2012

Craft beer: penetrating a niche market

Douglas W. Murray
Montclair State University, murraydo@montclair.edu

Published Citation
Douglas W. Murray, Martin A. O'Neill, (2012),"Craft beer: penetrating a niche market", British Food Journal, Vol. 114 Iss: 7 pp. 899 - 909

Craft Beer: Penetrating a Niche Market

Article *in* British Food Journal · June 2012

DOI: 10.1108/00070701211241518

Douglas W. Murray
Montclair State University

Craft beer: penetrating a niche market

Douglas W. Murray and Martin A. O'Neill
College of Human Sciences, Auburn University, Auburn, Alabama, USA

Received 24 January 2011
Revised 5 March 2011
Accepted 7 March 2011

Abstract

Purpose – The purpose of this paper is to examine the underexplored niche market potential of craft beer, especially as it may relate to independent food and beverage operations, as a means of gaining competitive advantage.

Design/methodology/approach – Data were collected through the distribution of a survey instrument to craft beer and home brewers, designed to assess the demographic profile, purchasing/restaurant selection, and decision behavior of this group and assess the likelihood of their future behavioral intentions toward continued participation in the craft beer segment.

Findings – The paper reveals that craft beer and micro brew pub success has been driven by the home brew movement and continues to gain market share at the expense of broad line food service and macro beer producers. The demographic profile of this group shows age range, income, and educational levels sufficient to drive continued growth. The high satisfaction and likelihood to recommend scores support this assessment.

Research limitations/implications – The sample is limited to members of the Brewers Association, the American Home Brewers Association, and craft beer enthusiasts known to members of the organization. Additionally, the survey was administered electronically limiting participation to people comfortable with this medium.

Practical implications – F&B operators who demonstrate commitment to craft beer through server education, beverage list commitment, and supporting events can achieve market differentiation and dominance within the niche; leading ultimately to competitive advantage.

Originality/value – This research sheds light on underexplored areas of craft beer and the opportunity for independent F&B operators to identify and penetrate an increasingly important niche market, which to date has been viewed primarily from the perspective of microbrew pubs.

Keywords Craft beer, Niche markets, Competitive advantage, Differentiation, Food and beverage, Beer, Niche marketing

Paper type Research paper

Introduction

Craft beers have been steadily gaining market share from the large national and international beer breweries. Most of the attention has been focused on micro breweries and brew pubs. Such operations offering only their in-house brewed beers and ales can fall victim to the same market trap of limited variety of offerings that have troubled the large brewers. Budweiser's advertisements reminding the public that the company's roots were originally that of a microbrewery provides strong anecdotal evidence that even the largest producers are feeling the effects of the growth in market share by the craft beer industry. It is posited here that Food and Beverage (F&B) operations that can meet the hunger for differentiation through variety of menu offerings, frequent menu changes, and marketing efforts such as; tastings, brewer dinners, and other craft beer events, and can better satisfy the needs of discerning craft beer enthusiasts. Put simply, the operator who demonstrates the same efforts currently put into wine

British Food Journal
Vol. 114 No. 7, 2012
pp. 899-909

0007-070X
DOI 10.1108/00070701211241518

merchandising to the craft beer market can achieve sustained loyalty and competitive advantage.

Competition within the hospitality industry has become increasingly fierce. Knowledgeable and sophisticated consumers, globalization, and the spread of technology have changed the business landscape. It has become increasingly clear that market segment identification and penetration can provide an avenue for businesses to remain viable. Hotel companies now offer boutique hotel concepts, personality hotel concepts, Leeds Certified facilities, and other niche strategies to appeal to discerning consumers and create identity and loyalty. Support for the notion of differentiation in F&B can be seen in craft-based products. This phenomenon can be readily observed in the rise of the gourmet coffee market, which is undergoing further fragmentation through the introduction of market sub sets such as; Fare Trade brands, shade grown beans, and organic beans. The growth in artisan cheese making and artisan bakeries and bread products, the increasing interest in heirloom seed stock produce (Tellistrom *et al.*, 2006; Alonso, 2011), and humanely raised and slaughtered meat and poultry offer compelling parallels to craft beers. The increase in both the number and the widening scope of craft and artisanal products provides further emphasis that product differentiation and niche market segments are becoming increasingly important to today's discerning consumer. In fact, recent research reveals the risk to small hospitality enterprises that do not incorporate artisan and local items into their offerings (Alonso and O'Neill, 2010). This study is designed to identify a potential niche of interest for F&B operators, while providing insight into a market segment.

All the literature reviewed indicates that businesses, which demonstrate commitment to a niche market through superior offerings and/or knowledge can gain differentiation and dominance within the niche (Caragher, 2008; Carroll, 1985; Garver, 2009; LoDuca, 2009). Further, the literature strongly indicates that satisfying the consumer needs within a niche segment positively correlates with consumer self-identification with the offering and the provider, and is the central determinant of customer satisfaction in niche markets (Garver, 2009; Zhu *et al.*, 2009). F&B operators who demonstrate commitment to craft beers through server education, beverage list commitment, and supporting events can achieve this same differentiation and in the process help mitigate the economy of scale advantages enjoyed by large chain operations.

This study will report the demographic profile, spending practices, and restaurant selection criteria of craft beer enthusiasts obtained through a survey of the membership of the American Home Brewers Association (AHA) and a snowball sample of craft beer enthusiasts including the Brewers Association members. The American Home Brewers Association (AHA) is the national organization, which supports individual members in their pursuit of the production of craft beers. With a membership of approximately 25,000 individuals brewing throughout the United States, this group represents an ideal population from which to gain access to a sample to study craft beer enthusiasm. The AHA membership is also composed of and linked to the Brewers Association whose membership consists of craft beer brewers that have made the transition from home brewing to commercial craft breweries or, in many cases, added commercial craft brewing to their home brewing activities. In partnership these organizations represent craft brewers in national and local lobbying, dissemination of knowledge, and as a central point to support and endorse craft brewing activities. The results obtained from this research will speak to the viability of craft beer enthusiasts as a niche market for independent F&B operators.

Market overview

The number of small specialty brewers in the US has increased dramatically since 1980; this sea change is linked to President Jimmy Carter's signing, in 1976, of legislation allowing home brewing nationally. This legislation allowed enthusiasts not only to brew for their personal consumption but facilitated small brewery and brew pub entry into the beer market to compete against the large scale brewers who held sway over the market. The interest in and perceived higher quality of the artisan made craft brews had initially gained a foothold in the commercial and F&B markets and in recent years has been the only brewing segment to enjoy increases in consumption. Ironically, and seemingly counter intuitively, the growth in the number of small brewers has increased as consolidation among the large commercial brewers has continued (Carroll and Anand, 2000; Elzinga, 2005; Tremblay *et al.*, 2005). This growth has overcome the vast economies of scale in place for the macro brewers for whom the highest expense in the cost of beer has become advertising (Nelson, 2005). In 1997 for the first time the number of US breweries exceeded that of Germany, the nation that still enjoys the strongest brewing tradition and the highest per capita consumption of beer worldwide (Carroll and Swaminathan, 1992). The market has changed dramatically since home brewing was legalized. Nearly every regional brewery, microbrewery, and brew pub traces its antecedents to home brewing (Carroll and Anand, 2000). The explosion of unleashed creativity due to legalization and the social and supportive interaction of home brewing enthusiasts is well documented (Ogle, 2006). Currently, craft beer is a $6.5 billion dollar annual market capturing 5.4 percent of the commercial dollar volume market share (Brewers Association, n.d.) with 1,525 breweries producing 8.5 million barrels of beer annually. These numbers highlight the incredible renewal of the brewing industry and the growing hunger of consumers for differentiation.

The Brewers Association report shows that in the first two quarters of 2010 overall beer consumption fell by 2.7 percent, with domestic brands down 2.9 percent and imports down 9 percent. Craft beer sales by contrast increased 9 percent by volume and over 12 percent by revenue, providing the only positive news for the industry. Similarly, over the past three years overall restaurant sales have declined in aggregate by 5 percent (National Restaurant Association, n.d.), with some operations having to reduce staff or cease operations entirely. By contrast, the number of microbrew pubs in this same timeframe has increased, with employment in these operations growing as well and surpassing 100,000 jobs (Brewers Association, n.d.). This increase, in an otherwise down market, clearly indicates that the growth in craft beer sales comes at the expense of the large national and international breweries and broad line restaurants. Clearly, the potential for craft beer's continued increase in market share is indicated by this growth in an otherwise down market. The growth in both the numbers of operations, the continually growing percentage of market share and sales gives strong support to the notion that home brewers are driving the market, and craft beer enthusiasts more broadly, can indeed be viewed as an important and attractive niche consumer market.

Research methods

A survey instrument was designed to obtain demographic information; along with a series of questions regarding consumption and spending on craft beers. Respondents were asked about their likelihood to continue supporting the craft beer segment and recommend the product to others as a means of assessing the depth of commitment to the activity and the product. The content validity of the instrument is supported by the participation and expert review of the AHA leadership, with refinement to the instrument made based on this expert input.

To minimize the potential for ambiguity of the survey questions, a pilot study was undertaken. The instrument was administered to a local chapter of the AHA in Auburn, AL. and feedback and comments from the respondents was solicited with an emphasis placed on the relevance and clarity of the questions. Twelve chapter members participated in the field test out of a possible 17 members. The time needed to complete the survey was monitored through the field test process. The resultant feedback led to further refinement of the instrument. The criterion of face validity is supported by the participation of this group of practitioners in the development of the survey.

The finalized instrument was administered directly by the AHA through email to the 25,000 membership base along with the request to the members to forward the link to the instrument via email to other brewers and craft beer enthusiasts of their acquaintance. The completed surveys were collected by an online independent third party service then transformed into statistical data. To maximize participation, the survey was designed to be web-based. The survey was administered from the AHA office to their membership electronically, using email. Email is the standard communication device employed by the AHA. The membership was asked to respond through an embedded link to the website hosting the instrument. The AHA sent out an initial response request and an additional reminder email two weeks prior to the survey closing deadline to solicit the greatest possible response. Over 5,000 responses were collected of which 4,207 were useable with 3,449 (approx. 79 percent) coming from AHA members and 758 (approximately 21 percent) who are not members of the organization.

Findings

Reliability is defined as the consistency of a measure (Huck, 2004). Put simply, the ability of solutions to reach valid reliability scores indicates that the measure itself, not error or chance, explains the result. Reliable research instruments allow future research to consistently measure the same factors and different results can be reliably attributed to differences in the sample and not to the instrument itself. The reliability of the instrument is supported by the Cronbach's alpha result 0.875.

Validity measures accuracy (Huck, 2004). In essence, validity is the underlying soundness of the instrument signaling sufficiency that the instrument does indeed measure what it is purported to measure. Validity for this study has been determined using content validity. Content validity was assessed through two methods, expert input at the executive level from the AHA and through a field test of active home brewers.

Though the number of respondents, 4,207, is sufficient for statistical testing, non-response bias must be accounted for. To determine if non-response bias was a problem the sample was split between the respondents who participated through the original email request and those that responded after the follow up emails were sent. This created a comparison base of 2,604 respondents classified as early respondents and 1,603 classified as late respondents. Statistical analysis comparing the group means and the total scores were computed using the independent samples *t*-test, with no statistically significant differences found between the two groups. This finding offers strong support that non-respondent responses would not be different from the sample and increases the confidence level of the results obtained from this study.

Demographically the results reveal the age range to be relatively youthful with approximately 42 percent falling in the 35-49 age grouping. This demographic indicates that craft brewers and enthusiasts are not a baby boom phenomenon and indicate the likelihood for the continued growth of this segment. What is striking is the overall profile of the respondent sample: approximately 72 percent of the respondents have earned a Bachelor's or higher graduate degree; 63 percent (approximate) enjoy household annual incomes over $75,000; and 50 percent (approximate) self-reported that their field of work is in one of the professions with an additional 15 percent (approximate) reporting they carry management responsibilities (Table I).

Clearly this demographic group possesses high disposable income with the education and life position to be comfortable in expressing discrimination and to demand their preferences. In an effort to understand the respondents own prediction of their future behavior, and by inference glean insight into the depth of self-identification with craft beer, the questionnaire asked the respondents to rate their satisfaction and likelihood to remain engaged as home brewers and to recommend home brewing to others.

The survey results clearly show that home brewing is meeting the needs of its practitioners with a robust 99 percent (approximate) of the scores recorded as satisfied or very satisfied (see Table II). To the questions asking the likelihood to recommend and continue 96 percent and 99 percent (approximate) responded that they were likely or very likely to continue the activity and recommend it to others (see Table II). The likelihood to continue in and recommend the activity speaks broadly to the level of passion and interest in not just the process but the product as well. Additionally, the respondents were asked to self-describe their commitment level with 93 percent describing themselves as passionate or enthusiasts (see Table III). The very strong scores clearly indicate the high level of interest in craft beers. In examining the high average income level and passion for craft beers exhibited by the sample indicate that craft beer brewers and enthusiasts may well be a market segment of interest to the savvy F&B operator.

In terms of F&B consumption, the results indicate that home brewing does not decrease spending and more importantly number of visits to restaurants, taverns, or pubs, with approximately 72 percent of the respondents saying their F&B spending has actually increased or remained the same since they took up the activity (see Table III). The breadth and variety of an operations beer list drives the location selection for approximately 80 percent of the respondents. The frequency of changing offerings and beer styles of the list received the highest mean score for location selection (see Table IV). Tangential offerings such as craft beer speakers and events such as competitions or demonstrations achieved high means scores as well in likelihood to frequent F&B operations. Most strikingly 55 percent of the respondents

	n	%
Frequency of ages		
< 21	7	0.2
21-25	229	5.4
26-34	1,109	26.4
35-49	1,746	41.5
50-65	1,023	24.3
> 65	85	2.0
Missing*	8	0.2
Total	4,207	100.0
Frequency of gender		
Male	4,001	95.1
Female	186	4.4
Missing*	20	0.05
Total	4,207	100.0
Annual family income (thousands)		
< 25	140	3.3
25-39	258	6.1
40-54	388	9.2
55-75	690	16.4
76-99	885	21.0
100-145	1,078	25.6
> 145	699	16.6
Missing*	69	0.16
Total	4,207	100.0
Education level		
Some High School	12	0.3
High School Grad	118	2.8
Voc/tech	132	3.1
Some College	591	14.0
Associate's Degree	312	7.4
Bachelor's Degree	1,791	42.6
Master's Degree	887	21.1
PhD	359	8.5
Missing*	5	0.01
Total	4,207	100.0
Field of work		
K-12	152	3.6
College/University Ed.	383	9.1
Military	125	3.0
Government	435	10.3
Service Industry	1,095	26.0
IT	841	20.0
Non-profit	152	3.6
Manufacturing	807	19.2
Brewing	119	2.8
Missing*	95	2.3
Total	4,207	100.0

(*continued*)

Table I.
Demographic profile of respondents

	n	%
Type of work		
Student	136	3.2
Educator	236	5.6
Construction	372	8.8
Clerical	110	2.6
Sales	93	2.2
Management	620	14.7
Consultant	267	6.3
Professional	2,110	50.2
Retired	49	1.2
Missing*	18	0.4
Total	4,207	100.0

Table I.

plan day trips around beer and approximately 37 percent of them plan their vacations around this activity, clearly indicating their willingness to travel to and spend in F&B operations featuring craft beers.

Discussion and conclusions

Through the examination of craft beer brewers and enthusiasts commitment to the product and activity and the measurement of the determinants for choosing F&B operations the study attempted to address the question: are craft beer enthusiasts a niche market and if so are they worth pursuing by F&B operators? The demographic niche identified is extremely attractive in terms of age, education, and most importantly annual income. Nearly 80 percent of the respondents reported higher family incomes than the national mean or median. Having this financial capacity these respondents can afford to pursue their interests by dining out and/or by planning vacations to famous brewing areas such as: the Pacific Northwest, Germany and/or Belgium to sample the wares. A market with this financial capacity and specificity of focus is a niche that independent operators seeking an area of competitive advantage would be foolish to ignore.

When asked what motivated their decision to frequent a F&B operation, respondents listed extensive and interesting beer lists and even more importantly, as exhibited by the highest mean score (see Table IV), the frequency of change and introduction of new products on the list as the crucial decision driver in their location choice. One key result of this study is that while a wide list is desirable it is the frequency of change, comparable to seasonal and frequent food menu changes that are the prime determinant for this market. This understanding can help mitigate what might otherwise be an onerous commitment to inventory in terms of space, dollars, and waste. Equally important in niche market dominance, as described in the literature, is evidence of expertise. The high mean scores for location selection based on events and speakers is intuitive when the academic level of this market is considered. The high propensity of degree holding participants supports the notion that learning would be important to this group. Even operations known for their beer selections are rarely limited to craft beers offering instead an incredible array of what is, in essence, national and international large scale brews. How much effort is put into wait staff education,

Table II.
Overall satisfaction with craft beer and likelihood to recommend and continue consumption

	Very unsatisfied		Unsatisfied		Neutral		Satisfied		Very satisfied		Very unlikely		Unlikely		Neutral		Likely		Very likely	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Overall sat.	6	0.1	2	0.0	31	0.7	1,205	28.6	2,950	70.1										
Recommend											5	0.1	15	0.4	131	3.1	1,232	29.3	2,821	67.1
Continue											3	0.1	5	0.1	35	0.8	725	17.2	3,419	81.3

	n	%
Since becoming involved in craft beers my restaurant and tavern spending has		
Decreased	1,190	28.1
Remained the same	1,681	40.7
Increased	1,304	30.8
Missing	18	0.4
Total	4,207	100.0
I describe my commitment level to the craft beer segment as		
Passionate	1,743	41.4
Enthusiast (time constraint)	2,165	51.5
Dabbler	146	3.5
Special occasion	14	0.3
Quit brewing	1	0.0
Missing	16	0.4
Total	4,207	100.0

Table III. Spending patterns and commitment to craft the craft beer market segment

	Mean	SD
Frequency of beer menu change	4.38	0.841
Breadth of beer list	4.35	0.855
Craft beer events	4.22	0.910
Craft beer speakers	4.17	0.949

Table IV. Location selection

food pairings, brewer dinners, tastings, and guest speakers? In how many operations is the same effort put into education, marketing, and presentation and service of beer as wine receives. It is these efforts, supported by the answers from the brewers themselves that will create the connection between this market and F&B operations. This convergence of the criteria, the results, and the affluence of the demographic profile provides powerful support to the arguments offered here. Putting together all these elements offers a strategy for operators looking to establish credibility and demonstrate the expertise needed to gain dominance in this potentially lucrative niche market.

The growth in the overall craft beer market and the movement towards craft beer type offerings by the large brewing companies indicate that the interest in craft beer is growing and that that the potential niche goes well beyond the active home brewer population. With over $6 billion in annual sales and growing this is a market that should interest any operator. As the literature illustrates targeting a niche market can level the playing field for an independent operator competing against chains with vast resources, large market presence and advertising budgets. By whatever name it is understood; customization/specialization/differentiation is the classic response to consolidation and economy of scale advantage as seminally expressed by Porter (1980). The significance of the strength of these concepts can be seen in the widespread increase in market share of such artisan products as bread, coffee, and heirloom seed stock, cheese, and livestock.

In the full service F&B marketplace where every operation has an extensive wine list and menus that feature phraseology such as; locally grown, free trade, artisan produced; where the food is plated vertically, sauces are colorful and creatively drizzled from squeeze bottles, and complex culinary techniques are the norm how can true differentiation be attained? The evidence from this study at least supports the inference that one approach to creating competitive advantage might be to commit to craft beers on menus through events, and education of both staff and customers. The loyal craft beer enthusiast could well emerge as both an advocate (e.g. let's go there, that is the place with the great beer list) or the veto vote (e.g. let's not go there, they do not have enough selection, let's try ...) that influences family and social group behavior and selection. Demonstrating expertise and filling the needs of this segment can, as the literature suggests, provide the credibility and "first in" recognition that can translate into sustained competitive advantage (Caragher, 2008, Garver, 2009, LoDuca, 2009). The operator who can capitalize on craft beer enthusiasm will not only reap the advantage of differentiation, but will be in the same position as the early in wine merchandisers who established their reputations and brand three decades ago. The risk, if managed properly is negligible requiring menu management, staff training and most critically commitment. The rewards in relation to the risk are potentially outsized.

Limitations and future research

Every effort has been made to plan the research so as to minimize limitations. However, limitations still exist and caution must be exercised in attempting to explain and generalize the results. The sample examined is comprised of AHA members and those they invited to participate and might therefore only represent this group and its norms. This survey was self-administered with all the inherent limitations of such an instrument: subjectivity of the participant, potential misinterpretation, and the lack of expert administration. The survey was administered electronically, and while there are compelling reasons that support this method (ease of use, sense of immediacy, accuracy of data transfer, etc) there is no question that those without computer and email access were excluded from participation. Lastly, the exploratory nature of this study must be acknowledged.

Future research examining both the motivation and emotion of craft beer enthusiasts are needed as well. Research specifically examining how to target and access this niche markets is also strongly suggested. Pragmatically, partnering with a willing restaurateur to meet the needs of this segment would allow a real-world measurement of sales impact and customer feedback. Empirically examining the links between craft beer and luxury, gourmet, and experiential tourism would add a much needed dimension to understanding this group and their market potential. Revisiting the sample and methodology longitudinally would offer insight into potential changes over time both behaviorally and demographically and chart the level of growth within the activity. Additionally, a broad based survey of the general public to test for craft beer enthusiasm as a restaurant selection determinant would greatly enhance the understanding of the overall potential of this market. Lastly, adding an international examination of craft beer would add depth and richness to this research.

References

Alonso, A. (2011), "Farmers' involvement in value-added produce: the case of Alabama growers", *British Food Journal*, Vol. 113 No. 2, pp. 187-204.

Alonso, A. and O'Neill, M. (2010), "Small hospitality enterprises and local producers: a case study", *British Food Journal*, Vol. 112 No. 11, pp. 1175-89.

Brewers Association (n.d.), "Beer information/education: craft brew statistics", available at: www.beertown.org/education/stats.html (accessed 18 July 2010).

Caragher, J. (2008), "Expand your horizons: niche marketing success stories", *Journal of Accountancy*, Vol. 205 No. 4, pp. 56-9.

Carroll, G. (1985), "Concentration and specialization: dynamics of niche width in population organizations", *The American Journal of Sociology*, Vol. 90 No. 6, pp. 1262-83.

Carroll, G. and Anand, S. (2000), "Why the microbrewery movement? Organizational dynamics of resource partitioning in the US brewing industry", *The American Journal of Sociology*, Vol. 106 No. 3, pp. 715-62.

Carroll, G. and Swaminathan, A. (1992), "The organizational ecology of strategic groups in the American brewing industry from 1975 to 1990", *Industrial and Corporate Change*, Vol. 1 No. 1, pp. 65-97.

Elzinga, K. (2005), "The beer industry", in Adams, W. and Brock, J. (Eds), *The Structure of American Industry*, Prentice Hall, Upper Saddle River, NJ, pp. 72-95.

Garver, M.S. (2009), "A maximum difference, scaling application for customer satisfaction researchers", *International Journal of Market Research*, Vol. 51 No. 4, pp. 481-500.

Huck, S. (2004), *Reading Statistics and Research*, Pearson Education, Boston, MA.

LoDuca, J. (2009), "Choose a foxhole", *Advisor Today*, Vol. 104 No. 8, pp. 56-7.

National Restaurant Association (n.d.), "Trends and forecasts", available at: www.restaurant.org/research.html (accessed 18 July 2010).

Nelson, J. (2005), "Beer advertising and marketing update: structure, conduct, and social costs", *Review of Industrial Organization*, Vol. 26 No. 3, pp. 269-306.

Ogle, M. (2006), *Ambitious Brew: The Story of American Beer*, Hardcourt, Orlando, FL.

Porter, M. (1980), *Competitive Strategy Techniques for Analyzing Industries and Competitors*, Free Press, New York, NY.

Tellistrom, R., Gustafsson, I. and Mossberg, L. (2006), "Consuming heritage: the use of local food culture in branding", *Place Branding*, Vol. 2 No. 2, pp. 130-43.

Tremblay, V., Iwasaki, N. and Tremblay, C. (2005), "The dynamics of industry concentration for US micro and macro brewers", *Review of Industrial Organization*, Vol. 26 No. 3, pp. 307-24.

Zhu, H., Wang, Q., Yan, L. and Wu, G. (2009), "Are consumers what they consume? – Linking lifestyle segmentation to product attributes: an exploratory study of the Chinese mobile phone market", *Journal of Marketing Management*, Vol. 25 Nos 3/4, pp. 295-314.

About the authors

Douglas W. Murray is a Doctoral Candidate at Auburn University. Douglas W. Murray is the corresponding author and can be contacted at: dwm0004@auburn.edu

Martin A. O'Neill is Bruno Professor and Department Head at Auburn University.