Cruise Line Product Differentiation Practice: A Cluster Analysis Approach

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Abstract
The cruise business is a big one. With 67 cruise lines that operate 224 ships, just about every combination of ship descriptions can be found. The cruise business has served an estimated 90 million passengers. The purpose of this article is to demonstrate the ways cruise lines and their ships can be differentiated. Using data from Ward’s compendium, cluster analysis is used to determine how these ships differ from each other. The analyses reveal six clusters by which the cruise lines differentiate their services. These results have implications for the marketing of services in the cruise line industry.

Keywords: cruise line, product differentiation, cluster analysis, ships, marketing

1. Introduction
The cruise line industry is large and expanding. The cruise business is dominated by two umbrella cruise organizations (Carnival Corporation, and Royal Caribbean Cruise Line) (Cruise Market Watch, 2012). And the business is big. Carnival Corporation reported income of over ten billion dollars in 2011. Carnival Corporation operates many well-known cruise lines (Carnival, Princess, P&O, Seabourn, Costa, and Cunard, to name a few!). The business expects to serve more than 21 million passengers in 2013 (Cruise Market Watch, 2012). The pace is growing at an expected compound annual growth rate (1990-2017) of over 7 percent per year (Cruise Market Watch, 2012).

Merriam Webster’s first definition of “cruise” is “to sail about touching at a series of ports” (Merriam Webster; 2011). Their third definition is “to travel without destination or purpose”. Douglas Ward (2011), President of The Maritime Evaluations Group describes 225 ships served by 68 business enterprises.

Numerous of studies have examined cruise line ships in the fields of economics, marketing and management. For instance, Meng, Gin-Shuh, and Chih-Hao (2011), studied the relationships of cruise image, perceived value, satisfaction, and post-purchase behavioral intention on Taiwanese tourists. They investigated the variables which are used by cruise lines to differentiate their product from other cruise lines using the multiple discriminant analysis measurement items. Further, Viña and Ford (2001) described the demographic and trip attribute factors of potential cruise passengers based on a nationwide sample of persons who previously requested travel information for tourist destinations in South Texas from regional convention and visitors bureaus. Moreover, Hosany and Witham (2010) investigated the dimensions of cruisers’ experiences, satisfaction, and intention to recommend.

This study investigates and describes how cruise ships are differentiated in practice by using cluster analysis. Thus, the purpose of this paper is to discover the methods that cruise line operators use to differentiate their products. The “products” that cruise lines offer are the physical configuration of their ships, and other more subjective evaluations of the accommodations, the food, the entertainment offered, etc. The physical descriptions and subjective evaluations were obtained from Ward’s (2011) descriptions of all the cruise ships that cruise the world. This paper will contribute to understanding how cruise lines differentiate themselves from other cruise lines.

The rest of the paper is structured as follows; Section Two provides a Literature review on product
differentiation; Section Three provides the methodology; The Section Four provides the empirical results while the Section Five provides the conclusions.

2. Literature Review

Product differentiation is a main competitive strategy. Porter (1985) identified product differentiation as one of the generic strategies. Product differentiation is the process of producing a product or service that is viewed as unique in a particular industry (Toften and Hammervoll, 2009). Specifically, we adopt the definition of product differentiation as defined by Dickson and Ginter (1987), which is when “a product offering is perceived by the consumer to differ from its competition on any physical or nonphysical product characteristic” (p. 4). This provides one of the most common ways that companies compete with each other (Phillips and Peterson, 2001). Further, product differentiation allows for companies to charge above average prices (Holcombe, 2009). Product differentiation is not only important to compete with current competition, but it also creates barriers to entry, customer loyalty, and lack of ability to imitate (Boehe and Cruz, 2010). It relates to differentiating the company’s overall image, and increased quality, where quality has to do with the distinct combination of numerous product characteristics (Boehe and Cruz, 2010).

The research on product differentiation has been mainly focused within the economics and marketing literature (Vandenbosch and Weinberg, 1995). From the marketing aspect, the degree of product differentiation is viewed as limited to consumers’ willingness to buy and suppliers willingness to produce, while from the economic perspective, the degree of product differentiation is only limited to the supply side of the market (Lancaster, 1990). Berry (1994) addressed the problem of the supply and demand analysis, utilizing a discrete-choice model. The results supported the analysis, showing that unobserved product characteristics improve the estimates for the company’s price elasticity. Holcombe (2009) addressed product differentiation and progress from an economics’ perspective. The paper looked at how, through product differentiation, the economy can progress, product costs can decrease, and quality can improve. Also, the economics literature on product differentiation has shown particular interest in trade relationships. Head and Ries (2001) studied United States and Canada trade patterns as a way to make distinctions about product differentiation and increased returns. This study emphasized the large extent of trade barriers and the elasticity of substitution. Besedes and Prusa (2006) also examined trade relationships, specifically focusing on the duration of the relationship. The study showed support for the longest duration of trade in products that were highly differentiated. Elhanan (1981) took a slightly different approach, by looking at trade from the international level, and incorporating economies of scale and monopolistic competition, as well as product differentiation. It essentially showed that differentiated products that have common types of production would allow for an ability to predict trade patterns.

Rare and valuable resources help firms create differentiation (Lado & Wilson, 1994). A strategy focusing on differentiation deals with identifying unique customer needs within their business environment (White, 1986). Firms must be able to create a competitive position in order to assure survival and success (White, 1986). “It is through strategy that the firm interprets its environment. And strategy should guide the choice of organizational structure” (White & Hamermesh, 1981, p. 217). Abell (1980) attempted to provide a classification for business strategies. Chrisman, Hofer, & Boulton (1988) extended this notion by suggesting a more developed classification system that they identified as optimal. Business strategies should not be one-dimensional (White, 1986). While the cruise industry used to be more focused on a narrow market oriented towards the rich, Carnival Cruise Lines were the first to try to provide a certain mix of facilities and amenities so that it would be more affordable to a broader demographic in the 1970’s (Gulliksen, 2008). The industry is expected to continue to grow with the “innovative guest-driven amenities and facilities desired by today’s consumer” (Gulliksen, 2008, p. 343). Companies must continue to rely on resources and relationships in order to provide innovative solutions to these desires (Toften & Hammervoll, 2008).

In recent years, Cruise lines have not only continued to increase their amenities due to new tonnage, but they have also started to refurbish existing ships (Gulliksen, 2008). Further, with the ability to ‘price the experience’, cruise lines can create much differentiated products and pricing (Garrow et al., 2006). The ‘price the experience’ is not just about the event but everything else that is going on around it (Garrow et al., 2006).

Additionally, Carnival corporation is not only the leader in the cruise industry specifically, but also the global hotels, resorts, and cruise line industry as a whole (Carnival Corporation and Plc Consolidated Statements of Operations, 2012). In 2010, Carnival Corporation held 2.5% of the market (Cruise Market Watch, 2012). The Cruise line industry differentiates their offerings in order to compete in an industry with such a highly demanding market. With the correct mix of differentiation, it allows for the ability to appeal to a much wider customer base (Gulliksen, 2008).
3. Methodology
The methodology used to find the ship’s descriptive characteristics which distinguished between ships is cluster analysis.

3.1 Data Used
The data was obtained for the 224 ships that are associated with 68 cruise lines as reported by Ward (2011) as of 2011. No ships were excluded. Those ships that did not present entertainment were coded as a zero for the value of the entertainment evaluation.

3.2 Variables Selected
All the variables described by Ward (2011) were entered in the data set for all ships. Those ships that did not present entertainment were coded as a zero for the value of the entertainment evaluation. Using correlation analysis on the complete set of variables for all ships, it was easy to see that some variables were highly correlated. For example, the tonnage of the ship was highly correlated to the length, beam, and draft of the ship. Hence length, beam, and draft of the ship were deleted from consideration. It was equally clear that food and accommodation evaluation variables were highly correlated and hence only accommodation, overall ship evaluation, and evaluation of the entertainment provided were considered from among all evaluations.

3.3 Study Hypotheses
The study posits the following hypotheses that cruise lines can be distinguished by the following variables:

H1: tonnage. The tonnage of a cruise ship reflects the overall size of the cruise ship.

H2: total number of passengers. The number of passengers in a cruise ship describes the customer capacity of the cruise ship. It also reflects in a certain sense the number of expected families or multiple people per cabin.

H3: total number of crew. The number of crew servicing a cruise ship reflects both the size of the ship and the level of service offered by the cruise ship.

H4: ratings for quality of entertainment. The rating for quality of entertainment reflects the quality of the different shows, movie theatres, swimming features and other entertainments offered by the cruise ship.

H5: ratings for overall accommodations. The rating for quality of overall accommodations reflects the quality of the size, furniture, bedding, computer access, and other accommodations offered by the cruise ship.

H6: rating for the overall quality of the ship. The rating for overall quality of the ship reflects the overall quality of the physical conditions of the ship.

H7: Age of the ship. The age of the ship reflects the overall quality of the physical conditions of the ship.

3.4 Method of Analysis
SPSS version 19 was used to perform the statistical analysis. K-means cluster analysis was used to cluster the ships. Quick cluster determined the initial cluster assignments, and then up to 20 iterations were performed to determine the initial cluster assignments. At first 20 clusters were forced. It became clear that using the key variables mentioned above created too many clusters. It became clear also that the basic determinant of the clusters was the tonnage of the ship. However it also became somewhat clear that within broad tonnage groups that Ward’s evaluations became important determinants.

So next, 12 clusters were forced. Now it became clear that tonnage was not the most important determinant. Age of the ship became interesting to watch. Also suddenly the Oasis of the Seas ship, the largest and newest ship, was identified as its own cluster. It was outstanding in size and Ward’s evaluations. Finally six clusters were forced. Still the Oasis of the Seas remained in its own cluster. But, the subsequent five clusters identified a clear membership among the ships.

4. Results
4.1 Analysis of Variance
Firstly it became important to determine that the six selected clusters were significantly different from each other as measured by Analysis of Variance. The ANOVA is reported in Table 1. The results in Table 1 show that all of the variables are very significantly different among the clusters.
Table 1. Analysis of variance results

<table>
<thead>
<tr>
<th>Characteristics of the Ship</th>
<th>Cluster</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Square</td>
<td>Df</td>
</tr>
<tr>
<td>Tonnage</td>
<td>69580000000</td>
<td>5</td>
</tr>
<tr>
<td>Age</td>
<td>1538</td>
<td>5</td>
</tr>
<tr>
<td>Total number of crew</td>
<td>6166965</td>
<td>5</td>
</tr>
<tr>
<td>Total number of berths</td>
<td>61658096</td>
<td>5</td>
</tr>
<tr>
<td>Total number of cabins</td>
<td>10123900</td>
<td>5</td>
</tr>
<tr>
<td>Overall ship evaluation</td>
<td>35597</td>
<td>5</td>
</tr>
<tr>
<td>Accommodation</td>
<td>2238</td>
<td>5</td>
</tr>
<tr>
<td>Entertainment</td>
<td>11723</td>
<td>5</td>
</tr>
</tbody>
</table>

4.2 Location of Cluster Centers

Having determined that the clusters were significantly different from each other, it becomes interesting and important to examine the location of the cluster centers.

Table 2. Cluster centers

<table>
<thead>
<tr>
<th>Characteristics of the Ship</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Tonnage</td>
<td>142032</td>
</tr>
<tr>
<td>Age of Ship</td>
<td>6</td>
</tr>
<tr>
<td>Total number of crews</td>
<td>1315</td>
</tr>
<tr>
<td>Total number of Berths</td>
<td>4100</td>
</tr>
<tr>
<td>Total number of cabins</td>
<td>1674</td>
</tr>
<tr>
<td>Overall ship evaluation</td>
<td>423</td>
</tr>
<tr>
<td>Accommodation</td>
<td>157</td>
</tr>
<tr>
<td>Entertainment</td>
<td>82</td>
</tr>
</tbody>
</table>

It is at this point that clear distinguishing characteristics of the clusters becomes clear. Interestingly, cluster 1, contains only one ship, the Oasis of the Seas. Observe also that the clusters start with large tonnages, and decline to small tonnage. At the same time, the age of the ships becomes larger as the tonnage declines (but not in all circumstances!). Interesting also is the fact that entertainment evaluations vary also with the age of the ship and somewhat with the size of the ships.

Cluster membership is identified by name of the ship. The following displays a sampling from each cluster as determined by the authors (i.e., Samples of Cluster Membership).

The one, the only, the best of everything:

Cluster Six-Oasis of the Seas (Royal Caribbean Line-RCL). The largest ship (223,000 tons), largest crew (2,164), largest passengers (6,360), youngest ship (2 years age), best ship evaluation (430), best entertainment evaluation (86), best accommodation evaluation (160).

Big ships, good evaluations:

Cluster One-12 ships, Adventure of the Seas, and nine other Royal Caribbean ships, Queen Mary 2 (Cunard-trans-atlantic passengers), and a few others. Big ships (142,000 tons), large crew (1,315), large passengers (4,100), new ships (6 years age), high ship evaluations (423), high entertainment evaluations (82), high accommodation evaluation (157).

Cluster Two-28 ships. Nine Carnival Line ships, nine Princess Line ships, and a few other lines. Big ships (112,000 tons), large crew (1,440), large passengers (3,501), new ships (7 years age), high ship evaluations (422), medium entertainment evaluations (78), high accommodation evaluation (161).

The next two clusters for the great middle:

Cluster Four-59 ships. A mixture of lines. Eleven Carnival Line ships, Six Holland-America ships, Six P&O ships. Fairly new ships (11 years age), medium large size ships (80,000 tons), medium crew (886), medium
passengers (2,512), medium ship evaluations (400), medium entertainment evaluations (74), medium accommodation evaluation (154).

**Cluster Three** - 74 ships. Ten Norwegian Lines ships, Six MSC (Mediterranean Shipping Line), Six Celebrity Line ships, Five Costa Line ships, both Disney Line ships, and others. Older ships (18 years age), smaller ships (41,000 tons), medium crew (489), medium-small passengers (1,296), poor ship evaluations (373), medium-poor entertainment evaluations (70), medium-poor accommodation evaluation (147).

The oldest ships, the poorest evaluations:

**Cluster Five** - 46 ships. No one line more than three ships. Small ships (12,000 tons), older ships (age=22), small passengers (405), small crew (180), poor ship evaluations (340), poor accommodation evaluations (139), and poor-to-none entertainment evaluations (35).

<table>
<thead>
<tr>
<th>Characteristics of the Ship</th>
<th>Biggest Name</th>
<th>Smallest Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnage</td>
<td>223,000 Oasis of Seas</td>
<td>7,400 Vistamar</td>
</tr>
<tr>
<td>Cost to build</td>
<td>1,500m Oasis of Seas</td>
<td>12m Delphin</td>
</tr>
<tr>
<td>Passengers to Crew</td>
<td>4.1 Balmoral</td>
<td>1.3 Seaborne Pride</td>
</tr>
<tr>
<td>Ship Evaluation</td>
<td>474 Europa</td>
<td>232 Discovery</td>
</tr>
<tr>
<td>Decks</td>
<td>16 Oasis of Seas</td>
<td>6 Vistamar</td>
</tr>
</tbody>
</table>

### 4.3 Characteristics of the Ships in the Clusters

**Cluster six and cluster one:** The largest ship in the world, the Royal Caribbean Oasis of the Seas can provide food and lodging for 6,360 passengers, and 2,164 crew! It is in a cluster of its own! At 222,900 tons with a length of 1,181 feet, a beam of 217 feet, and draft of 30 feet it is 44 percent bigger than the next nearest ship (the RCL Liberty of the Seas). It is also the newest ship. It also receives the highest evaluations by Ward (2011).

Almost all ships in cluster one are owned by the Royal Caribbean Cruise Line. These are big ships, new ships, and ships with very high evaluations about the overall ship, the accommodations, and entertainment. Clearly Royal Caribbean aims to have the biggest and best ships.

**Cluster two:** The Carnival Cruise Line brands of Carnival, Costa, and Princess dominate cluster two. Also found in this cluster are some of the Celebrity line. These ships are about 20 percent smaller ships than the Royal Caribbean ships. They are approximately the same age as the RCL ships. They also have approximately equal quality ratings by Ward, with the important exception of the rating of entertainment.

**Cluster four:** The ships of the Carnival, Costa, and Princess, and AIDA, and P&O brand of the Carnival Cruise Line are well represented in this cluster. Here also, one can find the ships of the Norwegian Line. These ships are about one-half the tonnage of the larger ships in cluster six, one, and two. These ships are also about twice the age of the ships mentioned above. The quality evaluations are also significantly lower than the earlier mentioned cruise lines in the above clusters.

**Cluster three:** Ships of the Costa, Holland-America, AIDA, ships of the Carnival Cruise Line are found here. Also, one finds the MSC Line in this cluster. Cluster three ships are about one third the size of the ships found in cluster six and one. The ships are quite old (averaging 18 years in age). The quality ratings are also substantially lower than for cluster four ships and the much higher rated ships in cluster six, one, and two.

**Cluster five:** Cluster five contains most of the host of other cruise lines. There are sixty eight cruise lines. In this cluster, you will find thirty-three cruise lines. These are, on the average, old ships with an age of 22 years. They are substantially smaller ships (tonnage=12,000), with smaller numbers of passengers (405), and a smaller crew (180). And some of the tonnages are quite small (7,400 tons for the VistaMar. And some of these ships do not serve the same markets as other cruise lines.

### 4.4 Product Differentiation by Cruise Line

**Size of Ship:** The Cunard brand of ship owned by the Carnival Cruise line has the largest tonnage than any brand. But, Cunard operates only one ship, the Queen Victoria II which functions mainly as a transatlantic passenger ship. The Oasis of the Seas, operated by Royal Caribbean Line is by far the largest ship. The brand of line with several ships that operates the largest ships is the Royal Caribbean line. The line with the smallest ship is the Blount Small line. The overall picture shows that there are many sizes ships. Some are large (over 222,000
tons-The Oasis of the Seas- Royal Caribbean), and some are very small (99 tons-Grande Caribe-Seabourn line). Most are in the great middle. Clearly Hypothesis one about tonnage is supported.

Age of Ship: The age of the ships vary considerably also. The oldest ship is over 40 years old. The youngest is less than four years old. In general, excluding the Cunard line, the AID, and Norwegian lines have the youngest ship (6 or seven years of age). And most of the big lines (with over six ships) operate ships that are less than eleven years of age. Hypothesis two (age) is supported.

Cost of Ship: Like the age of the ship, the cost to build the ships demonstrates that the big lines own the most costly ships. The cruise brand with the most costly ships, excluding the Queen Victoria II, is the Royal Caribbean line. The brand with the second most costly ships is Costa. These ships cost multiple hundreds of millions of dollars. The least costly ship to build belongs to the Blount Small line with a cost of “only” eight million dollars. Hypothesis three (cost) is supported.

Overall Ship Evaluation: The ship with the highest overall ship evaluation (474) is the Europa operated by the Hapag-Lloyd line. Ward (2011) suggests that the reason the Europa rates so highly is that the Hapag-Lloyd line pays attention to the details in every way. The ship is propelled by a quietly powerful thruster type of propulsion. It is also electronically and physically stabilized to avoid discomfort for the patrons. Of course the price for occupancy on this ship is high! The cruise brands which score the highest of this measure are small brands with few or one ships. Seabourn the cruise line and brand with more than one ship describes its cruises as, “A Seabourn ship is like a private club, where members share expansive open decks, inviting social spaces, and the personalized attention of an exceptional crew.” (Seabourn, 2012) Most ships are somewhere in the middle. The last sentence withstanding, it is clear the Norwegian, Holland America, and Royal Caribbean brands score very nearly as high as the lines with the smaller, more expensive ships. Hypothesis four is supported.

Entertainment Evaluation: The Disney brand operates only two large, medium young aged ships, but scores very well with the entertainment evaluation. These ships are scored along with some significantly small sized cruise ships operated by more specialized cruise brands. The Disney line is an independent line. The Princess, Royal Caribbean, Holland America, and Carnival brands score very similarly in entertainment, but noticeably below the Disney line scores. Hypothesis five is supported.

4.5 Cruise Line Descriptions

A view to Table 1 shows that the Carnival Cruise Line operates ten brands of cruise line. And The Royal Caribbean Line operates five cruise lines. These big cruise lines account for nearly 73 percent of worldwide passengers. How do they accomplish this? The answer can be found by examining the ships that compose the brand of cruise line under consideration.

Royal Caribbean Cruise Line: For example it is clear that the Royal Caribbean Cruise line operates the newest,
biggest, and costly (but not the most costly) cruise ships. The Oasis of the Seas, the world’s largest and newest passenger ship ever made is part of the Royal Caribbean brand cruise line. And, all but a few of the Royal Caribbean cruise ships are big, young in age, and offer superior amenities such as superior ships, entertainment, accommodations, and food.

The Celebrity Cruise Line, owned by Royal Caribbean Cruise Line, operates young, somewhat smaller ships (but certainly not small ships!). And, the overall quality evaluations are lower than the Royal Caribbean brand ships.

The Niche brands: Many cruise brands are independent cruise line operators that specialize in certain kinds of cruise. For example, the Hanseatic, a Hapag-Lloyd Line ship, is small (8,300 tons), specializes in nature cruises with qualified lecturers, and superb amenities. In a very different way, the Kapitan Khlebnikov is also a smaller ship (tonnage=12,288) with a small crew of 60, and berths of 114. It is a real working ice-breaker! It is the first ship to circumnavigate the Antarctica with passengers.

Some cruise brands specialize in speaking languages other than English. For example the Iberocruceros, a brand owned by Carnival Cruise Lines specializes in cruises in which Spanish is the language of the crew. The AIDA brand of cruises, owned by Carnival, is one in which the crew speaks German. Similarly, CDF (Crosieres de France), owned by Royal Caribbean, is French speaking.

5. Conclusions

This article seeks to demonstrate the ways cruise lines and their ships can be differentiated using data from Ward’s compendium. Cluster analysis is used to determine how these ships differ from each other marketing strategies. The analyses reveal six clusters by which the cruise lines differentiate their services. These clusters are: 1- Big ships with more than 3,500 passengers, new ships (less than 10 years old), high evaluations (>400) of ship, entertainment, and ship evaluations. 2-Big ships similar to cluster one, but much lower evaluation rating of entertainment. 3-Much smaller ships with just over 1,000 passengers, significantly lower evaluations, and much older ships (mean=18 years). 4- Medium size ships with about half the number of passengers (mean=2500), but still newer ships than the remaining clusters, and lower evaluations. 5-Very small ships with a few hundred passengers, very old ships (mean=22 years), and much lower evaluations. 6-The one, the only, the best of everything: Oasis of the Seas (Royal Caribbean Line-RCL). The largest ship (223,000 tons), largest crew (2,164), largest passengers (6,360), youngest ship (2 years age), best ship evaluation (430), best entertainment evaluation (86), best accommodation evaluation (160).

One can also identify which market segments the major cruise lines seek. Royal Caribbean Line offers the newest, biggest, and ships with the highest evaluations. While Carnival Cruise Line offers many brands of cruise experiences. Their cruise line brands offer cruise ships that speak French, Spanish, and German. And Carnival operates the specialty Cunard Line which specializes in transatlantic service. And the ship with very highest evaluations is operated by the Hapag-Lloyd Line.

The study shares the following limitation. Some cruise ships were not included. For example cruise ships below 9,000 tons were not included. This eliminated some interesting river cruises. Also eliminated from the study were cruise ships in which the said ship was the only ship in the cruise line.

The study provides the following implications for the marketing of cruise line ships in the cruise line industry. First, the cruise business is dominated by the two largest umbrella lines (Carnival, and Royal Caribbean) which earn about 75% overall market share of passengers. Second, the cruise lines offer a cruise experience for just about every passenger. Some ships are big (Royal Caribbean). Some are small (Seabourn). Some are very new (Royal Caribbean). Some are quite old (MSC). Some have very high service evaluations (Hapag-Lloyd). Some have low evaluations (Costa).

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