Competitive Positioning and Generic Strategies: Revisiting the 'Stuck in the Middle' proposition

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Abstract

We explorethe evolution of competitive positions using a formal model of competition with differentiated products in which production technologies improve over time. We show how the interplay between improving technologies and consumers' valuation of the resulting performance improvements affects whether or not the classic generic strategies of Low Cost and Differentiation remain viable in the face of a rival taking an intermediate position between them. We thus clarify when intermediate positions leave a firm'stuck in the middle' and when they allow a firm to 'dominate from the middle.'Our focus on consumer choice and value creation complements the traditional focus in the strategy literature on competition and value capture.

1. Introduction

The question of how to choose competitive positions (e.g., Porter, 1980) is core to both strategy thinking and teaching. 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. Countering the generic strategy proposition is the observation that some firms that pursue both cost and differentiation advantage simultaneously are, in fact very successful (e.g., Barney, 1997; Besanko et al. 2000; Kim and Mauborne, 2005). Although the notion of generic strategies is a pillar of many strategy lectures and courses, its underpinings have been underexplored in the strategy literature. More generally, a weakness with the received literature on positioning continues to be 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).

In this research note we develop an analytic model to test the logic of Porterian generic strategies and identify conditions under which they do and do not hold. Specifically, we explore when an industry segments according to the classic generic strategies of Cost Leadership and Differentiation, with firms located at other positions "stuck in the middle" (Porter, 1980), and when such generic strategies are out-competed by a Generalist that dominates from the middle (e.g., Kim and Mauborne, 1997). We focus on three questions: When should firms choose to follow classic generic strategies? When should firms position in the middle? What causes new competitive positions to arise over time?[1]

We build on Adner and Zemsky (2006), to develop a formal model to consider these questions. At the center of our model is an analysis of competitive advantage that is rooted in consumer choice and firm value creation. Our approach to competitive interactions follows the added-value methodology (e.g., Brandenburger and Stuart, 1996), which assumes that a firm's ability to capture value is governed by its added value. Thus, we equate competitive advantage with added value.

We are concerned with how consumers' relative willingness to pay[2] for competing product

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

[2] Following Brandenberger and Stuart (1996) the term willingness to pay indicates the maximum price a consumer would be willing to pay for an offer. It is is a distinct construct from market price, which reflects

and service offers changes according to the offers' cost-quality positions (i.e., Porter, 1996). We examine the role of three key constructs in in determining the viability of different competitive positions: (1) Consumers' decreasing marginal utility (DMU) – the extent to which consumers have a decreasing willingness to pay for performance improvements – as a key driver of dynamics that links supply-side technological progress and demand-side value creation; (2) Consumer heterogeneity – the extent to which consumers in different segments differ in their valuation of offers – as a key driver of the viability of different competitive positions; (3) The interaction of these factors with firms' production technology (e.g., the extent of economies of scale) in governing the convergence of value creation. Our focus on consumer choice and value creation complements the traditional focus in the strategy literature on competition and value capture.

Our results offer a logic with which to approach both cross-sectional comparisons as well as longitudinal patterns in positioning choices.The model contributes to our understanding of competitive positions, as well as to the emerging literature on the formal foundations of strategy (e.g., Brandenburger and Stuart, 1996; Makadok, 2001; Makadok and Barney 2001; MacDonald and Ryall, 2004; Adner and Zemsky, 2006; *others - eg. chatain and Zemsky; gonzalo and zemsky???*).

2. The Model

We closely follow Adner and Zemsky (2006) in building our model, which incorporates heterogeneity of consumers and offers in a discrete choice setting where each consumer buys a single unit of one offer or buys nothing at all. We depart from the earlier model by introducing the possibility that firms can use one of two different production technologies which vary in their fixed cost and scalability characteristics We explore how the choice of production technology affects the viability of different competitive positions.The specifics of the model are as follows.

2.1. Supply-Side

There are up to three firms that each produce a single offer. These offers differ in their cost of production and in their level of performance due to differences in production technologies,

relative value capture between producers and consumers and is influenced by bargaining power and rivalry.

resource endowments or competitive positions. We index the firms and their offers by $i = 1, 2, 3$. The performance of offer i is denoted by x_i and the marginal production cost is denoted c_i.

We model the performance of offer i as a function of a function of the firm's specific investments in differentiation, which we denote by d_i; and as a function of an exogenous technology trajectory, b, which governs the rate at which performance improves over time, t, independently of a firm's investments. Specifically, an offer's performance is given by $x_i(t) = bd_it$. This allows us to consider a situation where firms choose cost-performance positions (i.e., their choice of d_i) along a productivity frontier that is shifting outwards over time.We assume that costs are increasing in d_i such that there is a trade-off between performance and costs. While we do not model cost trajectories explicitly, we note that the cost of producing a given level of performance falls over time as t and hence x_i increases.Consistent with other work in the added value tradition (e.g., XXXX), we assume that price discrimination across segments is possible.

We examine two technologies that differ in their cost structures. For technology M there are no fixed costs and marginal cost is given by $c_i = c + d_i$, where $c > 0$ is the minimal cost to produce the offer. For technology F marginal costs are given by $c_i = c + (1 - f)d_i$ and fixed costs are given by fKd_i where $f \in [0, 1]$ reflects the scalability of the technology because it determines the sensitivity of costs to production volume.

2.2. Demand-Side

Consumers are divided into two discrete market segments, indexed by m based on their willingness to pay for offers. There is a high-end market segment ($m = H$) and a low-end market segment ($m = L$) [3] Denote by s_m the number of consumers in a segment. Denote by w_{im} 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 $q(x_i)$.[4] The second component is the segment's taste for quality, which is parameterized by a_m. Willingness to

[3] Although consumer heterogeneity is usually modeled as a uniform continuous distribution in industrial organization (e.g., most work on Hotelling's linear city), we consider discrete segments. Discrete segmentation is a good representation of heterogeneity in many settings such as when the product is a component used in multiple end products (e.g., hard disk drives, which are used in notebook, desktop and mainframe computers). Other examples of discrete consumer heterogeneity are personal versus professional users, industry segments (in business-to-business markets) and national markets.

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

pay for offer i at time t is then $w_{im}(t) = a_m q(x_i)$. We introduce decreasing willingness to pay for quality improvement by assuming that $q(x_i) = x_i^{\beta}$ where $\beta \in (0, 1)$.[5] Thus, a segment's willingness to pay for offer i at time t is $w_{im}(t) = a_m[q(x_i)]^{\beta}$.

Note that, consumers' willingness to pay for an offer increases with the offer's performance (which itself increases with over time), but at a decreasing rate, (i.e. $\frac{\partial w_i}{\partial x}, \frac{\partial w_i}{\partial t} > 0$ and $\frac{\partial^2 w_i}{\partial x^2}, \frac{\partial^2 w_i}{\partial t^2} < 0$)

2.3. Value Creation, Competitive Advantage and Consumer Choice

Definition 2.1. *We define 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* $v_{mi}(t) = w_{im}(t) - c_i$. *We definecompetitive advantage across competing firms as the difference in their value creation. It is useful to separate competitive advantage into two parts, relative costs and relative differentiation. We focus our analysis on offer 1 and define the following: the* ***cost (dis)advantage*** *of offer 1 is* $A_1^c = c_2 - c_1$. *The* ***differentiation (dis)advantage*** *of offer 1 is* $A_{1m}^d(t) = w_{1m}(t) - w_{2m}(t)$. *The net* ***competitive advantage*** *is then* $A_{1m}(t) = v_{1m}(t) - v_{2m}(t) = A_{1m}^d(t) + A_1^c$.

At a point in time, if no firm has positive value creation in a segment ($v_{mi} <= 0$), *consumers in the segment make no purchase. If only one firm's offer has positive value creation in the segment (e.g.,* $v_{m1} > 0, v_{m2} < 0$*) each consumer in the segment purchases one unit of the value creating firm's offer. If both firms' offers have positive value creation in the segment, each consumer in the segment purchases one unit of the offer with greatest value creation, which is the offer with net competitive advantage (i.e., the offer for which* $A_{1m} > 0$*) offerconsumers purchase the offer (creates value in a segment, consumers in the segment buNote that both an offer's value creation and its differentiation advantage will vary across segments.*

3. Competitive Positioning

Following Porter (1980), we assume a trade-off between product quality and production costs. Specifically, firms choose d_i, a level of differentiation, that determines both the quality of

[5] Note that, mathematically, 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.

their offer and their costs.[6] As elaborated below, the precise effect of d_i 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 taste for quality. Specifically, there is a low-end segment with a taste for quality of a_L and a high-end segment with a taste for quality of $a_H > a_L$. We allow for as many as three firms to be active in the market.

Our analysis proceeds in three steps. Section 3.1 characterizes 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. Section 3.2 shows how classic generic strategies breakdown in the presence of a sufficiently scale intensive technology. Following these static analyses, Section 3.3 shows how new positions arise over time as technologies improve.

3.1. Segmentation and Generic Strategies

In this subsection we show formally how a market can be segmented by firms using classic generic strategies. We assume that firms only have access to production technology M for which the quality of a firm's offer is given by $x_i = bd_i$ and the marginal cost of production is $c_i = c + d_i$. Because cost and quality are both increasing in d_i, 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.[7] Figure **??** illustrates.

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.[8] Because the optimal level of differentiation is increasing in the segment's taste for quality, we have $d_H^* > d_L^*$.

Proposition 3.1. *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*

[6] Thus, d_i can be interpretted as an investment in a performance resource.

[7] 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 performance level.

[8] 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 $\theta = H, L$.

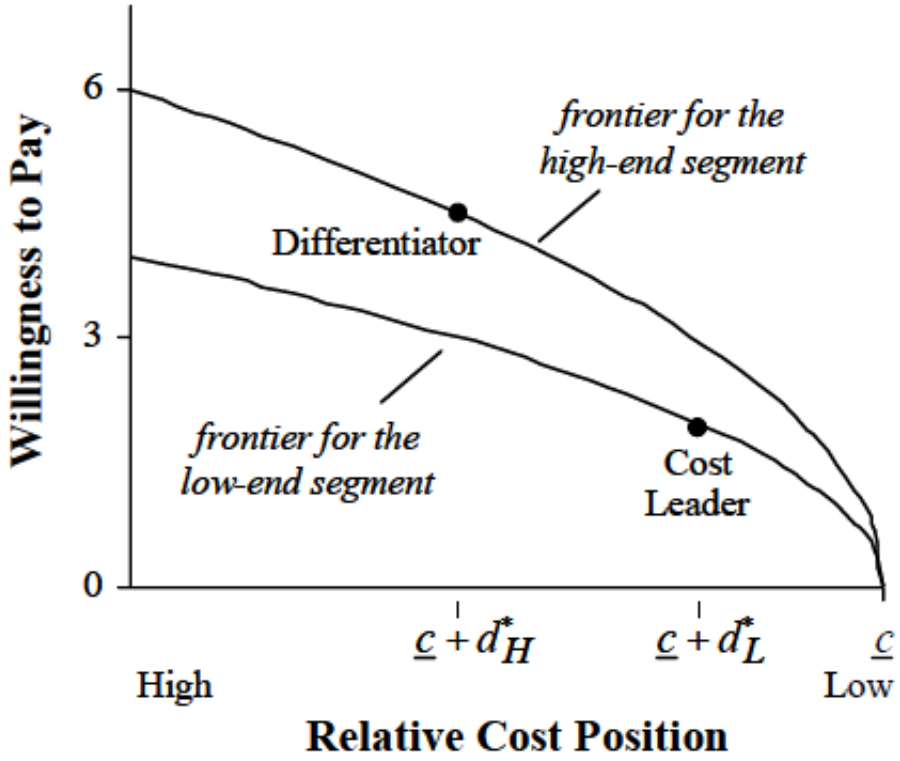

Figure 3.1: The cost-willingness to pay frontier for both segments when $\beta = 0.5, b = 1, a_L = 2$, and $a_H = 2$

technology trajectory (b) and the taste for quality in both the low end (a_L) and the high-end (a_H).

With the incumbent positioned in the middle, there is room to enter by exclusively targeting either segment. Recall from Proposition **??** that entry into a segment requires a competitive advantage for that segment. A Cost Leader has a competitive advantage in the low-end segment because its position d_L^* gives it a cost advantage that more than offsets its differentiation disadvantage in the low-end. However, it cannot enter the high-end because those consumers' greater taste for quality magnifies its differentiation disadvantage in the high-end segment. In contrast, a Differentiator has a competitive advantage in the high-end because its position d_H^* gives it a differentiation advantage that more than offsets its cost disadvantage in the high-end segment, but it has a competitive disadvantage in the low-end segment.

Part (ii) of Proposition 3.1 addresses the relative attractiveness of the two generic strategies. On the demand-side, as performance becomes more important for consumers (either due to increases in the taste for quality or due to decreases in the extent of DMU), the more attractive it is to be a Differentiator. 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, a better technology trajectory makes it easier it to increase performance and hence more attractive to be a Differentiator.

Corollary 3.2. *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.

3.2. De-segmentation and Positioning in the Middle

We now identify conditions under which a firm can profitably enter an industry by simultaneously serving both segments from a single position. From Corollary 3.2, we know that this

cannot occur if firms are limited to technology M. Extend the firms technology possibilities to include a "fixed-cost" technology F. As with technology M, the quality of a firm using technology F is $x_i = bd_i$. In contrast to technology M, with technology F a fraction f of the costs associated with differentiation are fixed. 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.[9] The marginal cost is then $c+d(1-f)$ and the fixed cost is dfK.[10] Note that the more scalable the technology, the lower the variable costs. An example of differentiation with low scalability is adding leather to a car's interior, which increases the production cost for each car. An example of differentiation with high scalability is adding a fuel cell engine to a car where the required R&D investment is a fixed cost that does not increase with production volumes. The fixed cost parameter K affects the level of fixed costs required for differentiation. We restrict attention to $s < K$.[11]

Proposition 3.3. *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 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

[9] Recall that for technology M all of the costs associated with differentiation increase marginal costs, which take the form $c + d_i$. Note that technology M is a special case of technology F with $f = 0$.

[10] This specification of technology F draws on Sutton (1991)'s work on endogenous fixed costs.

[11] 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 $s(c + d_i(1 - f) + d_i fK - s(c + d_i) = d_i f(K - s) > 0$.

specialist strategies of Cost Leadership and Differentiation using technology M because a firm can optimally trade-off marginal cost and performance (as in Proposition 3.1). 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 profitably enter the market. With access to a sufficiently scalable technology ($f_1 < f$), the Generalist is able to out compete the specialists in both segments.

Note that a successful Generalist might or might not be located in the middle, depending on the level of scalability of its technology. For intermediate levels of scalability ($f_1 < f < f_2$), the Generalist locates in the middle and offering a compromise product. For a sufficiently high level of scalability ($f_2 < f$), its cost of increasing performance is so low that the performance of the Generalist's offer exceeds that of a Differentiator. An example of a Generalist leveraging high fixed costs to target the mass of the market is Barnes and Noble book superstores which offered higher performance (e.g., wider selection, knowledgeable staff and in store cafe) than the differentiated independent booksellers that had dominated the high-end of the market prior to its entry.

3.3. The Evolution of Competitive Positions

Thus far, we have identified three strategies that can be viable at any point in time: Cost Leader, Differentiator and Generalist. We now consider the emergence of firms using these strategies in a dynamic setting where technologies improve over time. Since $x_i(t) = bd_i t$ the cost-willingness to pay frontiers are shifting outward over time. When $t = 0$, consumers have a zero willingness to pay for offers, while the marginal cost of production is always at least c. Hence, no firm can profitably enter the market.

We are interested in which strategy is used by the firm that pioneers the market and in whether that strategy is sustainable as technology matures. We identify three regimes.

Proposition 3.4. *Suppose there is pool of potential entrants with access to technologies M and F and $K < \bar{K}$. (i) For low levels of scalability ($0 < f < f_1$), a Differentiator pioneers the market and is later joined by a Cost Leader. (ii) 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. (iii) 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 3.3, we know that a Generalist strategy is never used. Because it is easier to create value in the high-end due to its greater taste for quality, a Differentiator is able to enter the market when a Cost Leader's offer still has negative value creation. As 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 displaces the Differentiator.

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

What factors determine which regime characterizes a given market?

Corollary 3.5. *The critical thresholds $f_1 < f_2 < f_3$ from Propositions 3.3 and 3.4 are increasing in consumer heterogeneity ($\frac{a_H - a_L}{a_H}$) and the extent of fixed costs (K) and 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 **??** 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 **??** 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,

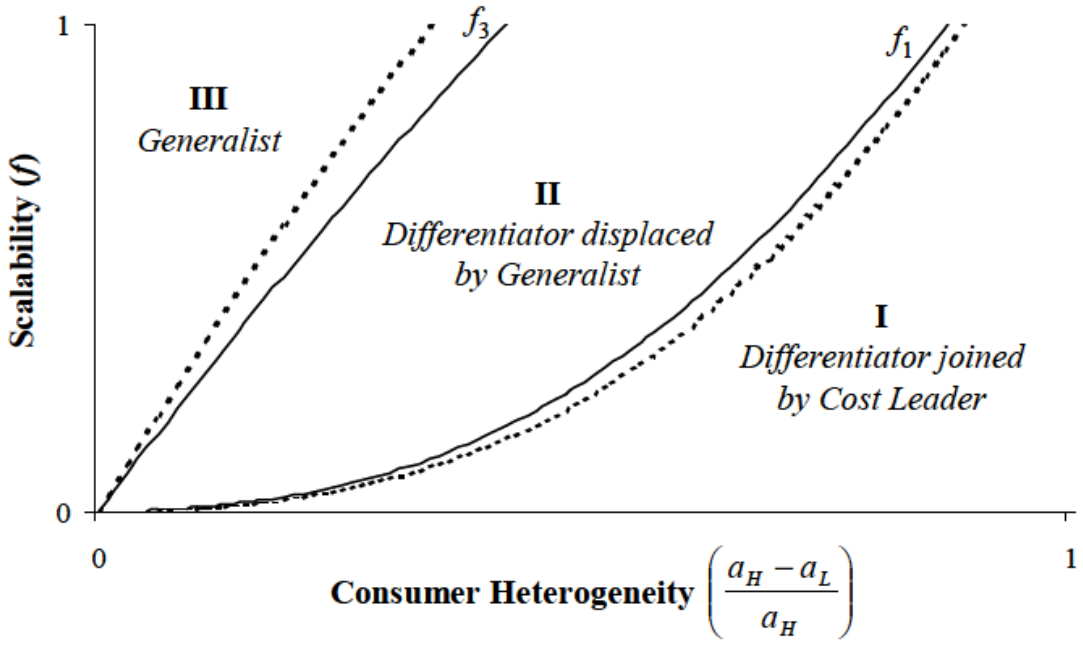

Figure 3.2: The evolution of competitive positions for different levels of scalability and consumer heterogeneity for $\beta = .5$ (solid lines) and $\beta = .4$ (dashed lines) and $K = 1.25s$.

growing market size can trigger a shift to a Generalist strategy. Conversely, the larger the fixed costs, the less attractive is the Generalist strategy. The spectacular failure of many internet companies at the bursting of the technology bubble 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.

4. Discussion

Porter's generic strategies are simultaneously a cornerstone of many core strategy courses and a source of intellectual friction in the field. On the one hand, they have served as concise yet powerful characterization of firms' strategic postures. On the other hand, they sit uncomfortably as simplified generalizations in a research field whose trajectory has been to clarify contingent relationships rather than make blanket claims. Explaining the long list of exceptions to the 'stuck in the middle' claim is emblematic of the problem. In this paper we try to resolve this tension by clarifying the contingent nature of the viability of generic strategies. Instead of positing the emergence of a 'new frontier' along which enlightened

firms face less stringnet tradeoffs between cost and quality (e.g., Porter, 1996), we show how the boundaries of generic strategies can be rooted in the notion of demand heterogeneity and alternative production technologies.

Our simple model has, as a necessity rooted in simplicity, many limitations These include the absence of strategic (i.e., game theoretic) interactions among firms, firms' inability to make additional investments to affect dynamics or innovation trajectories, and consumer preferences that do not change with time. We acknowledge these, and regard them as factors and dynamics that could be added to the baseline model presented here. Despite its simplicity, our model is able to shed light on a number of interesting questions regarding positioning at a point in time and across time. By identifying the relationship between between initial demand heterogeneity ($\frac{a_H - a_L}{a_H}$), decreasing marginal utility (β), and the scalability and fixed costs of production technologies (f and K), it offers a platform for thinking about the drivers of leadership changes in industries, and a structure for thinking about when incumbents may want to consider moving from specialist to generalist positions

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5. Appendix I: Proofs

Proof of Proposition 3.1 (i) Denote by d_E the position of the entrant. For all $d_E > d_I$ we have that $v_L(d_E) < v_L(d_I)$ and (by Proposition **??**) 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 3.3 Given Corollary 3.2, 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: $s(c+df)+fdK > s(c+d)$ 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 **??**, the profits of the entrant for any given d are

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

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 $v_\theta^F(d) = a_\theta(bd)^\beta - [c + df + dfK/(2s)]$ 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

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

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

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

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* $K < \bar{K}$. For $K > \bar{K}$, $f_1 > 1$ and a Generalist is never viable. ■

Proof of Proposition 3.4 This proof builds closely on the arguments and definitions in the proof of Proposition 3.3. The strategies that exist in the market at any point in time are those that have positive and superior value creation. Recall that $v_\theta^* = \gamma(a_\theta)^{\frac{1}{1-\beta}} - c$ 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 $v_L^* = v_H^* = -c$. Let t_H be the critical time at which $v_H^* = 0$ and a Differentiator becomes willing to enter the market. At this time, $\gamma = c/(a_\theta)^{\frac{1}{1-\beta}}$ 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 t. 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 3.5 The comparative statics follow from the expressions for f_1, f_2 and f_3 in Propositions 3.3 and 3.4. ■