entry had many different effects: eliminating any prospect of appropriation for the firm, stimulating competition that ensured appropriation of exactly $1, or guaranteeing a high minimum appropriation, $10. The differences among these different outcomes are a consequence of the various ways entry affects competition. Simply knowing that an entrant can do anything the firm can do is not nearly enough to know how entry will affect the firm because entry has many effects beyond simply replicating firm capabilities.

3 New results on the impact of entry

In this section we present our general results on the impact of entry on sustained profitability. As we discussed earlier, our focus is on the way entry impacts the firm’s minimum profitability guaranteed by competition. That is, profits consistent with competition, as described by feasibility and stability, always
exceed some number, \( \pi^{\text{min}} \), and fall short of another number, \( \pi^{\text{max}} \), where \( \pi^{\text{min}} \leq \pi^{\text{max}} \). So our goal is to determine how entry affects \( \pi^{\text{min}} \). For example, we will say entry destroys guaranteed sustained profitability if \( \pi^{\text{min}} > 0 \) before entry, but \( \pi^{\text{min}} = 0 \) post entry. (Note that this definition does not preclude \( \pi^{\text{max}} > 0 \) post entry, in which case it is possible that the firm appropriates post entry due to bargaining; however, there is no post entry guarantee of sustained profits.)

### 3.1 A basic tension

To explore how entry impacts minimum profitability guaranteed by competition, it is helpful to employ the following observation from MacDonald and Ryall (2004). Suppose the firm appropriates \( \pi_f = 0 \). Could this be feasible and stable, i.e., is \( \pi^{\text{min}} = 0 \)? Inspecting (1) and (2), it is clear that the answer is affirmative if and only if \( V \) is sufficiently large. That is, if \( \pi_f = 0 \), when \( V \) is large enough it is possible to distribute \( V \) among the other players in a way that makes acting on any alternative activity with the firm unattractive, despite the fact that the firm would willingly take part in any such activity if offered any positive appropriation. Simply, the other players are appropriating so much from the value maximizing activity that none of their competing alternatives is appealing. Conversely, when \( V \) is smaller, there is no way to distribute \( V \) among the others in a way that would deter every one of from acting on some other activity involving the firm. Indeed, the groups of players that cannot simultaneously be detered from their competing alternatives are precisely those forming the relevant competition that might guarantee the firm’s profitability. Altogether then, there is a critical value of \( V \), which we call the firm’s minimum value, \( mv \), with the feature that

\[
\pi^{\text{min}} = 0 \text{ if and only if } V \geq mv, \tag{3}
\]

or, equivalently, since \( \pi^{\text{min}} \) cannot be negative,

\[
\pi^{\text{min}} > 0 \text{ if and only if } V < mv. \tag{4}
\]

Since \( mv \) quantifies the amount of total value creation that is required for the forces of competition to be so blunted as to remove any guarantee of profitability for the firm, \( mv \) might be thought of as a firm-specific index of the extent of competiton. That is, a high value of \( mv \) indicates a great deal of competition that is relevant to the firm’s guarantee of profit.

\[5\] Strictly, \( \pi^{\text{min}} \) should have an \( f \) subscript to indicate that it represents the firm’s minimum profit. Formally, \( \pi^{\text{min}} \) can be calculated as the minimized value of the following linear programming problem: choose \( \pi_1, \ldots, \pi_n \) to minimize \( \pi_1 \) subject to (1) and (2), where, for the calculation, we assume the firm is player 1. An analogous calculation yields \( \pi^{\text{max}} \).
Simple as (3) and (4) are, they encapsulate all the economic forces that determine whether competition guarantees the firm sustained profits. That is, if \( V < mv \), the forces of competition – i.e., the possibility of acting on alternatives involving the firm – are too powerful to permit the firm zero appropriation: competition guarantees that when the most valuable activity (i.e., that which generates \( V \)) actually occurs, the firm must have positive appropriation. But when \( V \geq mv \), the firm might (if \( \pi^{\text{max}} > 0 \)) appropriate positive value, but the reason this occurs will not be competitive forces; the most competition actually guarantees is zero.

The forces captured by (3) and (4) allow us to derive three kinds of results. The first can be developed with no extra exploration of exactly what determines either \( mv \) or \( V \). These results follow simply from asking whether entry disturbs the general forces determining whether the firm is guaranteed profit by virtue of competition. The second collection explores the connection between the impact of entry on sustained profitability and the entrant’s added value (Brandenburger and Stuart (1996), MacDonald and Ryall (2004)). The final collection of results follow from more detailed exploration of exactly what determines minimum value, and how entry affects these determinants.

In what follows we will use a “-” to indicate post-entry variables. That is, \( \pi^{\text{min}} \) represents the firm’s minimum guaranteed appropriation pre-entry, and \( \bar{\pi}^{\text{min}} \) minimum guaranteed appropriation pre-entry. Thus, we say entry destroys guaranteed profitability if \( \pi^{\text{min}} > 0 \) and \( \bar{\pi}^{\text{min}} = 0 \); entry creates guaranteed profitability if \( \pi^{\text{min}} = 0 \) and \( \bar{\pi}^{\text{min}} > 0 \); entry sustains guaranteed profitability if \( \pi^{\text{min}} > 0 \) and \( \bar{\pi}^{\text{min}} > 0 \); otherwise, entry is irrelevant for guaranteed profitability.

### 3.2 Results I

The assumption that adding another player to any group never reduces the value that group might produce has two useful implications for understanding the impact of entry. First, \( V \leq \bar{V} \), i.e, including the entrant in the existing collection of agents does not reduce their overall value creation possibilities, and may increase them. Second, \( mv \leq \bar{mv} \), 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 players, 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.)

Our first general result follows immediately from (3) and (4):

**Proposition 1** Given \( n, V, \) and \( v_G \),
1. Entry *destroys* guaranteed profitability if and only if

\[ V < mv \text{ and } \bar{V} \geq \bar{mv}; \]

2. Entry *creates* guaranteed profitability if and only if

\[ V \geq mv \text{ and } \bar{V} < \bar{mv}; \]

3. Entry *sustains* guaranteed profitability if and only if

\[ V \geq mv \text{ and } \bar{V} < \bar{mv}; \]

4. Otherwise, entry is *irrelevant* for guaranteed profitability.

According to Proposition 1, in order to determine entry’s impact on guaranteed profitability, one needs to know exactly four things: \( V, \bar{V}, mv, \text{ and } \bar{mv} \). In Figure 1, total value created is measured on the horizontal axis, and minimum value on the vertical. According to (3) and (4), the \((V, mv)\) values consistent with the firm having no guarantee of profitability, i.e., \( \pi^{\text{min}} = 0 \), are those in the shaded area, including the dashed line corresponding to \( V = mv \); likewise, the points “northwest” of the shaded area are those guaranteeing profits. The impact of entry is indicated by the arrows, where the lower left point identifies the pre-entry values, \((V, mv)\), and the upper right corresponds to post-entry, i.e., \((\bar{V}, \bar{mv})\). Since \( V \leq \bar{V} \text{ and } mv \leq \bar{mv} \), the arrows must slope upward and to the right. Thus, entry destroys a guarantee of profitability when the the arrow enters the shaded area; creates it when the arrow departs the shaded area; sustains it when the arrow never touches the shaded area, and is irrelevant when the arrow remains inside the shaded area.
Proposition 1 and Figure 1 offer several interesting and very general insights about the impact of entry on guaranteed profitability. First, entry generally will both increase the relevant sources of competition, as quantified by $mv$, as well as value creation, measured by $V$. However, knowing this says very little about entry’s affects on guaranteed profitability. That is, all of the kinds of effects of entry – i.e., creating guaranteed profitability, destroying it,...– 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 guaranteed profitability standpoint.

Second, if the firm has guaranteed profitability pre-entry – that is, $(V, mv)$ is not in the shaded region in
Figure 1 – for entry to be detrimental to guaranteed profitability, it is necessary that entry results in strictly more value ultimately being created, i.e., $V < \bar{V}$ (so that the arrow in Figure 1 is not vertical, and thus might enter the shaded region). Entry opens up new alternative opportunities for players other than the firm. But the competing alternatives that originally caused the firm to have positive minimum appropriation are still there, and if $V = \bar{V}$, there is not enough value created post entry to blunt the competition these alternatives imply, despite the existence of new opportunities. (This is not to say that entry has no effects on firm profitability. Indeed, it may have significant effects on, e.g., the firm’s maximum appropriation. Or entry might yield some relation between the firm’s profits and the entrant’s, e.g., they might be the same.)

That entry must create value if it is to threaten guaranteed profitability has some surprising implications. For example, suppose entry occurs, or is being contemplated, as the result of loss of intellectual property, and that the firm has neither other special advantages nor capacity limitations. In this instance an entering firm can do essentially anything the firm can do, and so intense competition to appropriate value would be expected. But such entry does not allow any extra value to be created. Thus, the model tells us that entry must not destroy guaranteed profitability, which at first appears counterintuitive. The explanation is that in this situation there was no guaranteed profitability in the first place, i.e., $\pi_{\text{min}} = 0$. That is, suppose the firm 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 feasible and stable. In fact, any strictly positive appropriation pre-entry is due to some successful bargaining by the firm, not competition among buyers.\(^6\)

The previous example involved the firm being immune to reduction in guaranteed profitability because it actually had no guaranteed profit. But the same immunity can occur without the firm having zero guaranteed profit. For example, suppose the firm has two potential customers, say a pair of retailers, one of whom has a “volume requirement.” That is, if the firm is to serve a large chain retailer, it must do so at sufficient volume to satisfy the needs of all the retailer’s stores. Assume the firm has capacity to serve just one of the two retailers, and, to keep the numbers easy, has zero production costs up to its capacity constraint. Assume further that one potential retailer is “high end”, and values the firm’s total production run at $\$H$, whereas the other is “low end”, and values the firm’s output at $\$L$, where $\$H > \$L$; only the low end retailer has a volume requirement. In this case, the firm’s pre-entry guaranteed profit is $\$L$. That is, value maximization dictates that only the high end retailer buy the product. But if the firm were to receive strictly less than 

\(^6\)Observe that the textbook monopoly model assumes, without obvious justification, that the firm invariably has all the bargaining power.
it could offer to sell the product to the low end retailer at slightly less than $L$, a deal preferable to both. Thus, the firm must appropriate at least $L$ pre entry. Now suppose a new firm enters the market with a product tailored to the high end retailer, planning to attract a share of the firm’s high end business; implicitly, the low end retailer has no value for the entrant’s tailored product. (We also assume the high end retailer will purchase from just one seller.) Suppose the entrant has half as much capacity as the firm, and so might steal half the firm’s high end business, which, for simplicity, the high end retailer values at $H/2$. Post entry, there are two value creation scenarios that might occur, depending on the values of $H$ and $L$. One is simply that the entrant’s capacity is not used, and the firm continues to supply the high end retailer; this scenario creates $H$ in total value, the same as pre-entry. The other possibility is that that the entrant’s half a unit of capacity is employed to serve the high end retailer, and all the firm’s capacity is used to satisfy the low end retailer’s volume needs; this scenario creates $H/2 + L$ in value. For the moment, we are concentrating on instances in which entry creates no new value; thus, we assume $H \geq H/2 + L$, or $H - L \geq H/2$. Now, suppose the firm appropriates $L$ from sales to the high end retailer, the high end retailer appropriates $H - L$, and the entrant and low end retailer are left with nothing. What can the entrant do to avoid this? Its product is worth nothing to the low end retailer, so there is no deal to be made there. The product is worth $H/2$ to the high end retailer, and so the entrant can offer a share of $H/2$ to the high end retailer. But, since $H - L \geq H/2$, no offer the entrant would willingly make would be of interest to the high end retailer. Thus, the firm’s appropriating $L$ post entry is feasible and stable; indeed, the firm’s guaranteed profit is still $L$. Again, the entrant must create additional value if the firm’s guaranteed appropriation is to be threatened. In this example, the entrant’s attempt to compete away the firm’s high end business is unsuccessful since it does not add enough value to change the competitive impact of the firm having the competing alternative of serving the low end retailer.

A third implication of Proposition 1 and Figure 1 is that unless entry stimulates competition, as measured by $\overline{mv}$ differing from $mv$, if the entrant adds enough value – i.e., $\overline{V}$ is sufficiently greater than $V$ – the firm’s guaranteed profitability is always destroyed. For example, suppose that the entrant brings a new technology whose use is voluntary but cannot be precluded. In this case, $\overline{V}$ is the aggregate value creation based on the new technology, and the $\overline{v}_G$ values correspond to what groups can achieve via opting out of using the new technology. In this case, if the technology is valuable enough, the firm’s guaranteed profitability is destroyed. Intuitively, the technology makes the competing alternatives – which do not use the new technology – an ineffective source of competition. Indeed, value appropriation will be determined by bargaining among all the agents, not by competition. This example provides another way to think about the oft-discussed notion.
of “disruptive” technology. Value flows from being part of using the new technology, and competition based on the old technology that once sustained profitability can no longer do 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, it allows a lot more value to be created.

(USE THIS EXAMPLE AGAIN WITH THE ENTRANT ADDING H NOT H/2 TO SHOW ADDING ENOUGH AWAYS IS A PROBLEM)

results due to expanding resources
results due to growing competition
what’s in mv, what’s not?

$v_G$ goes up when we add $F$ to $G$

what does mv depend on?