Sentimental relationships between lottery participation and household consumption

Ann Shawning Yang

Institute of International Management, National Cheng Kung University, ROC

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A B S T R A C T
This study examines the sentimental correlation of lottery prizes with household consumption via Grey relational analysis. An approximate correlation with sequential order rankings is identified. Results demonstrate that all top five lottery prizes are strongly correlated with rational addictive consumption and income categories. These lottery prizes show a relatively strong correlation with entertainment consumption and a negligible correlation with desperation consumption. Although jackpot exhibits an approximate strong correlation with alcohol consumption, other prizes show an approximate strong correlation with tobacco consumption. The top five prizes demonstrate a relatively strong correlation with restaurant, recreation, and traveling consumption, as well as a negligible correlation with food and education consumption. Lottery prizes are negligibly correlated with salary with the least sentiment.

1. Introduction
Lottery prizes often attract considerable public interest with increased and extended participation (Haruvy, Erev, & Sonsino, 2001; Rogers & Webley, 2001; Sharpira & Venezia, 1992; Thaler & Ziemba, 1988). Consumer participation in lottery is influenced not only by jackpot prizes for lifetime winnings, but also by medium prizes to extend participation duration (Haruvy et al., 2001; Thaler & Ziemba, 1988). In particular, lottery participation increased from 26.6% with a single prize to 37.7% with multiple prizes (Haruvy et al., 2001). Consumers increase lottery participation for large jackpot prize opportunities, but also use small prize winnings to continue toward jackpot prize winnings (Rogers & Webley, 2001; Sharpira & Venezia, 1992). Therefore, consumers voluntarily contribute to lottery prizes in which lottery sales determine the prize structures (Dale, 2004).

Nevertheless, consumers may develop irrational or rational decision making via lottery prize structures with unknown probabilities of winning toward jackpot, rollover, or low-tier prizes (Lin, Kang, & Chan, 2005; Lin & Wang, 2004; Matheson & Grote, 2004). Thus, consumers exhibit rational addictive behavior toward large jackpot prizes with increased participation (Doran, Jiang, & Peterson, 2012). Moreover, the accumulations of rollovers encourage the development of lotto mania behavior among increased numbers of participants (Beenstock & Haitovsky, 2001; Harley & Lanot, 2006; Peel, 2010). Therefore, lottery games assist in developing sentimental reactions for hope and fear via regret aversion decision making for extended participation (Statman, 2002).

Additionally, consumers determine lottery participation and duration based on prize payout rates (Pérez & Humphreys, 2011). However, consumers may determine lottery participation based on income and consumption behavior changes (Kuhn, Kooreman, Soetevent, & Kapteyn, 2011; Pérez & Humphreys, 2011). Increases in income encourage existing consumers to purchase more national lottery tickets instead of attracting new potential consumers (Pérez & Humphreys, 2011). Consumers with lottery prize winnings significantly show ownership of newly purchased cars as well as spend more on food away from home and durables excluding cars; by contrast, their counterparts significantly exhibit greater monthly expenditures, including food away from home and other expenditures, renovation expenditures, durables, and more donations to charity (Kuhn et al., 2011). From the perspective of household consumption behavior, consumer sentiment reactions may relate closely to specific expenditures for addictive, recreation, or daily necessity purchases. Addictive research hypothesis indicates that tobacco and alcohol expenditures reflect rational addiction.
sentiment (Balabanis, 2002; Kearney, 2005; Lin & Lin, 2007). Entertainment research hypothesis states that restaurant, recreation, and traveling expenditures signify entertainment sentiment (Farrell & Forrest, 2008; Garrett & Marsh, 2002). Daily necessity research hypothesis posits that food and education expenditures (i.e., basic family consumption) represent desperation sentiment in which such expenditures are necessary for maintaining basic living standards (Landry & Price, 2007; Lee & Chang, 2005).

Thus, our empirical study is motivated by rational addictive theory (Becker & Murphy, 1988), accompanied by the various household consumption research hypotheses to identify sentiment reactions from lottery participation. We further expand lottery sentiment reaction analysis from jackpot prize to low-tier prizes. We analyze the influence of multiple prize structures for lottery games toward consumer decision making and behavior. This study aims to bridge the gap between higher and lower tier prizes by identifying the likely sentiments regarding each prize amount.

Despite existing studies on the demographic and socioeconomic analysis of lottery participation (Farrell & Walker, 1999; Garrett & Marsh, 2002; Ghent & Grant, 2007; Harley & Lanot, 2006; Ho, Lee, & Lin, 2006; Kearney, 2005; Lin & Lin, 2007; Lin & Wu, 2006; Matheson & Grote, 2004), the influence of multiple prize structures and sentimental consumption has not been established. In contrast to previous studies focusing on the causal relationship between lottery demand and demographic background (Farrell & Walker, 1999; Garrett & Marsh, 2002; Ghent & Grant, 2007; Harley & Lanot, 2006; Ho et al., 2006; Kearney, 2005; Lin & Lin, 2007; Lin & Wu, 2007; Matheson & Grote, 2004), we propose Grey relational analysis (GRA) (Deng, 1982) to identify the approximate correlation between consumption sentiment and lottery prizes for the order rankings of sequence influences for households. A sequential relationship, ranked by orders of Grey relational grades, is identified for individual and category sentiment indices comprising rational addiction, entertainment, and desperation behavior for various prize returns. The application of GRA builds on other models in identifying the influences on lottery consumption. GRA not only provides an order relation of variables by rankings of Grey relational grades, but also identifies the latent influences of variables that are less likely to be detectable using other methods. The government and authorities may refer to the empirical results in considering the formation of strategic alliances, formulation of promotional campaigns, and designing of lottery games. Meanwhile, lottery players may refer to the empirical results in determining the sentiment indicators on lottery purchases.

2. Literature review and theory

Rational addictive behavior generally influences lottery consumption by individual players, and lotteries possess addictive characteristics (Chang, 2004; Moore, 1997). The total prize amount strongly affects participation in lottery consumption, whereas the increased consumption of tobacco and alcohol is associated with increased consumption demand in lotteries (Lin & Lin, 2007; Zeng, 2006). Heavier smokers also tend to purchase more lottery tickets as an addictive and compulsive behavior (Balabanis, 2002). Thus, bounded rationality exists in lottery games in which most players react more to jackpots and respond less to smaller games with higher returns (Grote & Matheson, 2006). The level of rational addiction in the major influence lottery consumption (Chang, 2004; Harley & Lanot, 2006; Lin & Lin, 2007). Addictive products, such as tobacco, alcohol, and betel nuts, strongly influence lottery consumption (Chang, 2004; Kearney, 2005; Landry & Price, 2007). Low ticket prices similarly encourage lottery players to assume a higher risk than they otherwise would (Haisley, Mostafa, & Loewenstein, 2008).

Households may reduce their expenditure on non-addictive purchases, such as education, grocery, mortgage, rent, and other bills, to participate in lotteries (Kearney, 2005; Lee & Chang, 2005). The allocation of lottery proceeds to fund education encourages lottery sales (Landry & Price, 2007). Household expenditure on groceries and entertainment is mostly likely to be replaced by consumption needs in lotteries to improve the economic situation (Kearney, 2005; Lee & Chang, 2005). Therefore, restaurant expenditure negatively and significantly influences lottery sales; by contrast, tourism influences lottery sales because players seeking lottery prizes are willing to travel to increase their probability of winning (Farrell & Forrest, 2008; Garrett & Marsh, 2002).

Household income also influences lottery participation to improve economic conditions or seek entertainment (Garrett & Marsh, 2002; Ghent & Grant, 2007). Higher income households participate in lottery games for entertainment, whereas lower income households do so to improve their economic conditions (Ghent & Grant, 2007). However, income is also insignificantly related to lottery sales (Chen, Chie, Fan, & Yu, 2009). Nevertheless, income level and employment status may affect lottery consumption (Lin & Lin, 2007). A decrease in economic ability tends to increase lottery purchases and thus improve the quality of life and economic conditions (Blalock, Just, & Simon, 2007; Garrett & Marsh, 2002; Ghent & Grant, 2007).

2.1. Theory

Rational addictive theory, proposed by Becker and Murphy (1988), focuses on products with the potential to be addictive, including cigarettes. When making purchasing decisions, consumers consider and transform purchase price, product usage, and added value as their needs. Factors affecting the need for addictive products may include stress and income. Particularly, purchase prices are deterministic in encouraging addictive purchase behavior (Becker & Murphy, 1988). Therefore, rational addictive consumer behavior is more likely to develop predictive consumption behavior that is influenced by purchase price, product function, and product added value (Harris & Harris, 1996). Consumers with an addictive behavior toward products are more likely to be influenced by personal preferences and engage in long-term and regular consumption of addictive products (Miljkovic, Nganje, & de Chastenet, 2008).

National lottery games not only encourage consumers to double their consumption, but also induce a four-fold increase in the excessive consumption toward addiction among households (Grun & McKieuge, 2000). Lottery games with frequent advertisements are also often viewed as an acceptable gamble with accessible stores and affordable ticket prices, thus engendering the addiction behavior of consumers in which they participate in lottery games via past experiences to exert an illusion of control over their daily lives (Hardoon, Baboushkin, Derevensky, & Gupta, 2001). In the case of lottery participation, addictive consumption is common in less educated households (Grun & McKieuge, 2000; Shepherd, Ghodse, & London, 1998). Thus, lottery games induce addictive consumption in which less educated households spend more than their counterparts at an average of £2.42 per week on scratch cards or lottery tickets compared with £1.84 per week, particularly for households with an annual income of less than £20,000 (Shepherd et al., 1998). Low-income households also exhibit the highest percentage in spending more than 10% of income on lottery tickets, thus spurring addictive consumption (Grun & McKieuge, 2000).
3. Method

This study uses GRA, proposed by Deng (1982), to solve problems involving incomplete information systems or missing statistics. Based on Grey system theory, GRA can effectively deal with small sets of data containing indeterminate values, having multiple inputs, or are incomplete (Deng, 2000). Contrary to probability and statistical theories that are used in treating large samples of uncertain data, Grey system theory can treat uncertain acknowledged sets (Lui & Hsu, 1996).

Grey relational analysis identifies a sequential relationship among factors according to Grey relational grades that systematically rank the degrees of influence (Fu, 1992; Tzeng & Tsaur, 1994). Grey relational grades pertain to the relationship between two series of systems or factors, including how they are affected by time or other elements (Huang & Jane, 2007). Order relation, the key feature of GRA, can be used to identify the relationship between two sequences (Wang, 2008). An approximate correlation is thus identified using GRA between an objective factor and several affecting factors in a system characterized by limited data, simple calculations, and lack of statistical distribution (Chen & Tzeng, 2004; Lu, Lin, & Lewis, 2008). The advantages of GRA include the avoidance of defects common in conventional, large sample statistical methods, simple calculation, minimal data requirements, and quantified results that do not conflict with those of qualitative analysis (Li, Yamaguchi, Nagai, & Masuda, 2008; Lin & Chang, 2008). Thus, GRA potentially offers a reliable extension of existing methodologies.

3.1. Procedure

This study uses GRA to examine the relative value of nine individual sentiment indices and ultimately identify the variable that exerts the strongest influence on lottery returns using Grey relational software. Individual sentiment indices are compared based on the orders of Grey relational grades and evaluated according to the values of individual series indices. First, this investigation verifies the monthly data using Grey data processing to normalize and transform data expressed using different measurement units into a single numerical order (Chang & Lin, 1999). The direct application of raw data is also permitted if they meet the requirements of comparability, namely non-dimensionality, scaling, and polarization (Wang, 2008).

\[ x_i(k) = \frac{x_i^0(k) - \min_j x_i^0(k)}{\max_k x_i^0(k) - \min_j x_i^0(k)}, \quad (1) \]

where \( x \) is the index variable, \( i \) represents the various prize returns obtained during the \( i \)th month, and \( k \) denotes the variable values of the sentiment index during the \( i \)th month.

Second, prior to obtaining the Grey relational coefficient from Equation (2), this investigation applies Equation (3) to identify the absolute difference between two sequences and thus demonstrate their relationship with the entire system (Lu et al., 2008). Term \( \zeta \) is an identification coefficient that is used in adjusting the difference between relational coefficients (Lu et al., 2008). For stability and clarity, a value of 0.5 is widely applied (Fu, Zheng, & Zhao, 2001; Lu et al., 2008; Wang, 2008). In this case, \( \gamma(k) \) denotes the reference value of Grey relational calculation, \( x_i(k) \) represents the compared value of sentiment index \( k \) on the \( i \)th month, and \( \Delta \) is the value of the distinguishing coefficient multiplied by the maximum difference between the compared series \( x_i \) and reference series \( x_0 \), and \( \Delta_{\min}(k) \) and \( \Delta_{\max}(k) \) represent the difference between the collection of compared series and the reference series of Grey relational factors.

\[ \gamma(x_0(k), x_i(k)) = \frac{\Delta_{\min} + \zeta \Delta_{\max}}{\Delta_{\max} + \zeta \Delta_{\min}}, \quad (2) \]

where:

1. \( \Delta_{\min}(k) = |x_0(k) - x_i(k)| \)

Equation (3) expresses the absolute difference between the compared and reference series.

2. \( \Delta_{\min} = \min_{i,k} |x_0(k) - x_i(k)| \)

3. \( \Delta_{\max} = \max_{i,k} |x_0(k) - x_i(k)| \)

Equations (4) and (5) are subsequently used to determine the minimum and maximum distances in all of the compared sequences (Chang & Lin, 1999; Lu et al., 2008). \( \Delta_{\min} \) and \( \Delta_{\max} \) should be respectively defined as the minimum and maximum difference between the compared series \( x_i \) and reference series \( x_0 \), where \( k \) represents the value of sentiment index.

4. \( \zeta = \text{identification coefficient} \quad \zeta \in [0, 1] \)

Equation (6) is also applied, where \( \zeta \) is a distinguished identification coefficient, with \( \zeta \in [0, 1] \) used in adjusting the difference between \( \Delta_{\min} \) and \( \Delta_{\max} \) (Fu et al., 2001; Wang, 2008). The Grey relational coefficient is subsequently calculated using Equation (2).

Grey relational grade is calculated using Equation (7). Grey relational grade \( \gamma(x_0, x_i) \) represents the influence between the measured elements that are defined using Equation (7).

\[ \gamma(x_0, x_i) = \frac{n}{k=1} \beta_k \gamma(x_0(k), x_i(k)), \quad (7) \]

where \( \beta_k \) denotes \( k \) norm weight and \( \sum_{k=1}^{n} \beta_k = 1 \) (Ho & Lin, 2003).

This rank sequence the results according to the Grey relational order, from the most related to the least related. The relationship between investor sentiment indices and price volatility is ranked and termed the Grey relational rank (\( \gamma \)). A Grey relational rank value exceeding 0.9 indicates a strong influence, a value between 0.8 and 0.9 connotes a relatively strong influence, a value between 0.7 and 0.8 denotes a significant influence, and a value between 0.6 and 0.7 shows a negligible influence (Fu et al., 2001).

3.2. GRA example

We illustrate an example of the application of GRA. We obtain monthly jackpot prize returns and tobacco expenditures from January to December 2002. Columns 1 and 2 present the raw data for jackpot prize returns (\( x_{01} \)) and tobacco expenditures (in ln form \( x_{02} \)), respectively. In the first step, data normalization is conducted by taking the monthly values divided by the January value for both jackpot prize returns in Column 3 and tobacco expenditures in Column 4. Considering that January is determined as the base month, data normalization for January will become \( 1.0 \) for both jackpot prize returns and tobacco expenditures. In the second step, the absolute difference values are computed by the difference between Columns 3 and 4; we take Column 3 minus Column 4 and obtain the absolute value on a monthly basis (corresponding to Equation (3)). In step three, we identify the minimum and maximum values from Column 5 (corresponding to Equations (4) and (5)). In step four, we take 0.5 multiplied by the maximum value from Column 7 to adjust the difference between \( \Delta_{\min} \) and \( \Delta_{\max} \) and derive an adjusted value \( \Delta_{\text{max}} \) (corresponding to Equation (6)). In step five, Grey relational coefficients are calculated.
according to Equation (2). In step six, we sum up all of the Grey relational coefficients and take the average value to identify the Grey relational grade (corresponding to Equation (7)). The obtained Grey relational grade is compared for correlational relationship to identify the importance order and sequential order with other variables Table 1.

4. Research design

4.1. Selection of variables

This study follows Doran et al. (2012), Lin and Wu (2007), and Kearney (2005) in selecting and categorizing variables. Variables representing lottery returns are segmented into high- and low-tier prizes. Variables representing household consumption are classified into different groups based on whether they are used for the rationale addiction hypothesis, desperation hypothesis, or entertainment hypothesis. Table 2 lists the categories of variable selections. Three categories are studied, namely, lottery purchase, household consumption, and income.

4.2. Lottery returns

Lottery returns from a jackpot are frequently viewed as the primary motivation in lottery consumption (Garrett & Sobel, 2004). Although low-tier prizes from smaller lottery games may also yield high returns, they are frequently ignored owing to the prizes offered through jackpots (Grote & Matheson, 2006). Prize sizes, ranging from a jackpot win to various smaller prizes, represent the various probabilities of winning the lottery (Maeda, 2008). The current study selected jackpot (Jackpot), second prize (2nd Pz), third prize (3rd Pz), fourth prize (4th Pz), and fifth prize (5th Pz) returns to identify the relationship between different prize sizes and household consumption. The ratio of prize sizes to lottery sales is calculated using each prize.

4.3. Household expenditures

Household expenditure variables are classified into desperation hypothesis, rational addiction hypothesis, and entertainment hypothesis. This study refers to Landry and Price (2007), Balabanis (2002), Kearney (2005), and Garrett and Marsh (2002) for the selection of variables to indicate household consumption. Food expenditures (Fd) and education expenditures (Edu) are selected to represent expenditures for the desperation hypothesis. Tobacco expenditures (Toba) and alcohol expenditures (Alcho) are selected to represent expenditures for the rational addiction hypothesis. Restaurant expenditures (Resto), recreation expenditures (Rec), and traveling expenditures (Trvl) are selected to represent expenditures for the entertainment hypothesis.

4.4. Income

According to Garrett and Sobel (2004), income is a significant indicator of lottery sales. Ghent and Grant (2007) report that a higher income encourages greater lottery participation. Salary (Salry) is thus adjusted to identify the relationship between prize size and income for lottery purchases.

4.5. Study period and data sources

This study uses monthly data for 2002–2010 to identify the relationship between lottery prize returns and household consumption. Eight sentiment indices are selected for each of the five types of lottery prize returns for each month of the year. A total of

<table>
<thead>
<tr>
<th>Month</th>
<th>Jackpot prize returns (x0)</th>
<th>Tobacco expenditures (In. x0)</th>
<th>Alcohol expenditures (In. x0)</th>
<th>Resto expenditures (In. x0)</th>
<th>Rec expenditures (In. x0)</th>
<th>Trvl expenditures (In. x0)</th>
<th>Income</th>
<th>Grey relational grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>0.150</td>
<td>5.226</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Feb</td>
<td>0.153</td>
<td>5.166</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Mar</td>
<td>0.197</td>
<td>5.187</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Apr</td>
<td>0.179</td>
<td>5.107</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>May</td>
<td>0.171</td>
<td>5.241</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Jun</td>
<td>0.197</td>
<td>5.187</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Jul</td>
<td>0.100</td>
<td>5.113</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Aug</td>
<td>0.147</td>
<td>5.199</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Sep</td>
<td>0.140</td>
<td>5.077</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Oct</td>
<td>0.178</td>
<td>4.977</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Nov</td>
<td>0.123</td>
<td>4.906</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
<tr>
<td>Dec</td>
<td>0.109</td>
<td>4.912</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>5.097</td>
<td>0.807</td>
</tr>
</tbody>
</table>

Note: The min. and max. values are from Tobacco expenditures only. An extended min. and max. values should be identified from all variables to derive full model min. and max. values for further calculations.
108 observations consist of 12 monthly values from January to December for 9 years; 8 sentiment indices multiplied by 108 months result in 864 entries. Statistical lottery data are obtained from the Taiwan Lottery Company. The Taiwan Lottery Company, which is the only government-authorized sales agent for national lottery tickets, is located in Taipei, the capital of Taiwan. House- hold expenditure statistics are obtained from the Directorate General of Budget, Accounting and Statistics of the Taipei City Government. Data on average monthly salary are obtained from the Directorate General of Budget, Accounting and Statistics, Executive Yuan.

5. Results and analysis

This study analyzes the influences of five different lottery prize returns on household consumption in Taipei. Each lottery prize return, including those for the jackpot, second, third, fourth, and fifth prizes, is individually analyzed for the period 2002–2010. For each type of prize return, eight individual sentiment indices are selected and compared among four sentiment categories throughout the study period. Table 3 lists the results for various lottery returns and category sentiment indices, whereas Table 4 lists the results for various lottery returns and individual sentiment indices.

5.1. Category sentiment indices and lottery returns

Table 3 lists the four categories of sentiment indices, namely desperation category, rational addiction category, entertainment category, and income category, and ranks them according to Grey relational grades for all prize returns throughout all study periods. Rational addiction category indices consistently show an approximate strong correlation of various prize returns with household consumptions, with Grey relational grades ranging between 0.9497 (for jackpot return in 2005) and 0.9887 (for fifth prize return in 2006). Jackpot returns on rational addiction category exhibit an approximate strong correlation, with Grey relational grades ranging from 0.9497 to 0.9850 throughout the study period; by contrast, smaller prizes show Grey relational grade values between 0.9686 and 0.9862 (second prize return), 0.9693 and 0.9853 (third prize return), 0.9686 and 0.9857 (fourth prize return), and 0.9686 and 0.9887 (fifth prize return), respectively.

The sentiment indices of the income category also display an approximate strong correlation with all prize returns throughout the study period, with Grey relational grades between 0.9242 (for jackpot return in 2005) and 0.9834 (for fifth prize return in 2006). Jackpot returns are strongly correlated with income category, with Grey relational grades between 0.9242 and 0.9794, and the ranking in terms of strength of correlation subsequently follows this order: smaller prize returns between 0.9562 and 0.9808 (second prize return), between 0.9585 and 0.9808 (third prize return), between 0.9563 and 0.9810 (fourth prize return), and between 0.9562 and 0.9834 (fifth prize return).

The sentiment indices of the desperation category show an approximate significant correlation with all prize returns throughout the study period, with Grey relational grades between 0.6321 (for jackpot return in 2005; negligible influence) and 0.7270 (for fifth prize return in 2006). Jackpot returns are significantly correlated with desperation category sentiment indices, with Grey relational grades between 0.6321 and 0.7216. In 2005, jackpot returns are only negligibly correlated with desperation category sentiment indices, with a Grey relational grade value of 0.6321. Furthermore, the correlation of smaller prizes with household consumption classified as desperation category is significant, with Grey relational grades between 0.7095 and 0.7267 (second prize return), between 0.7095 and 0.7269 (third prize return), between 0.7084 and 0.7266 (fourth prize return), and between 0.7091 and 0.7270 (fifth prize return).

The sentiment indices of the entertainment category, ranked with the least correlation according to Grey relational grades, display a negligible correlation with all prize returns for all study periods, with Grey relational grades between 0.6200 (for jackpot return in 2005) and 0.6651 (for fifth prize return in 2006). The various Grey relational grades for all prizes range from 0.6200 to 0.6594 for jackpot return, from 0.6465 to 0.6643 for second prize return, from 0.6466 to 0.6642 for third prize return, from 0.6526 to 0.6642 for fourth prize return, and from 0.6524 to 0.6651 for fifth prize return.

Jackpot returns display the largest volatility in correlation with various category sentiment indices. Thus, jackpot returns display a range of Grey relational grades from 0.9497 to 0.9850 for the rational addiction category; from 0.9242 to 0.9794 for the income category; from 0.6321 to 0.7216 for the desperation category; and from 0.6200 to 0.6594 for the entertainment category. However, smaller prize returns display relatively stable Grey relational grade values throughout the study period from 2002 to 2010 for all category sentiment indices. Although lottery prizes are consistently strongly correlated with the income category, with Grey relational grades exceeding 0.9, rational addiction category sentiment indices display a stronger correlation. Therefore, the category sequence of Grey relational grades is as follows: rational addiction, income, desperation, and entertainment.

Table 2
Category and individual factors affecting lottery sentiment.

<table>
<thead>
<tr>
<th>Segmentation</th>
<th>Category sentiment indices</th>
<th>Individual sentiment indices</th>
<th>Symbols</th>
<th>Definitiona</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lottery</td>
<td>x₀ Lottery returns</td>
<td>x₀₁ Jackpot returns</td>
<td>Pₓjack</td>
<td>Jackpot amount/Sales amount,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₀₂ Second Prize returns</td>
<td>Pₓ2</td>
<td>Second Prize amount/Sales amount,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₀₃ Third Prize returns</td>
<td>Pₓ3</td>
<td>Third Prize amount/Sales amount,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₀₄ Fourth Prize returns</td>
<td>Pₓ4</td>
<td>Fourth Prize amount/Sales amount,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₀₅ Fifth Prize returns</td>
<td>Pₓ5</td>
<td>Fifth Prize amount/Sales amount,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₀₆ Food</td>
<td>Fₓ</td>
<td>LinFood(x)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₁₁ Education</td>
<td>Edu</td>
<td>In(Edu(x))</td>
</tr>
<tr>
<td>Household consumption</td>
<td>x₁ Desperation</td>
<td>x₁₂ Tobacco</td>
<td>Toba</td>
<td>Lin(Toba(x))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₁₂ Alcohol</td>
<td>Alcoh</td>
<td>In(Alcoh(x))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₁₂ Restaurant</td>
<td>Resto</td>
<td>Lin(Resto(x))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₁₂ Recreation</td>
<td>Recre</td>
<td>In(Recre(x))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₁₂ Traveling</td>
<td>Trvl</td>
<td>Lin(Trvl(x))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>x₁ Salary</td>
<td>Salry</td>
<td>In(Salry(x))</td>
</tr>
</tbody>
</table>

a Note: Lotto represents lottery sales, Food represents food consumption, Edu represents educational consumption, Tobac represents tobacco consumption, Alcoh represents alcohol consumption, Recre represents recreational consumption, Resto represents restaurant dining consumption, Trvl represents traveling consumption, and Salry represents salary received.
Table 3

<table>
<thead>
<tr>
<th>Category sentiment indices</th>
<th>Jackpot – Relational grades and rankings</th>
<th>Second prize – Relational grades and ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desperation</td>
<td>0.7168 (3) 0.7087 (3) 0.7216 (3) 0.6321 (3) 0.7201 (3) 0.7156 (3) 0.7196 (3) 0.7283 (3) 0.7178 (3) 0.7097 (3) 0.7267 (3) 0.7192 (3) 0.7258 (3) 0.7217 (3) 0.7113 (3) 0.7236 (3) 0.7246 (3)</td>
<td>0.9844 (1) 0.9773 (1) 0.9801 (1) 0.9497 (1) 0.9830 (1) 0.9792 (1) 0.9696 (1) 0.9806 (1) 0.9753 (1) 0.9641 (1) 0.9768 (1) 0.9849 (1) 0.9851 (1) 0.9862 (1) 0.9850 (1) 0.9886 (1) 0.9831 (1) 0.9790 (1)</td>
</tr>
<tr>
<td>Rational addiction</td>
<td>0.6576 (4) 0.6559 (4) 0.6555 (4) 0.6200 (4) 0.6594 (4) 0.6464 (4) 0.6488 (4) 0.6524 (4) 0.6496 (4) 0.6587 (4) 0.6570 (4) 0.6606 (4) 0.6465 (4) 0.6643 (4) 0.6532 (4) 0.6523 (4) 0.6566 (4) 0.6535 (4)</td>
<td>0.9721 (2) 0.9586 (2) 0.9747 (2) 0.9242 (2) 0.9794 (2) 0.9674 (2) 0.9550 (2) 0.9705 (2) 0.9550 (2) 0.9719 (2) 0.9582 (2) 0.9796 (2) 0.9590 (2) 0.9808 (2) 0.9733 (2) 0.9562 (2) 0.9732 (2) 0.9587 (2)</td>
</tr>
<tr>
<td>Entertainment</td>
<td>0.6576 (4) 0.6559 (4) 0.6555 (4) 0.6200 (4) 0.6594 (4) 0.6464 (4) 0.6488 (4) 0.6524 (4) 0.6496 (4) 0.6587 (4) 0.6570 (4) 0.6606 (4) 0.6465 (4) 0.6643 (4) 0.6532 (4) 0.6523 (4) 0.6566 (4) 0.6535 (4)</td>
<td>0.9721 (2) 0.9586 (2) 0.9747 (2) 0.9242 (2) 0.9794 (2) 0.9674 (2) 0.9550 (2) 0.9705 (2) 0.9550 (2) 0.9719 (2) 0.9582 (2) 0.9796 (2) 0.9590 (2) 0.9808 (2) 0.9733 (2) 0.9562 (2) 0.9732 (2) 0.9587 (2)</td>
</tr>
</tbody>
</table>

### Note
Grey relational category indices are presented by sentiment categories for all prizes from 2002 to 2010. Lottery prize categories include jackpot, second, third, fourth, and fifth prizes, which are ranked according to sentiment on desperation, rational addiction, and entertainment, plus income. Rational addiction sentiment shows a strong sentimental correlation with lottery participation, with Grey relational grades (GRAgrades) above 0.9, followed by income with a relatively strong correlation (GRAgrades between 0.8 and 0.9), desperation with a significant correlation (GRAgrades between 0.7 and 0.8), and entertainment with a negligible correlation (GRAgrades between 0.6 and 0.7) for all prizes.
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Fd</td>
<td>0.6897 (7)</td>
<td>0.6794 (7)</td>
<td>0.7003 (7)</td>
</tr>
<tr>
<td>Edu</td>
<td>0.7272 (6)</td>
<td>0.7127 (6)</td>
<td>0.7083 (6)</td>
</tr>
<tr>
<td>Tobac</td>
<td>0.9888 (1)</td>
<td>0.9888 (1)</td>
<td>0.9888 (1)</td>
</tr>
<tr>
<td>Alco</td>
<td>0.9018 (2)</td>
<td>0.9392 (2)</td>
<td>0.9392 (2)</td>
</tr>
<tr>
<td>Recre</td>
<td>0.8242 (3)</td>
<td>0.8501 (3)</td>
<td>0.8501 (3)</td>
</tr>
<tr>
<td>Resto</td>
<td>0.8483 (3)</td>
<td>0.8483 (3)</td>
<td>0.8483 (3)</td>
</tr>
<tr>
<td>Trvl</td>
<td>0.8136 (5)</td>
<td>0.8101 (5)</td>
<td>0.7778 (5)</td>
</tr>
<tr>
<td>Salry</td>
<td>0.6357 (8)</td>
<td>0.6515 (8)</td>
<td>0.6515 (8)</td>
</tr>
</tbody>
</table>

Note: Grey relational category indices are presented by sentiment indices for all prizes for the period from 2002 to 2010. Lottery prize categories include Jackpot, second, third, fourth, and fifth prizes, which are ranked according to individual sentiment indices on household consumption related to food, education, tobacco, alcohol, recreation, restaurant, and travel, plus salary. For all prize categories, tobacco consumption shows a strong sentimental correlation with lottery participation, with Grey relational grades above 0.9. Alcohol consumption, restaurant consumption, and recreation consumption demonstrate a relatively strong correlation (GRAgrades between 0.8 and 0.9). Travel consumption and education consumption exhibit a significant correlation (GRAgrades between 0.7 and 0.8). Food consumption and salary show a negligible correlation (GRAgrades between 0.6 and 0.7).
5.2. Individual sentiment indices and lottery returns

Table 4 lists eight sentiment indices, comprising household consumption on food, education, tobacco, alcohol, restaurant, recreation, and traveling, plus salary, which are analyzed and ranked according to Grey relational grades for various prizes throughout the study period. Alcohol and tobacco consumption consistently shows approximate strong correlations with various prize returns. Jackpot returns are most strongly correlated with alcohol consumption, given the Grey relational grades between 0.8741 in 2005 and 0.9733 in 2006. However, smaller prize returns display an approximate stronger correlation with tobacco consumption, with Grey relational grades ranging between 0.9404 for fifth prize in 2006 and 0.9887 for fourth prize in 2007; with most of study period being between 2002 and 2007, plus 2009. For the study periods 2008 and 2010, alcohol consumption is more influenced by smaller prize returns compared with tobacco consumption.

Restaurant consumption consistently shows a relatively strong correlation for all prize returns during all study periods, with Grey relational grades between 0.7518 for jackpot return in 2005 and 0.8708 for third prize return in 2006. For 2005, restaurant consumption consistently exhibits less correlation than recreation consumption for all prize returns. Meanwhile, traveling consumption displays a cyclical change in influence for all prize returns during all study periods. Furthermore, jackpot returns are significantly correlated with traveling consumption, with Grey relational grades exceeding 0.80 in 2002 and 2003, after which their correlation becomes negligible in 2005 and 2005, with Grey relational grades of 0.7996 and 0.7204, respectively. For later study periods, the correlation of jackpot returns with traveling consumption remains significant, with Grey relational grades of 0.8143 in 2006; the influence of Grey relational grade gradually decreases to become negligible between 2007 and 2009, after which the correlation of Grey relational grade becomes significant. Smaller prize returns experience similar changes in Grey relational grades and correlation levels. For the period between 2002 and 2004, in 2006, and in 2010, second, third, and fourth prize returns are significantly correlated with traveling consumption. Compared with the periods 2005 and between 2007 and 2009, Grey relational grades indicate a negligible correlation. However, fifth prize returns are significantly correlated with traveling consumption between 2002 and 2004, and during 2010. Fifth prize returns are also negligibly correlated with traveling consumption between 2005 and 2009, with Grey relational grades between 0.7594 and 0.7954.

Education consumption displays an approximate significant correlation with all prize returns for all study periods, with Grey relational grades between 0.6743 for the jackpot in 2005 and 0.7555 for fourth prize in 2009. In 2005, jackpot returns are only negligibly correlated with education consumption. Food consumption shows an approximate negligible correlation with all prize returns for all study periods, and exhibits Grey relational grades between 0.6156 for the jackpot in 2005 and 0.7016 for the jackpot in 2006. Jackpot returns are significantly correlated with food consumption, with a Grey relational grade of 0.7016 in 2006. In 2004, second, third, and fifth prizes are significantly correlated with food consumption, with Grey relational grades of 0.7002, 0.7005, and 0.7003, respectively. However, fourth prize return is consistently and negatively correlated with food consumption for all study periods.

Salary sentiment index consistently shows an approximate negligible correlation with all prize returns throughout the study period, with the exception of jackpot returns in 2005, when a Grey relational grade of 0.5743 indicates less than negligible correlation. Correlations of various prize returns on salary throughout the period indicate Grey relational grades between 0.5743 for a jackpot return in 2005 and 0.6553 for a fifth prize return in 2004.

Thus, jackpot returns display the largest volatility in correlation with individual sentiment indices, particularly for the study period 2005 for all individual sentiment indices. Consistent correlation levels are shown for most individual sentiment indices, except for traveling consumption with alternating levels of influences during the study period. Although jackpot returns are correlated with alcohol consumption more strongly than tobacco consumption, for smaller prize returns, including second, third, fourth, and fifth prizes, the relationship of the above sentiment indices is reversed. Restaurant consumption is more strongly correlated with prize amounts, and is ranked as the third index of sentiment when compared to the correlations of prize amounts with recreation consumption. Prize size shows an approximate significant correlation with education consumption, whereas the correlation of food consumption with salary is negligible. The Grey relational order, based on the rankings of Grey relational grades, for individual sentiment indices, follows this order: tobacco consumption, alcohol consumption, restaurant consumption, recreation consumption, traveling consumption, education consumption, food consumption, and salary.

6. Conclusion

This study attempts to identify the relationship between various lottery prize returns and household consumption. The degrees of correlation are identified and ranked sequentially to identify the correlation of prize returns with consumption patterns. In contrast to previous investigations focusing on the regression analysis of household lottery consumption and demographic analysis of lottery participants, this investigation clarifies the interactions of household consumption with lottery prizes. This investigation attempts to establish reference consumption indices as sentiment indicators closely related to lottery returns that influence household consumption.

This study includes various lottery prize returns and explores their approximate correlation with household consumption in relation to the rational addiction, desperation, and entertainment hypotheses. This investigation differs from previous investigations on lottery demand in that lottery prize returns are analyzed according to prize size to identify their influences on household consumption. Sentiment indicators for household consumption items are identified and ranked according to their relationship with lottery returns.

This investigation demonstrates that lottery prize returns are strongly correlated with rational addiction category sentiment indices, which comprise the individual sentiment indices of tobacco and alcohol consumption. The findings correspond to those of Ghent and Grant (2007), Kearney (2005), and Lin and Lin (2007), who indicate that lottery consumption may be driven by prize designs to encourage rational addictive behavior. Lottery prizes are also strongly correlated with income category sentiment index, but their correlation becomes negligible compared with individual sentiment indices. This finding corresponds to Chen et al. (2009) and Haisley et al. (2008), but contradicts Garrett and Sobel (2004). Moreover, lottery prizes are significantly correlated with the sentiment indices of the desperation category and negligibly correlated with individual sentiment indices that comprise education and food consumption. This finding contradicts that of Landry and Price (2007) due to the likely lower costs for food and education consumption. Negligible correlations with lottery prizes are demonstrated for the sentiment indices of the entertainment category and become relatively strong for individual sentiment indices related to restaurant, recreation,
and traveling consumption. These findings correspond to those of Blalock et al. (2007), Garrett and Marsh (2002), and Ghent and Grant (2007), who reveal that households view lottery consumption as a form of entertainment, including travel.

This investigation applies GRA to analyze the relationship between lottery returns from prizes, household consumption, and income. It builds on previous studies regarding lotteries by grouping factors, such as household consumption and macroeconomic conditions, to observe their influences on lottery prize returns. The results indicate that the Taiwanese lottery market is characterized by a strong correlation with rational addictive consumption, followed by mixed correlations among relatively strong, significant, and negligible correlations with desperate and entertaining consumption. These results differ from those in the previous literature demonstrating that most desperation or entertainment consumption behaviors are directed toward lottery purchases.

7. Contributions of the study

7.1. Theoretical contributions

This investigation contributes to the literature by applying GRA (Deng, 1982) to extend existing methodologies, including a questionnaire survey on the demographic analysis of lottery players, regression analysis of secondary statistical data on the lottery demands of various socioeconomic groups, and lottery game experiments to assess risk behavior among lottery game players (see Farrell & Walker, 1999; Garrett & Marsh, 2002; Ghent & Grant, 2007; Harley & Lanot, 2006; Ho et al., 2006; Kearney, 2005; Lin & Lin, 2007; Lin & Wu, 2007; Matheson & Grote, 2004). The GRA method adopts secondary statistical data to identify factors associated with lottery prize returns and household consumption. An approximate correlation with sequential order rankings by Grey relational grades is identified via minimal dataset, simple calculation, and lack of statistical distribution. Therefore, our empirical research contributes to the application of GRA to identify the degree of correlation among variables, which differs from traditional regression analysis, survey, or experiment for identifying a causal relationship.

This study applies GRA to analyze the influence of lottery consumption on household expenditure by identifying the theoretical support for lottery consumption based on rational addiction theory (corresponding to Balabanis, 2002; Kearney, 2005; Lin & Lin, 2007), desperation hypothesis (corresponding to Garrett & Marsh, 2002; Farrell & Forrest, 2008), and entertainment hypothesis (corresponding to Landry & Price, 2007; Lee & Chang, 2005). The individual sentiment indices of household consumption are identified in relation to lottery prizes to explain changes in consumption priority that occur for lottery prize winners. Additionally, category sentiment indices are examined in relation to lottery prize returns and ranked sequentially.

7.2. Applied contributions

This investigation contributes to the literature by examining the long-term relationship between lottery prizes and household consumption. Based on theoretical foundations, household consumption expenditures are analyzed in categories and individual sentiment indices corresponding to lottery prizes ranging from jackpot to low-tier prizes. Contrary to the previous literature on causal relationships in lottery demand (Kearney, 2005; Lee & Chang, 2005), the current study establishes the indicators of lottery prizes in relation to household consumption with latent emotional reactions. Sentiments related to rational addiction, desperation, and entertainment are tested based on their influence in providing potential directions for research on lottery games. Lottery prizes, ranging from jackpot to low-tier prizes, are successfully demonstrated to contain sentiments to exhibit lottery player behavior as a potential direction for research on designing lottery prize structures. Thus, our empirical study successfully applies rational addictive theory (Becker & Murphy, 1988) with household consumption hypotheses to identify the latent correlation of consumer consumption behavior with lottery prizes.

Our findings clarify the major influences on household consumption for lottery prize returns. Sentiment indices are ranked based on Grey relational grades to identify their importance and influences. The findings indicate that lottery players may not be desperate to participate in lottery games, which are contrary to those of Kearney (2005) and Lee and Chang (2005). However, rational addiction motivations strongly correlate lottery prize returns and likely consumption items representing motivations in seeking to win lottery prizes; this finding corresponds to those of Dale (2004) and Doran et al. (2012). Leading category sentiment and individual sentiment indicators of lottery consumption are identified to assist lottery development and strategic positioning for lottery promotions. Contrary to lottery promotions that deal with social welfare (Lee & Chang, 2005), the lottery market in Taiwan is characterized by more dominant risk-seeking behavior among lottery players. Furthermore, our empirical research contributes to policy making by exploring the possible household consumption alternations induced by lottery prizes.

7.3. Implications

For implications, we suggest that authorities could permit strategic alliances between lottery tickets and various business entities. For example, tobacco or alcohol discount coupons could be issued, which are accepted at government-owned tobacco and alcohol stores, for lottery ticket purchases. Similarly, the government tourism bureau could authorize the issuances of restaurant, recreation, and tourism-related discount coupons for each lottery ticket purchase. Furthermore, government could provide more medium and small prizes with better payout probabilities to encourage extended participation duration. Consumers could participate more in lottery ticket purchases via discount coupons and lottery prizes.

8. Limitation and future research

This investigation analyzes the relationship between lottery prize returns and household expenditures in Taipei. A questionnaire survey on lottery player segmentation and lottery demand model analyses complemented the use of sentiment indices in this investigation to identify consumption behavior in relation to lottery prizes. Future studies can also analyze the effects of other lottery products such as scratch cards on consumption sentiment indices.

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References


