The Stochastic Nature of Purchasing a State’s Lottery Products

Dick Mizerski, Rohan Miller, Katherine Mizerski & Desmond Lam

Abstract
Legal State Lotteries have significant effects on those state’s revenues, their residents’ behaviours and their ultimate welfare. Reported Lottery product purchase appears to reflect patterns that suggest high levels of habitual behaviour. Analysis of a US State’s Lottery data found that this pattern was exhibited early in a game’s introduction, and was evident in three apparently different product offerings: six-number and three-number Lotto, and Instant (scratch-off) games. These findings have important implications for understanding gambling behaviour, lottery marketing and gambling regulation.

Keywords: Lotteries, Gaming, Habit, Stochastic modelling

1. Introduction
Worldwide lottery sales in 1999 were estimated to be over US$124,185,000,000 and are arguably the largest and most popular form of legalized gambling. US lotteries account for over 35% of this total (National Gambling Impact Study Commission, 1999; Productivity Commission, 1999), with a growth rate of more than 8% per annum (Miyazaki, Brumbaugh and Sprott, 2001). The importance of lottery revenues to US state governments is clear with lotteries accounting for between the fourth and sixth largest source of state revenue for most of the 37 states with lotteries. These impressive sales are backed by sophisticated marketing and promotion budgets that are often over $50 million per year. State lotteries offer a range of games in addition to Lotto that usually have relatively high levels of use in a population (penetration) compared to almost all other repeat purchase consumer goods. For example, US lottery games generally have in excess of 52% of the adult population buy at least one game over the year (National Gambling Impact Study Commission, 1999). Nonetheless, there are few empirically-based reports that investigate the decision-making or behaviour of gamblers when they purchase lottery games.

2. Background
2.1 Problem and Regular Gambling
The vast majority of the published research on gambling, including lottery product decision-making and behaviour, has taken a psychological model for its study. The research tends to focus on how cognitions, affect and the gambler’s perception of the control they have in the process lead to problem gambling. Problem gambling is also known as pathological gambling (National Gambling Impact Study Commission, 1999) or compulsive gambling, and is typically defined on some clinical measures such as The Southern Oaks Gambling Screen (SOGS). These problem gamblers account for approximately 2% of gamblers, although their rates of prevalence are affected by the group collecting the data, the scale used to determine problem gambling, and the venue where the information is collected. Lottery play has been viewed as the “softest” form of gambling, with a relatively low proportion of problem gamblers associated with Lottery products (Productivity Commission, 1999; National Gambling Impact Study, 1999).

2.2 Cognitive Based Gambling Models
The influential role of cognitive processes has been well documented in the gambling literature. For example, Langer (1975) used an experimental method to show that gamblers display an “illusion of control” and believe in luck when gambling. Ladouceur and Walker (1996) proposed that gamblers have two types of cognitive bias. They believe they can influence the outcome of their gambling, and that they can often predict it.

A considerable body of literature has explored the
application of expectancy-value, the Theory of Reasoned Action and other attitude model variants as ways to explain gambling behaviour. For example, Miyazaki et al. (1998) suggest that general attitudes toward gambling are likely to influence attitudes and behaviours related to Lotto play.

Landman and Petty (2000) proposed a theory suggesting that counterfactual thinking (“the process of imaging what might have been …”) plays a role in repeat purchase of lottery games, particularly where they most often lose:

“Some of those that buy a lottery ticket and lose may be hooked into continuing to purchase through the desire to escape the adverse reality by engaging in useful counterfactual thoughts of winning” (p.303).

Heavy buyers of lottery games are also suggested to fantasize more and thus produce more counterfactual thoughts. Unfortunately, no empirical tests of these cognitions and their effects were provided.

Forrest, Simmons and Chesters (2002) tested an economic model with results that would counter the assumptions about counterfactual thought. They cite evidence in derived price elasticities that would support the argument that Lotto players do act rationally to make use of the best information available when they purchase Lotto games. Scott and Gulley (1995) provide additional economic modeling support for the existence of rational consumers in their analyses of Lotto data from the US states of Kentucky, Ohio and Massachusetts.

For both problem and regular gamblers, the most popular present paradigm for studying gambling behaviour is Ajzen and Fishbein’s 1980 Theory of Reasoned Action, and its present successor, Ajzen’s (1991) Theory of Planned Behaviour (Rogers, 1998). Application of these cognitive-based models typically view the core beliefs of all gamblers as flawed, and continued gambling behaviour as being maintained by irrational thinking (Walker, 1993), “misconceptions” about the random nature of gambling on Lottery products, and gamblers mistaken beliefs they can control the outcome of games like Lotto (Miyazaki et al., 2001).

Although cognitive based theories and measures have explained some variance in primarily problem gambling behaviour, they have had little support for their efficacy in explaining or predicting gambling behaviour in a market. For example, research investigating whether marketing activities were associated with developing favourable beliefs about, and affect toward Lottery games, found only ethnic background (Mizerski et al., 1998) explained reported Lotto game purchase. Daswani (2003) found that no significant attitudinal responses were associated with the purchase of instant Lottery games. Heiens (1993) analysed the State of Colorado’s Lotto sales in the sixth year after its introduction. He looked for the relationship of marketing activities like media advertising, jackpot size, publicity and point of purchase with Lotto game sales. The Lotto jackpot size explained almost all of the variance, with publicity the only other significant (but small) effect on sales. DeBoer (1990) found similar effects of jackpot size in New York State Lotto sales. Population growth has been the only other factor that has shown to be an effect in gambling purchase for Lotto products (Gullay and Scott, 1995; Mason, Steagall and Fabitius, 1998).

2.3 The Effect of Past Behaviour

Several researchers have argued that past behaviour should be included in testing the applicability of Reasoned and Planned Action models for frequent decisions. Ouellette and Wood (1998) used a meta-analysis across a range of behaviours that are done frequently (e.g., brushing teeth, seatbelt use) and infrequently (donating blood). They found that past behaviour was a significantly stronger direct effect and more predictive than cognitive factors when the behaviours were undertaken frequently (up to every two weeks). The frequent behaviours usually occurred in relatively stable contexts, so the effect of past behaviour was termed habit by the authors. Norman, Conner and Bell (2000) found frequent past behaviour a better predictor, than cognitive factors, of future health behaviours like physical exercise.

Oh and Hsu (2001) tested the Theories of Reasoned / Planned Action against past gambling behaviour in predicting future gambling. While many of the cognitive constructs had a significant influence on future gambling behaviour, the direct path of past gambling behaviour to future gambling was almost twice the size effect as the direct path behavioural intention to future behaviour. They found no significant direct effect of attitude to future behaviour. Although Oh and Hsu found that past gambling behaviour was a better predictor, there has been little research into the form that past gambling takes in this process.

2.4 A Stochastic Explanation

One possible reason for finding little effect of promotion on sales (Heiens, 1993; Mizerski et al., 1998) is that most
State lotteries have reached the maturity stage of their Product Life Cycle (PLC) and there is little beyond large jackpots that affect these rather stable product markets. The “jackpot effect” also appears to have no influence on sales following the winning (lag effect) of a large Lotto jackpot (Heiens, 1993). In the few areas where lotteries compete, such as the border areas of adjoining states, these markets quickly stabilize in terms of brand share for competing lottery products. Because lottery games are a stable and mature product, usually rely on retailers, require shelf space and are frequently purchased, they exhibit the salient factors that identify a fast moving consumer package good. If they act in that manner, the purchase of these lottery games may reflect an underlying stochastic pattern often observed in many consumer and industrial markets (Ehrenberg, 1972; East, 1997). If lottery products reflect an NBD pattern, that could have an impact on industry and public policy marketing strategies, and the efficacy of those strategies. For example, warnings about gambling or information odds would appear to have little impact on future gambling with strong habitual patterns of play (Mizerski and Mizerski, 2001).

The general theory associated with the recognition and application of patterns of behaviour is often referred to as NBD-type models or Stochastic Preference (Massy, Montgomery and Morrison, 1970; Morrison and Schmittlein, 1988; Wagner and Taudes, 1986). These models are often very accurate in predicting usage, future purchase incidence and brand choice based on only behaviour or reported behaviour over a period of time. Because no attitudinal or marketing variables (e.g., advertising expenditures) are input to the models, explanations for the patterns are not addressed.

2.5 The NBD Model

The negative binomial distribution (NBD) is perhaps the most widely reported of the stochastic models. Initially discussed by Greenwood and Yule (1920) in terms of the incidence of reoccurring diseases and accidents, it was first introduced into the marketing literature by Ehrenberg in 1959. Typically, the NBD model has been applied to study purchase incidence for the total product category or for a single brand. A derivation of the NBD, the Dirichlet, is used to predict brand shares in a product category. The outcome of applying the NBD to data about past behaviour are estimates of future penetration of population use, and estimates of usage by groups (e.g., nonusers, heavy and light users) over time (see East, 1997). This model is often quite accurate (c.f., Morrison and Schmittlein, 1988), and can be more accurate than using cognitive data (Ehrenberg, Goodhardt and Barwise, 1990) to explain and predict future purchase behaviour. Given the characteristics of Lottery product purchase, it is expected that there should be no difference between the proportion of buyers of Lottery games and their expected purchase derived from the NBD model.

3. Methodology

3.1 Sample

The data came from a quarterly nine-wave series of phone surveys conducted by a commercial market research firm for the Florida State Lottery Commission. The surveys collected self-reported demographics, psychographics, attitudinal and purchase information from quota-based samples of approximately n=800 each (total n=7401) Florida residents. The samples were developed to represent the demographic profile of the state resident population, and used different respondents and often different questions on each quarterly survey. Therefore, the survey data provided cross-sectional data over time.

3.2 Measures

Interviewers asked the respondents in all nine surveys if they had played Lotto, Instant and/or Cash-3 in the last two weeks. They also asked how many games of each the respondent had purchased over those 14 days. Respondents that provided a yes or no about their play in the previous two weeks, and also reported the number of games they purchased, were used to determine the ‘penetration’ and ‘purchase frequency’ (Ehrenberg, 1972) of each Lottery game. The use of number of games rather than frequency of purchase does not invalidate the use of the NBD (Ehrenberg, 1972; Morrison and Schmittlein, 1988).

3.3 The State of Florida Lottery Products

Lotteries can be defined as games of chance in which a large number of players produce a fund from which prizes, whose worth greatly surpasses the value of individual contributions, are distributed by lot (Weiss and Weiss, 1966). Each State Lottery typically has a number of different lottery brands in their product portfolio that differ on a number of characteristics. The State of Florida Lottery has been one of the most successful of the sellers of lottery games in the United States (Mason, et al., 1997). It began by selling tickets for its first Instant (scratch-off) game, MILLIONAIRE, on January 12, 1988. First week Instant game sales
totaled approximately $95 million and exceeded the previous national record (set by the California Lottery in 1985) by approximately $15 million. COOL MILLION, the Florida Lottery’s second Instant game, was introduced on January 28 of that same year, beginning a cycle of successful Florida lottery games. On January 29, 1989, 17 days after sales began, the Florida Lottery paid back over $15 million to the General Revenue Fund for the Lottery’s start-up loan plus interest.

In April 1988, the Florida Lottery introduced Lotto and Cash-3 products through a network of 3,100 retailers. By June 1988, Lotto and Cash-3 generated $52 million of sales in just one month. The Florida Lottery added other game products over the subsequent years.

3.3.1 Instant Lottery Tickets

‘Instant’ lotteries are widely considered easier to purchase than all other forms of gambling in the lottery product portfolio, and are commonly referred to as “paper slot machines” (Abt, Smith and Christiansen, 1985). In 1999, Instant game sales from the Florida Lottery exceeded $663 million and represented around 25% of the Florida Lottery’s revenue. As simple games of chance, ‘Instant’ lotteries offer the immediate winning of prizes with better odds than other Lottery games. Perhaps as important in driving instant sales is the opportunity for winners to reinvest immediately (Triplett, 1994). Unlike other lottery products that have their numbers periodically drawn and announced (e.g., Florida’s Lotto was initially drawn each Saturday), Instant tickets provide consumers the opportunity of an immediate reward after scratching off the numbers (Triplett, 1994).

3.3.2 Cash-3

Cash-3 is played by choosing any three-digit number from 000 through 999, and matching those with three numbers drawn by the Lottery. There is the potential to win prizes up to $500, depending on the type of play purchased and the amount wagered. As such, it is a form

Figure 1: Penetration of Lottery Games Over Nine Quarterly Surveys
(Penetration = reported purchase in last 14 days)
of lotto, but the winning player may immediately collect most levels of winning from the lottery retailer where they purchased the game.

3.3.3 Lotto

Lotto, or “Big” Lotto, is generally the most popular Lottery game, in percent of the population who play (penetration) and in State Lottery sales. Lotto uses the game players’ choice, or a random “machine pick” of 6 numbers, to determine a winner. Variations of the Lotto game tend to involve 60-80% of a state’s population (Roy Morgan Research, 2001; Productivity Commission, 1999).

4. Results

Figure 1 provides a plot of the reported penetration of Lotto, Instant and Cash-3 play over nine surveys of Florida state residents. The first survey began in June 1988, approximately six months from the start of Instant game sales. For all three games, the penetration of purchase in the population had a downward trend during the first 27 months covered by the quarterly surveys. This trend has largely continued. The Cash-3 game tended to lose share to the Lotto and Instant games from the sixth survey.

Figure 2 is an example of the sample’s reported Lotto purchases in wave four, and is similar to those for the other waves and the other products (Cash 3 and Instant) over those waves. Note that a disproportionate number of respondents tend to report patterns of purchase in multiples of games (10 for this game) over the previous two-week period. This is quite common in self-reports of gambling product purchase. The NBD phenomenon, where a large number of purchasers buy a small number of the product, and a small number of buyers account for most of the sales, appears to be reflected in the data.

4.1 Penetration and Number of Games Purchased

Table 1 provides the data for determining the penetration and ‘frequency’ of the Lotto games for each survey (in this study frequency of purchase is represented by ‘number of tickets purchased’). As an example of the information, note the characteristics of survey one. That
initial survey was the largest of all the surveys with \( n = 1001 \) final respondents. Of the 1001 individuals in the total sample, 847 provided: (1) a yes or no response to the question that asked if they had purchased a Lotto game in the last 14 days, and (2) reported the number of games they had purchased over that two-week period. Therefore, 688 of those 847 respondents who had purchased Lotto represented 81\% of the sample of relevant respondents. The average number of games purchased in the relevant population \( (n=847) \) was 13 (see East, 1997 for a discussion of NBD application).

Of the 688 purchasers in survey one, 293 respondents reported buying from one to five games in the last 14 days. These will be labeled the ‘light buyers’ based on previous research (East, 1997; Mizerski and Mizerski, 2001). The ‘heavy buyers’ are those who purchase six or more Lotto games over the 14-day period. Six of the nine waves had a median purchase of six games so this break is reasonable. Other partitions of the data (e.g., 1 to 7 and 8+) did not change the findings. Non-purchasers are the 159 respondents who reported not buying a Lotto game over the previous two weeks. A similar procedure was used to determine the penetration and frequency of Cash-3 and Instant game purchases (not displayed).

4.2 Observed vs NBD Expected

For purposes of further explanation, the tests for significant differences between the observed (reported) purchases and the NBD predicted proportions of buyers and of their proportion of sales are shown in Table 2. The NBD statistic requires three inputs: penetration of use in the potential market, the average frequency of purchase (or number of items/games) by those who purchased, and the time period of behaviour. Although the predicted and actual are not identical, the distributions are similar in this first survey and all the following eight surveys.

Using a 3 (user groups) x 2 (reported vs expected) \( \chi^2 \) statistic on each survey’s data, none of the comparisons had statistically significant \( (p > .05) \) differences between the distribution of observed and NBD predicted proportions of purchases in the two Lotto user and one non-user groups. Figure 3 is an example of the fit of the NBD to the data, and shows the reported and NBD expected profile of purchases for each number of Lotto games bought in wave four using Wright’s NBD software (1999). Even with the tendency of the sample to report ten based multiples of games, the NBD provides a very good statistical explanation \( (r = .68, p < .001) \) of the samples’ reported Lotto game play. The stochastic pattern appeared within 24 weeks after the introduction of the game of Lotto. This finding provides support for a strong stochastic element in Lotto play.

4.3 Distribution of Volume by User Group

The percent of games accounted for by the light (one to five) and heavy (six plus) buyers, derived from the NBD

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sample</td>
<td>1001</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>14 day purchase data(^1)</td>
<td>847</td>
<td>703</td>
<td>700</td>
<td>710</td>
<td>746</td>
<td>676</td>
<td>638</td>
<td>637</td>
<td>610</td>
</tr>
<tr>
<td>No</td>
<td>159</td>
<td>126</td>
<td>228</td>
<td>213</td>
<td>219</td>
<td>232</td>
<td>225</td>
<td>234</td>
<td></td>
</tr>
<tr>
<td>Yes (% Penetration)</td>
<td>688</td>
<td>577</td>
<td>472</td>
<td>497</td>
<td>527</td>
<td>453</td>
<td>406</td>
<td>412</td>
<td>376</td>
</tr>
<tr>
<td>Light(^2)</td>
<td>293</td>
<td>232</td>
<td>208</td>
<td>243</td>
<td>223</td>
<td>206</td>
<td>179</td>
<td>201</td>
<td>182</td>
</tr>
<tr>
<td>Heavy(^3)</td>
<td>395</td>
<td>345</td>
<td>264</td>
<td>254</td>
<td>304</td>
<td>247</td>
<td>227</td>
<td>211</td>
<td>194</td>
</tr>
<tr>
<td>Average games purchased</td>
<td>13</td>
<td>14</td>
<td>13</td>
<td>10</td>
<td>12</td>
<td>10</td>
<td>11</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>

\(^1\) If purchased, gave number of games  
\(^2\) Light =1 to 5 games in last 14 days  
\(^3\) Heavy = 6+ games in last 14 days
Table 2: Observed to NBD Expected Proportions of Lotto Buyers and Games Played

<table>
<thead>
<tr>
<th></th>
<th>Survey 1</th>
<th>Survey 2</th>
<th>Survey 3</th>
<th>Survey 4</th>
<th>Survey 5</th>
<th>Survey 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
</tr>
<tr>
<td></td>
<td>Observed</td>
<td>Expected</td>
<td>Observed</td>
<td>Expected</td>
<td>Observed</td>
<td>Expected</td>
</tr>
<tr>
<td>Proportion of Buyers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non</td>
<td>19</td>
<td>19</td>
<td>18</td>
<td>18</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Light</td>
<td>35</td>
<td>32</td>
<td>33</td>
<td>32</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Heavy</td>
<td>47</td>
<td>49</td>
<td>49</td>
<td>50</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>0.33</td>
<td>0.05</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;.85</td>
<td>&lt;.98</td>
<td>&lt;.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of Games</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>10</td>
<td>8</td>
<td>9</td>
<td>7</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Heavy</td>
<td>90</td>
<td>92</td>
<td>91</td>
<td>93</td>
<td>89</td>
<td>91</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>0.58</td>
<td>0.67</td>
<td>0.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;.45</td>
<td>&lt;.41</td>
<td>&lt;.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Survey 7</td>
<td>Survey 8</td>
<td>Survey 9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
</tr>
<tr>
<td></td>
<td>Observed</td>
<td>Expected</td>
<td>Observed</td>
<td>Expected</td>
<td>Observed</td>
<td>Expected</td>
</tr>
<tr>
<td>Proportion of Buyers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non</td>
<td>30</td>
<td>30</td>
<td>29</td>
<td>29</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Light</td>
<td>34</td>
<td>34</td>
<td>30</td>
<td>32</td>
<td>31</td>
<td>35</td>
</tr>
<tr>
<td>Heavy</td>
<td>36</td>
<td>36</td>
<td>41</td>
<td>39</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>0.003</td>
<td>0.22</td>
<td>1.23</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;.99</td>
<td>&lt;.89</td>
<td>&lt;.54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of Games</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>14</td>
<td>11</td>
<td>11</td>
<td>9</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Heavy</td>
<td>86</td>
<td>89</td>
<td>89</td>
<td>91</td>
<td>85</td>
<td>87</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>1.17</td>
<td>0.40</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;.28</td>
<td>&lt;.53</td>
<td>&lt;.47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Survey 7</td>
<td>Survey 8</td>
<td>Survey 9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
<td>NBD</td>
</tr>
<tr>
<td></td>
<td>Observed</td>
<td>Expected</td>
<td>Observed</td>
<td>Expected</td>
<td>Observed</td>
<td>Expected</td>
</tr>
<tr>
<td>Proportion of Buyers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non</td>
<td>36</td>
<td>36</td>
<td>35</td>
<td>35</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Light</td>
<td>28</td>
<td>32</td>
<td>32</td>
<td>33</td>
<td>30</td>
<td>33</td>
</tr>
<tr>
<td>Heavy</td>
<td>36</td>
<td>32</td>
<td>33</td>
<td>32</td>
<td>32</td>
<td>29</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>0.89</td>
<td>0.11</td>
<td>0.58</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;.64</td>
<td>&lt;.95</td>
<td>&lt;.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of Games</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>14</td>
<td>11</td>
<td>16</td>
<td>12</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Heavy</td>
<td>86</td>
<td>89</td>
<td>85</td>
<td>88</td>
<td>83</td>
<td>87</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>0.64</td>
<td>1.18</td>
<td>1.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>df</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;.42</td>
<td>&lt;.28</td>
<td>&lt;.25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
and actual data, are also presented in Table 2. Looking again at survey one, the observed data shows that the light buyers account for 10% of sales while the heavy buyers were responsible for 90% of the sales. Non-users obviously account for no purchase so they are not shown. The NBD statistic predicted that light buyers would purchase 8% of the game, while heavy buyers would account for 92% of the sales. The actual and NBD predicted figures were not significantly different from one another in any of the nine waves of surveys. The closeness of fit for the NBD for both the proportion of buyers and the proportion of games by user group, for all nine surveys (over 27 months) supports the second view that the NBD appears to provide a close approximation for predicting the distribution of Lotto game purchase.

It may help to put the importance of heavy use in Lotto in a form often cited in marketing discussions, the “80-20 rule of thumb”. This “rule” (see Anschuetz, 1997) suggests that 80% of a brand’s sales are bought by 20% of its buyers. While the veracity of this guideline is suspect given that the relationship is usually based on the brand’s penetration and frequency in a population, it may help to know that 20% of the buyers accounted for about 57% of the sales of Lotto games. This relationship of the heavy 20% to the sales they generate was quite consistent (r=.82) over the nine waves of surveys.

Table 3 provides the same data for the Instant and Cash-3 games except that the specifics of the χ² results are not shown to conserve space. As with the Lotto games, there were no significant differences (p>.05) between the observed and the NBD expected proportions of buyers that comprised the Light and Heavy buying groups for either game, for any of the nine surveys over the 27 months of data collection. Also, there were no significant differences (p>.05) in the proportion of game sales accounted for by Heavy and Light buyers in the observed, as compared to the NBD expected figures over the same surveys. Figures 4 (Cash 3) and 5 (Instant) show the correlation between the NBD expected and reported game play by number of games purchased for one wave (Instant, r=.83, p<.001; Cash-3, r=.89, p<.001). These results for these two other games provide additional support for the generalized stochastic explanation of Lottery product game play.

It may be argued that the patterns of purchasing the Instant and Cash-3 lottery games are simply a by-product...
of Lotto purchase. If most Lotto purchasers also purchase the Instant and Cash-3 games, then Lotto could be largely determining the NBD pattern evident in the purchase data for the other two games. Figure 6 provides plots of the proportion of reported purchasers who also purchased either Instant or Cash-3 games. The Instant game has a higher level of cross-play than the Cash-3 game, but both games show this relationship is going down over the nine surveys. Although cross-play is significant, the influence of the Lotto pattern of play is not a factor in over 50% of most purchases.

4.4 Relationship between Penetration and Frequency

The gradual decrease in penetration of the Florida population purchasing the three Lotto games over the 27 months of the surveys (Figures 2 and 3) revealed quite
Figure 4: Wave Four NBD Expected and Reported Cash 3 Game Purchase

Penetration = 50%
Ave. Frequency = 10
Correlation = 0.89
p<0.001

Figure 5: Wave Four NBD Expected and Reported Instant Game Purchase

Penetration = 51%
Ave. Frequency = 8
Correlation = 0.83
p<0.001
different relationships with the average frequency of those purchasing each game form. Lotto went from the initial 81% penetration and an average of 13 games purchased in the last 14 days, to 62% penetration and 10 games in the last survey. The Lotto penetration and average frequency of buyers were highly associated at \( r = .81 \). The instant game went from a high of 56% penetration and a 10 game average purchase in the last two weeks to 39% penetration and a nine game average purchase. The penetration and frequency of instant games had a weak association of \( r = .30 \). For both Lotto and to some extent Instant games, fewer buyers were buying fewer games over time.

Cash-3 penetration went from 54% of the population and an average of eight games purchased over the last two weeks, to 27% penetration and an average of 13 games purchased over the last 14 days. The correlation between the two measures was \( r = -.73 \), a strong negative relationship. As Cash-3 participation / penetration decreased, those that stayed increased their average frequency of purchase by over 60%. This would appear to run counter to the generalization that penetration and frequency are positively related (Ehrenberg et al., 1990). However, this generalization refers to brands in a category. The prevalence of negative associations between penetration and frequency in other categories, brands or product forms is unclear as little has been reported. That this negative association occurs with a lottery game may be potentially dangerous and will be discussed later.

5. Summary and Conclusions
The results from an application of the NBD statistic to reported lottery product game purchase supports an expected generalized stochastic pattern of buying the games. Lotto, Cash-3 and Instant game purchases reflected this pattern early in their product life cycle, and failed to deviate from this pattern over the next two and one quarter years of sales. This consistent pattern reflects what some term habit (East, 1997; Ouellette and Wood, 1998) and what would be expected to be an environment of weaker cognitive-based decision-making and purchase prediction. However, a cognitive-based alternative was not tested in this study, so future research needs to test the relationship between planned behavior and habituation in gambling (Ajzen, 2002).

The observed and expected distributions of lottery game users and usage tested were based on self-reported purchase over the last 14 days. However, the influence of repeated purchase may be projected over a longer period of 365 days. Table 4 shows the predicted minimum and maximum penetration and average number of games purchased by players when extrapolated to one year using NBD predictions (see East, 1997). These types of NBD projections are quite accurate when markets tend to be stable (Morrison and Schmittlein, 1988). The figures differ by survey so the survey number is also provided.

These projections suggest very high penetration rates often unmatched by any other consumer repeat purchase package good including toilet paper (Roy Morgan, 2001; Simmons, 1999). In addition, the average number of games purchased by those who bought that year runs between 100 and 200, depending on the game. This high frequency of purchase behavior, in turn, would be expected to reinforce the consistency of the habitual response.
Before the implications of these findings are discussed, some limitations of the methodology should be noted. The samples were collected to represent the residents of the State of Florida so extrapolations to other populations and other time periods must be made with caution. Product, marketing and cultural differences in a market may exert strong effects on the choice and frequency of play (see Mizerski et al., 1998).

The validity of predicted game play over a long period like a year with the NBD has not been tested. Moreover, the effect of jackpot size for the Lotto has been reported as strong in the short run (Heiens, 1993), but it is unclear if the surveys used to collect the data were able to capture this effect. Finally, the purchase of lottery games was based on respondent retrospective reports of their behaviour. These reports are known to have relatively consistent biases, where light users tend to overestimate, and heavy users underestimate their purchases (Lee, Hu and Toh, 2000).

6. Implications

For lottery marketers, the implications of stochastic preference primarily influence the relative effect of the marketing mix through the gambling product's Product Life Cycle. Given the high level of habit exhibited in game purchase for the three forms studied, the ability of advertising and promotion to affect the aggregate size of the market is questionable (Barnard and Ehrenberg, 1997) beyond the early stages of the PLC (Borden, 1942). Distribution appears to be the most important of the mix factors (National Gambling Impact Study Commission, 1999; Productivity Commission, 1999), perhaps even more important than jackpot size.

A strong habit-driven consumer franchise presents some public policy challenges. To the extent that cognitive-based information processing is limited, the role of warning information about addiction and its manifested problems would appear to be of little influence. Efforts to address buyer misconceptions about the random nature of the game would also be compromised by habitual buying. Where distribution may be controlled in land-based operations, cyber-play with online betting has opened up a vast number of new options for the potential consumer. This form of “distribution” is being met by moratoriums and promised bans, but it is not clear it can be controlled.

The area of stochastic models may offer policy makers more appropriate tools to judge when game play deviates from the “normal” purchase patterns expected. Using the NBD as a “baseline” measure needs more validation, but it may offer a more accurate measure than the present instruments, when judging an acceptable level of compulsive play in a population (Mizerski et al., 2000). The strong negative association between penetration and frequency of purchasing the Cash-3 game \( r=-.73 \) suggests a shrinking market that is increasing their average purchase. Could this be a sign of compulsive and possibly dangerous buying behaviour? Future research also needs to test for the applicability of a stochastic perspective for other gambling products as its potential contribution to the study of gambling and other habit-driven marketing behaviour could be significant.

References


Morrison, D. and Schmittlein, D., 1988. Generalizing the


Simmons, 1999. The Simmons Study of Media and Markets.


Wright, M., 1999. NBDNORMS. Microsoft Excel Based Software.


Biographies

Dick Mizerski, BS, PhD, is a Professor of Marketing in the School of Business, University of Western Australia, Perth. His research interests include: gaming and gambling on the internet, habit in the marketplace, the influence of marketing activity on the initiation and use of gambling, tobacco and alcohol.

Rohan Miller, PhD, is a marketing lecturer at the University of Sydney. His research seeks to better understand the initiation and maintenance of consumer habits, problem consumption and how marketing communications may influence consumption. His current studies investigate socially contentious product categories such as gambling and alcohol. Prior to becoming an academic, Rohan founded and operated a consultancy in management and marketing, and previously worked in the advertising and hospitality industries.

Katherine Mizerski is at Edith Cowan University, Perth.

Desmond Lam is a PhD candidate at the University of Western Australia, Perth.

Correspondence Addresses

Dick Mizerski, Marketing M261, School of Business, The University of Western Australia, Perth, WA 6009. Phone: +61 (8) 6488 7210. Facsimile: +61 (8) 6488 1055. Email: dickm@biz.uwa.edu.au. Rohan Miller, Lecturer in Marketing, School of Business, The University of Sydney, 540 The Economics & Business Building H69, Sydney, NSW 2006. Phone: +61 (2) 9351 3637. Facsimile: +61 (2) 9351 6732. Email: r.miller@econ.usyd.edu.au. Katherine Mizerski. Email: k.mizerski@ecu.edu.au Desmond Lam. Email: desmond@student.ecel.uwa.edu.au