
When Online Reviews Meet Hyperdifferentiation: A Study of the Craft Beer Industry

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Quarterly, Best Paper and Best Theme Paper at the 1994 International Conference on Information Systems, the 1999 Best Paper in IS Economics from the Workshop on Information Systems and Economics, five Wharton Excellence in Teaching Awards, the David Hauck Award for undergraduate teaching at Wharton, and the Lindback Award for Distinguished Teaching at the University of Pennsylvania. He serves on the editorial boards of *Management Science* and *Journal of Management Information Systems*.

ABSTRACT: We analyze how online reviews are used to evaluate the effectiveness of product differentiation strategies based on the theories of hyperdifferentiation and resonance marketing. *Hyperdifferentiation* says that firms can now produce almost anything that appeals to consumers and they can manage the complexity of the increasingly diverse product portfolios that result. *Resonance marketing* says that informed consumers will purchase products that they actually truly want. When consumers become more informed, firms that provide highly differentiated products should experience higher growth rates than firms with less differentiated offerings. We construct measures of product positioning based on online ratings and find supportive evidence using sales data from the craft beer industry. In particular, we find that the variance of ratings and the strength of the most positive quartile of reviews play a significant role in determining which new products grow fastest in the marketplace. This supports our expectations for resonance marketing.

KEY WORDS AND PHRASES: differentiation, online reviews, product positioning, product variety, resonance marketing, word of mouth.

Beer is living proof that God loves us and wants to see us happy.

—Ben Franklin, Founder, University of Pennsylvania

THERE IS A PROFOUND, UNDERREPORTED, and poorly understood relationship between information availability and product proliferation. It is generally accepted that word of mouth can influence the sale of products and that this trend has increased in recent years due to “viral marketing,” a phenomenon reported in the popular press and even in popular fiction [23]. Likewise, it is generally accepted that in all supermarket categories, from bottled water, coffee, iced tea, and other noncarbonated beverages to cheeses and designer breads, the range of products available has truly exploded [31]. As summarized by the Federal Reserve bank in 1999, the same phenomenon has been observed in categories as diverse as movie titles, books, fast food entrées, convenience food breakfasts, SUVs, and major appliances [18].¹ While these dramatic increases in variety coincided with the rise of the “information economy,” the relationship between information availability and product proliferation is not well understood.

Likewise, the relationship between online reviews and the success of new product launches is poorly understood. It is generally acknowledged that there has been an explosion in the number, range, completeness, and general availability of online re-

views, now often called simply “word of mouse” [12]. These online reviews are available for books (Amazon.com, nybooks.com), cameras (dpreview.com), movies (mrqe.com), travel (tripadvisor.com), appliances and consumer electronics (Bizrate.com), beer (beerhunter.com, ratebeer.com), and, indeed, virtually every imaginable category. While some of them are prepared by expert reviewers (beerhunter.com, nybooks.com), increasingly reviews are prepared and posted by individuals who have been profoundly delighted, or truly appalled, by an individual product or service experience (ratebeer.com, Amazon.com). Not unreasonably, most research on the market effects of online reviews has focused on the relationship between the average quality rating (mean) from online reviews and future sales [9, 14], just as similar measures from focus groups and more traditional consumer survey mechanisms have been used in the past. Surprisingly, our research has shown that the variance of reviews is often as important as the overall average rating in predicting future sales of a new product. Moreover, sales growth is especially related to the feelings expressed by the most enthusiastic quartile of customers.

This result is best explained by the theories of hyperdifferentiation and resonance marketing. These theories focus on the closely related observations that firms can now produce almost anything that a consumer might want, thus leading to a vast increase in product variety (hyperdifferentiation), and that consumers now respond most powerfully to products that precisely meet their cravings and longings, wants and desires (resonance marketing) [10]. When a more diverse product offering is available, consumer informedness becomes a more important factor in determining customers’ willingness-to-pay. Although this has been claimed before [10, 11], empirical support has been lacking. It seems self-evident that in product categories with a wide range of different choices and incompatible attributes, we cannot all have the same preferences. Some of us demand speed and handling in our automobiles, whereas others demand safety and carrying capacity; neither is compatible with the other, and neither is compatible with fuel economy. Some of us want dark, rich, hoppy, and malty ales, whereas others want low-calorie beer; again, the two alternatives are incompatible.

Hyperdifferentiation and resonance marketing predict that it is the most differentiated new offerings, whether in coffee and iced tea, beer, video games, or SUVs, that will generate the strongest positive responses among consumers for whom they are a perfect fit, leading to success in the marketplace. However, these products will also be unattractive to other consumers with very different preferences. This would suggest that product success of hyperdifferentiated products is more related to the proportion of most enthusiastic consumers (captured by the variance, or density, in the upper tail of the ratings distribution), rather than the overall market perception of the quality of the product (captured by the mean). Although this has been noted before,² systematic empirical evidence has been scarce.

This paper uses online reviews in the craft beer industry to study the relationships between online reviews and the success of new product launches.³ Overall, we find evidence that strongly supports the power of a hyperdifferentiation strategy. We use the craft beer industry for several reasons:⁴

- There has been explosive growth both in the number of new brewers and new beverages and in their total sales volumes.
- Customers have strong feelings about their selections; there is no fundamental need for beer, and certainly there is no fundamental need for more expensive beer. Purchases are motivated by customers' desires and not by customers' requirements.
- There is a considerable volume of online reviews available, over 320,000, from over 16,000 reviewers, of over 31,000 individual beverages.
- Beer is a consumable, not a durable good, and is a consumable good that is consumed again and again. A customer who likes a movie is unlikely to see it several dozen times more in a year, whereas a customer who loves a beer may drink two or three cases of it, close to 100 repeat experiences, in a year. Thus, ratings can be a predictor not only of sales to other consumers but repeat sales to the actual rater.

As noted above, our empirical findings of the correlation between online ratings and sales growth are consistent with the theories of hyperdifferentiation and resonance marketing. Our major analysis will focus on testing whether highly dispersed ratings are associated with greater product sales. However, our data do not allow us to properly test the causal role of consumer informedness in increasing the value of hyperdifferentiation. While online review forums are one source of consumer information, there are other channels (pubs, beer festivals) that also play a role in informing consumers about products in this industry. It may also be that consumers seeking highly differentiated products have lower costs or higher value for information acquisition, which makes the causal relationship between consumer informedness and hyperdifferentiation ambiguous in our analytical setting. For the purposes of our empirical analysis, we therefore do not rely on the assumption that online reviews cause sales, only that reviews reflect perceptions of consumers in the marketplace.

This paper explicitly examines one industry (beer), in which a decades-long trend toward consolidation of production in the hands of a small number of producers of uniform and undifferentiated products was halted, and then reversed. While we believe that the theory behind this is general and has been applied in other industries, this is an empirical study of one industry. Likewise, while we believe that, at some point, virtually all products in an industry may become extremely differentiated, as is the case with cosmetics, we are studying an industry for which this is not yet the case. Moreover, it is difficult to determine whether growth in a category has led to increased differentiation or increased differentiation has led to increased growth. The early and rapid growth of the industry after the end of Prohibition would suggest that rapid growth is, at times, not associated with differentiation. More importantly, resolving the question is not significant to the interpretation of our findings; we simply note that it is the more differentiated beers that are growing most quickly. We therefore use our empirical analysis and study of industry structure to make two claims. First, our data show that sales growth is strongly related to the degree of differentiation, which is consistent with our theory. Second, the industry conditions in the craft

beer industry suggest that online information is at least one plausible driver of this relationship.

Our major empirical innovation is to propose a means for using the distribution of a collection of online consumer ratings to construct measures for product positioning. By using this distribution and the reviewers' and the manufacturer's detailed description of the product, we are able to study the effects of product positioning strategies and of horizontal differentiation. In contrast, studies that observe only the mean of a product's ratings are often able to study only the product's vertical differentiation strategy, mostly product quality.

Literature Review

Product Differentiation Decisions

RESEARCH ON PRODUCT DIFFERENTIATION in economics can be traced back to Chamberlin [6] and Hotelling [26]. They concentrated on the oligopoly product positioning decisions and socially optimal degree of differentiation [15, 29, 36, 37]. Theoretical and empirical analysis of the differentiation decision has been pursued in both the marketing and operations management literature. Marketing research has examined consumer choice in the presence of differentiation [17], consumer variety-seeking behavior [19], and the resulting outcomes in terms of market share of competing sellers [3, 28]. Research in operations management has focused on the production process required to provide product variety including the effect on design [29, 32], internal operations [4, 20], and supply chain efficiency [33].

While the theory of product positioning is well developed (see, e.g., [6, 26, 36]), empirical research in this area has been limited due to difficulty of comprehensively describing product attributes. Consequently, most of the above empirical studies that attempt to observe product positioning deal instead with product variety proxied by simple measures such as a count of the number of products offered in the market. Consequently, it has not been possible to determine the effectiveness of product positioning strategies or to make normative judgments on how differentiated products should be positioned to accelerate sales at premium prices. Indeed, it is this lack of empirical support that motivates this current paper.

IT and Product Differentiation

During the past two decades, firms have been investing heavily in information technology (IT). This diffusion of IT has also occurred over a period where product proliferation has been dramatically increasing (cf. [5, 21]), which correlates with the growth in IT diffusion and product proliferation. IT can help reduce the costs of information-intensive tasks in new product developments, such as planning, design, quality control, and coordinating with suppliers [29, 38]. Recent research has suggested that IT investment is associated with greater product variety in large firms [21].

IT not only has greatly changed the techniques and processes that enable firms to offer product variety but it also is reshaping consumers' demand for differentiated goods [2]. Using the Internet, a consumer can now easily search for the product that best fits his or her preferences, cravings and longings, wants and desires. This sharp increase in consumers' information endowment has important implications for demand for differentiated products. Even though online purchase remains a relatively small part of total consumer spending (roughly 5 percent in 2003), online product information plays a significant role in consumers' purchase decisions. Forty-four percent of online consumers in a survey reported by the *Los Angeles Times* said they consulted review Web sites before making a purchase [34]. As consumers have more detailed and more accurate information on product attributes, their willingness-to-pay for these products increases, and producer profits increase [10].

Because of their economic importance [1], there has been an emerging literature on online reviews, and most focus on the relationship between online reviews and sales. Chen and Xie [8] construct an analytical model on how this new information channel influences a monopoly's sales. Godes and Mayzlin [24] use newsgroups as a measure of word of mouth to study TV show ratings. Dellarocas et al. [14] find that online reviews of movies can be a good proxy for word of mouth and can be useful in revenue forecasting. Chevalier and Mayzlin [9] find that improvement in a book's average ratings leads to an increase in relative sales at that site. In contrast, Chen and Wu [7] and Duan et al. [16] do not find average ratings to be significantly related to sales, but that the recommendations and number of ratings have significant impact on sales. Recently, scholars have been paying more attention to online consumer review itself. Li and Hitt [30] find that online ratings for a product decrease over time, suggesting self-selection of reviewers. Dellarocas and Narayan [13] examine what motivates consumers to post reviews for different kinds of movies. Hu et al. [27] find that most online reviews on Amazon.com are distributed bimodally and provide conditions under which these ratings will converge to the real product quality. Dellarocas [12] provides an overview of different kinds of online feedback mechanisms.

Hyperdifferentiation and Resonance Marketing

The theories of hyperdifferentiation and resonance marketing were developed to explain the behavior of well-informed consumers and the strategies that firms should follow in order to sell to them most effectively.

Hyperdifferentiation as a strategy reflects an organization's increasing ability to produce almost anything it thinks might sell; it has a supply-side focus. Whereas, once, golf club manufacturer TaylorMade might offer a driver with three different degrees of loft, it now offer drivers in four or five different lofts, with six or more different head sizes and styles, with neutral or draw bias ball trajectory, and with custom shafts from several manufacturers and in four different degrees of stiffness, for literally hundreds of different combinations. As the name suggests, hyperdifferentiation is differentiation almost without limit; products can be as different as the marketplace demands. At the high end of the craft beer market, Victory Hop Devil India Pale Ale is about 65 on

the International Business Units (IBU) bitterness scale, while a Stone's Ruination is a 100, and a DogFish Head 120 Minute India Pale Ale would come in closer to 120. In contrast, Anheuser-Busch's Budweiser is about 15 on the same scale. With combinatorial assembly (at Dell), outsourcing (at Brooklyn Brewing Company), parameterization of product design (for most banking product customization), and variations in final packaging or casing (the difference between a Hummer H2 and a Chevy Tahoe is, literally, only skin deep), it really is possible to bring almost anything to market. Hyperdifferentiation was first described in Clemons et al. [10].

Researchers have long known that consumers' willingness-to-pay is a function of fit; lack of fit reduces willingness-to-pay based on fit costs, which can be modeled much like transportation costs [26, 36]. Willingness-to-pay is reduced not only by fit but also by uncertainty concerning fit [10, 11], and as uncertainty is reduced, willingness-to-pay increases, increasing the value of fit and the value of hyperdifferentiation [10, 11]. Finally, willingness-to-pay is based on the availability of perfect substitutes and near substitutes in the marketplace. The more differentiated a product, the less likely the customer is to find close substitutes, and the less the customer's willingness-to-pay will be reduced by those substitutes.

Based on hyperdifferentiation and consumer informedness, resonance marketing is a strategy of developing products that produce the strongest favorable responses among targeted segments of the consumer population. It relies upon truly and fully informed customers to find what they want, evaluate it accurately, and decide to pay what it is truly worth to them in the absence of comparable competitive offerings. While the absence of comparable competitive offerings has always been a marketer's goal, with low-cost hyperdifferentiation technologies, it is now possible to develop products that are strongly differentiated and, indeed, so strongly differentiated in the marketplace that there are no directly comparable offerings. These products not only resonate, they resonate without direct competition from other products.

Together, hyperdifferentiation and resonance marketing are about developing and producing must-have products.

An Introduction to Beer

Beer as a Highly Differentiable Product

BEER IS PRODUCED MAINLY USING THE FOLLOWING ingredients: water, malt, hops, and yeast. It then goes through a basic process called fermentation. Yeast breaks down sugars into ethyl alcohol and carbon dioxide gas. Beer can be distinguished by the type of yeast and the temperature of fermentation. For example, lagers are fermented at cooler temperatures by "bottom fermenting" yeast, whereas ales are fermented at warmer temperature by "top fermenting" yeast strains. Malt is mainly produced from barley, but other ingredients may be added to change the flavor and appearance of the beer. For example, rye is usually added to create a spicy, robust flavoring to beer. By controlling other factors, beers can vary in both measurable (color and alcohol content) and hard-to-describe (flavor, aroma, and palate) dimensions.

By altering the ingredients and the parameters in production, there can be unlimited types of beers. Just like taste for food, people have different preferences for beer. Beer thus is a horizontally differentiated product. A higher degree of alcohol is not necessarily better than a lower degree. Some consumers enjoy a spicy flavor, whereas others may like the beer to be fruity. Within each niche segment, however, one beer can be better than the other, so there is vertical differentiation as well.

The History of Beer in the United States

Prior to the passage of the 18th Amendment to the U.S. Constitution in 1920 (Prohibition), beer was principally produced and consumed locally. There were more than 1,300 breweries in the United States; the average annual production during the decade preceding Prohibition was 57.4 million barrels. Prohibition came close to destroying the beer brewing industry in the United States. By the time the 21st Amendment repealed Prohibition in 1933, the number of brewers had decreased to less than three dozen. Until recently, we have seen competition based on economies of scale, facilitated by several factors:

- With the tremendous reduction in brewing capacity and the repeal of Prohibition, there was enormous unmet demand for beer. This demand could be best met by mass production of standardized products. All major producers of the time followed Anheuser-Busch in a race for scale-based, quality production of largely undifferentiated products.
- Refrigeration made it possible to store and ship beers such as mild lagers over great distances, eliminating the major barrier to centralized mass production. Print, radio, and television advertising created great economies of scale for advertising, reinforcing the scale advantages in production and logistics.

All of the above, acting together, led to a dramatic reduction in product variety in the industry. Ultimately, big players such as Anheuser-Busch chose to create barriers to competitors not through making a range of truly differentiated and truly superior beers that collectively appealed to all segments of the market but, rather, through massive marketing and advertising investments intended to create perceived differentiation for otherwise similar products. Smaller brewers were forced out of the industry as advertising became the single largest cost component in the production of beer in the American market, because small brewers simply did not have the resources needed to engage in national advertising campaigns. National advertising strengthened the largest brewers, leading to even more consolidation, and leading to even greater advantage for the largest brewers. By the mid-1990s, brewing in the United States came to be dominated by three large producers, Anheuser-Busch, Miller, and Coors, which collectively produced approximately 82 percent of the 190 million barrels of beer sold in the United States in 1997. The “big three” protected their control of the market with heavy advertising and promotional expenditures. Anheuser-Busch alone, with net sales of \$15 billion in 2004, accounted for nearly half of U.S. beer sales and spent \$2.6 billion on marketing.

Development of Hyperdifferentiated Breweries

Despite the trend of consolidation, production technology does not provide economies of scale or a barrier to entry in the beer industry. The technology used at a craft brewer looks very much like the technology used at larger, more mainstream brewers.⁵ Larger brewers just have more pieces of equipment, more breweries and the equipment is replicated many more times at each location.

In contrast to Anheuser-Busch's massive advertising budget, a successful craft brewer such as Victory Brewing Company in Downingtown, Pennsylvania (\$3.4 million in annual sales), cannot contemplate a meaningful advertising campaign. So, quite simply, they do not have one; promotional expenses have never exceeded 1.5 percent of sales, and traditional media-based advertising expenses are held constant at zero. Instead, Victory has been able to respond to a consumer-generated demand "pull" through product differentiation. Their beers really are different, and "beer geeks" (the beer industry equivalent of "wine connoisseurs") noticed their beers immediately. Praise for the beer on beer geek bulletin boards and beer rating services created a natural word-of-mouth buzz, and as more reports appeared, more consumers tried the beer, loved it, and posted still more favorable reviews. The results can be seen in recent ratings of Victory's beers, shown in Figure 1, which underscores just how easy it now is for consumers to find newly launched products, even those that have never been advertised. (Figure 1 is from the Ratebeer.com Web site in October 2002, when we did our first study of Victory.)

As an alternative medium for promotion and advertising, the Internet (especially online review forums) reduces the relative importance of scale, creating new opportunities for market entry. The percentage of beer produced by craft breweries has increased from previously negligible levels to more than 3 percent of the market (see Figure 2). After holding steady at much lower numbers, imported beers now account for 10 percent of the beer consumed in the United States.

Together, the increase in imports and smaller domestic breweries has reversed a decades-long process of consolidation in the U.S. beer industry. Virtually all of the growth in sales and profits in the industry has come from these two categories—imports and more differentiated domestics.

While we are making no claims that the Internet or information services more generally have contributed to the growth of the craft beer industry, it is clear that the craft beer industry has positioned itself to make use of the Internet. Ratebeer.com and BeerAdvocate.com provide hundreds of thousands of online reviews for thousands of beers. As important, the most advanced retailers and wholesalers are providing powerful Web sites that provide information to a vast community and that link directly into the rating Web sites. The Beer Yard, a wholesaler in Devon, Pennsylvania (www.beeryard.com), stocks and sells over 1,000 beers. A single click can get you a list of new arrivals in the past 7, 14, 30, or 60 days, another click gets you a description of any beer you find interesting, and one more click takes you to Ratebeer.com for their full array of online ratings of the beer. Although Pennsylvania state law does not permit online or telephone beer sales out of state, the Beer Yard estimates that

The RateBeer Top 50			
	Name	Score	Count Style
1	Westvlieten Abt 12	4.57	175 Belgian Strong Ale
2	Rochefort Trappistes 10	4.45	176 Belgian Strong Ale
3	Westvlieten Extra 8	4.45	107 Belgian Strong Ale
4	Dogfish Head World Wide Stout	4.38	103 Imperial Stout
5	AleSmith Speedway Stout	4.35	42 Imperial Stout
6	Stone Imperial Russian Stout	4.35	88 Imperial Stout
7	Ayinger Celebrator Doppelbock	4.32	244 Doppelbock
8	Three Floyds Dreadnaught IPA	4.31	19 American Strong Ale
9	Fulders Vintage Ale 1999	4.31	69 English Strong Ale
10	Calumet Dark	4.3	18 Dunkel
11	Kalamazoo Bells Expedition Stout	4.29	83 Imperial Stout
12	Victory Storm King Imperial Stout	4.28	139 Imperial Stout
13	Victory Old Horizontal	4.27	79 Barley Wine
14	La Terrible	4.25	15 Belgian Strong Ale
15	Chimay Bleu	4.25	290 Belgian Strong Ale
16	St. Ambroise Oatmeal Stout	4.25	83 Sweet Stout
17	Three Floyds Behemoth Barleywine	4.24	10 Barley Wine
18	Kalamazoo Bells Third Coast Old Ale	4.23	58 Barley Wine
19	Full Sail Old Boardhead Barleywine	4.23	31 Barley Wine
20	Andechser Doppelbock	4.22	43 Doppelbock
21	North Coast Old Rasputin Russian Imperial Stout	4.2	165 Imperial Stout
22	Stone 6th Anniversary Porter	4.2	24 Porter
23	Heartland Farmer Jons Oatmeal Stout	4.19	11 Sweet Stout
24	AleSmith Old Numbskull	4.19	22 Barley Wine
25	Fulders London Porter	4.17	179 Porter

Figure 1. Ratings of the Top 25 Beers on Ratebeer.com, a Popular Web-Based Rating Service for Beer

since the development of its Web site, its sales of “exotics” has gone from 90 percent local (within a 10-mile radius) to 70 percent drive-in from out of state.

Data and Hypotheses Development

Data

WE ARE FORTUNATE TO HAVE BEEN ABLE TO OBTAIN rich data from the craft beer industry. Our online review data come from Ratebeer.com, the most popular beer review Web site. The mission of Ratebeer.com is described as “to provide independent, unbiased, consumer-driven information about beer and breweries and to enhance the image and worldwide appreciation of beer.” We obtained all the 281,868 ratings for 1,159 U.S. craft brewers from 6,212 reviewers from Ratebeer.com from April 2000 to July 2004. Each review also contains detailed reviewer information. Since Ratebeer.com was established in year April 2000, we discard this initial year to exclude possible abnormal review behavior.

As with all studies of self-reported observation rather than controlled studies, there is the possibility of loss of data integrity. Reviewers could submit large numbers of favorable or unfavorable reviews for their most or least favorite beers, and brewers could file favorable reviews of their own products or unfavorable reviews of competitors’ offerings. There is little indication that this actually occurs, in part because each reviewer is allowed to review each beer only once, and flooding Ratebeer.com would

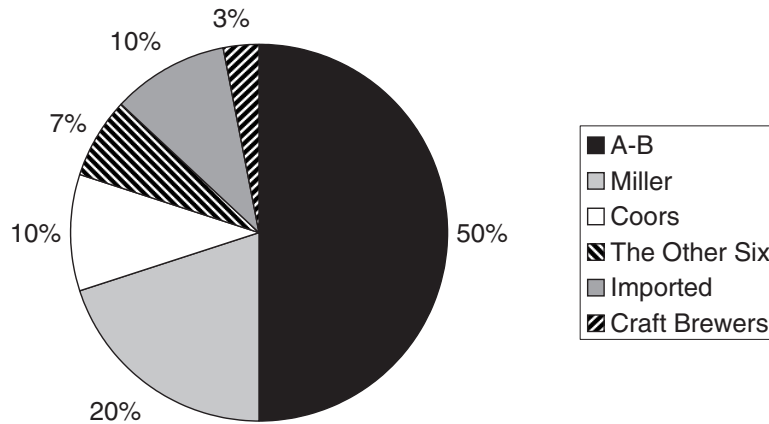


Figure 2. Market Shares for the Big Three American Brewers and for Other Categories of Brewers

Source: Association of Brewers Annual Report (2002)

thus require creating a large number of dummy accounts. Still, the authors did note some unusual behavior among reviewers who filed only two or three reviews and contacted Ratebeer's Web site manager. In response, Ratebeer does not count reviews from reviewers until they have submitted at least ten reviews. Flooding and manipulating would weaken our findings, not artificially strengthen them.

Because the data are self-reported rather than the result of a controlled laboratory study, there is also the possibility of significant self-selection bias. That is, we are all more likely to consume larger quantities of products that we strongly prefer. If, by extension, we all reviewed only products we preferred, the variance of reviews would be reduced and our results would be significantly weaker. Fortunately, this does not appear to be significant; all reviewers who have contributed a significant number of reviews have reviewed more beers outside their favorite categories (which they are required to report) than within them. This does not mean that the bulk of their consumption is outside their favorite categories, of course, but that reviewers rate a wide variety of products despite having potentially strong preferences.

Sales data are provided by the Association of Breweries for years 2000 to 2003. For each year, around 300 major craft brewers' sales data are available, although it is not a complete panel. Combining the above two data sets leaves us with 224 brewers that have both online reviews and sales data for years 2001 to 2003, with a total of 484 observations.

Unfortunately, while our reviews database is for individual beers, our sales database contains only company-wide sales figures. Consequently, our results appear weaker than they otherwise would. That is, a company that has several beers that produce resonance among consumers (e.g., Victory Hop Devil, Victory Storm King), as well as beers that produce very moderate responses (e.g., Victory Lager, Victory All Malt Dark Lager), would show the same sales growth for all of its beers.

Overview of Findings

We find that for premium products that sell at premium prices, dispersion of ratings is as important as the mean of ratings in predicting growth in sales. More specifically, we find that while the highest ratings are a good predictor of rapidly growing future sales, the presence of poor ratings is not a good predictor of poor sales. The results suggest that a company would do better designing new products that produce a wider range of responses, and a greater number of favorable responses, even if this were to lead to an increased number of unfavorable reviews as well.

Our result that mean of ratings is positively associated with sales growth is consistent with Dellarocas et al. [14], in which they report that average ratings are a good predictor of ticket sales for movies, and Chevalier and Mayzlin [9], who find that higher average rating is associated with higher book sales. Importantly, we expand the metrics of online ratings to include the variance of ratings, which we find to be significantly correlated to sales growth. Our finding that high-end ratings are more important to sales than low-end ratings seems to contradict one of Chevalier and Mayzlin's [9] results, where they find low-end ratings influence sales more than high-end ratings. This is not surprising, because two attributes differentiate craft beers from books. First, prices for a best-selling book and a mediocre book are largely equivalent. In contrast, premium and super-premium beers sell for premium and super-premium prices. Customers who consider a beer adequate may not be an accurate reflection of sales, whereas customers who consider a beer superlative may be a much better predictor of future sales, given the high price premium the beer commands. Second, craft beer is a repeat purchase product. Only those customers who give very high ratings tend to be repeat customers. So high-end ratings, which measure how enthusiastic these customers are, matter much more than low-end ratings to sales.

Ratings Dispersion as a Measure of Product Differentiation

Our major empirical innovation is to construct several measures based on online reviews that capture product differentiation. Consider a product market where products and consumer tastes are differentiated along a line (as in Figure 3). For simplicity, we assume that consumers are only located at the ends of the line. Three new products, A, B, and C, are launched. Products A and C are located at the extremes of the product space, targeting each segment of customers, while B is located in between, trying to please customers in both ends (this is actually the philosophy of mass production—one standard product fits all).

We now consider ratings from customers for three products. Suppose the rating scale ranges from 0 to 5. The left-end customer will give product A a 5, because this is the product with the best fit. This customer will give product B a 2.5, and give product C a 0, because this product is far away from his or her ideal. Similarly, the right-end customer will give product C a rating of 5, B a 2.5, and give a rating of 0 to product A. As to sales, only products A and C would have customers, because customers at the left-end would buy product A due to their strong preferences toward A,

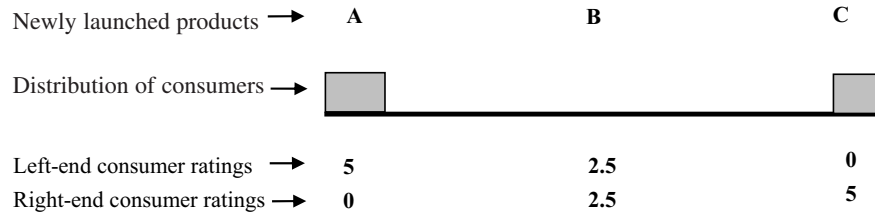


Figure 3. Ratings Dispersion as Measure of Product Differentiation

and customers at the right end would similarly buy product C. In contrast, no one would buy B given the presence of A and C.⁶ All three products have the same average rating (2.5), but the variance of ratings for product A and C is larger than B, due to product A and C's extreme positioning.

The key observation from above is that locations where entry is profitable are also product locations that will generate a larger dispersion of ratings than mass-market products. This motivates us to use the dispersion of ratings to capture the degree of hyperdifferentiation. Our first hypothesis is:

Hypothesis 1 (The Ratings Dispersion Hypothesis): Dispersion of ratings is positively correlated with sales growth.

We focus on sales growth rather than sales level for several reasons. First, the theory above suggests that a hyperdifferentiated beer targeted at a new market segments, which naturally should experience higher growth rate. Second, using sales growth rather than sales provides a natural control for size, which is especially important given the wide variation in the size of the firms in our sample. Finally, sales growth is a typically used measure for gauging the success of early-stage firms and thus is probably a more appropriate measure of early-stage success.

Ratings in the Upper Tail Represent a Strong Measure of Differentiation

The Ratings Dispersion Hypothesis (H1) is derived from the fact that in a differentiated market with numerous choices, consumers will buy what they like best; they will not buy things they merely like. Having good average reviews is less important than having some customers who give the product great reviews. Occupying an extreme position in the marketplace will produce some favorable reviews, as discussed earlier. Similarly, occupying an extreme position in the marketplace will produce some unfavorable reviews, but this is a natural consequence of the high variance that comes from an extreme position. However, negative reviews for differentiated products may have less influence on long-term purchases because changes in the ratings in the lower tail of the distribution represent ratings of consumers who are not likely to purchase anyway (or at least not repeat purchase).

This motivates us to examine the impact of high-end ratings on sales growth, and our second hypothesis is:

Hypothesis 2 (The Extreme Ratings Hypothesis): Average of the high-end reviews is positively correlated with sales growth, while the average of low-end reviews is not negatively correlated with sales growth.

Note that we are not suggesting that bad reviews are never significant, or that bad reviews are always unrelated to a product's future sales. In general, poor reviews are significant when products are competing vertically on quality rather than horizontally based on positioning in a product attribute space.

Analysis of the Data—Validation

IN DERIVING OUR HYPOTHESES, WE ASSUME that customer ratings accurately reflect customer preferences, which is a critical assumption for using customer ratings to measure product positioning. However, there are several ways in which this assumption could fail to be true.

- Ratings might turn out to be “overly erudite” in the sense that consumers might rate beers based on adherence to a style, whether or not they actually liked the product. Consumers who hated a beer but thought that it was a well-done example of its style would almost certainly not buy the beer again, and thus a high rating might not be an accurate predictor of future sales.
- Ratings might be noisy in the sense of having a high random component making it difficult to perceive a link with sales.
- Reviews might embed reviewer biases that affect the ratings. Perhaps the worst form of bias is that reviewers only rate products they prefer, leaving no meaningful variance in reviews.

All of these concerns address the issue of whether reviews adequately reflect individual preferences. Although this is impossible to show definitively, we do have data that can be used to explore this concern. First, to the extent there is either no variance or all variance in reviews is pure noise, there will be no correlation with sales, and we will not find support for our hypotheses. Second, if reviewers are reporting ratings truthfully, we would generally expect their ratings to be higher for the style they prefer and lower for others. Moreover, if reviewers rate a multitude of styles, this suggests that there is adequate diversity of reviews (closer to a random matching of beers to reviewers, rather than perfect self-selection).

Analysis of the ratings data confirms that reviewers do consider a wide variety of products. On average, each reviewer reviewed 45 beers in 12 styles (out of 84 styles). Second, at Ratebeer.com, every reviewer is required to fill out a short profile, which includes the explicit specification of his or her favorite style of beer. This information allows us to examine whether reviewers reflect a preference toward beers of their preferred style. We adopt the following empirical model:

$$\text{Rating} = \beta_0 + \beta_1 * \text{Favorite_Dummy} + \beta_2 * \text{Style_Dummy} + \beta_3 * \text{Reviewer_Dummy} + \varepsilon.$$

Rating is a reviewer's rating for a certain beer. We define variable *Favorite_Dummy* as 1 if a beer happens to be the reviewer's favorite style, 0 otherwise. We include *Style_Dummy* to control for the systematic differences across different styles of beer. Furthermore, *Reviewer_Dummy* variables are used to control for heterogeneity across reviewers. Huber–White robust standard errors are used because of repeated observations for each reviewer. Regression results are reported in Table 1. We find that the coefficient of *Favorite_Dummy* is positive and significant both statistically and economically (0.197 out of a maximum rating of 5). This means that consumers give significantly higher ratings to beers in their favorite categories. This suggests that the reviewers' assessments that we are utilizing are at least self-consistent, which gives us greater confidence that they adequately reflect individual preferences.

Results

Analysis of Hypothesis 1

HYPOTHESIS 1 SAYS THAT DISPERSION of ratings is positively related to sales growth. To examine this hypothesis, we adopt the following empirical model. The dependent variable is *Sales_Growth_Rate*. For the independent variable, we use standard deviation of ratings (*SD_Ratings*) as a measure of dispersion. Following existing literature of online reviews and sales, we also include the mean of ratings (*Mean_Ratings*) to test its effect. We add the logarithm of sales (*Log_Sales*) and logarithm of the number of reviews (*Log_Count_Ratings*) to control for size effects. Because it is possible that old firms tend to grow more slowly than new firms, we divide firms into three groups. Those firms that opened after 1996 are denoted as young firms (*Young*), and those opened in 1991 to 1996 are defined as middle-aged firms (*Middle*) (due to data limitations, we cannot use more refined measures of firm age). We add *Year* dummy variables to further control for unobserved heterogeneity across years and overall market trends.

$$\begin{aligned} \text{Sales_Growth_Rate} = & \beta_0 + \beta_1 * \text{SD_Ratings} + \beta_2 * \text{Mean_Ratings} \\ & + \beta_3 * \text{Log_Count_Ratings} + \beta_4 * \text{Log_Sales} + \beta_5 * \text{Young} \\ & + \beta_6 * \text{Middle} + \text{Year} + \varepsilon. \end{aligned}$$

A positive β_1 means that a larger standard deviation of reviews is associated with higher sales growth. The ordinary least squares (OLS) regression results are reported in Table 2. Because our panel data contain several observations for each brewer, we report Huber–White standard errors in parentheses, which are robust to heteroskedasticity across brewers. To make the results easier to interpret, we standardize all the

Table 1. Validation of the Ratings Data

	Ratings
<i>Favorite_Dummy</i>	0.197*** (0.012)
Other controls	Style and reviewer dummies
Observations	279,735
R^2	0.314

Notes: Huber–White robust standard error is shown in parentheses. *** $p < 0.01$.

Table 2. Ratings Dispersion and Sales Growth

	Sales growth	
	Original value	Standardized
<i>SD_Ratings</i>	0.156*** (0.0564)	0.0304*** (0.0110)
<i>Mean_Ratings</i>	0.0900*** (0.0299)	0.0341*** (0.0113)
<i>Log_Count_Ratings</i>	0.00489 (0.0098)	0.00791 (0.0158)
<i>Log_Sales</i>	0.0171 (0.0098)	0.0242 (0.0138)
<i>Young</i>	0.159*** (0.0567)	0.159*** (0.0567)
<i>Middle</i>	0.0941*** (0.0228)	0.0941*** (0.0228)
Controls	Year	Year
Observations	484	484
R^2	0.0568	0.0568

Notes: Huber–White standard errors are shown in parentheses. *** $p < 0.01$.

explanatory variables except the dummy variables (column 2, Table 2). As expected, we find that standard deviation of ratings (*SD_Ratings*) is significantly associated with sales growth. One standard deviation higher of this variable is associated with an extra 3 percent in growth rate. Considering that the average growth rate is around 10 percent, the effect of *SD_Ratings* on growth rate is economically significant. Thus we find evidence supporting the Ratings Dispersion Hypothesis (H1). The coefficient of the mean of ratings (*Mean_Ratings*) is also positive and significant, which indicates that firms with higher average ratings tend to grow faster. Interestingly, we do not find the number of ratings (*Log_Count_Ratings*) or the volume of sales (*Log_Sales*) has a significant impact on sales growth. Finally, we find evidence that firm age is associated with sales growth. Younger firms tend to have a higher growth rate than older firms, which is consistent with our expectation.

Analysis of Hypothesis 2

To examine how high-end ratings and low-end ratings are correlated with growth, our specification is similar as before, except now we use the mean of top quartile and bottom quartile of consumer ratings instead of the standard deviation of ratings. We expect β_1 to be positive and β_2 to be insignificant.

$$\begin{aligned} \text{Sales_Growth_Rate} = & \beta_0 + \beta_1 * \text{Mean_Top_Quartile} \\ & + \beta_2 * \text{Mean_Bottom_Quartile} + \beta_3 * \text{Log_Count_Ratings} \\ & + \beta_4 * \text{Log_Sales} + \text{Controls} + \beta_5 * \text{Young} \\ & + \beta_6 * \text{Middle} + \text{Year} + \varepsilon. \end{aligned}$$

The Extreme Ratings Hypothesis (H2) is supported by the empirical results reported in Table 3. The mean of top quartile ratings (*Mean_Top_Quartile*) is positively and significantly associated with sales growth. One point higher in the mean of top quartile ratings is associated with 15.5 percent more in growth rate. This means the growth rate will be more than doubled, given that the average annual growth rate is around 10 percent. Using standardized variables, one standard deviation higher in the mean of top quartile ratings is associated with five points higher in growth rate (column 2, Table 3). Compared with the coefficient of ratings dispersion (*SD_Ratings*) in Table 2, the mean of top quartile ratings seems to have a bigger impact on growth than the dispersion of ratings. The coefficient of the mean of bottom quartile ratings (*Mean_Bottom_Quartile*) is relatively small and not statistically significant. Coefficients of other variables are quite similar to the regression results in the last subsection.

Our results are not sensitive to the use of the top quartile. We repeated the analysis using the top quintile and the top tercile and obtained similar results.

The explanatory power of the above models is relatively low, which is reflected in the R^2 . This is due to several causes. First, we do not have detailed sales data by product, only by brewer. If a brewer produces several beers, even though the top quartile is a good predictor for sales growth of that beer, the overall firm-level sales may be dampened by other beers. Second, sales growth is influenced by many factors that we cannot measure, such as the quality of the management team, or local economic and demographic characteristics, and by the presence or absence of other craft brewers in the same geographic region. Strong correlations between online rating measures and these missing variables may bias our results. However, we do not have a priori reason to believe these omitted variables are simultaneously correlated with sales growth and rating deviation in a manner inconsistent with our theory, suggesting that this bias is low.

Summary of Regression Analysis

We find that the average and the standard deviation of ratings are significantly correlated with sales growth rate and that the marginal effect of review variance is nearly

Table 3. Top Quartile Rating and Sales Growth

	Sales growth	
	Original value	Standardized
<i>Mean_Top_Quartile</i>	0.155*** (0.0429)	0.0509*** (0.0140)
<i>Mean_Bottom_Quartile</i>	-0.0368 (0.0247)	-0.0193 (0.0130)
<i>Log_Count_Ratings</i>	0.000432 (0.0112)	0.000698 (0.0181)
<i>Log_Sales</i>	0.0163 (0.0112)	0.0232 (0.0159)
<i>Young</i>	0.162*** (0.0401)	0.162*** (0.0401)
<i>Middle</i>	0.0971*** (0.0271)	0.0971*** (0.0271)
Controls	Year	Year
Observations	484	484
<i>R</i> ²	0.0650	0.0650

Notes: Huber–White standard errors are shown in parentheses. *** $p < 0.01$.

as high as the review mean. Our results dividing the data into quartiles add a further interpretation that this variance is beneficial because it arises from larger numbers of customers with very high product ratings. For craft brewers, although offering a better-quality product is always beneficial, it is apparently more important to be the first choice of a significant segment than to be an acceptable substitute product for a large number of customers.

Conclusions

Findings and Implications

WE FIND THAT DISPERSION OF RATINGS is positively correlated with sales growth, and that the mean of the high end of the set of ratings likewise is positively correlated with growth. This provides evidence supporting the power of a hyperdifferentiation strategy and the value of resonance marketing. It is more important to have some customers who love you than a huge number of customers who merely like you. Consequently, firms that seek to provide products that are targeted at consumers who will have extreme reactions will grow faster. As noted consistently, both in the Introduction and in the Limitations subsection, no claim of causality is being made.

The findings have significant implications for the product-positioning strategy of new entrant firms. In markets amenable to hyperdifferentiation strategies, it may be particularly important to design a product that at least some consumers love, rather than developing a “middle-of-the-road” product that consumers neither love nor hate.

This contrasts with the way some types of market research are conducted, which (at least in part) seek to identify ways to satisfy everyone. Customers who hate your product will not buy it, but customers who merely like your product will not buy it either. This observation is particularly important to newly launched products because they are more expensive to produce, harder to find, less familiar to consumers, and can be lost in the clutter and competition against established brands. Good, solid, likeable, average, middle-of-the-range new products that consumers neither love nor hate will not sell. As consumers become better informed about the nature of the products they are buying, this relationship will be strengthened. This can best be described as endorsing a strategy of resonance marketing. Resonance marketing begins with the observation that when a product provides a unique degree of customer resonance, it can be sold at extremely attractive margins. The customer wants the product and sees no direct competition for it; thus, its price is determined solely by the customer's theoretical maximum willingness-to-pay for the product category and not by its cost to produce or by the price of competitors' offerings.

Although we focus on craft beer in this study, we believe our results are applicable to other products where consumers have extreme preferences and there exist unexploited opportunities for hyperdifferentiated products that produce resonance. We have alluded to several examples in our earlier papers [10, 11]; examples include diverse products such as golf equipment and sports cars, or iced teas and super-premium ice creams.

We believe that our empirical approach contributes to the emerging research on online reviews [1, 7, 8, 9, 14, 16, 27, 30]. First, although existing research has significantly advanced our understanding on online reviews, most regard online reviews as a measure of product quality, which will determine popularity and thus sales, and most prior research examines how this word-of-mouth effect influences sales of mass-market products. We expand the application of online consumer reviews to the measurement of the impact of product positioning on sales growth. Second, there has been little guidance on how to construct online review metrics and, more fundamentally, on what should be measured. By studying craft beer—a highly differentiated, premium-priced, and repeat purchase product, which is quite different from frequently studied items such as books and movies—we suggest that three factors need to be taken seriously when constructing measures of online reviews: (1) a deep understanding of the nature of the product and the positioning in a product-specific attribute space, (2) the differences in consumer behavior based on the location of individual products in their product attribute space, and (3) a careful examination of consumers' reviewing behavior.

Limitations

Our analysis strongly suggests a correlation between sales growth and ratings variance, and further, between sales growth and high-end consumer ratings. We cannot say, using our data, whether online review has any causal effect on sales growth, although two facts suggest the possible causality: (1) the rise of craft brewers concurrently with the

Internet and (2) most craft breweries do not have the capacity for other means of disseminating product information directly to consumers, such as advertising. However, there are other communications channels (e.g., distributors, retailers, beer festivals) that could also influence consumer choice. This limitation is not so much a limitation for examining predictions about hyperdifferentiation, which principally argues that product differentiation should relate to sales growth, but does affect interpretations about the specific role of the Internet in driving this relationship.

At present, we can say that customer behavior is consistent with the presence of resonance marketing. We are currently exploring alternative data (especially retailer experiments and consumer-level data) that might be able to directly examine the role of the Internet in driving sales of hyperdifferentiated products.

Extensions and Directions for Future Research

This analysis raises issues about how new information channels potentially change the nature of competition. If new entrants with strongly differentiated products are the ultimate beneficiaries of Internet-based information dissemination, who are the losers and what sorts of companies are disadvantaged? Will loss of share come from highly efficient mass producers with strong economies of scale on distribution and highly effective promotional campaigns; that is, will Budweiser's low cost and domination of advertising cease to provide advantage? Or, will the gain of the new producers be at the expense of middle-of-the-road firms that offer a high-quality product at a high cost, but are principally "better" versions of mass-market products (e.g., Sam Adams)? With free and reliable information access, their advertising approach ("Best Beer in America™") could be less effective, as consumers discover the "best beer" for someone else may not be the best beer for them. These same questions are relevant for a wide variety of products (e.g., food) and services (e.g., hotels), which have untapped potential for greater differentiation, but have been hampered by the limited ability to convey product information to consumers.

We are also seeking additional data that disaggregates product sales by brewer so that we can tie specific product reviews to specific product sales (e.g., Victory Hop Devil Ale, Stone Ruination, Rogue Dead Guy Ale) instead of overall brewery sales (e.g., Victory, Stone, Rogue). This could strengthen the results.

In this research, we only make limited utilization of information contained in consumer reviews. Our measures are constructed mainly based on the numerical part (i.e., ratings) of online reviews. We believe there is great opportunity for scholars to exploit the contents of consumer online reviews [22, 35]. Given the growing importance of online reviews, it is also important to examine how the format of online reviews should be designed to better present product information [25].

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NOTES

1. According to the Federal Reserve bank report [18], between the early 1970s and the late 1990s, the number of varieties of breakfast cereals increased from 160 to 340, bottled water varieties increased from 16 to 50, varieties of dental floss increased from 2 to 64, the number of TV channels increased from 5 to 185, and running shoe styles increased from 5 to 285.

2. For instance, J.D. Power's APEAL (automotive performance, execution, and layout) study notes that the most successful new car introductions in the auto industry exhibit styling that evokes a strong response from consumers (www.jdpower.com/corporate/news/releases/pressrelease.asp?ID=2005174).

3. According to the Association of Brewers, craft brewers are defined as brewers with annual production of fewer than 1 million barrels. Most of the craft brewers have an annual production of fewer than 15,000 barrels.

4. There are numerous other industries where extreme differences in opinions and preferences exist, and where these extreme differences are reflected in differences in prices and in sales growth. We focus on beer, in part, because the state of informedness is relatively new, and because the growth of extremely differentiated new entrants is new as well. Wine would be less appropriate as a study because information on wine has been available for far longer, and because the major transformation of American wine-buying behavior occurred much earlier as well. Our study is of hyperdifferentiated products and, in particular, the growth of sales of these products. It is not a study of undifferentiated products, nor of products that, at least relative to new entrants, are in steady state, such as mass-market beers.

5. We thank Victory Beer in Philadelphia for this information.

6. In this illustration, we do not take into account the price effect for three products. One could argue that because product B is located in between, it will achieve economies of scale in production and thus lower its price sufficiently to attract customers in both ends, thus selling better than product A or C. This is unlikely to happen for two reasons: first, product B follows exactly the strategy of mass beer producers like Anheuser-Busch and Coors, thus there should be a mass-product in the middle of the line, which is hard to compete based on price; second, even without the appearance of a tough mass-production competitor, empirical experience with new product introductions in this industry have shown that the strong preferences of customers for extreme beers have been sufficient to overcome price differences of two to one, three to one, or more. The introduction of slightly better products in the middle of the product attribute space has generally failed.

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