

REVEALED PREFERENCE ANALYSIS OF WINE ATTRIBUTES USING POLARISATION (REFEREED)

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Abstract

The usual method of analysis of product attributes in marketing is to conduct a Multinomial Logit (MNL) model and measure the impact of each attribute on the choice probability, which is equivalent to market share. Most of these types of studies in marketing have used stated choice experiments as the research environment. Few studies have analysed attribute effects at the revealed preference level, mainly because of the limited ability to find data sets with a rich set of attribute classifications (Guadagni and Little 1983; Fader and Hardie 1996). Revealed preference allows for a study into repeat purchase and loyalty. In this paper, we introduce a loyalty measure, polarisation, and show results based on a wine data set of revealed preference. Polarisation is a function of the Beta Binomial Distribution (BBD) and can also be a function of the Dirichlet Multinomial Distribution (DMD). The DMD provides an overall loyalty effect for each attribute and the BBD results for each attribute level provide an understanding of the reinforcing, niche or change-of-pace tendency of these levels. Firstly, the results show higher loyalty towards price and variety rather than to region and brand. More importantly, the results reveal the structure of the market. This ability to show market structure is the major contribution of the paper.

Introduction

When a survey is undertaken and respondents specify the selection they would make in hypothetical decisions then this is known as stated preference (Ben-Akiva & Lerman, 1985; Louviere, Hensher and Swait, 2000). When a shopper's or consumer's actual selections, made in their day to day lives, are recorded, such as in consumer data bases and panel surveys, then this is known as revealed preference (Rungie & Laurent, 2003). In revealed preference therefore, consumers' loyalty can be measured and this allows for an investigation into the aggregate level loyalty towards brands, attributes or any other type of alternative.

One form of studying such behaviours for alternatives is to utilise a zero order model as a benchmark, with the Dirichlet Multinomial Distribution (DMD) model being one of the more popular (Fader and Schmittlein 1993; Bhattacharya 1997). The reasons for this refer to the DMD's appealing ability to accommodate the double jeopardy phenomena (Bhattacharya 1997). Deviations from the DMD benchmark can be measured by reducing the multinomial calculations of the DMD down to a binomial model such as the BBD model. The BBD results for each alternative can infer possible variety seeking or reinforcing behaviours for alternatives. On the concept of loyalty and referring to double jeopardy, small market share brands are known to suffer from two specific disadvantages compared with high share brands: they tend to have fewer buyers than high share brands, and they also tend to be bought less often (Goodhardt et al. 1984). Authors have also referred to small brands as being "change-of-pace", where small brands are picked up even less within consumers' portfolio's (Kahn et al. 1988). Niche brands are the opposite where a small brands customer base has higher loyalty relative to the rest of the market. Fader & Schmittlein (1993) have also proposed a "reinforcing" effect for large market share brands where these large brands are purchased more excessively within consumers portfolio's.

The notion of a small niche brand is discussed regularly in industry and academic marketing journals (Day et al. 1979). Aside from stable DMD-type markets where portfolios are steady, most empirical research has shown a tendency away from, rather than toward a niche positioning (Fader and Schmittlein 1993). To test this empirically, researchers have assessed deviations from double jeopardy using either actual results such as penetration and purchase frequency or by utilizing the BBD model and comparing it to the DMD baseline result.

In this paper we are concerned with using the Dirichlet as a baseline and assessing deviations from it to determine niche or change-of-pace type alternatives. While the usual unit of analysis in Dirichlet type studies is the brand, we are concerned with assessing attributes and attribute levels and running a loyalty type analysis. This gives a loyalty level for each attribute, as well as indications into reinforcing, niche or change-of-pace type behaviour for the different attribute levels.

To summarise, polarisation captures the loyalty towards an alternative, consistent for market share. Polarisation reveals the excess or lower loyalty left after the expected level of loyalty is taken out. The expected level of loyalty is based on the number of

alternatives in the market, and the switching of these alternatives, given their market share. If a small market share alternative has excess loyalty, it is defined in the literature as a niche alternative (brands with excess loyalty are commonly referred to as niche brands). Niche alternatives are said to compete within their own 'niche' group of customers – a small customer base that shows higher repeat purchase and therefore higher loyalty, relative to the rest of the market. They effectively are not competing with other alternatives in the market. If a small market share alternative has lower loyalty than what is expected, it is regarded as a 'change-of-pace' or 'variety-seeking' alternative.

Methodology

Repeat purchase probabilities ($P_{(ij)}$) and market shares (m) are linked by the following equation 1 (Rungie and Laurent 2003);

$$\text{Equation 1} \quad \rho = m + \varphi - m\varphi \quad \text{where } 0 \leq \rho \leq 1.$$

Repeat purchase probability or as it is sometime known, the repeat rate (ρ), is therefore defined as the probability of choosing brand i conditional on a previous purchase of the same brand i . This is a measure of loyalty and is the repeat purchase probability for the brand. φ is a function of either the DMD or the BBD. The φ from the DMD is an overall level of loyalty and refers to the double jeopardy effect that loyalty is constant, no matter what the market share of the alternative. This constant is therefore the loyalty baseline, with the BBD φ 's being for each alternative and allowing for comparisons to be made with the baseline DMD result. φ is similar to other measures of brand loyalty such as Kalwani's coefficient of polarisation (Kalwani 1980); Hendry's k (Kalwani and Morrison 1977) and Bass et. al.'s θ construct (Bass et al. 1976). Typically and intuitively, larger brands have a higher repeat purchase probability and therefore higher loyalty. If variety seeking or niche behaviour are not present, the φ for each brand would be the same as the φ from the DMD. The aim of the paper is to therefore investigate if wine consumers deviate in their loyalty to different attribute levels and what type of deviations are present.

The Data

The data is a panel of 3,942 wine consumers from a retail chain in Australia over a three year period. For this study, the red bottled wine category was selected. This left 3,045 shoppers of red wine in the sample. This analysis was also limited to a one year time period, being the usual time period length for similar studies. In this instance it was the year two time period. To analyse loyalty (ρ) as part of the series and to subsequently compare results, the sample was further refined to include only shoppers who satisfied the following requirements; 1) purchased a minimum of 10 units of wine; and 2) had repeat purchased. This procedure further reduced the sample to 2,036 shoppers. The number of wine bottle units purchased over the one year period was 85,902, with an average purchase rate per shopper of 42.2 units. There were 31,193 actual transactions with an average transaction rate of 15.3 per shopper. Three attributes (market share of the brand, price, region of origin, variety) with 4 levels within each were chosen for the study. The attributes and levels are shown in table 1. All stock keeping units (SKU's) were coded as per the attribute classifications. There were 9,244 SKU's for red wine in this data set. As an initial indication of the preference for each individual attribute level, the market shares for each of the attribute levels are reported in table 2.

Table 1: Attributes and Attribute Levels for the Revealed Preference Experiment

	Brand (Market Share)		Price		Region		Variety	
	Levels	Code	Levels	Code	Levels	Code		Code
1	Top 10 brands	b0	< or = \$7.49	p0	Australian or state general	r0	Cabernet	v0
2	Next 20 = 11-30	b1	\$7.50 - \$12.49	p1	Australia region specific high awareness	r1	Shiraz	v1
3	Next 20 = 31-50	b2	\$12.50 - \$17.49	p2	Australia region specific low awareness	r2	Cabernet/Shiraz blends	v2
4	51+	b3	\$17.50+	p3	Foreign	r3	Other	v3

Table 2: Market Shares for each Attribute Level.

	Brand (Market Share)		Price		Region		Variety	
	Levels	Market share (m)	Levels	(m)	Levels	(m)		(m)
1	Top 10 brands	0.41	< or = \$7.49	0.07	Australian or state general	0.33	Cabernet	0.24
2	Next 20 = 11-30	0.26	\$7.50 - \$12.49	0.30	Australia region specific high awareness	0.41	Shiraz	0.29
3	Next 20 = 31-50	0.12	\$12.50 - \$17.49	0.29	Australia region specific low awareness	0.18	Cabernet/Shiraz blends	0.25
4	51+	0.21	\$17.50+	0.34	Foreign	0.08	Other	0.22

The Results

Any analysis of this type is influenced by the makeup of the attribute levels. The initial loyalty results show that there is higher loyalty to price versus all the other attributes. Price is driving loyalty more than the other attributes. This is followed by variety, region and brand. These are interesting findings and show that consumers are more loyal to price and variety than they are to region and brand. These results are shown in table 3. φ is bounded between 0 and 1 with high values of φ indicating consumers always choosing the same alternative and low values indicating considerable switching amongst levels within each attribute.

Table 3: DMD φ for each attribute.

Attribute	DMD φ
price	0.44
variety	0.32
region	0.31
brand	0.29

The next results are specific to the ϕ from the BBD model. These are the individual attribute level ϕ 's. These are shown in table 4, along with the market shares for each level as stated in table 2.

Table 4: BBD ϕ for each attribute level vs. market share (m).

Attribute	ϕ	Market share (m)
Price DMD ϕ	0.44	
\$17.50+	0.52	0.34
\$7.50 - \$12.49	0.44	0.29
\$12.50 - \$17.49	0.36	0.30
< or = \$7.49	0.47	0.07
Variety DMD ϕ	0.32	
Shiraz	0.35	0.29
Cab/Shiraz Blends	0.33	0.25
Cabernet	0.38	0.24
Other	0.31	0.22
Region DMD ϕ	0.31	
Aus region high awareness	0.33	0.41
Australian/State general	0.38	0.33
Aus low awareness	0.25	0.18
Foreign	0.37	0.08
Brand DMD ϕ	0.29	
top 10	0.37	0.41
11-30 brands	0.31	0.26
51+	0.31	0.12
31-50 brands	0.25	0.21

Price

Table 4 shows the φ 's and market shares for each price level. We note that 27% of the market is wine over \$17.50 and 8% of the market is wine under \$7.50. This sample is skewed towards consumers that purchase bottled wine and therefore has a lot of relevance to small as well as large wine companies. In the example above the baseline loyalty for these 4 price categories is 0.44. There is some switching going; consumers do not stick to buying only from one price tier, they buy from a portfolio of price points and they do switch. They do however, show more loyalty to price tiers than they do to other attribute levels. Any alternative price level φ above the baseline DMD φ are considered to have excess loyalty. Within the portfolio of price tiers that buyers purchase from, there is more loyalty towards wine products <\$7.50 and wine products >\$17.50. More propensity is placed on these two categories within buyers' portfolio's. Buyers' have higher repeat rates for these two price categories once they have purchased from them. This in effect similar to a segmentation technique where consumers show more polarisation to high price wines or to low priced wines.

Region

'Australian/State General' are wines in which the region is not specified on the bottle, just an Australian classification such as 'South-Eastern Australia' or a states such as 'South Australia'. 'Australian Region/High Awareness' are wine products that are specified as coming from a specific region, in this case a region that has high awareness in the Australian market and rich associations with wine – Barossa Valley, Margaret River, Hunter Valley, Coonawarra, Clare Valley, McLaren Vale, Yarra Valley, Mudgee. 'Australia Region/Low Awareness' are wine products that are specified as coming from a specific region, but from regions that have low awareness. The 'Foreign' category is all wine products from overseas producers. We note in table 2 that the market share for 'Foreign' is 8%.

The results in table 4 show that foreign wines are acting as niche brands. They have low market share but high loyalty. The important finding in the results is that foreign wines, while having lower market share, have a higher polarization than 'Australian Region/Low Awareness'. They are not competing with these small Australian regions. It seems within consumers' portfolio's, they are more loyal to large brands that

specify an 'Australian/State General' and also 'Australian Region/High Awareness' region, and then variety-seek or change-of-pace on 'Australian Region/Low Awareness'. The interesting finding is that wines that have a general classification for region are showing more relative loyalty than the high awareness, region specific wines. This would reiterate the overall finding that consumers are more loyal to price and variety than they are to region and brand. Consumers switch between regions and actually show more loyalty to regions that aren't region specific.

Brand

Within an analysis of how brands behave, most researchers take the definition of a brand as something similar to the American Marketing Association's (AMA) 1987 definition, "A name, term, symbol or design, or a combination of them which is intended to identify the goods and services of one seller or group of sellers and differentiate them from those of competitors" (McCarthy and Perreault 1987). Using this definition, the wine brands were identified as the proprietary brand names in the SKU description. For example, Hardy's Tintara Shiraz Cabernet was categorized under the Hardy's brand. In other words, the proprietary brand was used when it appeared on the product description. 550 brands were identified using this procedure. The quantities of each individual brand purchased were determined within the time period specified for the study and then categorised into four categories based on the order of their ranking. The market shares for each of the categories are shown in table two.

A note on brand competition

The notion of a small niche brand is discussed regularly in industry and academic marketing journals (Day et al. 1979). Aside from stable Dirichlet-type markets where repertoires are steady, most empirical research has shown a tendency away from, rather than toward a niche positioning (Fader and Schmittlein 1993). To test this empirically, researchers have assessed deviations from double jeopardy, being where small brands have lower penetration and also a customer base that purchases less of the brand (purchase frequency) than larger brands in the category. The interesting finding in the following results suggest that small wine brands can show a tendency towards, rather than away from, niche positions. It is proposed that niche wine positions are sustainable, but 'change-of-pace' wine brands are not (Jarvis and Goodman 2003).

Firstly from table 4, we note the excess loyalty for the top 10 wine brands. We also note excess loyalty for the 51+ brands in the category. We note also that the lowest share brands are not showing change-of-pace characteristics, although the middle tier brands (31-50) are. This finding deserves further investigation outside the scope of this paper.

Variety

Jarvis, Rungie and Lockshin (2003) have shown excess loyalty towards the two largest share white wine varieties in the Australian market. Their findings showed excess loyalty for Chardonnay and Riesling and lower than expected loyalty for most of the other white wine varieties. Their interpretation of this was that the majority of a white wine buyer's portfolio is taken up with Chardonnay and Riesling. Instead of sharing the other varieties within their portfolio in line with the market shares, the other varieties in this category are being purchased as variety seeking or change-of-pace alternatives (Jarvis et al. 2003). Buyers are undertaking variety seeking behaviour, buying these white wine varieties irregularly while constantly reinforcing (excessively repurchasing) Chardonnay and Riesling.

From a marketing management perspective, Chardonnay and Riesling require strong reinforcement techniques such as strong branding and strong advertising. They may also require less marketing activity, because of their strong position and they may also have their own sub-categories in retail stores (i.e. Chardonnay sub-category; Riesling sub-category; all other white wines sub-category). If we find that white wine buyers only ever have two strong white wine varieties that they choose from at higher than expected levels, whether it is Chardonnay and Riesling or Riesling and Sauvignon Blanc, then all other varieties may be variety seeking in nature. Marketing for variety seeking usually requires sales promotion. If product marketers were marketing Semillon-sauvignon blanc and knew it was behaving like a variety seeking white wine variety, for example, they would undertake instore promotion, price promotion and other techniques such as the use of competitions and coupons (Jarvis et al. 2003). More effective marketing here would lead to more buyers utilising it in their variety seeking behaviour and portfolio, therefore increasing its market share. It is unclear from this study whether these marketing techniques can change a grape variety from a variety seeking one to a reinforcing one, with its own sub-category, such as Chardonnay and Riesling.

In this study we undertake a similar study, but as mentioned, this analysis is with red wine and with four levels rather than all varieties. Firstly, only one large market share straight varietal is showing excess loyalty, in this case, Shiraz. Cabernet has higher loyalty also but all other red wines are showing lower loyalty.

Conclusion

Polarisation is a robust modelling technique for analysing loyalty. In marketing, the usual level of analysis of loyalty is the 'brand' and polarisation has been applied to the analysis of brands. It can be utilised to study attributes, both individually (BBD) and categorically (DMD). A rich benefit of polarisation is its ability to compare the loyalty between alternatives and to therefore imply category structure. This analysis of structure includes the identification of niche and change-of-pace alternatives for small share attribute levels and reinforcing behaviour for large share attribute levels. Our results using one large revealed preference data set have shown some interesting results for the wine category. Firstly, overall we have identified higher loyalty to price and variety rather than region and brand. We have also identified higher loyalty to both high priced wine and low priced wine and we have also shown that no excess loyalty exists for Australian wine specific regions that have high awareness. We have also shown that small wine brands can have excess loyalty and therefore develop niche positions.

Further studies need to replicate these results and combine attribute levels to determine what levels might influence higher polarisation and therefore loyalty. An interesting extension to this research is to test Fader & Schmittlein's (1993) high-share/excess brand loyalty result for attributes. A positive result would suggest that large share brands are large because they focus on the large share attribute levels which have excess loyalty. Small brands, in an effort to identify niche positions, wrongly focus on small share attributes. Also, models being developed can incorporate interaction effects for attribute levels to measure the impact of combination of attribute levels on the loyalty towards a product. Such results could determine the optimum level of attributes for both small and large wine brands.

References

- Bass, F., A. Jeuland and G. Wright (1976). "Equilibrium Stochastic Choice and Market Penetration Theories: Derivations and Comparisons." Management Science **22**(10): 1051-1063.
- Bhattacharya, C. (1997). "Is your brand's loyalty too much, too little, or just right? Explaining deviations in loyalty from the Dirichlet norm?" International Journal of Research in Marketing **14**.
- Day, G., A. Shocker and R. Srivastava (1979). "Customer-oriented Approaches to Identifying Product-Markets." Journal of Marketing **43**(Fall).
- Fader, P. and B. Hardie (1996). "Modelling Consumer Choice among SKU's." Journal of Marketing Research **23**(November).
- Fader, P. and D. Schmittlein (1993). "Excess Behavioural Loyalty for High-Share Brands: Deviations from the Dirichlet Model for Repeat Purchasing." Journal of Marketing Research **30**(4 November): 478-493.
- Goodhardt, G., A. Ehrenberg and C. Chatfield (1984). "The Dirichlet: A Comprehensive Model of Buying Behaviour." Journal of the Royal Statistical Society **147**(5): 621-655.
- Guadagni, P. and J. Little (1983). "A Logit Model of Brand Choice Calibrated on Scanner Data." Marketing Science **2**(3).
- Jarvis, W. and S. Goodman (2003). "To Niche or not to Niche?" The Australian and New Zealand Grapegrower and Winemaker Journal **477**(Sept).
- Jarvis, W., C. Rungie and L. Lockshin (2003). An Investigation into Excess Behavioural Loyalty. Australian and New Zealand Marketing Academy Conference, Adelaide, South Australai.
- Kahn, B., M. Kalwani and D. Morrison (1988). "Nicheing Versus Change-of-Pace Brands: Using Purchase Frequencies and Penetration Rates to Infer Brand Positionings." Journal of Marketing Research **25**(Nov): 384-390.

Kalwani, M. (1980). "Maximum Likelihood Estimation of Zero-Order Models given variable numbers of purchases per household." Journal of Marketing Research **17**.

Kalwani, M. and D. Morrison (1977). "A Parsimonious Description of the Hendry System." Management Science **23**(January): 467-477.

McCarthy, E. and W. Perreault (1987). Basic Marketing - A Managerial Approach. Illinois, Irwin.

Rungie, C. and G. Laurent (2003). "Repeated Revealed Preference Methods: Dirichlet Multinomial Regression." Working Paper: University of South Australia.