



Research on the Importance of Corporate Social Responsibility in the Digital Economy Based on Intelligent Consumer Behavior Algorithm

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Abstract. This research brings up an adapted consumer utility model based on marginal utility to describe the relationship between corporate social responsibility (CSR) and corporate development in the age of digital economy. It then conducts verification based on the controversial gambling industry in Macau. The comprehensive assessment model shows that implementing CSR contributes to the gambling industry's healthy growth and sustainable development. Gambling corporations' awareness of CSR increased by six times and the gross income increased by approximately seven times during the last 20 years. Besides, this essay also points out the dilemma of industrial and economic structure in digital age and provides a long-term possible solution to realize company and industry sustainable development and even social economic reform.

Keywords: corporate social responsibility · consumer utility model · gambling industry · digital marketing

1 Introduction

“Companies with their eye on the ‘triple-bottom line’ outperform their less fastidious peers on the stock market.” [1] The triple-bottom line here is defined as the trifacta of social, economic, and environmental responsibility. The ongoing development of the economy and intensely competitive environment today make social responsibilities no more optional but necessary for corporations. Despite a large number of researches on the relationship between corporate social responsibilities (CSR) and their future performance, the literature is not inclusive. Some of the current studies have focused on the influence of implementing corporate social responsibility on companies' latter actions in the local area [2]; some focused on its influence on corporations' international operations [3–6]; and some domestic studies mainly focused on its influence on companies overseas merge and acquisition [7–10]. However, the majority of these studies have selected emerging industries in developed countries as research subjects, leaving blanks in some other special industries, and lacking the researches of new information and technology applications in the rea of digital economy. This essay selects one controversial industry gambling and the influence of gambling companies' CSR. We collect and obtain

gambling industry relevant data based on artificial intelligence algorithm, bring up an adapted consumer utility model based on marginal benefit to describe the relationship between CSR of the gambling industry and corporations' development and selected the example of Macau to verify. After data analysis through artificial intelligence algorithm, and based on the research findings, we provide further implications to other domestic industries in digital age and make some suggestions for domestic companies and economic structure transformation.

2 An Adapted Consumer Utility Model Based on Marginal Utility

2.1 Variable Explanation

Before setting models, there are some variables that should be explained clearly. As we rely on three sets of data and had acquired all of the data from the social survey of Macau University and Gaming Inspection and Coordination Bureau Macau SAR, when some of the data are not available, we need to conduct imputations.

Besides, we have considerable thoughts about the assurances of gambling which include the following basic elements:

- (i). The safety of consumption environment (advertisement propaganda; direction on healthy gambling; web design; intervention in excessive consumption);
- (ii). Various guarantees during consumption (protection of consumption privacy; consulting hotline; website and institution service);
- (iii). Design of gambling game (entertainment; Sustainability; addiction; excitement);
- (iv). The diversification of gambling games (diverse games and selling methods);
- (v). Consumers' rational cognition towards gambling (odds of winning and returning money).

2.2 Model Setting

Figure 1 illustrates the influence of CSR on enterprise benefit [11]. MU refers to marginal utility curve; MSC refers to marginal social cost; MPC refers to marginal private cost; MC refers to marginal external cost, and $MSC = MPC + MC$. MPC 、 MU and MSC 、 MU separately interact at point A and B . In markets, point A refers to Pareto Optimality, meaning that point Q_1 is the best point to invest on CSR. The sum of consumer surplus and producer surplus, also the enterprise benefit can be represented by the area of $S_{P_1AP_2}$; when corporations' irresponsibility causes negative externality, changes of marginal external cost are not considered and the investment is determined by point Q_2 (when $MPC = MU$) alone to realize the equality between marginal benefits and marginal costs and reach a partial balance. At this time, the enterprise benefit of industry becomes $S_{P_1AP_2} - S_{ABC}$ and the total enterprise benefit decreases by S_{ABC} .

3 Verification Based on Gambling Industry in Macau

3.1 Current Situation of Gambling Industry in Macau

The origin of the Macau gambling industry could date back to the 16th century when the Macau port had just opened. Then in the following 180 years, it experienced four revolutions, namely, legalization, monopolization, setting "permanent gaming area" and

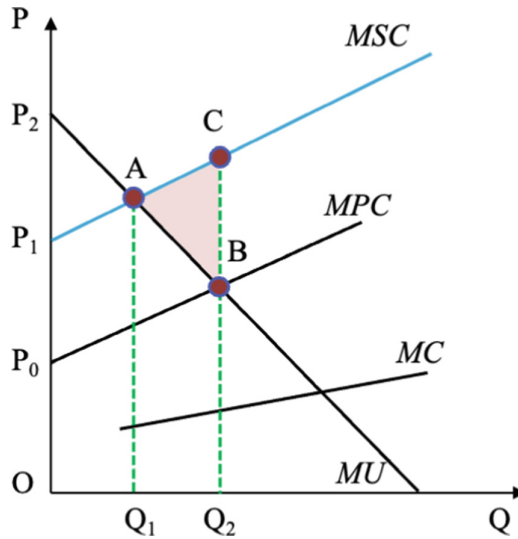


Fig. 1. The influence of CSR on enterprise benefit

bringing in competitions, and gambling in Macau started to flourish from the 21st century. In 2012 the gambling revenue gross in Macau reached 30 trillion and was six times of Las Vegas, with average revenue ranking first worldwide. It also had brought enormous economic benefits to local places. In 2005 the GDP of Macau was 56.2 billion while in the year 2012, the number soared to 348.2 trillion and the GDP per capita exceeded 610 thousand, ranking 2nd in Asia and 6th in the world. Besides, it contributes over 12 trillion to the taxation of this year, taking over 85% of the governments' total income [12].

To guarantee the healthy development of this industry, major gambling corporations in Macau have long been actively presenting themselves to be socially and ethically responsible and launched policies like RG information kiosks, problem gambling helping and resulting platform, community education on correct cognition towards gambling, and education class preventing adolescents from problem gambling, etc. Responsible Gambling (RG) has obtained favourable effects. According to the gambling survey by University of Macau 2020, the popularity of RG among populations has reached 64.4% [13].

3.2 The Controversy of Gambling Industry

According to Satz's work [14], the controversy of this industry lies in the sources and consequences of this particular market.

1). Transactional Nature of the Gambling Industry.

The organization of the gambling industry is illustrated in Fig. 2. The supply chain of the gambling industry mainly includes two parts: gambling firms' cooperation with suppliers and interaction with consumers [15, 16]. In this digital age, with the spread of

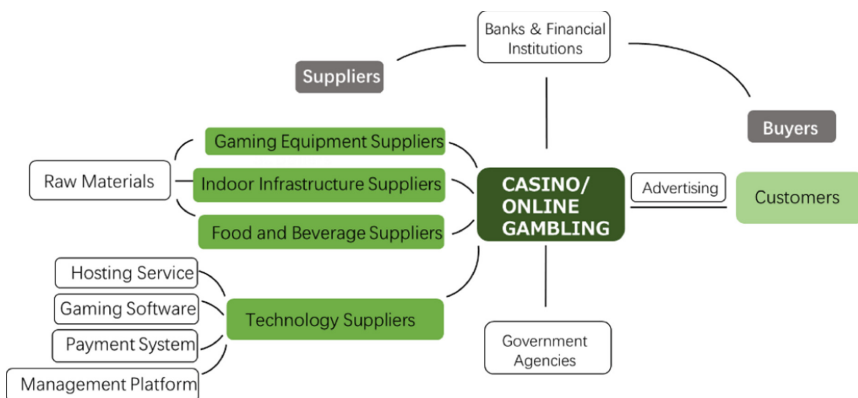


Fig. 2. Supply chain of the gambling industry

the pandemic, the online gambling industry based on artificial intelligence is developing rapidly. There has also been a gradual increase in cybersecurity attacks disguised as online gambling, which further increased the controversy over the gambling industry.

2). The Consequences of Gambling.

According to Public Health, the harmful consequences of gambling is mainly composed of two parts—addiction and social problems.

John pointed out that though from the view of entertainment consumption, gambling does not have many differences with electronic games and even golf, the problem is that when gambler invested money and time that he could not afford, it is very possible that he could suffer psychological disorder and commit economic crimes or family violence and other social problems, which harm the entire society [17]. In other words, over gambling may harm the social total welfare, and people may conduct cross-border criminal activities such as money laundering through the digital currency transactions of online gambling. Thus, the social problems caused by gambling usually affect larger and longer.

3). Why People Gamble.

Generally, the controversy of the gambling industry mainly comes from the concerns about problem gambling. To understand what caused problem gamble, we need to understand why people gamble.

As mentioned above, people go to casino resorts not only to look for games but also for various purposes [18]. According to Richins' work [19], gambling consumers can realize their purposes through four symbolic values of gambling, namely, utility value, interpersonal value, hedonic value and identity value. Gamblers could acquire money, socialization, excitement and admiration from other people, which all together make gambling addictive. Figure 3 is a comic from "Family Guy" from which vividly illustrates the hedonic value of gambling.



Fig. 3. Gambling vs working

3.3 Verification

Figure 4 illustrates the accounting of the total revenue of the gambling companies in our verification. The dashed line refers to the marginal benefits of corporations, and we assume that U is positive utilities that corporations acquire.

Gambler Utility Model,

$$U = \alpha \ln(R + 1) + I - Q \quad (1)$$

Net loss of utility,

$$NL = R \quad (2)$$

Profits of gambling institutions,

$$\pi = \frac{R(1-p)}{p} \quad (3)$$

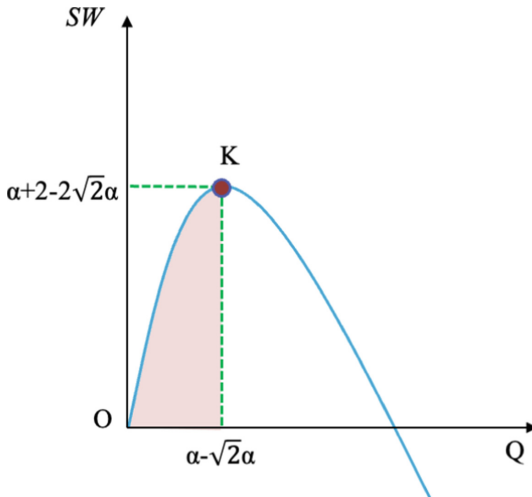


Fig. 4. Function of social total profits

Social total profits,

$$SW = \pi - NL \quad (4)$$

α refers to consumers' preference towards gambling (or other consumption), $\alpha > 2$; I refers to the total money income of consumers; R refers to the money award consumers gained through gambling; $p \in (0, 1)$ refers to the odds of returning money; Q refers to the number of gambling consumers and π refers to gambling companies' profits.

According to the definition, we can get the following relations,

$$R = p \cdot Q \quad (5)$$

Assuming that there is only one gambling company, and gambling consumers aim to realize their effect and benefits maximizing,

$$\frac{dU}{dR} = \frac{\alpha}{R+1} - \frac{1}{p} = 0 \quad (6)$$

And we can get $R = \alpha p - 1$. Due to the fact that gambling games are released by gambling companies, they have to consider the social cost of releasing games, thus to realize the social total profits maximizing,

$$SW = \pi - NL = \frac{R(1-p)}{p} - R \quad (7)$$

Now plug (6–7) into (5) and we can get a function that SP varies according to the value Q ,

$$SW = Q + 2 - \frac{2\alpha}{\alpha - Q} \quad (8)$$

Thus, when $Q = \alpha - \sqrt{2\alpha}$, companies get the maximum of social total profits SP , that is $W = \alpha + 2 - 2\sqrt{2\alpha} > 0$, and the function is illustrated in Fig. 4.

According to the analysis above, we can infer that during the appropriate consumption stage, the social total profits increase with the amount of gambling consumption, and when reaching a particular amount, the social total profits reach their maximum. When gambling consumption continues and enters the excessive consumption stage, though the profits of companies increase to some extent, the negative social externality caused by this results in a decrease in marginal utility and the decreasing rate of MU is faster than the increasing rate of companies' profits. But more important is that social total profits are impacted in this process, and thus causes extra social costs. Therefore, companies should implement social responsibility in time to realize the sustainable development of companies and the whole industry and the healthy development of social total profits.

Table 1 illustrates a summary of gross income by gaming type from 2005 to 2021, Fig. 5 shows the gross income of gambling with less amount of money apart from lucky gambling from 2005 to 2021, and the main gambling type is lucky gambling.

Figure 6 shows the gross income and the increasing social responsibility awareness of the gambling industry in Macau from 2005 to 2021. During the last 20 years, both the gross income and social responsibility awareness increased significantly, contributing to better sustainability of gambling companies in Macau.

Table 1. Summary of gross income by gaming type

| Year | LB | DR | HR | CL | JF | FB | BB | Total |
|------|---------|-----|-----|----|--------|-----|-----|---------|
| 2005 | 46,047 | 67 | 636 | 7 | 0.03 | 333 | 44 | 47,134 |
| 2006 | 56,623 | 67 | 437 | 7 | 0.03 | 327 | 60 | 57,521 |
| 2007 | 83,022 | 98 | 403 | 6 | 0.02 | 274 | 44 | 83,847 |
| 2008 | 108,772 | 186 | 501 | 6 | 0.003 | 304 | 57 | 109,826 |
| 2009 | 119,369 | 327 | 333 | 6 | 0.0024 | 279 | 69 | 120,383 |
| 2010 | 188,343 | 340 | 440 | 6 | 0.0023 | 380 | 79 | 189,588 |
| 2011 | 267,867 | 297 | 440 | 6 | 0 | 362 | 86 | 269,058 |
| 2012 | 304,139 | 205 | 356 | 6 | 0.0014 | 418 | 111 | 305,235 |
| 2013 | 360,749 | 178 | 365 | 5 | 0.0024 | 419 | 150 | 361,866 |
| 2014 | 351,521 | 145 | 306 | 6 | 0.0014 | 598 | 138 | 352,714 |
| 2015 | 230,840 | 125 | 166 | 7 | 0.0021 | 503 | 170 | 231,811 |
| 2016 | 223,210 | 71 | 141 | 7 | 0.0004 | 541 | 158 | 224,128 |
| 2017 | 265,743 | 46 | 104 | 10 | 0.0001 | 519 | 185 | 266,607 |
| 2018 | 302,846 | 23 | 101 | 13 | 0.0014 | 674 | 222 | 303,879 |
| 2019 | 292,455 | - | 98 | 14 | 0.0009 | 534 | 211 | 293,312 |
| 2020 | 60,441 | - | 50 | 13 | 0.0006 | 400 | 143 | 61,047 |
| 2021 | 86,863 | - | 47 | 16 | 0.0009 | 415 | 214 | 87,555 |

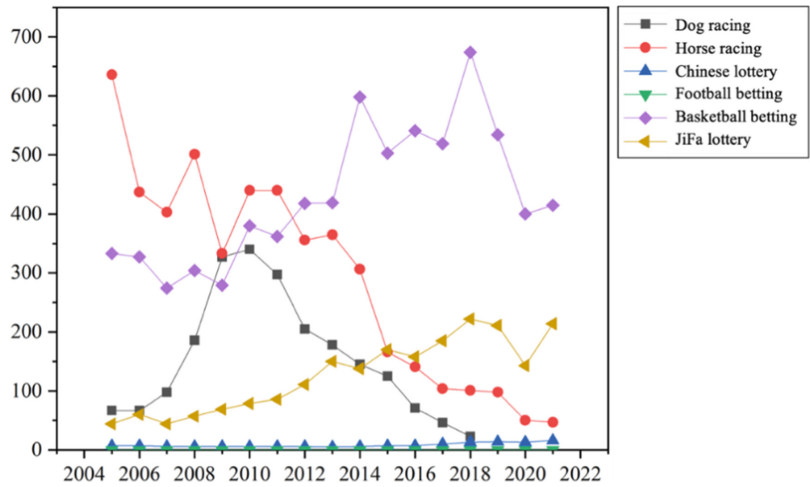


Fig. 5. The gross income of gambling with less amount of money apart from lucky gambling from 2005 to 2021.

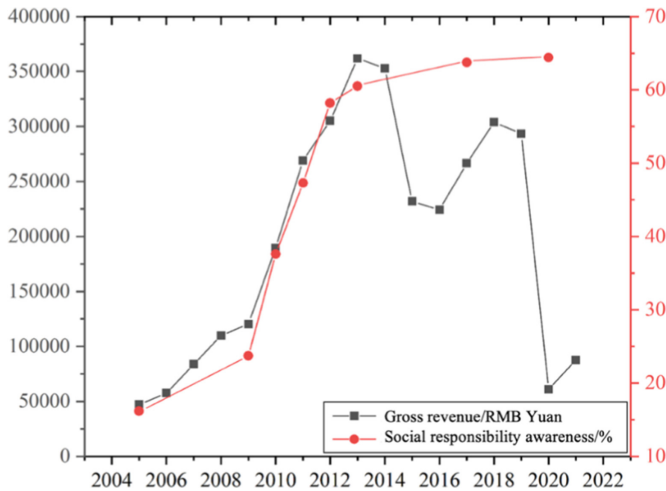


Fig. 6. The gross income and the social responsibility awareness of the gambling industry in Macau from 2005 to 2021.

4 Implications for Other Industries

Gambling is one of the industries that bear the most bias because of its unique cultural background and economic structure. However, such a controversial industry has not only survived from hundreds of years of turbulent history and colonial stages but also became the most significant industry in Macau, contributing over 85% of local taxation and 80% of GDP, becoming the main income resource of Macau government. It boosted other industries like tourism, construction and retailing, and the GDP per capita ranked 2nd in Asia in 2012. Figure 7 shows that the gross revenue of gaming and gambling industry in Macau kept increasing in the last years before 2020 when pandemic burst out. The main reason is that the long-run benefit of the gambling industry in Macau is always highly consistent with the overall interest of the economy and society of Macau, which means that every gambling company has to integrate social responsibilities as the major part of its company culture and value. This inspired us that if such an industry can overcome bias, survive hundreds of years and guaranteed both the healthy development of the industry but also the stable progress of the entire society by implementing social responsibilities, why cannot the other industries?

In contrast with gambling, the future of another entertainment industry gaming is not optimistic. According to Fig. 8 from China Audio-Video and Digital Publishing Association, though the gross revenue of the domestic gaming market increased by 6.4% in 2021, the increasing rate has decreased by 15% due to the decline of stay-at-home economy and the number of innovative gaming products, and the users are becoming saturated and only increased 0.22%. The gaming industry will experience a stressful future if this situation continues. Compared with the gambling industry, making profits is still the biggest goal of game companies. According to relevant surveys, the game addiction rate of Chinese adolescents is nearly 30%, which results in society's poor reception of this industry. Society's perception also affects the amount of investment in

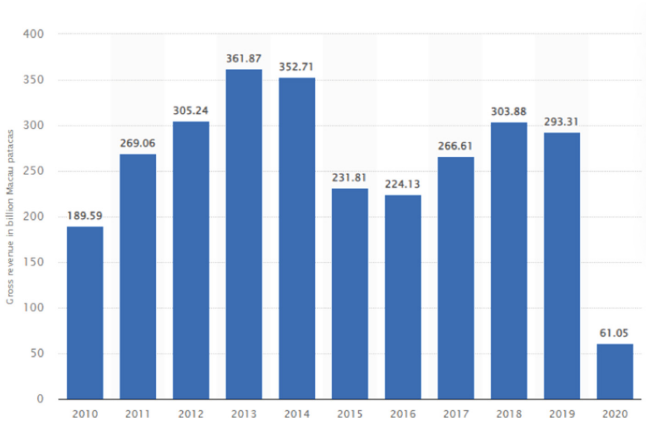


Fig. 7. Gross revenue from gaming and gambling in Macau from 2010 to 2020 (in billion Macau patacas)

the gambling industry. According to “The Report on Mobile Game Industry in China 2019”, the total investment in the gaming industry has dropped 92.6% from 2016.

The same situation and contradictions also exist in many industries like the Internet and manufacturing. For most domestic companies, carrying out social responsibilities and making economic profits are still two separate parts. Top companies worldwide have long shown their active interest in building their company core value as socially responsible. Since 1970, Starbucks has committed to sustainability and strengthening the community, such as opening special stores for disabled people. In 2020, Apple Inc. Has realized 100% carbon-neutral in all its subsidiary corporations, and improved forest management in over 100 acres forests globally.

In contrast, the domestic economic structure is not optimistic. There are domestic companies that are trying to implement CSR strategies like Lenovo who committed to

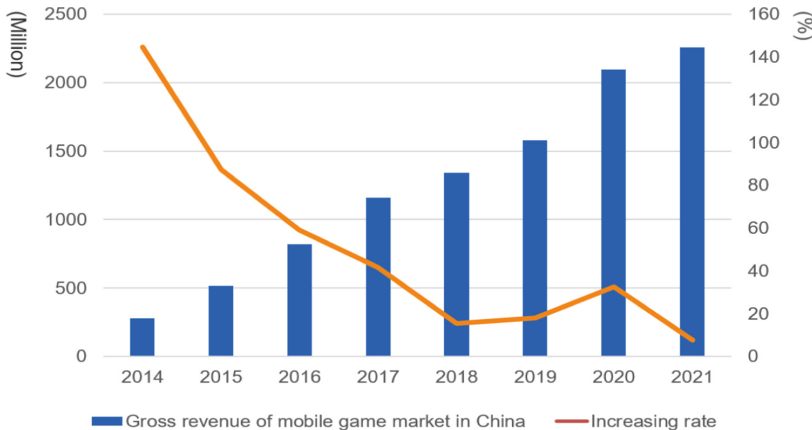


Fig. 8. Increasing rate of the gross revenue of game market in China

domestic education reform, launching the “5 ABCEDS” strategy, providing technics and software supports to the informationization and optimal allocation of resources in domestic education. In 2016 The Ant Group launched “Ant Forest” and claimed to be responsible for the environment. However, while carrying out social welfare project, The Ant Group still did not forget to conduct heavy propaganda to promote higher user traffic. But for many domestic companies like The Ant Group, implementing CSR is still a partial strategy that serves to make profits, donating some money or organizing several public welfare projects occasionally while making profits. However, providing money is the most “irresponsible” social responsibility, and CSR needs to be a long-run strategy.

Thus in this new age where unexpected challenges happen without warning, besides seeking economic transformation and technology innovation to realize economic development in a short term, implementing CSR strategy and company value is a part of each company’s necessary formation which contributes to one company’s healthy growth, sustainable development and even structural reform in a long run.

5 Conclusions

This essay applied an adapted model based on margin benefits to describe corporate social responsibility and verified the model using the example of Macau, which contributes to the lack of CSR literature study in special industries. Meanwhile, we give further advice to other industries carrying out social responsibility based on the findings and provide suggestions on the domestic company and economic structure transformation.

Covid-19 has brought challenges to economics and industries, at the same time, it also provides chances for corporations to better carry out social responsibilities and combine CSR with company values. A more optimistic view is that covid-19 will accelerate the post-pandemic CSR development as companies realize the importance of the balance between pursuing profit and harmony with their various stakeholders. Pandemic could be the end of some corporations, and also a turning point for those companies that present higher CSR value.

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