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Strategy Dynamics through a Demand-Based Lens: The Evolution of Market Boundaries, Resource Rents, and Competitive Positions

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Abstract

We develop a novel approach to strategy dynamics grounded in an explicit treatment of consumer choice when technologies improve over time. We adress the evolution of market boundaries, resource rents, and competitive positions by adapting formal models of competition with differentiated products. Our model captures the central strategy insight that competitive interactions are governed by superior value creation and competitive advantage. More importantly, it shows how the interplay between improving technologies and consumers' valuation of resulting performance improvements affects which market segments new technologies are able to enter, how the rents from different types of resources change over time, and whether or not markets are segmented according to classic generic strategies. Our focus on consumer choice and value creation complements the traditional focus in the strategy literature on competition and value capture.

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1. Introduction

In addressing the question of how to achieve superior performance in competitive market settings, the strategy literature offers two alternative approaches. The competitive strategy school (e.g., Porter, 1980) offers insight into how a firm's industry and its choice of position affects its performance. The resource based school (e.g., Wernerfelt, 1984) explores how a firm's resources and capabilities affect its ability to sustain above average returns. While their joint contribution has advanced our understanding of firm performance, there is a sense in the field that more could be done to illuminate how the returns to both industry positions and firm resources evolve over time (Porter, 1991; Foss 1997) – the dynamics of strategy.

In considering these dynamics, we find three questions to be of particular interest: (i) How do industry boundaries change over time? (ii) How do resource rents change over time? (iii) How does optimal positioning within an industry change over time? We address these distinct questions using a single unified approach. The origin of dynamics in our model is that the performance of product and service offers improves over time. We interpret performance improvement broadly (e.g., the increasing speed of microprocessors; the increasing safety of automobiles; the increasing breadth and timeliness of financial information). At the center of our approach is an explicit treatment of consumer choice, which leads us to focus on a firm's **value creation**, the difference between consumer's willingness to pay for an offer and the firm's production cost (Ghemawat, 1991). A key link between performance improvement and value creation is the extent of consumers' **decreasing marginal utility (DMU)**, which determines the degree to which consumers have a decreasing willingness to pay for performance improvements. Our focus on consumer choice and value creation complements the traditional focus in the strategy literature on competition and value capture. Our approach extends prior work that has elaborated a demand-based perspective on technology competition (Adner and Zemsky, 2001; Adner 2002) and technology evolution (Adner and Levinthal, 2001).

We study these dynamics using a formal model. Our objective is to validate our approach to strategy dynamics with a simple tractable model, just as Lippman and Rumelt (1982) used a simple model to demonstrate the importance of barriers to imitation for explaining firm performance. To achieve the desired simplicity, we minimize complex game theoretic interactions by abstracting away from repeated game equilibria and by allowing firms to price discriminate. We consider a Bertrand duopoly where firms and their offers differ in both cost and performance. We allow for consumer heterogeneity by grouping consumers into discrete market segments. Though simple, our model generates complex dynamic behaviors. We see ours as a tractable baseline model upon which future work can build.

We begin by formalizing, in the context of our model, competitive advantage. We distinguish between a firm's **differentiation advantage**, the extent to which consumers have a higher willingness to pay for its offer, and a firm's **cost advantage**, the extent to which it has lower production costs. The sum of these advantages, which we show is equivalent to a firm's relative value creation, is what determines competitive outcomes: whether a firm serves a given market segment, and its profits from doing so. The critical role of DMU in the model is in shaping the way in which a firm's relative value creation evolves over time as the performance of offers improves.

In considering the evolution of industry boundaries, we ask whether a new offer enters a given market segment; if so, when it enters; and finally, whether this entry is permanent or temporary. We show that DMU has an important effect on entry timing which depends on whether or not the firm has a cost advantage. With a cost advantage, higher DMU advances the time of entry, while with a cost disadvantage, higher DMU delays entry.

We consider the evolution of resource rents in a setting where firms posses unique and inimitable resources. First, we offer a typology of resources based on how they create value in the market. For example, we distinguish between timing resources that allow a firm to enter a market earlier, and innovation resources that give a firm a superior technology trajectory. We show how the time path of resource rents varies by resource type. These resource dynamics arise not from imitation, but from the evolution of relative value creation. Among other results, we show that the net present value of resource rent streams is decreasing in DMU. This occurs for two reasons: First, DMU lowers consumers' willingness to pay, and hence value creation, and therefore delays entry into new segments. Second, it speeds the erosion of differentiation advantages that come from performance-enhancing resources.

Finally, we consider the evolution of competitive positions. We show when conditions are such that industries segment according to the classic generic strategies of Cost Leadership and Differentiation and firms located at other positions are "stuck in the middle" (Porter, 1980). We also show when these generic strategies break down and the industry is dominated by a Generalist located in the middle. The viability of the Generalist strategy depends on the degree of consumer heterogeneity and the extent to which the Generalist can leverage fixed costs. We characterize the sequence in which different competitive positions arise over time, and show that higher DMU makes it more likely that a Differentiator pioneers a market, but it also makes it more likely that a Generalist dominates the market in the long-run. This is because DMU has two competing effects: First, it reduces willingness to pay and thus makes it less attractive to have broad market coverage early on, which is required for the Generalist to cover its higher fixed costs. Second, it masks consumer heterogeneity, which reduces the benefits to specialized strategies and thus favors Generalists in the long run.

In addition to characterizing the effects of DMU, we also characterize the effects of the trajectory of technological progress, consumer's taste for quality, consumer heterogeneity and cost structure on strategy dynamics.

The paper proceeds as follows. In Section 2 we introduce the model. In Section 3 we discuss some of the key assumption, their implications, and their boundaries. In Section 4 we formally define competitive advantage and value creation in the context of our model and show how these concepts govern competitive interactions at a point in time. In Section 5, we use the model to examine the evolution of market boundaries over time. In Section 6, we characterize how the rents from different types of resources change over time. The analysis in Sections 5 and 6 is for one market segment and a single resource. In Section 7, we show how these analyses can be aggregated to look at the evolution of market boundaries and rents when there are multiple market segments and multiple resources. In Section 8, we turn to firms' choice of competitive positions and how they evolve as technologies improve over time. Section 9 concludes.

2. The Model

We borrow three important elements from traditional models of product differentiation (e.g., Hotelling 1929; Shaked and Sutton, 1987). The first is heterogeneity of both consumers and offers. Specifically, offers differ in their performance levels and consumers differ in their willingness to pay for a given level of performance. Second, we assume a discrete choice setting where each consumer either buys a single unit of one offer or buys nothing at all. Finally, we assume Bertrand (i.e. price) competition. We deviate from standard differentiation models by grouping consumers into discrete market segments and by assuming that offers improve over time. The specifics of the model are as follows.

2.1. Supply-Side

There are two firms that each produce a single product or service offer.[1] These offers vary in their cost of production and performance. We index the firms and their offers by $i = 1, 2$. Firm i bears a marginal cost in producing its offer of $c_i > 0$. We denote the performance of of offer i at time t by $x_i(t)$. We denote offer i's **technology trajectory**, which determines its rate of improvement over time, by b_i. We make different assumptions about $x_i(t)$ in each of the three applications, which we present below. We provide further discussion of these assumptions in the appropriate sections.

[1] In parts of Section 8, we consider the existence of a third firm.

2.1.1. Market Boundaries

In Section 5 where we study the evolution of market boundaries, we consider a situation where firm 1 is bringing a new offer to market. The key attribute of both offers improves exogenously over time as $x_1(t) = b_1 t$ and $x_2(t) = b_2(t + h)$, where $h > 0$ reflects the assumption that firm 2 has a head start in the market.

2.1.2. Resource Rents

In Section 6, where we study the evolution of resource rents, we consider a situation where firms 1 and 2 and are identical except that firm 1 has a unique and inimitable resource. But for this unique resource, the firms would have the same costs ($c_1 = c_2$) and their offers would follow the same exogenous trajectory ($x_1(t) = x_2(t) = bt$). We consider four types of resources. A **cost resource** gives firm 1 lower production costs so that $c_1 < c_2$. A **performance resource** increases firm 1's performance level by some $r > 0$; that is $x_1(t) = bt + r$ and $x_2(t) = bt$. A **timing resource** gives firm 1 a head-start of h in developing its offer; that is $x_1(t) = b(t + h)$ and $x_2(t) = bt$. An **innovation resource** gives firm 1 a better trajectory so that $b_1 > b_2$; that is $x_1(t) = b_1 t$ and $x_2(t) = b_2 t$.

2.1.3. Competitive Positioning

In Section 8, where we study the evolution of competitive positions, we consider a situation where firms choose cost-performance positions along a productivity frontier that is shifting outwards over time. In this setting, an offer's performance is characterized as $x(t, d) = b(t)d$, where $d \geq 0$ is the a firm's positioning choice. We assume that costs are increasing in d, such that there is a trade-off between performance and costs (details given below). We assume that $b(t)$ is any unbounded, monotonically increasing function. Thus, in this part of the analysis, there is a productivity frontier that shifts out exogenously and the performance levels of each firm's offer is endogenous.

We examine two technologies whose cost structures differ. For technology M there are no fixed costs and marginal cost is given by $c_i = \underline{c} + d$. Thus $\underline{c} > 0$ is the minimal cost to produce the offer. For technology F marginal costs are given by $c_i = \underline{c} + (1-f)d$ and fixed costs are given by fKd where $f \in [0, 1]$. We refer to f as the **scalability** of the technology because it determines the extent to which total costs increase with volume. The importance of fixed costs depends on both f and K. Note that technology M is a special case of technology F where $f = 0$.

2.2. Demand-Side

Consumers are divided into market segments based on their willingness to pay for offers (i.e., the benefit they receive from consuming the offer). Through Section 6, we focus on a single segment. We denote by s the number of consumers in this segment. We denote by w_i the segment's willingness to pay for offer i. We decompose willingness to pay into two components. The first is the offer's quality as perceived by the segment $q(x_i)$, which we assume to be an increasing function of the offer performance.[2] The second component is the segment's taste, or ability to pay, for quality, which we parameterize by a. Willingness to pay for offer i at time t is then $w_i(t) = aq(x_i)$. We introduce decreasing willingness to pay for quality improvement by assuming that $q(x_i) = x_i^{\beta}$ where $\beta \in (0, 1)$.

The parameter a can be interpreted in several ways. If consumers are individuals, a can be interpreted as a taste for quality, or alternatively as an ability to pay that is (usually) increasing in income level. If consumers are organizations, a can be interpreted as the importance of the input (e.g., airplane engines performance might be more important for military rather than civilian buyers) or as the intensity at which the offer will be used.

The parameter β determines the extent to which consumers have decreasing marginal utility (DMU) from performance improvements. For example, the utility from an additional megahertz of processing power was much higher when micro processor speeds were 100mhz than when they were 1000mhz. DMU is of interest because it

[2] For expositional simplicity, we will sometimes drop the explicit reference to time dependence. Here, for example, we write $q(x_i)$ for $q(x_i(t))$.

varies across products and services. For example, while DMU is high for microprocessor speed (relative to the rate of technological advance), DMU seems less pronounced for the resolution of digital cameras, where the latest models still seem to command a significant price premium. Formally, for $x_i > 1$, DMU is decreasing in β, while for $x_i < 1$ DMU is increasing in β. We restrict attention to $x_i > 1$ so that β has an unambiguous effect on DMU.[3]

2.3. Pricing

Denote by p_i the price that firm i quotes to the segment. We assume that consumers buy one unit of the offer that gives them the greatest surplus (or delivered value), $w_i - p_i$, unless this is negative for both offers, in which case they make no purchase.[4] As in classic work on product differentiation, we assume that prices form an equilibrium of the one-shot game played between the firms at a point in time. Thus, we abstract away from repeated game effects. Note that we are assuming that price discrimination across segments is possible. This results in a maximum level of rivalry where the price of a weaker offer is competed down to its marginal cost. Abstracting from repeated games and allowing price-discrimination greatly simplifies the game theoretic interactions between firms.

3. Further Discussion of the Model

Our intent is to present a stylized model that is useful in characterizing strategy dynamics. We see ours as a very tractable base model upon which future work can build. Despite the simplicity of our model, we are still able to capture reasonably complex dynamic behaviors. We now discuss some of our main simplifying assumptions in more detail.

[3] The functional form $q(x) = x^\beta$ that we use to model DMU is conservative in that consumer utility is unbounded and hence $\lim_{x\to\infty} w_i = \infty$. Imposing an upper bound on willingness to pay would imply that DMU is even more pronounced than our functional form.

[4] For simplicity, we assume that a consumer indifferent between offer 1 and her next best alternative (either buying offer 2 or not purchasing at all), buys offer 1.

We assume that technological progress is exogenous, in that offers get better independently of the activities of the focal firms. Such progress can be driven by the activities of suppliers of general purpose inputs (e.g., improvements in customer relationship management software, computer aided manufacturing systems and worker education that allow downstream firms to offer better products and services). Alternatively, progress can be driven by spillovers and transfers from external sources such as basic science, military R&D and other industries (e.g., engines, navigation systems, construction materials and techniques that have been transferred to civilian aviation from the military). With this assumption we abstract away from important drivers of technological progress such as firm capabilities and incentives to innovate (Klepper, 1996; Nelson and Winter, 1982). We note however that the assumption of exogenous technological progress may not be critical to our results. Adner (2002) studies the evolution of market boundaries using a simulation model with endogenous technological progress and finds results that are broadly consistent with ours.

A key property of the model is that consumers' willingness to pay increases over time but at a decreasing rate, (i.e. $\frac{\partial w_i}{\partial t} > 0$ and $\frac{\partial^2 w_i}{\partial t^2} < 0$). We simplify our model by assuming a constant rate of technological progress (e.g., $x_1(t) = b_1 t$) and assuming decreasing returns to performance improvements on the demand side (i.e., $\beta < 1$). We could relax these assumptions by assuming that $x_1 = b_1 t^\alpha$, where $\alpha < 1$ corresponds to a decelerating rate of technological progress (e.g., Foster 1986) and $\alpha > 1$ corresponds to accelerating rates (e.g., Moore's Law). All our results hold in this more general model as long as $\alpha\beta < 1$ so that there are net decreasing returns.[5]

We assume that firms follow the one-shot equilibrium of the pricing game.[6] The applicability of this assumption hinges on whether firms are able to tacitly collude

[5]Formally, if $x_1 = b_1 t^\alpha$ then

$$\frac{\partial^2 w_1}{\partial t^2} = -\frac{(1-\alpha\beta) a b_1^\beta \alpha\beta}{t^{2-\alpha\beta}}$$

which is negative *iff* $\alpha\beta < 1$.

[6]Repeatedly playing the one-shot equilibrium of the stage game is always one possible equilibrium of the repeated game. It is the unique subgame perfect equilibrium if the firms only meet a finite number of times (Vives, 1999).

or whether they are competing as fiercely as possible, attempting to maximize their profits in every period. The semiconductor industry, where firms are aggressive in attempting to capture returns on their investments in one product generation before the next generation emerges, is one example of such a setting (consider, for example, the intense competition between Intel and AMD).

Although consumer heterogeneity is usually modeled as a uniform continuous distribution (e.g., most work on Hotelling's linear city), we consider discrete segmentation. We believe that discrete segmentation is a reasonable description of heterogeneity in many settings. Examples of discrete heterogeneity include personal versus professional users, differences across national markets, and differences across industry sectors (for business-to-business markets). Moreover, continuous distributions over consumer heterogeneity can always be approximated by a sufficiently large number of discrete segments.

We assume that firms can price discriminate across segments in that consumers in one segment do not have access to the prices quoted in other segments. For example, price discrimination is possible among geographically distinct segments when transport costs are sufficiently large. Similarly, price discrimination holds in settings characterized by negotiated prices (e.g., outsourcing contracts). In Adner and Zemsky (2001), we study the evolution of market boundaries in a related, but more complex model, that includes the case where price discrimination is not possible. We find that the main effect of the inability to price discriminate is to delay firms' decisions to enter new segments because entry requires them to lower prices in their existing segments.

Besides the above simplifications, we abstract from other important factors that are important for strategy dynamics such as evolving costs (e.g., due to economies of learning or scale), shifting demand structure (e.g., due to network externalities, improving complements, firms' actions to stimulate demand or market growth), and the possibility of multi-product firms. The tractability of our baseline model suggests it as a potential vehicle to explore these additional research avenues.

4. Preliminaries

We begin the analysis by formally defining two strategy concepts—value creation and competitive advantage—in the context of our model. We then show how these concepts determine which firm serves a given segment and the resulting profit at a given point in time. These concepts and the static analysis provide the necessary foundation for the dynamic analysis in the rest of the paper.

Definition 4.1. *An offer's* ***value creation*** *for a consumer in a given segment is the difference between the consumer's willingness to pay and the marginal production cost. We denote this by* $v_i(t) = w_i(t) - c_i$.

It is useful to break competitive advantage into two parts, relative costs and relative differentiation. We focus our analysis on offer 1 and define the following:

Definition 4.2. *The* ***cost (dis)advantage*** *of offer 1 is* $A_c = c_2 - c_1$. *The* ***differentiation (dis)advantage*** *of offer 1 is* $A_d(t) = w_1(t) - w_2(t)$. *The* ***net competitive advantage*** *is then* $A_d(t) + A_c$.

Note that both value creation and differentiation advantage will vary across segments.

We now characterize the outcome of competition between firm 1 and firm 2 at a given point in time. Specifically, we take as given the value creation of each firm, v_1 and v_2. We are interested in whether firm 1 sells its offer to the segment and if it does, what level of profits it achieves. The answer depends on whether or not offer 2 has positive value creation for the segment. If it does not ($v_2 < 0$), then offer 2 is irrelevant because consumers are not willing to pay the marginal cost of production ($w_2 < c_2$). Firm 1 serves the market if its price is no greater than consumer's willingness to pay, $p_1 \leq w_1$. The firm optimally sets the highest possible price $p_1^* = w_1$ and this is profitable if $w_1 > c_1$ or equivalently $v_1 > 0$. Profit is then $s(p_1^* - c_1) = sv_1$. Thus, firm 1's ability to serve the segment and its profits depend on its level of value creation.

Now suppose that firm 2 does have positive value creation so that $v_2 = w_2 - c_2 > 0$. Firm 2 will be willing to reduce its price to c_2 in order to capture the segment, which results in a delivered value of $w_2 - c_2$. For firm 1 to serve the segment it must then set a price so that $w_1 - p_1 \geq w_2 - c_2$. In this case, the optimal price is $p_1^* = w_1 - w_2 + c_2$. Charging this price is only profitable if $p_1^* - c_1 > 0$. Note that $p_1^* - c_1 = w_1 - w_2 + c_2 - c_2 = A_d + A_c = v_1 - v_2$. If $p_1^* - c_1 > 0$, the profit is $s(p_1^* - c_1) = s(A_d + A_c) = s(v_1 - v_2)$. Thus, in the competitive case, firm 1's ability to serve the segment and its profits depend on its net competitive advantage over firm 2, which is equivalent to the superiority of firm 1's value creation. We collect these results in the following proposition.

Proposition 4.3. *(i) Consider a segment where the alternative offer does not create value ($v_2 \leq 0$). Consumers buy the focal offer if it has positive value creation ($v_1 \geq 0$) and the profit is then proportional to the size of the segment and the value created: sv_1. (ii) Now consider a segment where the alternative does create value ($v_2 > 0$). Consumers buy the focal offer if it has superior value creation ($v_1 \geq v_2$), which is equivalent to having a net competitive advantage ($A_d + A_c \geq 0$). The profit is proportional to the size of the segment and the net competitive advantage: $s(A_d + A_c)$.*

We note the transition in the drivers of a firm's profits when rivals begin to create positive value and become potential entrants in the segment. Specifically, the profit driver shifts from the firm's absolute value creation to its relative value creation. Our result that firm profit depends on the additional value that a firm brings to the market is consistent with Brandenburger and Stuart (1996), who use cooperative game theory to argue that a firm's added value places an upper bound on the rents that it can appropriate.

5. The Evolution of Market Boundaries

Industry analysis (Porter, 1980) is often criticized as taking too static a view of market boundaries (e.g., Grant, 1998). The importance of understanding shifts in market boundaries is highlighted, for example, by the phenomenon of disruptive technologies (Christensen, 1997). Disruptions occur when existing industry boundaries are redrawn by the entry of firms using new technologies that, as they improve, displace existing technologies from mainstream segments. The recent technology bubble, in which many promising new technologies turned out *not* to be disruptive, underscores the need to critically assess the threat posed by new technologies.

We consider whether a new offer will displace an established offer from a given segment; if so, when this will occur; and finally, whether displacement will be permanent or transitory. We show how the answers depend on technology trajectories, cost positions, consumer's taste for quality, and the extent of DMU. Note that one can interpret offers broadly, including competition between different strategies such as discount retailers and department stores.

We consider a situation where firm 1 is bringing a new type of offer to the market. We assume that firm 2 has a head-start in the market of $h > 0$. The performance of both offers improves over time as follows:

$$\begin{aligned} x_1(t) &= b_1 t, \\ x_2(t) &= b_2(t+h). \end{aligned}$$

We refer to b_i as the **technology trajectory** along which offer i is improving. Thus, the firm's value creation increases over time as follows: $v_1(t) = ab_1^\beta t^\beta - c_1$ and $v_2(t) = ab_2^\beta (t+h)^\beta - c_2$.

At time $t = 0$, offer 1 must have a negative value creation since $v_1(0) = -c_1$. Let $t_0 > 0$ be such that $v_1(t_0) = 0$. We assume that at this time firm 2 is already creating value for the segment (i.e., $v_2(t_0) > 0$), which assures that offer 2 is already established in the segment. Finally, we assume that $t_0 b_1 > 1$ so that DMU is decreasing in β.

Since offer 2 already has positive value creation, from Proposition 4.3 we have that offer 1 can only enter the segment profitably if it has a net competitive advantage, $A_d(t) + A_c > 0$. The cost advantage A_c is fixed while the differentiation advantage $A_d(t)$ changes over time as follows

$$A_d(t) = w_1(t) - w_2(t) = a(b_1 t)^\beta - a(b_2(t+h))^\beta.$$

The timing of entry, which we denote by t_E, occurs when $A_d(t_E) + A_c = 0$. We begin by characterizing entry dynamics when the offers have the same trajectories.

Proposition 5.1. *Suppose the technologies have the same trajectory ($b_1 = b_2$). Without a cost advantage ($A_c \leq 0$), the new firm never enters the segment. With a cost advantage ($A_c > 0$), the new firm displaces the established firm from some time t_E onwards. The greater the extent of DMU and the smaller the segment's taste for quality, the sooner the new firm enters the segment (i.e., t_E is increasing in β and a).*[7]

The intuition for Proposition 5.1 is as follows. Due to its later start and identical trajectory, firm 1 always has a differentiation disadvantage (i.e., $A_d(t) < 0$ for all t). However, this disadvantage shrinks over time due to DMU; in particular $\lim_{t\to\infty} A_d(t) = 0$. Thus, as long as firm 1 has a cost advantage, it will enter the segment eventually. The lower the marginal utility for quality improvements, which depends on DMU and taste for quality, the faster the differentiation gap erodes and the sooner entry occurs. This proposition highlights the importance of cost advantage and consumers' willingness to pay for performance improvements when identifying disruptive threats.

Now consider entry dynamics when technologies have different trajectories:

Proposition 5.2. *Suppose the new technology has a better trajectory ($b_1 > b_2$). The new firm always displaces the established firm from some time t_E onwards. The effect of DMU and the taste for quality depends on the cost position. Specifically, if $A_c > 0$ the time of entry is delayed as the taste for quality increases and as DMU decreases; conversely, if $A_c < 0$ the time of entry is delayed as the taste for quality decreases and as DMU increases.*

In this case, firm 1 starts with a differentiation disadvantage ($A_d(0) < 0$) due to its later entry, but over time it develops a differentiation advantage due to its superior technology trajectory. As the differentiation advantage grows, it eventually overwhelms any cost disadvantage and entry occurs. If $A_c > 0$ then firm 1 enters while it still has a

[7] All proofs for Section 5 are in the Appendix.

differentiation disadvantage (since $A_d(t_E) = -A_c < 0$) and hence anything that reduces the marginal willingness to pay for quality (i.e. the taste for quality and the extent of DMU) speeds entry. Conversely, if $A_c < 0$ then firm 1 only enters when it has a differentiation advantage and hence entry timing is decreasing in the taste for quality and increasing in the extent of DMU.

We note that this proposition, like many that will follow, presents empirically testable hypotheses. For example, Proposition 5.2 predicts that whether a new technology will first enter segments with a high or low taste for quality depends on its cost advantage and trajectory.

Now consider the longevity of a firm's entry into a market segment:

Proposition 5.3. *Suppose the new technology has a worse trajectory ($b_1 < b_2$). If the new firm does not have a sufficiently large cost advantage, it never enters the segment. If it does have a sufficiently large cost advantage, it enters the segment, but only for a limited interval of time. The period of entry is decreasing in DMU and in the segment's taste for quality.*

With a worse trajectory and a late entry, firm 1 always has a differentiation disadvantage. At first the differentiation disadvantage falls as the effect of firm 2's head-start erodes. This allows firm 1 to enter the market if its cost advantage is large enough to offset its remaining differentiation disadvantage. However, firm 1's net competitive advantage is not sustainable. Over time, firm 2's superior trajectory causes its differentiation advantage to grow. Eventually, firm 2's differentiation advantage offsets its cost disadvantage and firm 2 re-enters the segment. Thus, our simple model highlights a distinction between permanent and temporary threats; an example of the latter is the threat posed to traditional stock brokers by deep-discount brokers who made early market share gains in the mainstream retail segment, but have since receded. This logic holds implications for when firms should respond to threats by continuing to invest along their existing trajectory and when they should embrace emerging alternatives.[8]

[8] We note that all the results in this section generalize to there being any $n_i \geq 1$ firms producing

6. The Evolution of Resource Rents

A fundamental question in strategy is the sustainability of resource rents. The question of how the value of resources evolves, however, is largely unexplored. The resource based view argues that competitive advantage is conferred to those firms that possess valuable, rare, inimitable and non-substitutable resources. The received literature has primarily focused on the threat posed by competitor imitation to resource rents (e.g. Lippman and Rumelt (1982) and Barney (1991)). Although the resource-based view does recognize the importance of resource value, its treatment of value is much less well developed than its treatment of barriers to imitation (Priem and Butler, 2001). Imitation is clearly important but, as we show, it is not the only driver of rent dynamics. We show that even when resources remain rare and inimitable at all times, the value of resources may nonetheless change. We highlight the role of DMU in both dampening the rate at which resource rents buildup over time and in hastening the rate of decay.

In this section we distinguish among different types of resources based on how they affect a firm's value creation. Our fundamental question is how resource rents vary over time and by type of resource. We assume that firms 1 and 2, and their offers, are identical except that firm 1 has a unique and inimitable resource that improves its ability to create value for the segment. But for this unique resource, the firms would have the same costs ($c_1 = c_2$) and their offers would follow the same technology trajectory ($x_1(t) = x_2(t) = bt$). Recall the resource typology introduced in Section 2.1.2

A **cost resource** gives firm 1 a cost advantage (i.e., $c_1 < c_2$ and hence $A_c > 0$). Dell's superior supply chain management in the PC industry could be characterized as a cost resource.

A **performance resource** gives firm 1 a differentiation advantage by increasing the performance of firm 1's offer by some $r > 0$ so that $x_1(t) = bt + r$. McKinsey's

offer i. With $n_i > 1$, Bertrand competition among firms producing an offer reduces price to marginal cost and the segment still buys based on value creation, which is the key result from Section 4 used in the proofs of this section.

reputation in management consulting and Sony's advantages in miniaturization could be characterized as performance resources.

A **timing resource** gives firm 1 a differentiation advantage by giving it a head-start of h on developing its offer so that $x_1(t) = b(t+h)$. One can think of firms that are consistently fast to market such as 3M as possessing a timing resource.[9]

An **innovation resource** gives firm 1 a differentiation advantage due to a better trajectory. In this case, $x_1(t) = b_1 t$ and $x_2(t) = b_2 t$ where $b_1 > b_2$. One could interpret Gillete's superior product development process as rooted in an innovation resource.

The early rent dynamics for all resources are broadly the same: Because of its unique resource, firm 1 has a net competitive advantage over firm 2 at all times, $A_d(t)+A_c > 0$. Therefore, firm 1 will be the first to enter the segment and is never displaced. Let t_1 be the time of entry for firm 1. Let $t_2 > t_1$ be the time at which firm 2's offer creates positive value in the segment. Although firm 1 is always dominant, its rents change over time:

Proposition 6.1. *From the time of firm 1's entry into the segment (i) the rents from cost-resources increase over time and then stabilize; (ii) the rents from both performance-resources and timing-resources first increase and then decrease over time; (iii) the rents from innovation resources increase over time, but at a decreasing rate.*

Proof For all four resource types, $A_d(t) + A_c > 0$ for all $t > 0$ and hence firm 1 enters the segment first and is never displaced. We have that t_i is defined by $v_i(t_i) = 0$. From Proposition 4.3, we have that firm 1's rent (profit) from its resource is

$$\pi_1(t) = \begin{cases} 0 & \text{if } t \leq t_1, \\ sv_1(t) & \text{if } t \in (t_1, t_2], \\ s(v_1(t) - v_2(t)) & \text{otherwise.} \end{cases}$$

For all resource types, $v_1'(t) > 0$ as performance increases in t and hence rents are

[9] Note that performance and time resources are formally equivalent, differing only by a factor b. In particular, the dynamics are identical for $r = bh$ since $x_1(t) = bt + r$ for an attribute resource and $x_1(t) = b(t+h)$ for a timing resource.

always increasing for $t \in (t_1, t_2)$. For a cost resource, $v_1(t) - v_2(t) = A_c$ and rents are flat for $t > t_2$. For all other resources, $v_1(t) - v_2(t) = A_d(t)$ varies with time. For performance and timing resources, $A'_d(t) < 0$ and rents decline for $t > t_2$. For innovation resources, $A'_d(t) > 0$ and rents increase over time but at a decreasing rate since $A''_d(t) < 0$. ■

The general intuition for the results is as follows. From time t_0 to t_1 neither firm is in the market. From time t_1 to t_2, firm 1 is alone in the market because firm 2 does not create value ($0 > v_2(t)$) and hence from Proposition 4.3 part (i), we have that firm 1's rents are proportional to the size of the segment and to firm 1's value creation ($sv_1(t)$). Over time, as the quality of firm 1's offer improves, its value creation and its rents increase (but at a decreasing rate due to DMU). Starting at time t_2, firm 2's offer has improved sufficiently that it too has positive value creation in the segment and hence Proposition 4.3 part (ii) applies. From time t_2 firm 1's rents are proportional to the size of the segment and the extent to which it offers superior value creation: $s(v_1 - v_2) = s(A_d(t) + A_c)$. The evolution of rents from this time on depends on the type of resource.

For cost resources, there is no differentiation advantage ($A_d(t) = 0$ for all t) and hence the net competitive advantage is a constant ($v_1 - v_2 = A_c > 0$), which implies that rents stabilize at sA_c. Figure 6.1 illustrates. Until time t_1, neither firm has positive value creation. From time t_1 to time t_2 only firm 1 has positive value creation and during this interval firm 1's rent ($sv_1(t)$) increases with its value creation. After time t_2 both firms have positive value creation that is increasing at the same rate, and hence rents stabilize.

For both timing resources and performance resources, firm 1 has a differentiation advantage ($A_d(t) > 0$), but this advantage erodes over time ($A'_d(t) < 0$) due to DMU. Hence, firm 1's rents decay starting at time t_2. Figure 6.2 illustrates. Thus, we show that even when a resource is not imitated, such that offers remain different (i.e., $x_1(t) - x_2(t)$ is a constant over time), resource rents may decay as DMU erodes consumers willingness to pay for those differences.

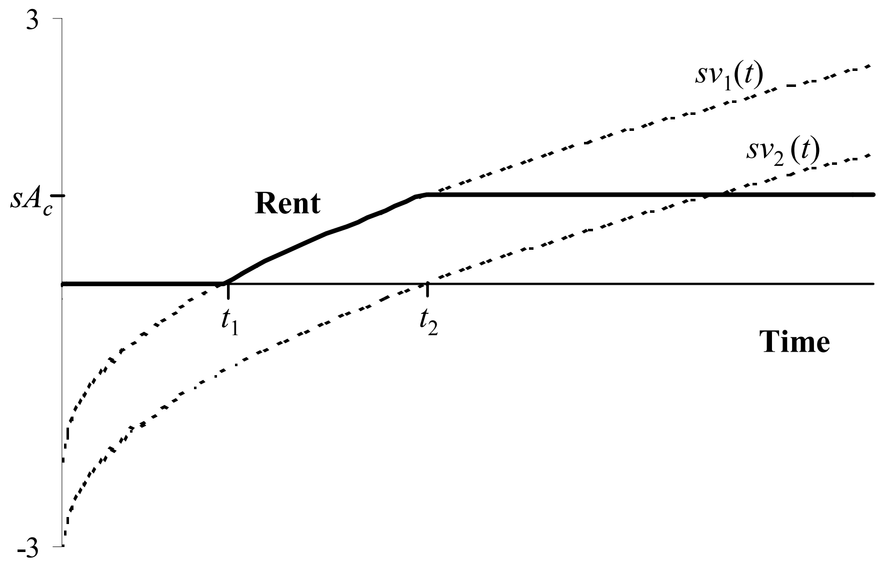

Figure 6.1: The evolution of value creation and rents when firm 1 has a cost resource (for $c_1 = 2$, $c_2 = 3$, $\beta = .5$, and $b = 1$).

With innovation resources, firm 1 again has a differentiation advantage, but in this case the advantage grows over time ($A_d'(t) > 0$), but at a decreasing rate ($A_d''(t) < 0$). Hence, firm 1's rent continues to increase even after firm 2 has positive value creation, although the rate of profit growth decelerate. Figure 6.3 illustrates.

We close by considering the effect of consumers' willingness to pay for quality on the net present value of resource rent streams.

Proposition 6.2. *For all resource types, the net present value of the resource rent stream is decreasing in the extent of DMU and increasing in the taste for quality.*

Proof We have that $v_1(t)$ is increasing and $v_1(t) - v_2(t)$ is nondecreasing in a. Hence, we have that $\pi_1(t)$ is nondecreasing in a for all t and increasing for some t, which implies that the net present value of resource rents is increasing in a. An analogous argument holds for β. ■

As the taste for quality increases, both $v_1(t)$ and $v_2(t)$ shift up proportionally, which speeds firm 1's entry ($\partial t_1/\partial a < 0$) and increases rent prior to time t_2. For performance, timing and innovation resources, the taste for quality also increases subsequent rents

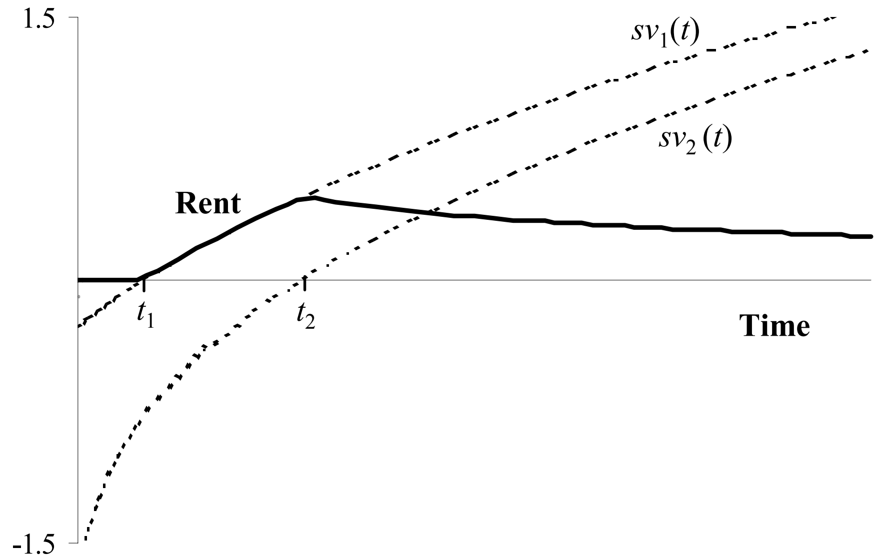

Figure 6.2: The evolution of value creation and rents when firm 1 has a performance resource or a timing resource (for $c_1 = c_2 = 2$, $\beta = .4$, $b = 1$, $r = h = 4$).

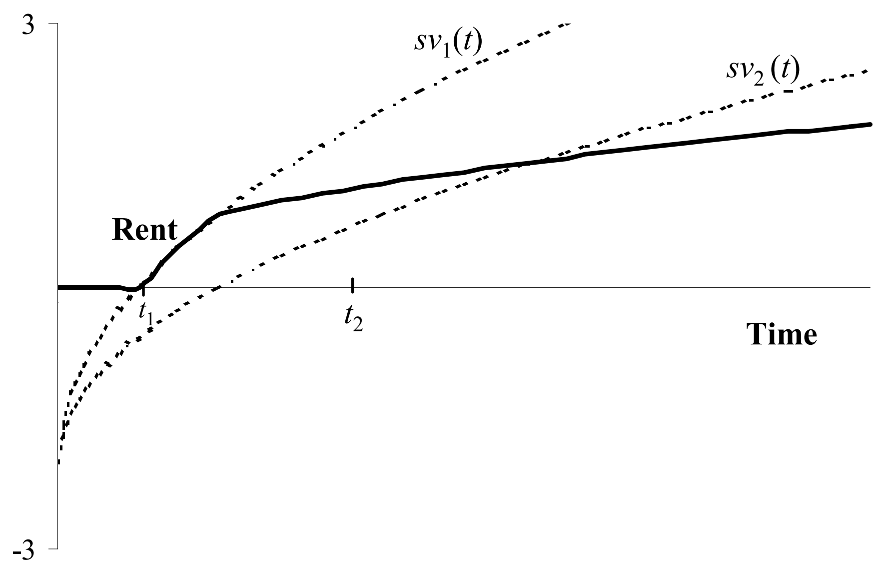

Figure 6.3: The evolution of value creation and rents when firm 1 has a innovation resource (for $b_1 = 2$, $b_2 = 1$, $c_1 = c_2 = 2$, $\beta = .5$).

by magnifying the differentiation advantage ($\partial A_d/\partial a > 0$). Conversely, the extent of DMU decreases both $v_1(t)$ and $v_2(t)$, which delays firm 1's entry and (weakly) reduces rent at any point in time.

Our objective in this section was to demonstrate a novel, demand-based approach to understanding the evolution of resource rents. Obviously, the particular setting we study is highly stylized. However, it is relatively straight forward to extend the model to consider more complex and realistic rent dynamics, as we show in the following section.

7. A Two-Resource, Two-Segment Example

To this point we have restricted ourselves to a single segment and to studying one resource at a time. These analyses provide building blocks that can be assembled to examine more complex settings. Most industries have multiple market segments and many resources. In this section, we consider an industry with two segments and two competitors, each possessing a different resource. We are interested in how competition and firm rents evolve.

Consider the following setting: There is a high-end segment with a taste for quality $a_H = 2$ and a low-end segment with a taste for quality $a_L = 1.4$. In a loose analogy to Sony and Matsushita in consumer electronics, firm 1 has a performance resource ($r = 3$) and firm 2 has a cost resource ($A_c = 0.7$).[10] Figure 7.1 shows how each firm's rents change over time.

First note that offers have positive value creation in the high-end segment before the low-end segment, because of the former's higher taste for quality ($a_H > a_L$). In this example, firm 1 is first to create value in the high-end, starting at t_1. Until time t_2, only firm 1 creates value in the high-end segment. Firm 1's rents, which are equal to its value creation for the segment, increase as its offer improves over time. At time

[10] Other parameters are as follows: $\beta = 0.5$, $b = 1$, $s = 100$, $c_1 = 3.5$, $c_2 = 2.8$.

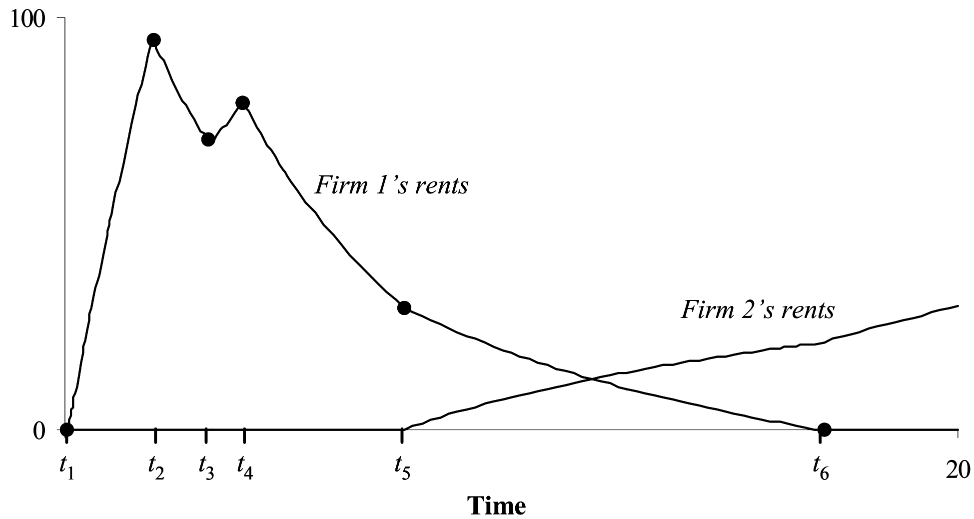

Figure 7.1: The evolution of firm rents when firm 1 has a performance resource and firm 2 has a cost resource in a two segment setting.

t_2, firm 2's offer begins to create value in the high-end segment as well. At this point firm 1's rents, which are now its net competitive advantage, begin to decay as DMU erodes its differentiation advantage. (To this point, the dynamics are the same as those illustrated in Figure 6.2.)

At time t_3, firm 1 returns to a period of profit growth as its offer begins to deliver sufficient value to serve the low-end segment. Hence, firm 1 starts earning rents from the low-end segment, which increase as its offer improves over time. The increasing rents from the low-end segment more than offset the continued decay in rents from the high-end.

At time t_4, firm 2 begins to create value in the low-end, triggering a permanent decline in firm 1's fortunes. Now, firm 1's rents from both segments are decaying over time.

Note that until time t_5, firm 2 does not sell to either segment. It is the increasing threat of entry by firm 2 that limits firm 1's rents. At time t_5, the threat is realized: DMU has eroded firm 1's differentiation advantage sufficiently that firm 2's cost advantage gives it superior value creation in the low-end segment. Consequently, at time t_5 firm 1 is displaced from the low-end segment. Then, at time t_6, the differentiation advantage has eroded so much that firm 2 displaces firm 1 from the high-end segment as well. After time t_6, firm 2's rents continue to increase as firm 1's differentiation advantage further decays, converging to a final profit level of $sA_c = 70$ in each segment.

Thus, by assembling different elements of our simple model, we are able to characterize some relatively complex dynamics including shifts in market leadership across segments and shifts in firms' absolute and relative profits over time.. In this section, we examined how firms' competitive advantage varies across market segments and over time given *exogenous* resource endowments. Below we examine competitive advantage as an *endogenous* outcome when firms choose their competitive positions.

8. Competitive Positioning

Beyond the question of resources, firms' value creation is substantially affected by their choice of competitive positions (e.g., Porter, 1980). Porter argues that firms face a choice between positioning as Cost Leaders or Differentiators, where the latter have higher quality offers and higher costs than the former. Those firms that do not choose one of these positions risk being "stuck in the middle" and being out competed.[11]

One limitation of the generic strategy perspective is the observation that firms that pursue both cost and differentiation advantage simultaneously are sometimes very successful (e.g., Besanko et al. 2000; Barney, 1997). More generally, a weakness with the received literature on positioning is that "our understanding of the dynamic processes by which firms perceive and ultimately attain superior market positions is far less developed [than our understanding of advantage at a point in time]" (Porter, 1991, p. 95; see also Rumelt, 1987). Motivated by these critiques, we focus on three questions: When do firms follow the classic generic strategies? When do firms position in the middle? What causes new market positions to arise over time? Our results offer

[11] We do not address the generic strategy of Focus in this paper. To do so would require introducing niche segments based on horizontal differentiation, which is beyond the scope of this paper.

a logic with which to approach both cross-sectional comparisons as well as longitudinal patterns in positioning choices.

Following Porter (1980), we assume a trade-off between product quality and production costs. Specifically, firms choose d, a level of differentiation, that determines both the quality of their offer and their costs.[12] As elaborated below, the precise effect of d on costs depends on the nature of the technology that the firm uses. We consider the case of two market segments that vary in their ability to pay. Specifically, there is a low-end segment with an ability to pay of a_L and a high-end segment with an ability to pay of $a_H > a_L$. We suppose that there can be as many as three firms active in the market.

Our analysis proceeds in three steps. In Section 8.1 we characterize the static choice of positioning in a Porterian world where firms that do not follow Cost Leadership or Differentiation strategies are indeed stuck in the middle. In Section 8.2, we show how classic generic strategies breakdown in the presence of a sufficiently scale intensive technology. Having characterized the statics, in Section 8.3 we show how new positions arise over time as technologies improve.

8.1. Segmentation and Generic Strategies

In this section we show formally how a market can be segmented by firms using classic generic strategies. The results provide a useful benchmark for subsequent analysis. In this subsection we assume that firms only have access to production technology M. Thus, the quality of a firm's offer is given by $x = bd$ and the marginal cost of production is $d + \underline{c}$. Because cost and quality are both increasing in d, there exist production possibility frontiers along which production cost and willingness to pay are traded off (Porter 1996; Saloner, et. al., 2001), with a different frontier for each segment.[13] Figure 8.1 illustrates.

[12] Thus, d can be interpretted as an investment in a performance resource.

[13] The familiar depiction of a single cost-willingness to pay frontier ignores consumer heterogeneity. We show two different frontiers because our segments differ in their taste for quality, and hence in their willingness to pay for a given quality level.

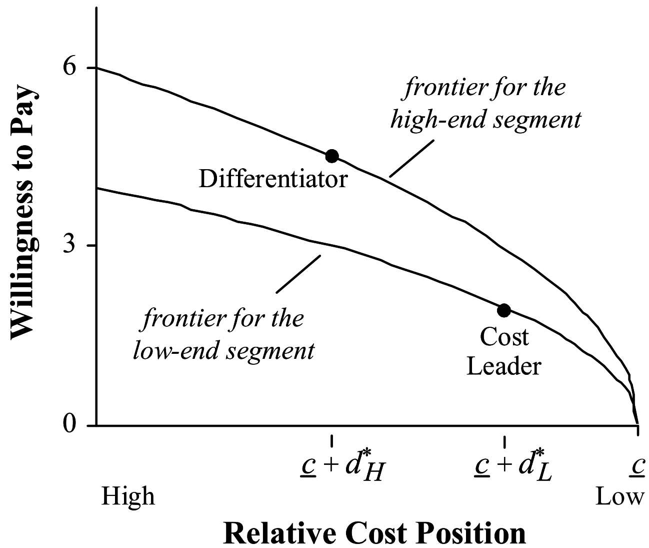

Figure 8.1: The cost-willingness to pay frontier for both segments when $\beta = .5$, $b = 1$, $a_L = 2$, and $a_H = 3$.

We define d_H^* as the level of differentiation that maximizes value creation, and hence competitive advantage, for the high-end segment. Similarly, we define d_L^* as the level of differentiation that maximizes value creation for the low-end segment.[14] Because the optimal level of differentiation is increasing in the segment's taste for quality, we have $d_H^* > d_L^*$.

Proposition 8.1. *Suppose an entrant faces a single* ***Generalist*** *incumbent serving both segments from a middle position d_I (i.e., $d_L^* < d_I < d_H^*$). (i) The optimal position for the entrant is either as a* ***Cost Leader*** *serving only the low-end segment from the position d_L^* or as a* ***Differentiator*** *serving only the high-end segment from the position d_H^*. (ii) The relative attractiveness of being a Cost Leader is increasing in the quality level of the incumbent (d_I) and the extent of DMU. The attractiveness of being a Differentiator is increasing in the trajectory (b) and consumers' taste for quality (a_L and a_H).*

With the incumbent in the middle, there is room to enter by exclusively targeting

[14] That is $d_\theta^* = \arg\max_d (a_\theta (bd)^\beta - (\underline{c} + d)) = \left[a_\theta \beta b^\beta\right]^{\frac{1}{1-\beta}}$ for $\theta = H, L$.

either segment. Recall from Proposition 4.3 that entry into a segment requires a net competitive advantage for that segment. A Cost Leader has a net competitive advantage in the low-end segment because its position $d = d_L^* < d_I$ gives it a cost advantage ($A_c = d_I - d_L^*$) that more than offsets its differentiation disadvantage in the low-end ($A_d = a_L(bd_L^*)^\beta - a_L(bd_I)^\beta$). However, it cannot enter the high-end because those consumers' greater taste for quality magnifies its differentiation disadvantage. In contrast, a Differentiator has a net competitive advantage in the high-end because its position $d = d_H^* > d_I$ gives it a differentiation advantage that more than offsets its cost disadvantage, but only in the high-end segment.

Part (ii) of Proposition 8.1 addresses the relative attractiveness of the two generic strategies. On the supply-side, one consideration in choosing a generic strategy is to move away from existing competition, a familiar result from Industrial Organization models. Thus, the higher the incumbent's quality (d_I) the more attractive it is to be a Cost Leader. In addition, the easier it is to deliver increased quality (b) the more attractive it is to be a Differentiator. On the demand-side, as consumers' marginal utility from additional quality increases (either due to increases in a_L and a_H or due to decreases in the extent of DMU), the more attractive it is to be a Differentiator.

Corollary 8.2. *Suppose two entrants face a single Generalist incumbent positioned at some $d_L^* < d_I < d_H^*$. The Generalist is "stuck in the middle" in that firms will enter as both Cost Leaders and Differentiators, which leaves the Generalist with a competitive disadvantage in both segments. Further, with firms positioned at both d_L^* and d_H^* there is no position at which a new firm can profitably enter using technology M.*

Thus, we offer a formal characterization of generic strategies and the condition of being stuck in the middle.

8.2. De-segmentation and Positioning in the Middle

We now formalize the argument that firms can enter an industry with an offer that de-segments the market (Kim and Mauborgne, 1997). We suppose that in addition to technology M, firms have access to the "fixed-cost" technology F. The quality of a firm's offer is $x = bd$. Recall that for technology M all of the costs associated with differentiation increase marginal costs, which take the form $\underline{c} + d$. An example of this sort of differentiation is adding leather to a car's interior, which increases the production cost for each car.

With technology F, a fraction f of the costs associated with differentiation are fixed. An example is adding a fuel cell engine to a car where the fixed component represents the required R&D investment. The parameter $f \in (0, 1)$, which we refer to as the "scalability" of the technology, splits the effect of differentiation into a fraction fd that increases fixed costs and a fraction $(1 - f)d$ that increases marginal costs. The marginal cost is then $\underline{c}+d(1-f)$ and the fixed cost is dfK. Note that the more scalable the technology, the lower the variable costs. The fixed cost parameter K affects the level of fixed costs required for differentiation. We restrict attention to $s < K$.[15]

Proposition 8.3. *Consider a potential entrant facing incumbents at d_L^* and d_H^* using technology M. There exists a critical value $\bar{K} > s$ such that for $K \geq \bar{K}$, entry is never profitable. For $K < \bar{K}$ we have: (i) for low levels of scalability $(0 < f < f_1)$, profitable entry is not possible and the market remains segmented by firms pursuing Cost Leadership and Differentiation; (ii) for intermediate levels of scalability $(f_1 < f < f_2)$, entry as a Generalist (using technology F) is profitable and the entrant's optimal position d_E^* allows it to dominate both segments from the middle (i.e., $d_L^* < d_E^* < d_H^*$); (iii) for high levels of scalability $(f_2 < f)$, entry as a Generalist (using technology F) is profitable and the entrant dominates both segments with a quality level higher than the Differentiator's (i.e., $d_E^* > d_H^*$).*

The balance of two countervailing forces determines the possibility of "dominating from the middle." On the one hand, a firm's ability to exploit economies of scale acts

[15] The restriction means that technology F is unattractive to a firm that serves a single segment but potentially attractive to a firm serving both segments. Specifically, the difference between the cost of serving a single segment with technology F and the cost with technology M is $s(\underline{c} + d(1 - f) + dfK - s(\underline{c} + d) = df(K - s) > 0$.

to increase the attractiveness of serving both segments as a Generalist using technology F. On the other hand, heterogeneity across market segments acts to increase the attractiveness of the specialist strategies of Cost Leadership and Differentiation using technology M, which allows firms to optimally trade-off marginal cost and performance, as in Proposition 8.1. With low scalability ($0 < f < f_1$), the economies of scale are insufficient to offset the advantages of fine tuning the offer to a single segment and the Generalist is unable to enter the market. With access to a sufficiently scalable technology ($f_1 < f < f_2$), the generalist is able to out compete the specialists in both segments. With a highly scalable technology ($f_2 < f$), the Generalists beats the Differentiator on quality.

We note that the finding that Generalists may locate either in the middle or above the differentiator depends on our assumption that fixed costs relate to innovation (i.e., by having the parameters d and K interact). Examples of Generalists leveraging high fixed costs to target the mass of the market with offers superior to incumbent differentiators include Barnes and Noble book superstores and Monsanto's genetically modified "Roundup Ready" soybeans.[16]

8.3. The Evolution of Competitive Positions

Thus far, we have identified three generic strategies that can be viable at any point in time: Cost Leader, Differentiator and Generalist. We now consider the use of these strategies in a dynamic setting where technologies are improving over time. Specifically, let $b = b(t)$, where $b(t)$ is any increasing and unbounded function with $b(0) = 0$.[17] This implies that the cost-willingness to pay frontiers are shifting outward over time.

At first, with $b(0) = 0$, consumers have a zero willingness to pay for offers, while the marginal cost of production is always at least $\underline{c}$. Hence, no firm can profitably

[16] A somewhat simpler modeling approach is to assume that marginal costs are $c+d$ and that there is a fixed cost K independent of d. Then, for K/s small there will be a Cost Leader and a Differentiator. For large values of K/s, the Cost Leader will not be able to cover its fixed costs and the remaining firm might repond by becoming a Generalist and serving both segments. However, it is straightforward to show that in this case the Generalist will always be in the middle with $d_E = (d_L^* + d_H^*)/2$.

[17] For example, it could be that $b(t) = rt$ for any $r > 0$. Recall that for both technology M and F, offer quality is $x = bd$. Hence, shifts in b have the same effect on each technology.

enter the market. We are interested in which strategy pioneers the market and how positioning evolves as technology improves.

Proposition 8.4. *Suppose there is pool of potential entrants with access to technologies M and F and $K < \bar{K}$. For low levels of scalability ($0 < f < f_1$), a Differentiator pioneers the market and is later joined by a Cost Leader. For intermediate levels of scalability ($f_1 < f < f_3$), a Differentiator pioneers the market and is later displaced by a Generalist; for $f_1 < f < f_2$, the Generalist has lower quality than the Differentiator and for $f_2 < f < f_3$ the Generalist has higher quality. For high levels of scalability ($f_3 < f$), a Generalist is the first and only firm to enter the market.*

Consider first the case where technology F is not very scalable ($f < f_1$). From Proposition 8.3, we know that a Generalist strategy is never used. Because the willingness to pay for any given quality level is always greater in the high-end segment, a Differentiator, whose offer is targeted at the high-end segment, will be able to enter the market while a Cost Leader's offer still has negative value creation. As the technology improves further, the Cost Leader strategy becomes viable as well and the two strategies coexist in the market.

For intermediate levels of scalability ($f_1 < f < f_3$) the Generalist strategy dominates in the long-run. Initially, however, the willingness to pay of the low-end segment is too low to justify the broad market deployment that is the hallmark of a Generalist. The Differentiator, unencumbered by fixed costs and focused only on the high-end, is then the first to create value and therefore pioneers the market. Over time, with further technology improvements, the willingness to pay of the low-end segment increases sufficiently that the Generalist strategy becomes viable and it follows from Proposition 8.3 that it displaces the Differentiator.

For high levels of scalability ($f_3 < f$), the Generalist's marginal costs are so low that serving both segments is profitably early on, leaving no room for other strategies.

Now consider the factors that affect the boundaries between the different regimes.

Corollary 8.5. *The critical thresholds $f_1 < f_2 < f_3$ from Propositions 8.3 and 8.4 are increasing in consumer heterogeneity ($\frac{a_H - a_L}{a_H}$) and the extent of fixed costs (K) and*

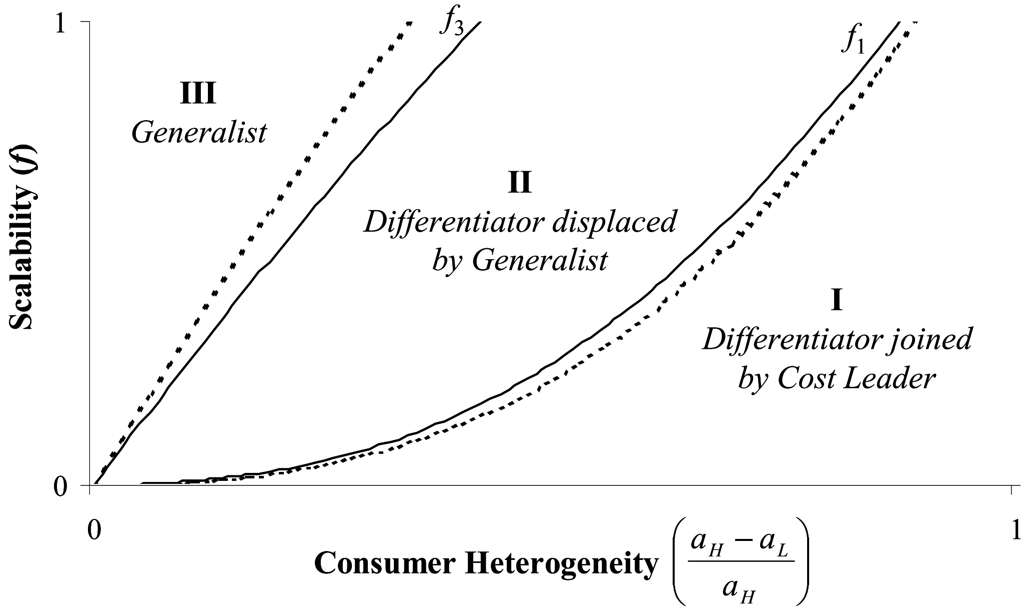

Figure 8.2: The evolution of competitive positions for different levels of scalability and consumer heterogeneity for $\beta = .5$ (solid lines) and $\beta = .4$ (dashed lines) and $K = 1.25s$.

they are decreasing in the size of the segments (s). *The extent of DMU decreases* f_1, *increases* f_3 *and does not affect* f_2.

Consumer heterogeneity ($\frac{a_H - a_L}{a_H}$) reflects the extent to which the segments differ in their taste for quality. As heterogeneity increases the returns to targeting individual segments increase and so the Generalist strategy becomes less attractive. Thus, as Figure 8.2 illustrates, the thresholds f_1 and f_3 both increase in consumer heterogeneity. Now consider the effects of DMU. On the one hand, DMU acts to mask heterogeneity between segments by reducing the difference in optimal quality levels ($d_H^* - d_L^*$), which shrinks region I in which the Differentiator is joined by a Cost Leader (i.e., f_1 falls in DMU). On the other hand, DMU acts to lower overall willingness to pay, which makes it less attractive to serve both segments early on, which shrinks region III in which the market is pioneered by a Generalist (i.e., f_3 increasing in DMU). The dashed lines in Figure 8.2 show the effects of an increase in DMU (moving from $\beta = .5$ to $\beta = .4$).

Finally, consider the effects of market size (s) and fixed costs (K). The larger the size of the market, the more attractive is the Generalist strategy due to its scale economies. Hence, growing market size can trigger a shift to a Generalist strategy.[18] Conversely, the larger the fixed costs, the less attractive is the Generalist strategy. The spectacular failure of many internet companies highlights the importance of these factors. For example, the large fixed costs in advertising and warehouses required for firms such as Etoys and WebVan were too large relative to the size of their markets.

9. Conclusion

Our approach to strategy dynamics starts with product market competition and improving technologies. The novelty is that we introduce an explicit treatment of how technology improvements affect consumer choice among competing offers. This leads us to focus on demand-side drivers: consumer taste for quality, the degree to which utility from quality improvements decreases as offers improve, and the extent of consumer heterogeneity. We combine these elements in a simple model that we use to address a wide range of issues.

Our analysis generates new insights and formalizes old truths. We characterize the critical role played by cost advantage in the dynamics of technology competition, for example, in determining when taste for quality and the extent of decreasing marginal utility serve to speed up or slow down the onset of disruption. Further, our theory identifies factors that affect whether or not the threat posed by a new technology is permanent or merely temporary. In terms of resource strategy, we show how the rents from some resources decay over time even when the underlying resource is unique (i.e., inimitable). This result highlights how differentiation advantage can erode, not because the absolute levels of performance converge, but because consumer valuation of the differences declines due to decreasing marginal utility. In terms of competitive positioning, we show that Generalists are not necessarily stuck in the middle. Rather,

[18] This is to be contrasted to a simple, exogenous fixed cost story (see footnote 16), where increasing market size makes segmentation more likely. This relates to Sutton's (1991) results on endogenous fixed costs and industry concentration.

being a Generalist can be a viable generic strategy when technologies are sufficiently scalable. Our explicit treatment of consumer heterogeneity is critical to clarifying the existence of different competitive positions. Moreover, consumer heterogeneity is an important determinant of the sequence in which these positions arise over time.

We see competitive interactions, the firm's internal resources and the demand environment as being intimately connected. Among the three, however, we think that the demand-side is underdeveloped in the received strategy literature.

Our model and propositions suggest new ways to approach longitudinal studies of business strategy. We specify the effects of several understudied independent variables: b_i, performance improvement trajectories; f, K scalability and extent of fixed costs; β, the extent of decreasing marginal utility; a, segments' tastes for quality; $\frac{a_H - a_L}{a_H}$, the extent of consumer heterogeneity in a market; and A_c cost (dis)advantage. At the very least, they suggest the need for strategy studies to control for these variables. More ambitiously, many of our propositions are potentially testable. Consider, for example, a new technology with a superior trajectory displacing an incumbent technology—which segment does it enter first? An implication of Proposition 5.2 is that if the technology has a cost advantage it will start in the low-end segment and move up into segments with greater and greater quality; conversely, if it has a cost disadvantage it will start in the high-end and then move down market (See Adner and Levinthal (2001) for additional results on entry sequencing). Beyond large sample testing, many of our more nuanced results might be better addressed through case-based longitudinal studies at the industry and firm level (e.g., Sutton 1991). In terms of theory, we think that an elaboration of the effects of horizontal differentiation and multiple product attributes is a valuable next step that would open up new research questions. For example, one could develop propositions about the mix of attributes that allow Generalists to de-segment a market. Moreover, by including the possibility that different resources improve different product attributes, one could address the question of which resources a firm should develop and how resource strategy changes over time.

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10. Appendix

Proof of Proposition 5.1 Suppose $b_1 = b_2$. We have $A_d(t) = ab_1^\beta(t^\beta - (t+h)^\beta)$ and hence $A_d(t) < 0$ and $A_d'(t) > 0$ for all $t > 0$ and $\lim_{t\to\infty} A_d(t) = 0$. If $A_c \leq 0$, then $A_d(t) + A_c < 0$ for all $t > 0$ and entry does not occur. Conversely, if $A_c > 0$, then there exists a t_E such that $A_d(t) + A_c > 0$ iff $t > t_E$ where t_E satisfies $a(b_1t_E)^\beta - a(b_2(t_E + h))^\beta + A_c = 0$. Using this equality and the implicit function theorem,

$$\frac{\partial t_E}{\partial a} = -\frac{(b_1t_E)^\beta - (b_2(t_E+h))^\beta}{A_d'(t)} = \frac{A_c/a}{A_d'(t)}, \tag{10.1}$$

which is positive since $A_c > 0$. Similarly, we have

$$\frac{\partial t_E}{\partial \beta} = -\frac{a(b_1t_E)^\beta \ln(b_1t_E) - (a(b_1t_E)^\beta + A_c)\ln(b_2(t_E+h))}{A_d'(t)}, \tag{10.2}$$

which is positive since $A_c > 0$ and $\ln(b_2(t_E + h)) > \ln(b_1t_E) > 0$ as $b_1t_E > b_1t_0 > 1$. ■

Proof of Proposition 5.2 Suppose $b_1 > b_2$. Since $A_d(0) + A_c < 0$, $A_d'(t) > 0$ and $\lim_{t\to\infty} A_d(t) = \infty$, there exists a $t_E > t_0$ such that $A_d(t) + A_c > 0$ *iff* $t > t_E$ where t_E satisfies $a(b_1t_E)^\beta - a(b_2(t_E+h))^\beta + A_c = 0$. Thus, $\frac{\partial t_E}{\partial a}$ is given by (10.1), which is positive iff $A_c > 0$. Finally, $\frac{\partial t_E}{\partial \beta}$ is given by (10.2), which is positive if $A_c > 0$ since in this case $b_1 t_E < b_2(t_E + h)$, while conversely $\frac{\partial t_E}{\partial \beta} < 0$ if $A_c < 0$ since in this case $b_1 t_E > b_2(t_E + h)$. ■

Proof of Proposition 5.3 Suppose $b_1 < b_2$. Then $A_d(t) < 0$ for all $t \geq 0$ and there exists a t^* such that $A_d'(t) > 0$ iff $t < t^*$. If $A_c < -A_d(t^*)$, firm 1 never enters the segment. If $A_c \geq -A_d(t^*)$ then firm 1 enters the segment at some $t_1 \in (0, t^*]$. As $\lim_{t \to \infty} A_d(t) = -\infty$, entry is reversed at some time $t_2 > t^*$. We have that $\frac{\partial t_j}{\partial a}$ and $\frac{\partial t_j}{\partial \beta}$ are given by (10.1) and (10.2) with t_E replaced by t_j for $j = 1, 2$. The numerator of both equalities are positive since $A_c > 0$. Since $A_d'(t_1) > 0$, $\frac{\partial t_1}{\partial a} > 0$ and $\frac{\partial t_1}{\partial \beta} > 0$. Since $A_d'(t_2) < 0$, $\frac{\partial t_2}{\partial a} < 0$ and $\frac{\partial t_2}{\partial \beta} < 0$. Hence, the interval of entry $[t_1, t_2]$ is falling in a and β. ■

Proof of Proposition 8.1 (i) Denote by d_E the position of the entrant. For all $d_E > d_I$ we have that $v_L(d_E) < v_L(d_I)$, by Proposition 4.3, the entrant does not serve the low-end segment. Hence, the optimal positioning for $d_E > d_I$ is the one which maximizes value creation and rents from the high-end segment, which is $d_E = d_H^*$. Similarly, if $d_E < d_I$ the entrant does not have superior value creation in the high-end segment and hence the optimal positioning is $d_E = d_L^*$. (ii) The profit from being a Differentiator is $\pi_H = s(v_H(d_H^*) - v_H(d_I))$ and the profit from being a Cost Leader is $\pi_L = s(v_L(d_L^*) - v_L(d_I))$. The relative attractiveness of being a Cost Leader is then $\pi_L - \pi_H$. The results then follow from evaluating the partial derivatives (e.g., $\partial \pi_L / \partial d_I > 0 > \partial \pi_H / \partial d_I$). ■

Proof of Proposition 8.3 Given Corollary 8.2, the entrant must use technology F. It cannot be that the entrant serves only one of the segments since its costs would be greater than those of the incumbent for any level of d: $s(\underline{c} + df) + fdK > s(\underline{c} + d)$ for $K > s$. Moreover, given the scale economies in technology F, either the potential entrant serves all customers (in both segments), or it stays out of the market altogether. We proceed by assuming that the entrant is serving both segments using technology F and check whether or not this is profitable.

Incumbents reduce their prices to marginal cost in an effort to fight off entry. Following the logic used to derive Proposition 4.3, the profits of the entrant for any given d are

$$\pi_E(d) = s(v_H^F(d) + v_L^F(d) - \max\{v_H^*, 0\} - \max\{v_L^*, 0\}),$$

where $v_H^* = v_H(d_H^*)$ is the value creation of the Differentiator in the high-end and v_L^* is the value created by the Cost Leader in the low-end and where $v_\theta^F(d) = a_\theta(bd)^\beta - [\underline{c} + df + dfK/(2s)]$ for $\theta = H, L$ is the value created by the entrant when it serves a customer in segment θ. The level of differentiation which maximizes the entrant's profits is then

$$d_E^*(f) = \left[\frac{a_H + a_L}{2 - f(2 - K/s)}\beta b^\beta\right]^{\frac{1}{1-\beta}}.$$

Let $v_E^*(f) = v_H^F(d_E^*(f)) + v_L^F(d_E^*(f))$ be the entrants maximum possible value creation for one customer from each segment. We have

$$\begin{aligned} v_E^*(f) &= \gamma\left(\frac{a_H + a_L}{(2 - 2f + fk)^\beta}\right)^{\frac{1}{1-\beta}} - 2\underline{c}, \\ v_H^* &= \gamma(a_H)^{\frac{1}{1-\beta}} - \underline{c}, \\ v_L^* &= \gamma(a_L)^{\frac{1}{1-\beta}} - \underline{c}, \end{aligned}$$

where $\gamma = (1-\beta)(b\beta)^{\frac{\beta}{1-\beta}}$. Note that $d_E^*/\partial f > 0$ and $\partial v_E^*/\partial f > 0$.

Given that there are incumbents at d_L^* and d_H^* we assume that v_L^*, $v_H^* \geq 0$. Then $\pi_E(d_E^*) = s(v_E^*(f) - v_L^* - v_H^*)$. Let f_1 be such that $v_E^*(f_1) = v_L^* + v_H^*$, which yields

$$f_1 = \left(1 - \frac{1}{2}\left(\frac{a_L + a_H}{((a_L)^{1/(1-\beta)} + (a_H)^{1/(1-\beta)})^{1-\beta}}\right)^{1/\beta}\right) \Big/ \left(1 - \frac{K}{2s}\right).$$

Let f_2 be such that $d_E^*(f_2) = d_H^*$, which yields

$$f_2 = \frac{1}{2}\left(\frac{a_H - a_L}{a_H}\right) \Big/ \left(1 - \frac{K}{2s}\right).$$

It follows that $f_1 < f_2$ and that there exists a $\bar{K} \in (s, 2s)$ such that $f_1 < 1$ iff $K < \bar{K}$. ■

Proof of Proposition 8.4 This proof builds closely on the arguments and definitions in the proof of Proposition 8.3. The strategies that exist in the market at any point in time are those that have positive and superior value creation. Recall that $v^*_\theta = \gamma(a_\theta)^{\frac{1}{1-\beta}} - \underline{c}$ for $\theta = H, L$ where $\gamma = (1-\beta)(\beta b)^{\frac{\beta}{1-\beta}}$. Hence, $v^*_H > v^*_L$ and both are increasing over time with $b(t)$ from an initial value of $v^*_L = v^*_H = -\underline{c}$. Let t_H be the critical time at which $v^*_H = 0$ and a Differentiator becomes willing to enter the market. At this time, $\gamma = \underline{c}/(a_\theta)^{\frac{1}{1-\beta}}$ and hence $v^*_E(f) > 0$ is equivalent to

$$f > f_3 = \left(1 - \left(\frac{a_L + a_H}{2a_H}\right)^{1/\beta}\right) \Big/ \left(1 - \frac{K}{2s}\right)$$

where $f_3 > f_2$. Thus, for $f > f_3$ the market is pioneered by a Generalist, otherwise by a Differentiator.

We have that $v^*_E(f) > v^*_L + v^*_H$ is equivalent to $f > f_1$ where f_1 is independent of b. For $f < f_1$, the Generalist never enters and the Differentiator is joined by a Cost Leader. For $f > f_1$, the Differentiator is displaced by the Generalist before the Cost Leader would have entered. ■

Proof of Proposition 8.5 The comparative statics follow from the expressions for f_1, f_2 and f_3 in Propositions 8.3 and 8.4. ■