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A Double-Edged-Sword Effect of Overplacement: Social Comparison Bias Predicts Gambling Motivations and Behaviors in Chinese Casino Gamblers

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Abstract
Overconfidence, a widely observed cognitive bias, has been linked to increased gambling motivations and behaviors. However, previous studies have largely overlooked overconfidence under a social comparison context, known as overplacement, i.e., the tendency of individuals to believe that they are better than their similar peers. In the present study, we tested the effect of overplacement on gambling motivations and behaviors though a Pilot Survey of Chinese college students (N=129) and a Field Survey of Chinese Macao casino gamblers (N=733). Our results revealed a double-edged sword effect of overplacement: Serving as a risk factor, evaluating one self's earning ability as higher than others was linked to *more* gambling motivations (β=0.18, p=.005) and frequency (β=0.18, p=.004); Serving as a protective factor, evaluating oneself as happier than others was linked to *less* gambling motivations (β = −0.32, p<.001) and problem behaviors (β = −0.26, p<.001). These findings expand the relationship between overconfidence and gambling from a cognitive bias perspective to a social comparison perspective. Our study not only revealed a typical profile of gambling motivations and behaviors among different demographic groups in Chinese casino gamblers, but also highlighted the importance of considering social factors in the study of the psychological mechanisms of gambling.

Keywords Overplacement · Social comparison · Gambling motivation · Gambling behaviors · Chinese gamblers

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Introduction

As a popular recreation of modern human society, gambling industry was called to be "the centrality of economy in the post-industrial era" (Schüll, 2012). Even in countries where gambling is prohibited by law, such as China, the flurry of Chinese gamblers makes Macao has surpassed Las Vegas as the world's largest gambling market (Tang & Sheng, 2009). Numerous research has shown that gambling can be potentially harmful to individual's health, economy, and society (Muggleton et al., 2021; Salonen et al., 2018; Williams et al., 2012). Therefore, it is crucial to identify and intervene with potential problem gamblers at an early stage by screening for potential identifiers of problem gambling.

Most previous studies have revealed factors involved in an individual's cognitive process can predict their gambling intention and behaviors, e.g., illusion of control (Johansson et al., 2009), illusion of causality and correlation (Jacobsen et al., 2007), risk perception (Mishra et al., 2010), and temporal discounting (Cosenza et al., 2017; Nigro & Cosenza, 2016). However, the role of social cognition processes in gambling have been previously overlooked, albeit the increasing recognition of the importance of social context in gambling research (Gordon & Reith, 2019). In the current study, we highlight the role of overconfidence during social comparison (i.e., overplacement) in predicting gambling motivation and behaviors.

As a widely observed cognitive bias, *overconfidence* could be roughly divided into two aspects (Moore & Healy, 2008): (1) Overestimation (or overprecision), which refers to people subjectively estimating their own ability or precision as better than their objective performance (Pallier et al., 2002); and (2) Overplacement, which refers to people believing themselves to be better than other similar peers (also known as illusory superiority or the better-than-average effect) (Larrick et al., 2007; Moore & Healy, 2008).

In the field of gambling, most previous studies have focused on the first aspect of overconfidence, i.e., overestimation, and have identified overestimation as one of the key positive reasons for (problem) gambling (Clark, 2010). Overconfident gamblers (i.e., gamblers who inflated the probability of winning) may have a greater willingness to wager (Kwak & Hee, 2016) and place larger bets (Camchong et al., 2007; Goodie, 2005), although their actual betting performance is even worse compared to those who are less confident (Goodie, 2005). As a risk factor for problem gambling, greater overconfidence has also been observed among pathological gamblers (Camchong et al., 2007; Goodie, 2005). From the cognitive mechanism of gambling (Clark, 2010), this inappropriately overconfident estimation of the probability of winning may stem from distorted beliefs (e.g., illusions of control) about gambling (Clark, 2010; Langer, 1975; Thompson et al., 1998), which may be the main cause of continuous gambling (Raylu & Oei, 2004; Toneatto et al., 1997).

However, the role of the other half of the overconfidence, i.e., *overplacement*, has still been under-investigated in gambling. Recent studies have shown that people's risky behavior could be significantly impacted by the social comparison process (Linde & Sonnemans, 2012; Liu et al., 2021; Spohn et al., 2022). For example, higher social comparison orientation has been related to higher trait competitiveness and more risk-taking behaviors (Liu et al., 2021). Given that gambling is a typical form of taking risks (Mishra et al., 2010), one's willingness or behavior towards gambling should also be impacted by the same social comparison process and the bias during this process, such as overplacement (Larrick et al., 2007).

In this current study, we propose a double-edged-sword hypothesis of overplacement bias in relation to gambling. That is, overplacement bias can predict people's gambling motivation and behavior, and the direction of this prediction may be opposite depending on the domain of the overplacement bias. Specifically, overplacement bias on one's external ability (e.g., earning ability) may positively predict gambling, while overplacement bias on one's internal states (e.g., well-being) may negatively predict gambling.

Here, we proposed that the overplacement bias on one's external ability may function as a risk factor links to greater gambling motivations and behaviors. This hypothesis is supported by evidence in the broader domain of risk-taking behavior. The overplacement bias, which involves evaluating oneself as superior to peers, shares a similar psychological basis with the overestimation bias, which involves evaluating oneself as better than reality (Larrick et al., 2007). Thus, the overplacement bias on ability may predispose individual to adopt biased risk perceptions and engage in risky behaviors (Bruhin et al., 2018; Măirean & Havârneanu, 2018). For example, in a lab experiment, participants who perceived they could earn more relative to others also exhibited greater risky behavior (Linde & Sonnemans, 2012).

On the contrary, the overplacement bias on one's internal states (e.g., happiness) may indicate greater subjective well-being, and protect individuals from gambling motivations or behavior. The related evidence comes from a small but growing number of studies focused on overplacement bias about one's happiness or well-being (Taylor & Brown, 1988; Wojcik & Ditto, 2014). It should be noted that the overplacement bias regarding one's well-being is distinct from mere happiness or well-being. While happiness or well-being typically refers to one's subjective state of feeling good, overplacement bias places greater emphasis on the comparison with others (Moore & Healy, 2008). In other words, beyond experiencing happiness, individuals exhibiting higher levels of overplacement bias may perceive themselves as happier or better off than others or an average individual. Happier-than-average individuals may have higher self-esteem and experience less depression (Taylor & Brown, 1988), which may serve as protective factors against problem gambling (Farrell, 2018; Lai, 2006; Oei & Goh, 2014). Overplacement bias also indicates a general propensity for self-serving and self-enhancement (Alicke & Sedikides, 2011), while an attenuate self-serving bias was related to more behavioral addiction disorders (Wang et al., 2020).

The Current Study

Given that the role of overconfidence under a social context (e.g., overplacement) in the field of gambling has been overlooked, this research aimed to describe the key characteristics of gambling among different demographic groups of Chinese casino gamblers and to reveal the predictive effect of overplacement on gambling motivations and behaviors by two survey studies. Since higher risk-taking preference (Ciccarelli et al., 2016; Cosenza et al., 2017; Ledgerwood et al., 2009) and a higher temporal discount rate (Cosenza et al., 2017; Nigro & Cosenza, 2016) have been widely studied as risk factors of gambling, our research also compared the predicting effect of overplacement with these two risk factors.

In the Pilot Survey, with a college student sample (N=129), we designed a hypothetical scenario of legalized gambling, and preliminarily tested the predicting effect of overplacement bias on gambling motivations and expenditure. To ensure the ecological validity and

replicability, we then conducted the Field Survey (N = 733) around a casino in Macao with a representative sample of Chinese casino gamblers.

Pilot Survey

Method

Participants

A total of 129 college students were recruited through advertisements on social media. All participants were Chinese residents and above 18-year-old. All participants spent about 25 min to finish the survey through the WJX platform (www.wjx.cn). To ensure the quality of online responding, three questions were included to check attention (e.g., "Please choose Disagree for this item") in the questionnaire. Participants who failed to respond correctly on these questions were excluded from subsequent data collection. Participants who passed check questions received a payment of 30 RMB.

All participants gave written informed consent before the survey. The study was approved by the Institutional Review Board of the Institution of Psychology, Chinese Academy of Sciences (No. H22090).

Measurements

The survey was consisted of four questionnaires: (1) gambling motivation and expenditure; (2) overplacement bias; (3) gamble-related decision preferences (risk preference and temporal discounting); (4) demographics.

Gambling Motivation and Expenditure

Since gambling is illegal in mainland China, it could be foreseeable that most participants would report no gambling motivation or expenditure based on the real-world situation. Thus, participants were required to imagine a hypothetical scenario that they were living in a city approving the legalization of gambling, and then answered the following questionnaires:

Gambling Motivation. The revised Chinese version of Gambling Motives Questionnaire (GMQ) (Stewart & Zack, 2010) asked participants to report the reasons of their gambling on a 4-point Likert scale (1 = *almost never / never*, 4 = *almost always*). GMQ comprises 3 subscales (i.e., social motives, coping motives and enhancement motives) on 15 items with a Cronbach's α in our sample of 0.93 (for three subscales, ranged from 0.78 to 0.87). A higher score refers to higher gambling motivation.

Gambling Expenditure. Participants were told to imagine their monthly income was 10,000 RMB, and then they needed to estimate their average monthly expenditure on gambling on a sliding bar ranging from 0 to 10,000.

Overplacement Bias

A two-item peer-comparison task was used to measure participants' overplacement bias (OB) on well-being and earning ability. Participants self-ranked their well-being and earning ability within 100 randomly selected peers (1 = *the top ranking*, 100 = *the last ranking*). The two overplacement bias scores (range: −0.50 ~ +0.49) were calculated by (50 – self-ranking) / 100. A positive/negative score represents an over/under-placement tendency, meaning the participant estimate his/her level of well-being or earning ability is above/below than average peers. Here, the measurement of overplacement bias diverged from conventional assessments of mere well-being (Farrell, 2018; Oei & Goh, 2014) or ability: Rather than a self-rating absolute value, this score measured the well-being or ability relative to others through a social comparison. Thus, this measurement could align closely with the concept of overplacement, and provide an unambiguously index of one's self-evaluation bias (Zell et al., 2020).

Gamble-Related Decision Preferences

Risk Preference. The Risk Propensity Scale (Meertens & Lion, 2010) was used to measure participant's dispositional risk-taking tendency. Participants rated 7 items on a 9-point Likert scale ranging from 1 (*totally disagree*) to 9 (*totally agree*), except for the last item (1 = *risk avoider;* 9 = *risk seeker*). After reversed scoring for 4 items, the scores of all items were averaged. A higher score means the participant tends to be more risk-taking. In this sample, the scale's Cronbach's $\alpha = 0.71$.

Temporal Discounting. Participants' temporal discounting was measured by the 21-item Monetary Choice Questionnaires (Kirby & Marakovic, 1996). Participants needed to make choices between a small but immediate reward and a larger but delayed reward. The former option ranged in value from 75 RMB to 415 RMB, while the latter option ranged in value from 150 RMB to 425 RMB with delays ranging from 10 to 75 days. The automatic scoring tool (Kaplan et al., 2016) was used to calculate the overall discount rates of participants. A higher discount rate means that individuals discount future rewards more steeply.

Demographics

The demographic information including participant's age, gender (0 = Female, 1 = Male), education level (0 = Undergraduate student, 1 = Postgraduate student), and their family income group (0 = Under 10,000 RMB/month, 1 = Above 10,000 RMB/month).

Data Cleaning and Data Analysis

A valid sample of 128 participants was included for data analysis since one participant showed low consistency (lower than 80%) in the Monetary Choice Questionnaires. No outliers were detected or excluded for other variables.

The data analysis was conducted by R 4.0.3 (R Project for Statistical Computing). The following R packages or functions were used respectively: *lm* for linear regression models and *bruceR* (Bao, 2022) for presenting results. The levels of significance for all analyses were set to 0.05.

Results

The descriptive results and correlation matrix were reported in Table 1. These results suggested that (1) the gambling motivation was positively correlated with gambling expenditure; (2) the overplacement bias on well-being was negatively correlated with gambling expenditure; (3) the correlation between overplacement bias, risk preference, and discounting was not significant, indicating our measurements of gambling had a fair validity and the predictors of gambling were relatively independent.

To test the predicting effect of overplacement bias, regression models were conducted using two overplacement bias as predictors, gambling motivation / expenditure as outcomes respectively. For gambling motivation, the regression models showed that the effect of both overplacement bias was insignificant ($ps > .05$). For gambling expenditure, overplacement bias on well-being showed a negative predicting effect ($\beta = -0.25$, $p = .008$); while the predicting effect of overplacement bias on earning ability was insignificant with a positive direction ($\beta = 0.13$, $p = .181$). After controlling the risk preference, temporal discounting and demographics, the predicting effect of overplacement bias on well-being ($\beta = -0.25$, $p = .009$) and on earning ability ($\beta = 0.17$, $p = .068$) was still the same in significance and direction.

These results provided preliminary evidence for a double-edged-sword effect of overplacement bias. In detail, the overplacement bias on well-being was negatively associated with gambling; while in contrast, the overplacement bias on earning ability showed a weak correlation (in positive direction but not significant) with gambling. However, the ecological validity of these results may be poor because (1) the measurement of gambling motivations and expenditure were based on a hypothetical scenario instead of the real-world situation; (2) most of our participants were college students without any gambling experience. To solve these limitations, in the followed Field Survey, we replicated the survey among large, ecologically valid sample of casino gamblers.

Field Survey

Method

Participants

Casino visitors were randomly interviewed to participate in the survey by 30 trained postgraduate students outside of the biggest casino of Macao. The entry criteria of participants were: (1) Chinese residents (including Mainland China, Hong Kong, Macau, and Taiwan residents) and Chinese native speakers; (2) above 18-year-old; (3) having casino gambling experience during the previous year. A total of 733 participants voluntarily completed the survey (about 20 min). For participant's detailed demographic information, see Table 2.

The study was approved by the Research Committee of Macao Polytechnic University (P028/GTRC/2011). All participants completed oral informed consent before survey and received a payment of 30 MOP (about $ 3.7) after survey.

Table 1 The descriptive and correlation of main variables in the pilot survey

Variable	*M* / %	*SD*	1	2	3	4	5	6	7	8	9
1. Gender (Male)	0.61	—	—								
2. Age	21.35	1.63	–0.14	—							
3. Education (Postgraduate)	0.04	—	–0.09	0.18*	—						
4. Family income (>10,000 RMB/month)	0.54	—	0.00	0.03	0.10	—					
5. Gambling motivation	2.63	0.66	–0.15	–0.15	–0.09	–0.18*	—				
6. Gambling expenditure (sqrt)	32.76	18.66	0.05	–0.05	–0.12	–0.09	0.44***	—			
7. Overplacement (well-being)	0.14	0.23	–0.00	0.13	0.03	0.07	–0.04	–0.19*	—		
8. Overplacement (earning ability)	0.02	0.21	0.13	–0.17	0.07	0.10	–0.06	0.03	0.43***	—	
9. Risk preference	2.97	0.90	0.18*	–0.14	–0.01	–0.01	0.06	0.02	–0.07	0.09	—
10. Discount rate (log)	–4.08	1.41	0.08	0.16	–0.09	–0.06	0.16	0.32***	–0.01	–0.11	–0.08

Note *$p<.05$. **$p<.01$. ***$p<.001$

Measurements

The survey was mostly similar to the Pilot Survey, and consisted of four questionnaires: (1) gambling motivation and behaviors; (2) overplacement bias; (3) gamble-related decision preferences; (4) demographics.

Gambling Motivation and Behaviors

The Field Survey quantitated participant's gambling with four aspects: gambling motivation, gambling frequency, gambling expenditure, and problem gambling behavior.

Gambling Motivation. The measurement of gambling motivation was the same as the Pilot Survey. In this sample, the Cronbach's α was 0.94 (for three subscales, ranged from 0.81 to 0.90).

Gambling Frequency. Participants were required to report their gambling frequency on each of 13 popular gamble games[1] in Macao casino during the previous year. The gamble types were revised from the previous research (Li et al., 2010; Zhou et al., 2012). The sum of gambling times of all games was used as participant's gambling frequency.

Gambling Expenditure. Participants were required to report their average gambling expenditure per month on 13 popular gamble games (Li et al., 2010; Zhou et al., 2012). The reported gambling expenditure by other currency (e.g., MOP, RMB, etc.) were converted to RMB at the prevailing exchange rate. The summed of gambling expenditure of all games was used as participant's gambling expenditure.

Problem Gambling Behavior. The diagnostic criteria for pathological gambling in DSM-IV (American Psychiatric Association, 2012) was used to measure participants' problem gambling behavior. Participants answered whether they had 10 gamble-related problem behaviors (e.g., lies to conceal the extent of involvement with gambling) in the previous year. Gamblers meeting five (or more) of those behaviors should be categorized as problem gamblers. The total number of positive responses (ranging from 0 to 10) was used as problem gambling score.

Overplacement Bias

Same as the Pilot Survey, a two-item questionnaire of overplacement bias was used.

Gamble-Related Decision Preferences

Risk Preference. The same as the Pilot Survey, the Risk Propensity Scale was used. In the Field Survey, the scale's Cronbach's $\alpha = 0.71$.

Temporal Discounting. In the Field Survey, participants' temporal discounting was measured by a matching task. Participants filled in a blank with an amount that would make them feel equal between an amount of immediate reward and a delayed reward of 10,000 RMB. Participants answered questions about three different delays: 0.5 year, 1 year, and 3 years. The area under the curve (AUC, range 0∼1) method was used as a single index to

[1] These games included Fan-tan, baccarat, greyhound racing, cussec, football lottery, paikao, horse racing, blackjack, roulette, Chinese lottery, mahjong, stud poker, and slot machines. Please refer to the DICJ web site for detailed information, http://www.dicj.gov.mo/web/en/rules/index.html.

Table 2 The demographic characteristics of participants in the Field Survey

Variables	Levels	*N*	%
Gender	Male	388	52.96%
	Female	339	46.25%
	Missing	6	0.82%
Age (years)	18–24	128	17.46%
	25–34	236	32.20%
	35–44	185	25.24%
	45–54	131	17.87%
	> 55	42	5.73%
	Missing	11	1.50%
Personal income per month	< 10,000 RMB	381	51.98%
	≥ 10,000 RMB	309	42.16%
	Missing	43	5.87%
Education	Junior high school or below	177	24.15%
	Senior high school	233	31.79%
	Junior college	123	16.78%
	University or above	192	26.19%
	Missing	8	1.09%
Region	GuangDong province	197	26.88%
	Other provinces	146	19.92%
	Hongkong / Taiwan / Macao areas	384	52.39%
	Missing	6	0.82%

Note Given that about 44% of the Macao casinos visitors from China mainland is from GuangDong province (https://www.chyxx.com/industry/201806/647097.html), we listed GuangDong province as a separated group

compare discounting flexibly and sensitively (Myerson et al., 2001). A smaller AUC means that individuals discount future rewards more steeply.

Demographics

The demographic information including gender, age group, education level, income group, and region, details see Table 2.

Data Cleaning and Data Analysis

No outliers were detected or excluded for most of the variables, except for the temporal discounting. A valid sample of 407 participant were included for temporal-discounting related analysis after data cleaning (details see Supplementary Materials). For the results of gambling expenditure, since about 29% participants (N=214) declined to report their expenditure on gambling, these results were only included in our Supplementary Materials (Table S4).

The principle of data analysis was similar to the Pilot Survey. An extra R functions *lmrob* of *robustbase* (Maechler, et al., 2022) was used for robust regression, *yarrr* (Phillips, 2017) and *ggplot2* (Wickham, 2016) was used for visualization in the Field Survey.

Results

Validity Check of Gambling Motivation and Frequency

A comparison between problem and non-problem gamblers was conducted to the cross-check the validity for the measurement of gambling motivation and frequency. A total of 110 participants (15.00%) met five (or more) diagnostic criteria in DSM-IV and were categorized as problem gamblers. Since all the respondents were casino visitors, the prevalence rate of problem gamblers in our sample was similar to but somewhat higher than the previous study in Macao (10.4%, Chen et al., 2018).

Independent *t*-tests (Fig. 1) showed that problem gamblers had significantly higher gambling motivation ($p < .001$, Cohen's $d = 1.15$) and gambling frequency ($p < .001$, Cohen's $d = 0.95$) than non-problem gamblers. In particular, while comparing the motivation differences between the two gambler groups (ANOVA), the difference on enhancement motivation ($p < .001$, Cohen's $d = 1.68$) and coping motivation ($p < .001$, Cohen's $d = 1.51$) were significantly greater than on social motivation ($p < .001$, Cohen's $d = 0.88$). These results replicated that the difference of internal, emotion-regulation motive (coping and enhancement) between problem and non-problem gamblers was significantly larger than social

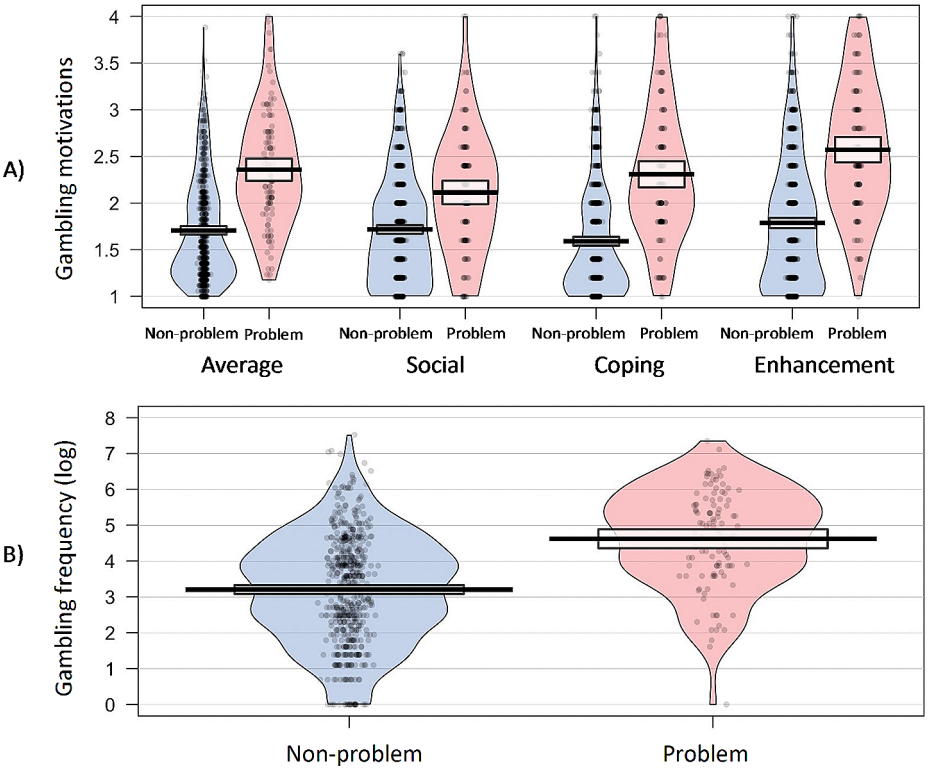

Fig. 1 The violin plot of gambling motivation (**A**) and gambling frequency (**B**) among problem and non-problem gamblers. Points, raw data point; lines, means; rectangles, 95% confidence interval (same as below)

motive (Stewart & Zack, 2010), suggesting the validity of the measurements of gambling motivation and frequency.

The Differences of Gambling Motivation and Behaviors among Demographic Groups

Overall, different demographic groups in our sample showed some significant and consistent individual differences on gambling motivation and frequency (see Fig. 2 for detailed information). *T*-test (for gender and income) and ANOVA (for age, education, and region) showed that males had higher gambling motivation, frequency, and problem behaviors ($ps < .05$) than females; Younger gamblers (18–24 years) had the lowest, while middle-aged gamblers (35–44 and 45–54 years) had the highest gambling motivation, frequency, and problem behavior ($ps < .001$); Gambler with the junior high school or below education level had the highest gambling frequency and problem behavior ($ps < .05$); Gamblers with higher income (above 10,000 RMB/month) had higher gambling motivation, frequency, and problem behavior ($ps < .05$); Gambler from other provinces (except Guangdong) of China had the highest gambling motivation and problem behavior ($ps < .05$).

The Predicting Effect of Overplacement on gamble-related Outcomes

The descriptive results (see Table 3) showed that the two overplacement bias scores were significantly greater than 0 ($ps < .001$), suggesting significant overplacement bias on both well-being and earning ability among participants. Moreover, the correlation matrix suggested the two overplacement bias and risk preference were significantly correlated with gambling motivation and frequency; while the correlation between overplacement bias, risk preference, and discounting was not significant (r range from – 0.08 to 0.07, $ps > .05$), showing these predictors were relatively independent.

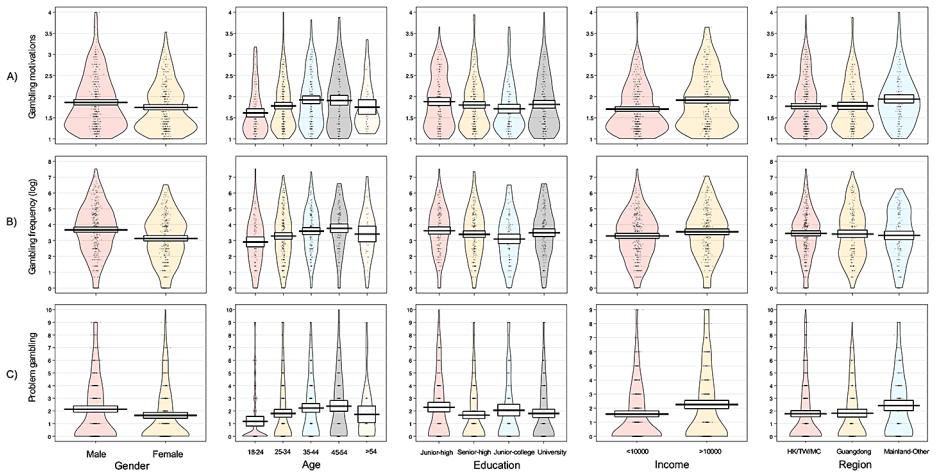

Fig. 2 The violin plot of gambling motivation (**A**), gambling frequency (**B**) and problem gambling behavior (**C**) among different demographic groups (gender, age, education, income, and region). Points, raw data point; lines, means; rectangles, 95% confidence interval

Table 3 The descriptive statistics and Pearson correlation matrix of main variables in the Field Survey

Variable	*N*	*M*	*SD*	1	2	3	4	5	6
1. Gambling motivation	700	1.81	0.61	—					
2. Gambling frequency (log)	682	3.43	1.57	0.35***	—				
3. Problem gambling	733	1.91	2.37	0.53***	0.42***	—			
4. Overplacement (well-being)	728	0.21	0.26	–0.18***	–0.03	–0.23***	—		
5. Overplacement (earning ability)	726	0.12	0.26	0.00	0.08*	–0.11**	0.51***	—	
6. Risk preference	720	3.74	1.22	0.23***	0.29***	0.20***	–0.04	0.07	—
7. Temporal discounting (AUC)	403	0.63	0.35	–0.00	–0.08	–0.08	–0.08	0.03	0.02

Note The sample sizes differed due to missing values. *$p<.05$. **$p<.01$. ***$p<.001$

A set of regression models were conducted to test the predicting effect of two overplacement bias on gambling motivation and behaviors. Given the violation of residual normality assumption, the robust regression models based on an M-estimator using iteratively reweighted least squares estimation (Field & Wilcox, 2017; Koller & Stahel, 2011) was used instead of the OLS regression. The OLS regression showed similar results and was reported in Supplementary Materials (Table S5). Given no significant interaction between overplacement bias and sub-types of gambling motivation, the average score of gambling motivation was used in later analysis (see Table S6 in Supplementary Materials for the results on three sub-types of gambling motivation).

Model 1 estimated the pure predicting effect of two overplacement bias on gambling motivation and behaviors. Model 1 (Table 4, see Figure S1 for the scatterplot) showed that the overplacement on well-being and earning ability had similar but opposite predicting effect on gambling motivation and frequency. In detail, participants with a higher level of overplacement on well-being (i.e., self-reported more well-being than average peers) would have less motivation to gamble ($\beta = -0.25$, $p<.001$), and gamble less frequently ($\beta = -0.11$, $p=.028$). Contrarily, participants with a higher level of overplacement on earning ability (i.e., self-reported higher earning ability than average peers) would have higher motivation to gamble ($\beta=0.14$, $p<.001$), and gamble more frequently ($\beta=0.15$, $p=.003$). However, only overplacement on well-being can predict problem gambling behavior: participants with a higher level of overplacement on well-being also showed less problem gambling behaviors ($\beta = -0.21$, $p<.001$). These results added more evidence to the double-edged-sword effect of overplacement bias: overplacement on well-being more likely functioned as a protective factor; while in contrast, overplacement on earning ability more likely functioned as a risk factor.

Model 2 showed similar patterns of results after controlling demographic variables, except that the overplacement on well-being failed to predict gambling frequency. The results also suggested the predicting effects of several demographics: male (vs. female), middle-aged (vs. young-aged), low-income (vs. high-income), and low-education (vs. senior-high-school or junior-college education) gamblers may likely to have higher gambling motivation, frequency, or problem behaviors (see detailed coefficients in Table S1 - S3).

Model 3 and Model 4 examined the predicting effect of overplacement bias vs. two competing predictors: gamble-related decision preferences, i.e., risk preference and temporal discounting respectively. Still, these models showed a same prediction pattern of two overplacement bias (well-being and earning ability). Meanwhile, a higher risk preference or steeper future-discounting tendency was also linked to more gambling. That is, a higher

Table 4 Robust regression results of overplacement to predict gambling motivation, gambling frequency and problem gambling behaviors

Outcome	Gambling motivation					Gambling frequency					Problem gambling behavior				
Model	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
OB-WB	–0.25***	–0.25***	–0.23***	–0.33***	–0.32***	–0.11*	–0.09	–0.07	–0.15*	–0.09	–0.21***	–0.21***	–0.21***	–0.27***	–0.26***
	(0.04)	(0.04)	(0.04)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
OB-EA	0.14***	0.14**	0.12**	0.21**	0.18**	0.15**	0.18***	0.12*	0.20**	0.18**	0.03	0.01	0.001	0.004	–0.04
	(0.04)	(0.05)	(0.04)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
Risk preference			0.19***		0.11			0.30***		0.27***			0.19***		0.17***
			(0.04)		(0.05)			(0.04)		(0.05)			(0.03)		(0.05)
Discounting				–0.04	–0.09				–0.11*	–0.15**				–0.13**	–0.15**
				(0.04)	(0.05)				(0.05)	(0.05)				(0.05)	(0.05)
Demographics	No	Yes	No	No	Yes	No	Yes	No	No	Yes	No	Yes	No	No	Yes
N	697	645	688	383	358	678	628	669	378	352	726	671	717	402	375
R^2	0.048	0.120	0.083	0.072	0.193	0.015	0.091	0.101	0.037	0.193	0.043	0.118	0.091	0.089	0.249
Adj. R^2	0.045	0.102	0.079	0.065	0.157	0.012	0.072	0.097	0.03	0.157	0.040	0.101	0.087	0.082	0.218

Note: OB-WB, overplacement bias of well-being; OB-EA, overplacement bias of earning ability. Standardized regression coefficients (*SE*) are displayed. The demographic variables are gender, age, education, and region (*Yes* means the regression included all these variables, detailed results see Table S1 – S3 in Supplementary Materials). * $p<.05$. ** $p<.01$. *** $p<.001$

risk preference (Model 3) could predict higher gambling motivation (β = 0.19, $p < .001$), frequency (β = 0.30, $p < .001$), and problem gambling behaviors (β = 0.19, $p < .001$); a smaller discounting AUC (Model 4) could predict higher gambling frequency (β = – 0.11, $p = .048$) and problem gambling behaviors (β = – 0.13, $p = .005$).

As a full model, Model 5 included all above-mentioned predictors. Again, the full model also supported a similar effect of two overplacement bias (well-being and earning ability). It should be noted that in Model 5, neither risk preference nor discounting AUC could predict gambling motivation ($ps > .05$), while the overplacement bias was the only factor showing a consistently significant predicting effect across gambling motivation and behavior ($ps < .01$). Overall, these results not only replicated the double-edged-sword effect of overplacement on gambling, but also showed that overplacement had a unique and more-generalized predictive validity on gambling even after controlling risk preference, discounting, and demographic variables.

General Discussion

With a Pilot Survey among Chinese college students and a Field Survey among Chinese casino gamblers, the study tested the predicting effect of overplacement on gambling motivations and behaviors, as well as revealed the profile of gambling motivations and behaviors among different demographic groups in Chinese casino gamblers. The results of two surveys supported the double-edged-sword hypotheses: overplacement on earning ability may function as a risk factor of (problem) gambling, while overplacement on well-being may function as a protective factor instead. In line with the recent appeal to incorporate the social context in gambling studies (Gordon & Reith, 2019), these results highlighted the overlooked predictor of overconfidence for gambling in a social comparison context (i.e., overplacement).

Characteristics of Gambling among Chinese Casino Gamblers

This current study described the key characteristics among different demographic groups of Chinese gamblers and their inter-group differences. Since surveys about Chinese gamblers, especially casino gamblers, were still limited (Un & Lam, 2016; Zeng et al., 2020), these results can help to draw typical demographic profiles of potential at-risk gamblers and lay the foundation for further targeted intervention programs.

On a population level, our study found that Chinese gamblers in Macao shared similar characteristics with those from other countries, especially the systematic differences in gambling motivations and behaviors among different demographic groups. Many of these demographic differences were consistent with previous research. Specifically, male (Loo et al., 2008; Welte et al., 2017), middle-aged (Welte et al., 2011, 2017) and low-education-level (Loo et al., 2008; Wills, 1981; Wong & So, 2003) gamblers were found to have higher gambling motivation or to engage more in gambling. Additionally, although previous findings about the impact of income on gambling have been mixed (Welte et al., 2017), our results supported the association between higher income and higher gambling motivation, frequency, and problem behaviors.

In addition, our revealed several enlightening differences between non-problem gamblers and problem gamblers in our sample. For example, non-problem gamblers reported lower

(M=1.71 on a 4-point scale) gambling motivations while the value of problem gamblers (M=2.36 on a 4-point scale) was higher, which was similar to the previous report (M=1.15 and 2.49, respectively) (Stewart & Zack, 2010). Consistent with the previous study in Canada (Stewart & Zack, 2010), this pattern of increased motivations from non-problem to problem gamblers was especially evident in coping and enhancement motivations rather than social motivations. Besides, our results also reported a prevalence rate of problem gamblers was about 15% among Macao casino gamblers, which was extraordinarily higher in gamblers from other provinces of Mainland China except Guangdong (24%) than other regions (14%). This rate closed with the previous data of 10.2% among Macao residents who gambled in the previous year (Chen et al., 2018), but notably higher than the rate in other countries, e.g., 6.8% in UK (Orford et al., 2013). This difference in prevalence rates may be due to the inconvenience to visiting casinos for gamblers from other regions of China compared to gamblers from Guangdong. However, it is important to note that these prevalence rates may be overestimated and difficult to compare between surveys due to two reasons: there is substantial heterogeneity in methodology and definitions of problem gambling across different studies (Calado & Griffiths, 2016); our sample mainly consists of casino visitors instead of a general population.

The Double-Edged-Sword Effect of Overplacement on Gambling and its Mechanism

Across two surveys, our results suggested that the overplacement on earning ability vs. happiness could predict a higher or lower level of participation in gambling. Specifically, this double-edged-sword effect of overplacement worked in predicting gambling motivations, gambling frequency, and problem gambling behaviors.

This observed double-edged-sword effect was in line with two separate lines of evidence on the impact of overconfidence. The predicting effect of overplacement bias on earning ability as a risk factor for gambling was consistent with the previous studies that mentioned overconfidence as a cognitive bias. That is, overestimation of the probability of winning may lead gamblers to bet more (Goodie, 2005; Kwak & Hee, 2016). This consistency may be due to the similar psychological basis shared by overestimation and overplacement (Larrick et al., 2007) when evaluating one's ability. For the overplacement on happiness as a protective factor for gambling, our results also added new evidence to support that overplacement could be a manifestation of self-enhancement (Moore & Healy, 2008), and promote one's psychological well-being (Taylor & Brown, 1988).

Overall, this double-edged-sword effect of overplacement on earning ability and happiness in predicting gambling may be explained by the different social comparison processes involved in evaluating one's external ability and internal states. In social comparison of external ability, a greater overplacement bias may imply that the individual is accustomed to choose an inferior target to compare with (downward comparison) (Zell et al., 2020). If this habitual trend of downward comparison can be generalized into the field of gambling embedded in a social context, it may lead gamblers to believe they could win at a higher probability than their peers. However, social comparison process of internal states is irrelevant to the comparing target and predominantly self-focused (Klar & Giladi, 1999). That is, although the respondents should have a similar level of happiness with the comparing target in the peer-comparison task, they may rank themselves as happier than others simply because they are just happy (Klar & Giladi, 1999). As previous studies suggesting subjec-

tive well-being as a protective factor of gambling(Farrell, 2018; Oei & Goh, 2014), a higher overplacement bias on happiness and (problem) gambling could also protect people from gambling.

An alternative explanation for the double-edged-sword effect may involve the joint effect of general and specific factors of overplacement. It is worth noting that overplacement bias on different domains may share a similar general factor, as our both surveys found a medium-level correlation ($r = .43$ or .51) between the two types of overplacement. Given that the wild-reported specificity and generality in overconfidence (West & Stanovich, 1997) as well as other decision-making field, e.g., Tsukayama and Duckworth (2010); Weber et al. (2002), we can infer that the effect of overplacement on gambling may also involve at least two components: a constant general one, and a variable specific one, which may vary in both direction and magnitude depending on the particular domain. Here, the specific effect of overplacement on earning ability (or happiness) may aggravate (or compensate for) the general negative effect of overplacement, resulting in the observed double-edged-sword effect. This alternative explanation could be further excluded by measuring overplacement in more domains and conducting multivariate analysis, e.g., principal components analysis.

Contributions and Limitations

Our results may contribute to the field in the following ways.

Theoretically, echoing the call for attaching importance to the social factors of gambling (Gordon & Reith, 2019), our study expanded the relationship between overconfidence and gambling from the previous perspective to treat overconfidence as a cognitive bias (i.e., overestimation) to a social comparison bias (i.e., overplacement). We further integrated this relationship by proposed a double-edged sword effect of overplacement, instead of a traditional single-direction risk factor that overplacement always positively correlated with more gambling. Our results reminded to the future studies that overplacement about one's well-being, i.e., feeling happier than others, may function as a protective factor of gambling.

Practically, these double-edged sword effect of overplacement also hints at a potential new intervention strategy for problem gambling. Given that the self-enhancement (including overconfidence, overplacement, etc.) can be a mixed blessing for one's psychological functioning (Dufner et al., 2018), our results highlighted that, in order to decrease (problem) gambling, downregulating one's self-enhancement motivation on earning ability but upregulating the self-enhancement motivation on happiness could be useful. Further intervention shall also focus on improving self-enhancement motivation as a key factor, in addition to the widely-used cognitive-behavioral therapy (Petry et al., 2017).

Methodologically, our study's sample and measurement in the Field Survey, may bring a merit to future studies. By recruiting respondents outside of real casinos, this method ensured the ecological validity of the results, as respondents had both gambling experience and sufficient involvement while filling out the questionnaire. We also used a multi-measurement approach to cover the main gambling related psychological and behavioral variables (i.e., motivation, frequency, and problem behaviors), as well as alternative predictors (i.e., risk preference and discounting). This broad coverage effectively improved the stability and comprehensiveness of our results.

Some limitations of the current study need be addressed here. Firstly, it remains an open question whether overplacement on other domains may work as a risk or protective fac-

tor for gambling. Further studies should include overplacement on more other domains (e.g., gambling skills) to explore this issue. Secondly, although our study proposed potential mechanisms for the double-edged sword effect of overplacement, the causal evidence is still lacking. Further studies may include potential mediators (e.g., social comparison orientation) to explain the underlying mechanism of the double-edged sword effect. Lastly, the sample in this study only consisted of college students and casino gamblers. Given that the psychological features of casino gamblers may differ from those of other gamblers (e.g., online gamblers) (Hubert & Griffiths, 2018), it's necessary for further studies to replicate the overplacement effect among other types of gamblers.

Conclusion

During a pilot survey among Chinese college students and a field survey among Macao casino gamblers, we found overplacement, as a common social comparison bias, could work as a predictor of gambling motivation, frequency, and also problem behaviors. This predicting effect of overplacement is a double-edged sword, i.e., evaluating one self's earning ability as higher than others is a risk factor of (problem) gambling, while evaluating oneself as happier than others is a protective factor instead.

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Author contribution Yuepei Xu performed statistical analysis and drafted the manuscript; Gui-Hai Huang designed and collected data for the field survey; Yi Xiao collected data for the pilot survey and drafted part of the manuscript; Wei Wang conducted statistical analysis; Shu Li designed the field survey; and Zhu-Yuan Liang designed and coordinated the study, revised the manuscript, and provided supervision.

Data Availability The data that support the findings of this study are available from the corresponding author.

Declarations

Competing Interests The authors declare that there are no conflict and/or competing interests.

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