Applicability of the Duplication of Purchase Law to Gaming

Desmond Lam

Abstract

In a bid to explore the use of an empirical-based model to explain regular gaming purchases, this study applies the Duplication of Purchase Law to gaming. Developed from empirical-based marketing theory and observed in many consumer brands, the Duplication of Purchase Law states that the dominant factor of purchase duplication between two brands is their market share. Using data obtained from the U.S. Gambling Impact Study, this study found that the duplication of games played was highly correlated to their penetration rates and hence, market share. In addition, the number of sole gamblers in each game was also related to its penetration rate. The results suggest the applicability of the duplication law to gaming. The implications of the findings to gaming businesses and public policy makers are discussed.

Keywords: duplication of purchase law, gaming

Introduction

Gambling is big business worldwide and a relatively low cost entertainment activity enjoyed by many individuals in various forms (Ministry of Public Safety and Solicitor General, 1994). Generally accepted by the modern society, gambling embraces the essence of risk taking (Bernstein, 1996) in exchange for something of greater value (Abbott & Volberg, 2000). It can be defined as "*staking money on uncertain events driven by chance*" (Productivity Commission, 1999, p. 6). Based on major gambling studies around the globe, more than 90% of the people (Ministry of Public Safety and Solicitor General, 1994; Abbott & Volberg, 2000) surveyed gambled at least once in their lifetime.

Nowadays, gambling is often used interchangbly with gaming. Today, popular games include lotteries, track betting, instant tickets, keno, and bingo. While research on gaming is extensive, many gaps remain. Often, the most serious literature of gambling considers it to be pathological - a form of human sickness or weakness (c.f. Herman, 1976). Hence, many studies focus on the negative aspects of gambling. Given the size of the regular gaming market, consumption behavior deserves greater attention than it is presently given. In particular, few empirical-based business models have been applied in gaming research.

In a bid to explore the use of an empirical-based model to explain regular gaming purchases, this study applies the Duplication of Purchase Law to gaming. The Duplication of Purchase Law, also known as a brand-switching law, stipulates the relationship between the duplicated purchases of two competitive or complementary brands and their market shares (Ehrenberg, 1996). It is developed from empirical-based marketing theory and observed in many brands or products for the past few decades (Uncles et al., 1995). The applicability of the duplication law to gaming may have important implications for businesses and public policy makers.

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Duplication of Purchase Law

The Duplication of Purchase Law was discovered after decades of research on consumer loyalty, which began since 1923 through the works of Copeland (Jacoby & Chestnut, 1978). Over the years, there were numerous definitions of the loyalty construct and with many different measurement methods employed. Jacoby and Chestnut (1978), for example, cited 53 definitions in their review. The lack of a clear definition did not hamper the progress of loyalty measurement techniques. Some early researchers began by focussing on behavioural measures (e.g., Ehrenberg, 1959; Bass, 1974) that included consumer purchase sequence, frequency of purchase, proportion of purchase, and probability of purchase (Jacoby and Chestnut 1978).

Ehrenberg (1959) was among the first marketers to examine regular patterns of consumer purchases, assuming a stochastic process, based on behavioural measures. When one considers consumers in aggregate, many markets are relatively stable and follow simple empirical '*marketing laws*' (Ehrenberg, 1959). Ehrenberg (1971) demonstrated that such '*law-like*' patterns are, in fact, predictable. It is common to find regularity in consumer purchases (Ehrenberg, 1995; East, 1997), even in multi-brand buying. In a stable market and at any given period, a consumer can either buy only one brand or a number of brands (i.e., multi-brands). According to Ehrenberg (1988), the proportion of consumers who are loyal to one brand is related to its penetration rate. Hence, consumer loyalty is generally higher for high penetration (i.e., high market share) brands compared to low penetration brands.

The key factor for the purchase duplication between any two brands is the penetration of each brand.

According to Ehrenberg (1996), the Duplication of Purchase Law states that buyers of one brand will buy a second brand in proportion to the penetration of the second brand. Hence, the key factor for the purchase duplication between any two brands is the penetration of each brand (Uncles et al., 1995). Based on this duplication law, a brand in a market is expected to have many of its own buyers purchasing from other large brands and only a few of its own buyers purchasing from the smaller brands (Sharp & Sharp, 1997). The percentage of buyers any two brands share (i.e., duplicated buyers) depends on their market shares rather than on their marketing related activities such as positioning (Ehrenberg, 1988).

The observations of this duplication law were reported by marketing researchers for the past few decades and found in a wide range of brands and products (e.g., Goodhardt, 1969; Ehrenberg & Goodhardt, 1970; Kau et al., 1998). The law establishes, mathematically, the extent to which different brands of a category are complementary to each other. Any deviations from the Duplication of Purchase Law would reflect the differences or similarities between different brands (Sharp & Sharp, 1997).

Suppose b_{xy} represents the proportion of population under examination who buys both brand X and Y in a given period. The Duplication of Purchase Law, hence, states that b_{xy} depends only on the penetrations of brand X (b_x) and brand Y (b_y). So, the higher the penetrations, the higher is the proportion of population who buy brand X and Y. Mathematically,

$$b_{xy} = D\, b_x b_y$$

where D is constant representing the average value of $b_{xy}/b_x b_y$ across all pairs of brands in the given period under consideration.

Past research has found that the duplication coefficient, D, tends to increase with the period under consideration (Ehrenberg & Goodhardt, 1970). Hence, the longer the period analyzed, the higher is D. Values of D less than 1 represent negative correlation between the purchase of brand X and brand Y, in which the purchase of one brand reduces the purchase of another brand (i.e., highly competitive brands). If D is equal to 1, the pair of brands is uncorrelated (i.e. $b_{xy} = b_x b_y$). For D greater than 1, the purchase of brand X is positive correlated to the purchase of brand Y. According to Ehrenberg (1996), if D>1,

$$b_{xy}/b_y > b_x$$

Another closely related theme of the Duplication of Purchase Law is that the number of sole buyers of a product varies with its penetration level b (Ehernberg, 1988; 1996). Sole buyers are buyers who only buy one brand (e.g., brand X) in the period analyzed. Thus, the percentage of buyers of a brand who are sole buyers is approximately the same for different brands and this is determined by the brand's own market share.

Applying the Duplication Law to Gaming

The Duplication of Purchase Law has been proven to hold true on numerous occasions, mostly involving high purchase-frequency products. According to Mizerski and Miller (2003), the gaming market has the highest penetration and purchase frequency among consumption goods. If so, is the purchase of games similar to the purchase of consumer products? Is the Duplication of Purchase Law also applicable to the study of gaming purchases? Up to this stage, given the similarity between buying a game and a brand/product, one would expect the law to be able to apply to gaming. Hence, the following hypotheses are formed:

H1: Gamblers of one game will play a second game in proportion to the penetration rate of the second game.

H2: The number of sole gamblers of a game varies with its level of penetration.

Research Methodology

States around the world usually promote various multi-million dollar games. These games include lotto, instant one-off scratch tickets, keno, sport betting, video lottery terminals and various number draw games with varying prizes. The availability of these different games varies by jurisdictions across the world and within each individual country. In an effort to test the hypotheses, a dataset from the National Gambling Impact Study Commission (U.S.A.) was used. The dataset was produced by the National Opinion Research Center in 1999 and distributed by the Inter-university Consortium for Political and Social Research in 2002 (National Gambling Impact Study Commission, 1999).

Sample and Measures

The Gambling Impact Study was conducted in 1998 on the behalf of the National Gambling Impact Study Commission to examine the gaming behavior and attitudes of adults and youth in America. The original study includes two major independent surveys on adults and youth. After examining the data collected from these surveys, only data collected for the adult survey (n= 2,947) were used. The data for the youth survey was not used because of the small sample of youth gamblers (n<100 for many games). The adult study was conducted through a nationally representative telephone survey on adults, aged 18 or older, regarding their gaming behavior, attitudes, and related factors. The sample was drawn randomly from a telephone databank using a national random-digit dial design. Through screening and follow-up, the study team from the National Opinion Research Center at the University of Chicago and its partners at Gemini Research, The Lewin Group, and Christiansen/Cummings Associates achieved a final participation rate of 55.5%.

The questionnaire consisted of a number of items with regards to regular and problem gaming behavior. The respondents were asked if they ever play a particular game ('*Yes*' or '*No*'). If so, have they played the game in the last 12 months ('*Yes*' or '*No*')? The answers to these questions were used to test the hypotheses. Four different types of gambling (or simply called games in this study) were examined in this study:

1. Lottery – gambling on lottery tickets such as Lotto, Powerball, and Instant.
2. Bingo – a numbers game.
3. Racing or track betting - betting on horse and dog races on-course and off course.
4. Casino gambling – gambling on a range of games such as slot machines, blackjack, poker, roulette and baccarat.

The Gambling Impact Study also included other types of gambling such as private gambling, unlicensed gambling, charitable gambling, and gambling in store/bar/ restaurant. These types of gaming were not included in this study as they were not unique games but rather games that were played in different venues or under unique situations.

There were slightly more males (48%) than females (52%) in the sample and the median age of the sample was 40-49 years old. About 59% of the respondents had at least a college education. More than half of them (53%) were married and 24% were single. Table 1 shows the sample size for each game and their past-year penetration rates. In all, lottery play had the highest penetration rate (75%) and bingo had the lowest (22%).

Table 1
Sample Sizes and Penetration Rates

	Casino	Track	Lottery	Bingo
Non-Gamblers	839	893	548	529
Gamblers	1002	320	1659	146
Total	1841	1213	2207	675
Penetration Rate	54%	26%	75%	22%

Data Analysis and Results

The analysis began by finding out the duplications of games played. Table 2 shows the duplication table for the games.

Table 2
Duplication of Games Played
Who also gamble…y
(b_{xy}/b_x) -

		2nd game			
	X/Y	**Casino**	**Track**	**Lottery**	**Bingo**
People	**Casino**	-	35%	85%	29%
who	**Track**	77%	-	88%	29%
gamble	**Lottery**	60%	29%	-	24%
…x	**Bingo**	66%	29%	82%	-
- 1st game					
	Penetration Rate (b_y)	54%	26%	75%	22%
	Observed Average Duplication (b_{xy}/b_x)	65%	32%	86%	29%
	Theoretical Duplication ($D*b_y$)	67%	32%	92%	27%

* E.g., 35% of respondents who reportedly gambled in casino also gambled in Track, 85% also gambled Lotto, 29% also gambled Bingo.
* D = 1.24, see Table 3.

The results showed that there were high levels of duplication in games played, ranging from an average of 29% to 86%. For example, on average, 86% of gamblers who played other games also played lottery. The duplication level of bingo was lower (i.e. 29%). Comparing the observed average duplication rate with the penetration rate of the second game, a very high correlation of 0.999 ($p<0.001$) was found. The theoretical duplication rate for each game was calculated by multiplying the duplication coefficient, D, with the penetration rate of the second game. A close fit between observed and theoretical average duplication rate was found. The next section shows how D is derived.

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Table 3 shows duplications of games as percentage of the total sample, the calculation of the duplication coefficient (D) and the estimation of the theoretical duplications (among total sample). For example, 19% of all respondents played casino and track and 47% of them played casino and lottery. The $b_{xy}/b_x b_y$ for each pair of games was calculated by dividing the observed duplication (b_{xy}) by their penetration rates (b_x and b_y). Hence, the coefficient for casino/track pair is:

Observed duplication ($b_{xy,O}$) / (penetration rate $_{casino}$ x penetration rate $_{track}$)

Individual $b_{xy}/b_x b_y$ were first calculated for each duplication and an average was computed thereafter. These coefficients were all greater than one (ranging from 1.12-1.35), which reflected the different levels of complementary (in purchases) between pairs of games. The duplication coefficient (D) was calculated to be 1.24 (See Table 3). Table 3 also shows the calculated theoretical duplications for each pair. Comparing these results with the observed duplication pairs, one would notice the close fit between the two groups of results.

Table 3
Duplication of Games among Population and Results

Observed Duplication ($b_{xy,O}$)		Game y			
		Casino	Track	Lottery	Bingo
Game x	Casino	-	19%	47%	16%
	Track		-	23%	8%
	Lotto			-	18%
	Bingo				-
($b_{xy,O}/b_x b_y)_{n}$, where n=1…6		Casino	Track	Lottery	Bingo
Game x	Casino	-	1.33	1.14	1.32
	Track		-	1.18	1.35
	Lotto			-	1.12
	Bingo				-
Duplication Coefficient, D = Average ($b_{xy,O}/b_x b_y)_{n}$, where n=1…6 = 1.24					
Theoretical Duplication ($b_{xy,T} = Db_x b_y$)		Casino	Track	Lottery	Bingo
Game x	Casino	-	18%	51%	15%
	Track		-	25%	7%
	Lotto			-	20%
	Bingo				-
Difference between Observed and Theoretical (($b_{xy,T} - b_{xy,O}$)		Casino	Track	Lottery	Bingo
Game x	Casino	-	-1%	4%	-1%
	Track		-	2%	-1%
	Lotto			-	2%
	Bingo				-

Next, the number of sole gamblers were extracted and compared with the total number of gamblers in each game. Table 4 shows the figures. A high correlation of 0.955 ($p<0.001$) was found between the number of sole gamblers and total number of gamblers; between sole gamblers and penetration rate, it was 0.830 ($p<0.001$). A close to linear relationship was thus found.

Table 4
Sole Gamblers in Relation to Total Gamblers

	No. of Sole Gamblers	Total No. of Gamblers	Penetration Rate
Lottery	578	1,659	75%
Casino	159	1,002	54%
Track	21	320	26%
Bingo	17	146	22%

Discussions and Implications

This study tested the applicability of the Duplication of Purchase Law in gaming. Discovered by marketing researchers, the Duplication of Purchase Law states that purchase duplication between two brands or products is related to their penetration rates. The results of this study showed that gaming (or game purchases) obeyed the Duplication of Purchase Law, which was found to hold true in the consumption of many consumer products. The proportion of duplication play among gamblers was found to be correlated to the penetration levels of each pair of games. Hence, hypothesis H1 is supported. Moreover, the number of sole gamblers in each game was closely associated with its total number of gamblers. Hence, hypothesis H2 is supported. Despite the close fit, some degree of variability between observed and theoretical results were found. These slight deviations from the theoretical '*norms*' might represent the extent to which there might be effective segmentation in the gaming market or might be simply due to sampling errors (Kau et al., 1998). As the data used came from a national survey and game types varied (e.g., different lottery games offered) with each jurisdiction within the country, the deviations might also reflect such differences. Moreover, the slight differences in product life cycle among games might have also contributed to these errors. In an extreme situation, a game in an early product life cycle would experience volatile market share fluctuations and the Duplication of Law would not be applicable in this case. Hence, a comparison between a game in the early cycle against another one in a matured cycle might lead to significant deviations from the norm. However, in this case, this was unlikely the case as the deviations were slight.

The findings from this study advocated the importance of pursuing market share in gaming. Games with high market share appear to have more duplicated gamblers (i.e., from other games) and greater number of sole gamblers. At the same time, games with small market share tend to have fewer duplicated gamblers and sole gamblers. Game loyalty behavior is thus a function of the market share of each game. The findings infer that there are generally more loyal customers to a game with high market share compared to a game with low market share. A game with high market share will find itself having more loyal customers, while a game with low market share may have more switchers. This phenomenon is commonly found in consumer-packaged markets (c.f. Ehrenberg, 1988; East, 1997) and would be useful as a benchmark for performance comparison and monitoring between games.

One simple application of the findings is that if one knows that 20% of gamblers of game X also gamble game Y and if 40% of gamblers of game Y also gamble game X, to ascertain the accuracy of these figures, one can compare the penetration rates of both games. Any significant deviations may potentially mean inaccurate accounting. In marketing, the Duplication of Purchase Law often acts as a useful benchmark or norm to measure differences or similarities between brands or products (Sharp & Sharp, 1997). It specifies the brand switching and loyalty behavior of consumers in situations of stable choices. Is there a tendency for gamblers of game X to also gamble in game Y? If so, how strong is the tendency? Also, does gambling in game Y reduce the gambling of game X? In the same way as in the marketing of consumer products, duplication law may also be employed by gaming businesses or state governments as a benchmark to study or track changes in the gaming market such as the relationship of new games to existing ones or between existing games over time, and track changes in gaming seasonality.

It is important to note that, in this study, the various types of gambling such as a casino, track, lottery and bingo were referred to as unique games, whereas within each type of gambling such as casino, there exists various games such as slot machines and table games like blackjack, baccarat, roulette, etc. This study only examines the relationships between each type of gambling and not specific games within the type. Given the close fit between observed and theoretical results found in this study, one would speculate that the duplication law could also be applied to specific games within each type of gambling. This will be an interesting area for future research.

This study also did not examine problem gambling, but merely looked at regular gambling as a whole. Nonetheless, this study provides greater insights to the understanding of factors that may help identify situations of problem gambling.

In addition, this study used secondary dataset to support its hypotheses. The quality of survey and types of measures used to support the findings were, thus, not within the control of the researcher of this study. Hence, the use of secondary data might potentially limit the research scope and quality of this study. Future research should enhance the quality of research through primary findings.

Lastly, this study did not examine other elements such as cognitive and affective factors that might have an influence on the findings. While these factors might be able to explain some of the variances that were found in this study, the close fit and large effect size (i.e., in correlation test) found between the observed and expected results led the author to firmly believe in the explanatory ability of the law to gaming behavior.

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