African Journal of Business Management Vol.6 (37), pp. 10238-10252, 19 September, 2012
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM11.1916
ISSN 1993-8233 ©2012 Academic Journals

Full Length Research Paper

Quality choice of China's domestic online game firms: Simulation and implication based on individual conjoint analysis

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Accepted 29 June, 2012

Through combining conjoint individual analysis and numerical simulation, we studied game behaviour among China's online game firms and their quality choices. By calculating equilibrium of firms' different quality choices in a simulated online game market, we drew two conclusions: (1) Liberal market environment will stimulate firms to provide games with high quality; either innovations on profit model or R&D subsidies from government are able to move equilibrium towards a status with higher quality. (2) Some characteristics of online game players will also affect firms' choice on online game quality, such as education background and length of the history of playing games. Current composition of online game players can still permit firms to gain profits and market share by low quality products, but as the maturing of the market, quality will finally be the most important factor for firms' survival.

Key words: Online game, quality choice, conjoint analysis, numerical simulation.

INTRODUCTION

The online game presented here refers to internet-based computer game that enables multiplayer to play simultaneously. Previews studies on online game industry can be classified by their research perspectives: (1) Perspective of sociology. Research from this perspective is more inclined to the negative sides of online game, for example the addiction and the bad influence of playing too many offensive games (Griffiths and Hunt, 1995, 1998). Wang et al. (2006) referred to supervision of the harmful content of online games; Yang (2006) advocated an improved classification system of online games to prevent adolescents from over-gaming. (2) Perspective of management. Based on the analysis of service process and industrial chain, Ren (2004) discussed the business model of online game industry; Zhu (2005) investigated development, operations and distributions of online games; Quan (2005) studied competitive strategy of online game firms in China. (3) Perspective of marketing. Researches of this field investigated the behaviour of players as well as some demographic factors, for example, Zhang (2005) investigated consumers' perceived value factors of online game; Guo (2006) analyzed consumer behaviour of online game and Chen (2007) took insight into the influencing factors of consumers' satisfaction, so as to provide theoretical basis for marketing strategy of online games.

Compared to the above three research perspectives, very few studies focus on the economic perspective of online games, particularly in China. Previews studies on online game in China mostly focus on the development of online game industry, and the effects to promote a range of ancillary industries and national economy, for example, the influence of online game industry on value-added services (Bao, 2003). Zhang (2005) investigated the positive effects of online game to related industries, such as telecommunication industry, IT industry, and media industry. Most of these studies are lack of empirical analysis and data support. In addition, there is no study on quality choice of online game firms in China. However, quality is exactly one of the most crucial factors for long-

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term sustainable development of an industry; quality is also indispensable in the framework for industry research. Therefore, our study, based on empirical results of individual conjoint analysis on online game players in China, analyzes quality choice of China's domestic online game firms, in the hope of shedding light on future research in this area and providing policy suggestion to further develop China's online game.

INDIVIDUAL CONJOINT ANALYSIS

General steps of individual conjoint analysis

Individual conjoint analysis is able to derive statistically consumers' subconscious scores for each product profiles by changing feature combination of products and using consumers' evaluation on a set of product profiles. There are three general steps of individual conjoint analysis.

Step 1: Ascertaining product attributes and levels of each attribute

The ascertained attributes should be significant enough to affect consumers' behaviour. Too many attributes will make it impossible for respondents to rank or score in a meaningful way; while too few attributes will lead to a loss of some key information and thus negatively influence the serviceability of model. Then we should define the level of each selected attribute. The number of attributes and levels determines the number of parameters to be estimated in the conjoint analysis. It also affects the number of product profiles to be scored by respondents.

Step 2: Carrying out orthogonal design

The procedure of multi-factor test will be of growing complicacy as the increasing of number of factors (attributes) and levels. For those multi-factor tests with more than three factors, to complete them, we can use what is termed as fractional factorial design. This method presents a suitable fraction of all possible combinations of the factor levels. The resulting set, called an orthogonal array, is designed to capture the main effects for each factor level. The orthogonal array is a kind of standardized form and can be denoted as $L_n(M^J)\cdot L$ is the orthogonal array; n shows the number of rows in it, that is, we need to do the test for n times, with degree of freedom as $n-1$ for each test; J shows the number of columns in the list, which also gives the maximum of factors in each test; M denotes the number of levels of referred factors.

Step 3: Performing test and data analysis

First, the data about consumers' evaluation on assumed products by questionnaires, and then estimate components' utility score. The general summation model of conjoint analysis is shown as follows:

$$y_k = \mu + \sum_{j=1}^{J}\sum_{m=1}^{M_j}\beta_{jm}x_{jm} \quad (1)$$

Here y_k is the estimated total utility score of object k; μ is the constant term; β_{jm} is component's utility score of j th attribute and m th level. $x_{jm}=1$ when the j th attribute of object k is m, $x_{jm}=0$ otherwise. We adopted the general summation model in our study and complete estimation of β_{jm} by conjoint analysis module in SPSS.

Research design and data collecting

As the most popular type of online games, massive multiplayer online game (MMOG) enables multiplayer to play in the same scene simultaneously and it is continuous and not confined to innings or set. Performed by players, the roles survive and grow in the virtual world by player's game skills and other kinds of inputs. In the virtual world, the roles can further participate in interpersonal communication and other social activities. The most popular online games in China are of this type, for instance, World of Warcraft, Final Fantasy, Monster and Me and Fantasy Journey to the West.

MMOG can be divided into: massive multiplayer online role playing game (MMORPG), massive multiplayer online first person shooter (MMOFPS), massive multiplayer online racing (MMORAC) and so forth. Especially, in recent years, MMORPG is the mainstream MMOG in China. To make our research about online game industry in China more pertinent, we choose this most representative type of online games.

We conducted a study on consumers' behaviour by questionnaire in two ways: Online delivery and field survey in colleges in Xiamen. Our subjects are MMORPG players. We obtained 411 respondents, of which 268 are eligible. As shown in Appendix B, there are two parts in the questionnaire. The first part is basic information about the respondents, such as gender, degree of education, length of playing history (how long he/she has played online games) and so forth. The second part requires respondents to score the 9 feature combinations of products generated by orthogonal design. There are two steps in our orthogonal design procedure.

Selection of attributes and levels of each attribute

We selected four attributes to measure consumers' behaviour of MMORPG (for notation convenience, hereafter we refer online game as MMORPG): Background story, game quality, way of charging and number of friends who devote in the same online game. The reason why we did not select "price" as one of the attributes is that most online games in China do not sell cards in recent years, thus there is no universal price standard for online games. Generally speaking, the main cost to the players is the purchase of virtual goods. Even if some existing online games (for example World of Warcraft by Blizzard Entertainment) sell cards, it is the player who decides how much to spend on playing games. Therefore, for the players, game's content outweighs how much it costs. The game's content affects players' decision on which game to choose, while price influences how much the player is willing to pay. Thus we divide player's behaviour into two steps. The first is the decision on which game to play; the second is to decide how much to spend on it. For conjoint analysis, we just need to focus on the first step. The levels of each attribute are shown in Table 1.

Orthogonal design

We get 9 sets of factor levels in the orthogonal design (Question 10 in Appendix B) after inquiring about the orthogonal table of 4 factors and 3 levels (not all the attributes have the same number of levels). We adopted preference score here so that each set could get a score and was comparable. Respondents are required to score the

Table 1. Attributes and levels of each attribute that affect the players' choice of games.

Level	A (background story)	B (game quality)	C (way of charging)	D (number of friends in the same online game)
1	Domestic culture	Good	Selling properties, equipment and outfits	None
2	Foreign cultures	Medium	Selling cards	1-2
3		Poor		3 and above

Table 2. Quality sensitivity of players with different degrees of education.

Degree of education	Number of players with high quality sensitivity	Number of players with low quality sensitivity
College and above	88	92
Secondary, high school and below	8	80

Table 3. Quality sensitivity of players with different lengths of playing history (college and above).

Length of playing history	Number of players with high quality sensitivity	Number of players with low quality sensitivity
Long_history; College and above	72	32
Short_history; College and above	16	60

Table 4. Quality sensitivity of players with different lengths of playing history (secondary, high school and below).

Length of history of playing online games	Number of players with high quality sensitivity	Number of players with low quality sensitivity
Long_history; Secondary, high school and below	4	52
Short_history; Secondary, high school and below	4	28

9 sets (A to I) in Appendix B, and they give higher score for what they prefer more. The base distribution of the scores is the base of data analysis.

Statistics of questionnaires based on online game quality sensitivity

In order to simulate the market, we need to analyze players' sensitivity on online game quality. We divided players into two types: One with high quality sensitivity and the other with low quality sensitivity. The players with high quality sensitivity are able to tell a slight difference in quality and can distinguish among games with different qualities. However, players in other group can only tell the quality difference when it is big enough.

In the questionnaire, there is a question to measure player's quality sensitivity: The respondents are required to describe the quality difference between domestic online game and imported online game. The answers of the 268 respondents to this question can fall into two categories: Quality of domestic online game is far behind the imported counterparts and otherwise (the quality of domestic online game is better, more or less the same or slightly behind the imported counterparts).

According to the definition of quality sensitivity above, we assumed that the player whose answer was "far behind" was of higher quality sensitivity. We found that quality sensitivity is influenced by degree of education and the length of history of playing online game. The quality sensitivity of players with different degrees of education and length of history of playing online games is shown in Table 2, 3 and 4.

According to the statistical analysis above, we tested degree of correlation between quality sensitivity and degree of education, as well as quality sensitivity and length of playing history. φ denotes correlation coefficient between quality sensitivity and education background. As a simple rule, we assume that if φ is larger than 0.3, the correlation is considered to be more important than the general relationship. The corresponding values of φ in Tables 2, 3, and 4 are 0.39, 0.39 and -0.09. Therefore, we can reach the conclusions that quality sensitivity and degree of education is related; moreover, the quality sensitivity of players of college and above is also related to the length of playing history; and the two relationships are important. But we can not draw the same conclusion when it comes to the players of secondary, high school and below.

According to the results of correlation tests, we divide players into three categories: "Long_history, college and above", "short_history, college and above" and "secondary, high school and

Table 5. Example of results of individual conjoint analysis.

		Utility estimate	Std. Error
A	Domestic Culture	2.083	2.332
	Foreign Culture	-2.083	2.332
B	Good	17.222	3.110
	Medium	8.889	3.110
	Poor	-26.111	3.110
C	(Way of Charging) Selling properties and outfits	2.083	2.332
	Selling cards	-2.083	2.332
D	None	10.000	2.693
	1-2	20.000	5.386
	3 and above	30.000	8.079
Constant		23.056	5.921

below".

Results of individual conjoint analysis

We first studied results of individual analysis on 268 respondents. The score vector of corresponding respondent of Table 5 is (60, 55, 70, 40, 50, 70, 10, 15 and 30). As it is shown in Table 5, the respondent cared about game quality, the number of friends in the same online game. He/She also preferred domestic culture and the way of charging.

Similarly, we could get the results of individual conjoint analysis of the 268 players, which enabled us to calculate the basic utility of any feature combinations (profiles) of products. Take the corresponding respondent in Table 5 as an example, if there is a MMORPG product with domestic culture, good quality and the charging method of selling properties and outfits, along with more than 3 friends of the respondent in the same game, according to Equation 1, then the respondent's utility of playing this game is 74.444 (= 2.083+17.222+2.083+30.000+23.056). For any respondent in the individual conjoint analysis, we were able to estimate his/her utility score for any feature combinations of products in the similar way. In next section, our simulation will be based on the results of individual conjoint analysis.

MMORPG MARKET MODEL BASED ON INDIVIDUAL CONJOINT ANALYSIS

Random consumer group based on individual conjoint analysis

Based on the results of individual conjoint analysis, we constructed random consumer group to simulate MMORPG market by the following steps:

1. We selected behaviour samples from each of the three following categories of players: "Long_history, college and above", "short_history, college and above", and "secondary, high school and below".
2. Using the selected samples as template, we duplicated the samples' behaviour to 1000 simulated players in our market model. Taking the sample of "secondary, high school and below" as an example, there were 88 subjects. By the way of programming, we randomly assigned the first 968 consumers by duplicating the 88 subject 11 times. Then we assigned the rest 32 consumers by selecting 32 subjects randomly out of the 88 subjects. Thus, based on selected samples, we got the random consumer group with 1000 consumers.
3. The friendship was generated randomly among the players of the random consumer group, and the algorithm is as follows:
(1) The number of friends was generated randomly, which was no more than an established positive integer. We set 10 as the limit here. We referred the number of friends generated here as "specified number of friends" below.
(2) Traversing every player, if any one with friends less than the "specified number of friends", we selected one randomly from the 1000 players, whose number of friends is less than his/her "specified number" and set them as friends.
(3) Repeating step (2) until the number of friends of all the players equaled to his/her "specified number". The maximum repetition was 1000.
4. Differentiating players' quality sensitivity. As assumed above, the distribution of players' quality sensitivity varied

among different players. We further assumed that players with high quality sensitivity are able to distinguish all the classifications of game quality and the players with low quality sensitivity can tell neither the "good" ones from the "medium" ones, nor the "medium" ones from the "poor" ones. But they could tell the difference between the "good" game and the "poor" game, in other words, the quality difference between the two kinds of games was big enough for the players to tell. In the simulation, players with low quality sensitivity would consider the "medium" ones as the "good" ones and the "poor" as the "medium".

State vector of products and firm's behaviour

State vector of products includes seven components which are all dummy variables, and each component represents product's level of one attribute. The seven components are domestic culture (yes=1, no=0, the same below for other components), foreign culture, high quality, medium quality, poor quality, charging by selling properties and outfits and charging by selling cards. Therefore, the state vector of (1, 0, 0, 1, 0, 1, 0) means an online game with domestic culture, medium quality and charging by properties and outfits.

To maximize profit, the firm decides which kind of products to provide. We mainly analyze firm's choice of game quality in this study. To simplify, we assumed that the firm's profit is calculated by the following equations.

$$\pi_j = \sum \pi_{j,t} - cT_j^{\lambda} \quad (2)$$

$$\pi_{j,t} = aD_{j,t} \quad (3)$$

Among them, $\pi_{j,t}$ is the profit of product j in period t; π_j is the total profit of product j in the designated period; $D_{j,t}$ means the demand for product j in period t; a measures the conversion of click to profit (for the convenience, all firms here are the same in converting click to profit); c is the cost of quality; T_j denotes the quality level of product j (good=3, medium=2, poor=1); in Equation 2, λ >1 means that the marginal output of R&D decreases with the upgrading of quality. For the convenience, we set λ =3 here.

Consumers' behaviour in multi-phase iteration

In the multi-phase iteration model, consumers evaluate the online games on the base of all relevant variables of last period; then, in random order they score and choose among every online game at each phase. If consumer has the same evaluation on two or more products, we will choose one randomly for him/her. The choice of every consumer is recorded and will have effects on the choice of his/her friends. The iteration is controlled by external variables.

NASH EQUILIBRIUM AND FACTORS OF ONLINE GAME QUALITY

Firms' choice on game quality depends on external environment and rivals' strategy. In the following section, by simulation, we try to find the Nash equilibrium for online game market, and interpret the results. We first investigate what level of quality the firm of domestic online game will choose when there is an imported online game with "good" quality and charging by selling cards. In other words, the online game market is constituted by an imported online game with the state vector of (0, 1, 1, 0, 0, 0, 1) and some domestic online games with the state vector of (1, 0, B_1, B_2, B_3, 1,0). The values of B_1, B_2 and B_3 are determined by the external market environment.

When there is only one domestic online game in the market, the choice of game quality is simple, just by comparing prospective profits of the three quality choices. On the basis of random consumer group, we set different values for a and c, and conducted 50 iterations for the simulated online game market, with 20 periods each iteration. After getting the average profits of each set of a and c, we then chose the profit-maximizing strategy. The results are shown in Table A.1, A.2 and A.3.

When there are two domestic online games, we need to find the Nash equilibrium by plotting the optimal response curve. Based on the random consumer group of "short_history, college and above", we first set $a = 0.1$ and $c = 30$, and conducted 50 iterations for the simulated online game market, with 20 periods each iteration. The firms choose game quality to maximize their profit. The optimal strategy for the two firms is plotted in Figure 1.

In Figure 1, quality choices of the two firms are shown as the horizontal axis and vertical axis; "o" and "*" are the best response to the given strategy of the rival. As shown in Figure 1, there is no intersection point of "o" and "*", which indicates that there is no Nash equilibrium in the market. We then changed the parameters as $a = 0.4$ and $c = 30$, the optimal strategy for the two firms is then plotted in Figure 2. The intersection point of "o" and "*" at (3, 3) indicates the Nash equilibrium in the market. The market is stable when the quality of two domestic online games is "medium", and the two firms have no motivation to change quality strategy.

Similarly, we found the Nash equilibriums of two domestic online games in the market with different parameters of a and c. The results are presented in Tables A.4, A.5 and A.6.

When there are three domestic online games in the market, we need to find Nash equilibrium by plotting the optimal response curve in three-dimensional space. Take

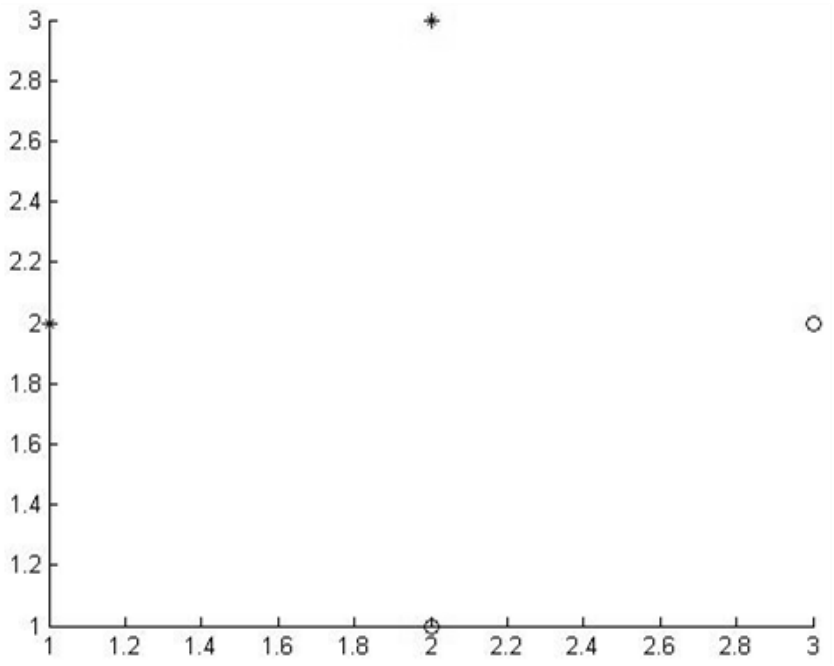

Figure 1. Example I of Nash equilibrium of two domestic online games.

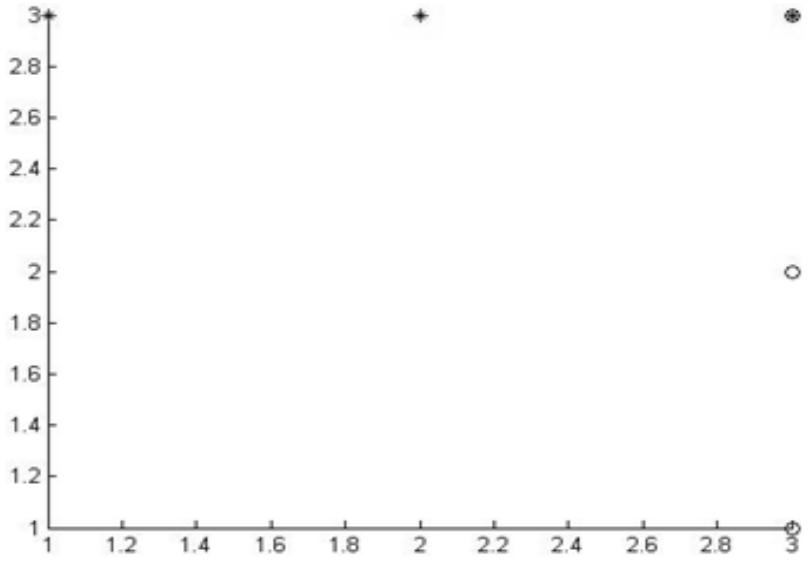

Figure 2. Example II of Nash equilibrium of two domestic online games.

the “Secondary, high school and below” as an example to generate random consumer group, we set $a = 0.1$, $c = 0$ and conducted 50 iterations for the simulated online game market, with 20 periods each iteration. The firms choose game quality to maximize their profit; the optimal strategy for the three firms is plotted in Figure 3.

In Figure 3, quality choices of the three firms shown as the three axes, “o”, “x” and “+” are the best response to the given strategy of rivals. The intersection point of “o”, “x” and “+” at (3, 3, 3) indicates the Nash equilibrium in the market.

There may be many Nash equilibriums in the market. For example, when $a = 0.1$ and $c = 60$, the optimal strategy for the three firms is plotted in Figure 4. There are three Nash equilibriums in the market at the same time, (2, 2, 1), (2, 1, 2) and (1, 2, 2). At the equilibrium state, the firm which chooses to provide “poor” game earns less than the firms which produce “medium”

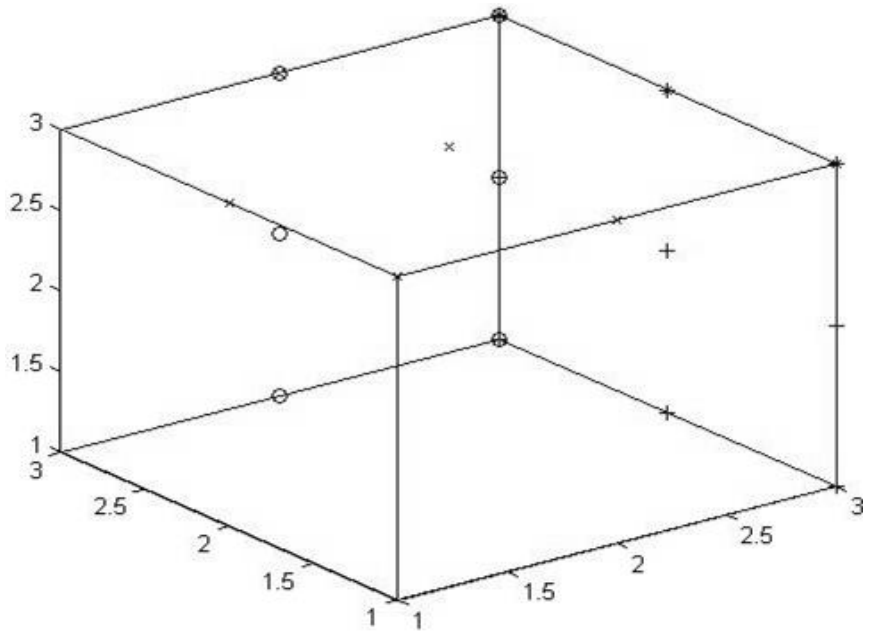

Figure 3. Example I of Nash equilibrium of three domestic online games.

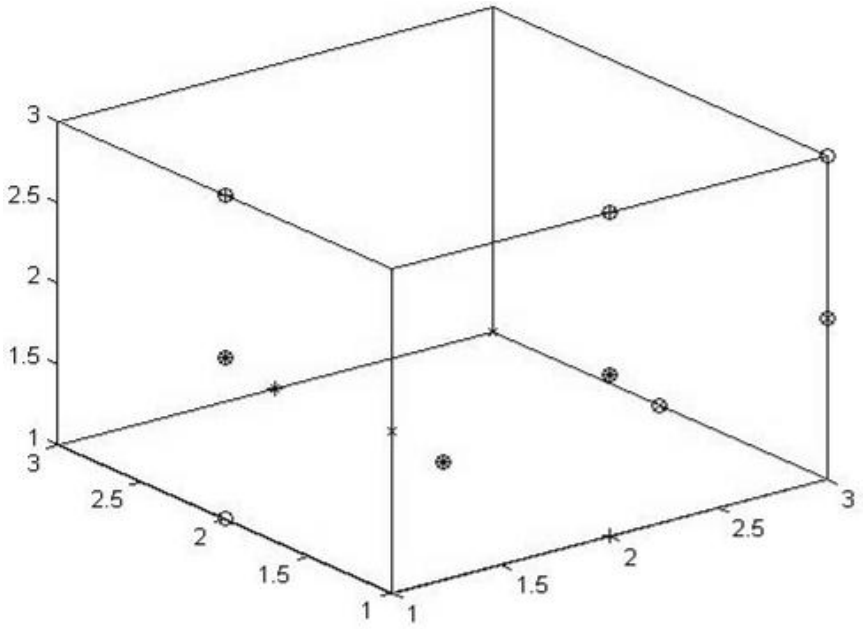

Figure 4. Example II of Nash equilibrium of three domestic online games.

games. However, when two of the firms choose "medium", the optimal choice for the rest is "poor".

Similarly, we found the Nash equilibriums of three domestic online games in the market with different parameters of a and c. The results are presented in Tables A.7, A.8 and A.9.

Tables A.1 to A.9 in the appendix, are tables of 9 rows and 10 columns, in other words, 90 different combinations for a and c in each simulation. From Tables A.1 to A.9, we can see there is a trend from the top right to the bottom left that the market changes from the unstable status or Nash equilibrium with poor quality

Table 6. Statistics of v with different numbers of domestic online games and different samples.

Number of domestic online game	Long_history, college and above	Short_history, college and above	Secondary, high school and below
1	(83,7,0)	(73,17,0)	(15,75,0)
2	(30,0,60)	(43,9,38)	(10,80,0)
3	(51,3,36)	(53,18,19)	(10,78,2)

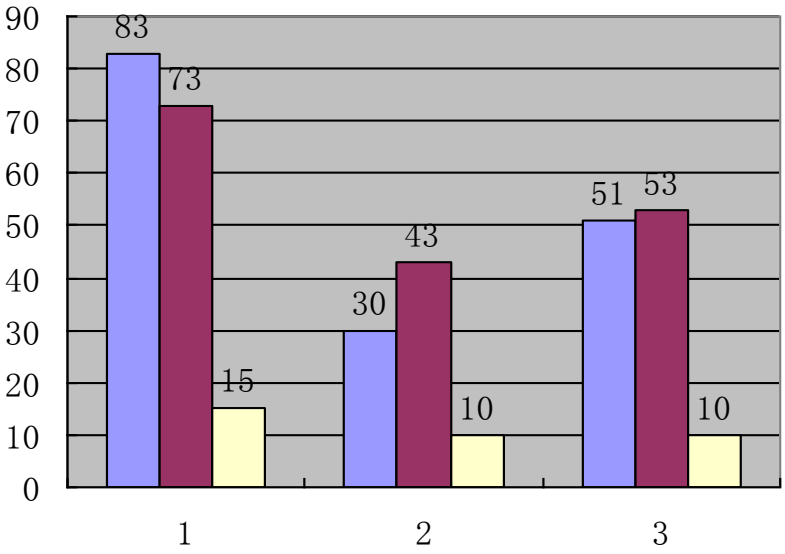

Figure 5. Frequency of "all games on the market are of 'good' quality at the equilibrium".

to the Nash equilibrium with high quality. Thus it illustrates that the influence of a and c on the market is significant. As the increase of conversion of click to profit and the decrease of cost of quality, the market tends to be stable; moreover, the incentives for domestic online games to improve quality become larger.

In addition, by horizontal comparison among Tables A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8 and A.9, we can infer that besides market environment (a and c), market equilibrium is affected by degree of education and how long the player has played online games. We then set a vector v to denote the number of occurrences of the following terms: "All games on the market are of 'good' quality at the equilibrium", "all games on the market are of 'medium' or 'poor' quality at the equilibrium" and "there is no Nash equilibrium". Each of the 9 tables is corresponding to a different vector, the statistics are presented in the following table.

Based on the statistics in Table 6, for the three sample groups, Figure 5 shows the Frequency of "all games on the market are of 'good' quality at the equilibrium" and Figure 6 describes the Frequency of "all games on the market are of 'medium' or 'poor' quality at the equilibrium".

In Figures 5 and 6, 1, 2, and 3 beneath the horizontal axis represent the numbers of domestic online games. Each of the three groups has three columns, which correspond to the three different sample groups: "Long_history, college and above" (left), "short_history, college and above" (middle) and "secondary, high school and below" (right).

As shown in Figures 5 and 6, the market with players of higher education bears larger incentives for firms to provide online games with high quality (in Figure 5, left columns of the three groups are higher on average. By contrast, in the market with players of lower education, online games with low quality are more likely to appear (in Figure 6, right columns of the three groups are higher than the left and middle ones).

Besides education background, how long the player has played online games is also an important factor. Similarly, based on the data of the length of playing history ("long_history, college and above", and "short_history, college and above") in Table 6, Figure 7 depicts the ratios of Frequency of "all games on the market are of 'medium' or 'poor' quality" to the Frequency of stable market.

Similar to Figures 5 and 6, 1, 2 and 3 beneath the

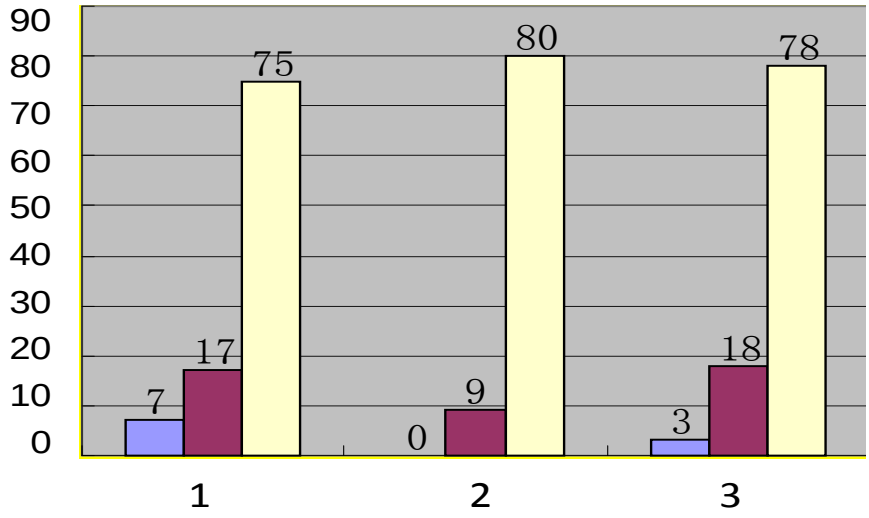

Figure 6. Frequency of "all games on the market are of 'good' quality at the equilibrium".

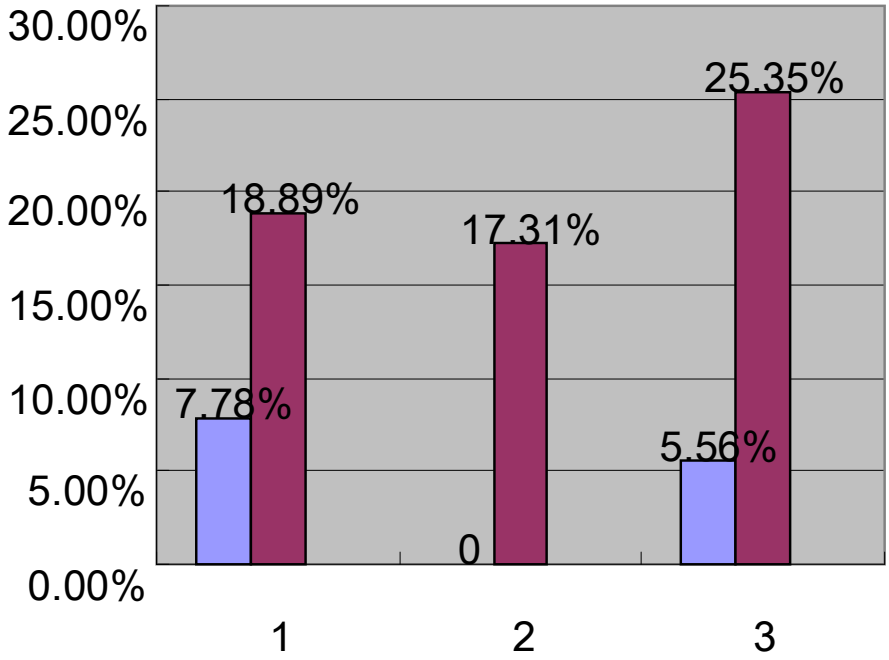

Figure 7. Ratios of frequency of "all games on the market are of 'medium' or 'poor' quality" to the frequencies of stable market.

horizontal axis represent the numbers of domestic online games. The two columns of each group correspond to two different samples groups: "Long_history, college and above", and "short_history, college and above". It is obvious in Figure 7 that the market with players of shorter playing history bears higher tolerance for games with medium and poor quality (left columns of the three group are significantly lower than the right ones). In comparison, the market with players of longer playing history is more likely to consist of games with high quality.

Conclusion

By combining conjoint analysis and numerical simulation, we studied the star industry of digital content industry, the online game industry, the conclusions are as follows:

1. Relaxed market environment (referred as conversion of click to profit and cost of quality in this paper) has incentives for firms to improve product quality in the online game market. Either innovation in firms' profiting model or R&D subsidy from government will stimulate market and then drive market to be stable with higher product quality.
2. Education background and length of playing history affect consumers' behaviour by influencing players' quality sensitivity, and then have effects on firms' decision on quality selection. The market with players of higher education and longer playing history has stronger tendency for online games of "good" quality, thus it has larger incentives for firms to provide online games of "good" quality. By contrast, the market constituted by players of lower education level and shorter playing history bears higher tolerance for online games of "medium" and "poor" quality, thus it is more likely to have those kinds of online games on this market.

In terms of the structure of current players, those of lower education, shorter playing history and lower quality sensitivity take a significant proportion. This gives the domestic online games a big advantage at the take-off stage by empowering those firms to gain market share and profit through low quality products. However, with the growing maturity of players and improving of players' quality, the market will evolve into a market with lots of attention on quality and by then, quality will be the key for firms to survive. Whether China's online game industry can achieve sustained growth depends on firms' ability to take advantage of current favorable situation to vigorously invest in R&D and improve product quality.

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Appendix A

Table A.1. Quality choice when there is one domestic online game in the market (long_history, college and above).

c / a	0	30	60	90	120	150	180	210	240
0.1	3	3	3	3	1	1	1	1	1
0.2	3	3	3	3	3	3	3	1	1
0.3	3	3	3	3	3	3	3	3	3
0.4	3	3	3	3	3	3	3	3	3
0.5	3	3	3	3	3	3	3	3	3
0.6	3	3	3	3	3	3	3	3	3
0.7	3	3	3	3	3	3	3	3	3
0.8	3	3	3	3	3	3	3	3	3
0.9	3	3	3	3	3	3	3	3	3
1	3	3	3	3	3	3	3	3	3

Where c is the cost of quality, a measures the conversion of click to profit.

Table A.2. Quality choice when there is one domestic online game in the market (short_history, college and above).

c / a	0	30	60	90	120	150	180	210	240
0.1	3	3	2	2	2	2	2	2	2
0.2	3	3	3	3	2	2	2	2	2
0.3	3	3	3	3	3	3	2	2	2
0.4	3	3	3	3	3	3	3	2	2
0.5	3	3	3	3	3	3	3	3	3
0.6	3	3	3	3	3	3	3	3	3
0.7	3	3	3	3	3	3	3	3	3
0.8	3	3	3	3	3	3	3	3	3
0.9	3	3	3	3	3	3	3	3	3
1	3	3	3	3	3	3	3	3	3

Table A.3. Quality choice when there is one domestic online game in the market (secondary, high school and below).

c / a	0	30	60	90	120	150	180	210	240
0.1	3	2	2	2	2	2	2	1	1
0.2	3	2	2	2	2	2	2	2	2
0.3	3	2	2	2	2	2	2	2	2
0.4	3	2	2	2	2	2	2	2	2
0.5	3	2	2	2	2	2	2	2	2
0.6	3	3	2	2	2	2	2	2	2
0.7	3	3	2	2	2	2	2	2	2
0.8	3	3	2	2	2	2	2	2	2
0.9	3	3	2	2	2	2	2	2	2
1	3	3	2	2	2	2	2	2	2

Table A.4. Quality choice when there are two domestic online games in the market (long_history, college and above).

c / a	0	30	60	90	120	150	180	210	240
0.1	(3,3)								
0.2	(3,3)								
0.3	(3,3)	(3,3)							
0.4	(3,3)	(3,3)							
0.5	(3,3)	(3,3)	(3,3)						
0.6	(3,3)	(3,3)	(3,3)						
0.7	(3,3)	(3,3)	(3,3)	(3,3)					
0.8	(3,3)	(3,3)	(3,3)	(3,3)					
0.9	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)				
1	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)				

Note: blank cell means Nash equilibrium does not exist with the corresponding parameter, similarly hereinafter.

Table A.5. Quality choice when there are two domestic online games in the market (short_history, college and above).

c / a	0	30	60	90	120	150	180	210	240
0.1	(3,3)								
0.2	(3,3)	(3,3)		(2,2)					
0.3	(3,3)	(3,3)	(3,3)		(2,2)				
0.4	(3,3)	(3,3)	(3,3)			(2,2)	(2,2)		
0.5	(3,3)	(3,3)	(3,3)	(3,3)			(2,2)	(2,2)	
0.6	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)			(2,2)	(2,2)
0.7	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)				(2,2)
0.8	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)			
0.9	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)		
1	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)	(3,3)		

Table A.6. Quality choice when there are two domestic online games in the market (secondary, high school and below).

c / a	0	30	60	90	120	150	180	210	240
0.1	(3,3)	(2,2)	(2,2)	(2,1) (1,2)	(1,1)	(1,1)	(1,1)	(1,1)	(1,1)
0.2	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,1) (1,2)	(2,1) (1,2)	(1,1)	(1,1)
0.3	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,1) (1,2)	(2,1) (1,2)
0.4	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)
0.5	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)
0.6	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)
0.7	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)
0.8	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)
0.9	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)
1	(3,3)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)	(2,2)

Table A.7. Quality choice when there are three domestic online games in the market (long_history, college and above).

c / a	0	10	20	30	40	50	60	70	80
0.1	(3,3,3)								
0.2	(3,3,3)	(3,3,3)							
0.3	(3,3,3)	(3,3,3)	(3,3,3)						
0.4	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)					
0.5	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)				
0.6	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)			
							(3,3,1)		
0.7	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,1,3)		
							(1,3,3)		
								(3,3,1)	
0.8	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,1,3)	
								(1,3,3)	
									(3,3,1)
0.9	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,1,3)
									(1,3,3)
1	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)

Table A.8. Quality choice when there are three domestic online games in the market (short_history, college and above).

c / a	0	10	20	30	40	50	60	70	80
		(3,3,2)							
0.1	(3,3,3)	(3,2,3)							
		(2,3,3)							
			(3,3,2)						
0.2	(3,3,3)	(3,3,3)	(3,2,3)						
			(2,3,3)						
				(3,3,2)	(3,3,2)				
0.3	(3,3,3)	(3,3,3)	(3,3,3)	(3,2,3)	(3,2,3)				
				(2,3,3)	(2,3,3)				
				(3,3,2)	(3,3,2)	(3,3,2)	(3,3,2)		
0.4	(3,3,3)	(3,3,3)	(3,3,3)	(3,2,3)	(3,2,3)	(3,2,3)	(3,2,3)		
				(2,3,3)	(2,3,3)	(2,3,3)	(2,3,3)		
						(3,3,2)	(3,3,2)	(3,3,2)	(3,3,2)
0.5	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,2,3)	(3,2,3)	(3,2,3)	(3,2,3)
						(2,3,3)	(2,3,3)	(2,3,3)	(2,3,3)
							(3,3,2)	(3,3,2)	(3,3,2)
0.6	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,2,3)	(3,2,3)	(3,2,3)
							(2,3,3)	(2,3,3)	(2,3,3)
								(3,3,2)	(3,3,2)
0.7	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,2,3)	(3,2,3)
								(2,3,3)	(2,3,3)
									(3,3,2)
0.8	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,2,3)
									(2,3,3)
0.9	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)
1	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)	(3,3,3)

Table A.9. Quality choice when there are three domestic online games in the market (secondary, high school and below).

c / a	0	10	20	30	40	50	60	70	80
						(2,2,1)	(2,2,1)		
0.1	(3,3,3)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,1,2)	(2,1,2)		
						(1,2,2)	(1,2,2)		
0.2	(3,3,3)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
0.3	(3,3,3)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
0.4	(3,3,3)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
0.5	(3,3,3)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
		(3,2,2)							
0.6	(3,3,3)	(2,3,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
		(2,2,3)							
		(3,2,2)							
0.7	(3,3,3)	(2,3,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
		(2,2,3)							
		(3,2,2)							
0.8	(3,3,3)	(2,3,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
		(2,2,3)							
		(3,3,2)							
0.9	(3,3,3)	(3,2,3)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
		(2,3,3)							
		(3,3,2)							
1	(3,3,3)	(3,2,3)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)	(2,2,2)
		(2,3,3)							

Appendix B

Consumer behaviour survey of MMORPG

Instructions: please mark your choice with "√" or fill in the blank space.

1. Gender: A. male B. Female
2. Education Background: A. Junior High School B. Secondary High School C. College or Undergraduate D. Master and above
3. The length of your playing history is:

A. Less than Half Year B. Half to One Year C. One to Two Years D. Two to Three Years E. More than Three Years

4. Generally speaking, the average time of your playing online games every week is:

A. Less than 10 Hours B. 10-15 hours C. 15-20 hours D. 20-30 hours E. More than 30 hours

5. The average monthly expense on online games is:

A. 0 B. 1-20RMB C. 20-30RMB D. 30-50RMB E. 50-100RMB F. More than 100 RMB

6. Do you tend to support domestic online games?

A. Yes B. No

7. Which kind of background story do you prefer?

A. Domestic Culture B. Foreign Culture C. No Special Preference

8. Compared to imported online games, at present, the quality of domestic online games is (referred in particular to the MMORPG):

A. at leading position B. at the same level C. slightly behind D. far behind E. have no idea

9. The online game(s) that you currently playing is/are:
10. Please score the following sets (total score is 100). Take Set A as an example, it is based on domestic culture, with good quality and charging by properties and outfits, but no friends around you are playing it. What is your score to A? (Game quality here refers to the comprehensive evaluation of audio-visual enjoyment, story, interaction, balance and so forth.)

Set	Background story	Game quality	Way of charging	Number of friends in the same game	Score
Set A	Domestic culture	Good	Selling properties and outfits	None	
Set B	Foreign culture	Good	Selling properties and outfits	1-2	
Set C	Domestic culture	Good	Selling cards	3 and above	
Set D	Foreign culture	Medium	Selling cards	None	
Set E	Domestic culture	Medium	Selling properties and outfits	1-2	
Set F	Domestic culture	Medium	Selling properties and outfits	3 and above	
Set G	Domestic culture	Poor	Selling properties and outfits	None	
Set H	Domestic culture	Poor	Selling cards	1-2	
Set I	Foreign culture	Poor	Selling properties and outfits	3 and above	