

Problem Gambling and Income as Predictors of Loot Box Spending

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Abstract

Loot boxes are randomised virtual rewards often purchasable for real money. They have often been compared to gambling activities, with a demonstrated link between loot box spending and problem gambling symptomology. We reanalysed Drummond et al.'s (2020) data from 1049 participants across three countries to determine if established link between gambling symptomology and loot box spending is concentrated to high income problem gamblers, or if problem gamblers are disproportionately spending on these mechanisms regardless of income. Results indicate that there is a general increase in loot box spending as income increases, however, across all income brackets, problem gamblers are still the highest spenders.

Loot boxes - virtual items providing randomised rewards, purchasable within some video games - have been compared to gambling activities (e.g., Drummond & Sauer, 2018). In terms of resemblance to conventional gambling, loot boxes are most akin to electronic gambling machines. They allow continuous play, with desirable rewards delivered on variable ratio reinforcement schedules; schedules known to facilitate the rapid uptake and frequent repetition of behaviour (Ferster & Skinner, 1957). The accessibility of gambling activities is related to the prevalence of problematic gambling behaviours (Blaszczynski & Nower, 2002), and Zendle et al. (2020) determined that the majority of PC gamers have played games that include loot boxes. This accessibility to a mechanism that closely resembles conventional gambling activities has been subject to considerable speculation and growing research interest.

The most consistent finding in the literature is that loot box spending is positively correlated with problem gambling symptomology, an association of practical significance (for review, see Garea et al., 2020), meaning it bears relevance to outcomes in the real world (Kirk, 1996). To clarify the relationship between spending on loot boxes and problem gambling symptomology, and to assist in understanding risk factors for problematic loot box engagement, it is necessary to explore potential similarities (or differences) between the populations engaging with loot boxes and problem gambling. Around half of the top 5% of spenders on loot boxes can be categorised as problem gamblers (Zendle et al., 2019), suggesting that akin to traditional gambling (see: Fiedler et al., 2019), a small percentage of problematic gamblers generate a disproportionate amount of revenue for gaming companies through these mechanisms. It is currently unknown if high spenders on loot boxes are wealthy individuals who may be able to withstand financial losses, or if they are lower income gamers at risk of financial harm from these potentially predatory monetisation features. Essentially, if the established relationship between loot box spending and problem

gambling holds only for people with substantial disposable incomes, there may be less cause for concern.

Consistent with findings from previous research (e.g., Brooks & Clark, 2019; Zendle & Cairns, 2019; Drummond et al., 2019), Drummond et al. (2020) demonstrated a link between loot box spending and problem gambling symptomology for Australian, Aotearoa New Zealand, and United States participants. Problem gamblers spent, on average, approximately \$13 USD more per month on loot boxes than non-problem gamblers. Drummond et al. (2020) also collected data relating to participants' yearly income; an important index of socio-economic status (SES), but these data were not analysed. Although higher SES is predictive of increased gambling engagement and expenditure, lower SES is a predictor of greater problematic gambling outcomes (Van der Maas, 2016; Welte et al., 2004) as the negative outcomes of financial losses are exacerbated. The 2017 Household, Income and Labour Dynamics in Australia survey showed that gamblers in the lowest income households invested considerably higher proportions of their income on gambling activities than those in the highest income households, despite spending less money on average (Armstrong & Carroll, 2017). Currently, only one study has investigated the role of income on loot box spending. Close et al. (2021) analysed an aggregated dataset from three studies that measured loot box spending, gambling symptomology and income. They found loot box spending correlated positively with problem gambling score but found no correlation between loot box spending and annual income. They did not investigate the interaction between gambling symptomology and income. We reanalysed Drummond et al.'s (2020) data to extend upon Close et al. (2021) by investigating whether the established relationship between problem gambling and loot box spending is present across all levels of income, or if it is concentrated to high income gamers who may be at reduced risk of financial harm from overspending.

Participants were excluded from the original sample from Drummond et al. (2020) for failing seriousness checks, reporting loot box spending greater than 3.29 SD's beyond the sample mean, and indicating that they had never played a video game. These criteria were upheld for this reanalysis to maintain the integrity of the statistical measures. This left a total of 1049 (663 females) participants: 339 from Australia, 323 from Aotearoa New Zealand, and 387 from the United States. There were 3 key variables in the current study. First, loot box spending, measured by a single question asking about how much a participant had spent on loot boxes in the past month, this was recorded in their domestic currency, and then standardised to USD by researchers for the purpose of statistical analysis. Second, the Problem Gambling Severity Index (PGSI) was used to assess how often (0 = never – 3 = almost always) during the past year an individual has experienced problems due to gambling behaviours. This questionnaire is 9-items long, and scores can range from 0-27. Scores can be used to categorise participants into groups of differing levels of problem gambling. A score of 0 indicates non-problematic gambling, 1-2 indicates low-risk gambling, 3-7 indicates moderate risk gambling, and scores >8 indicates problem gambling. Finally, participants reported their weekly household earnings, after tax. This was answered on a Likert scale ranging from “1 = less than \$350” to “5 = over \$3,500” (note: this was in the individual's domestic currency). These brackets were designed to reflect Australian resident taxable annual income bands from 2016/17¹. These bands were similar to tax brackets from both Aotearoa New Zealand² and the United States³. These brackets were not standardised to be in USD as exact spending figures were not obtained, and therefore it would be impossible to accurately convert currencies. The current research examined if income is positively

¹ <https://www.ato.gov.au/Rates/Individual-income-tax-for-prior-years/>

² <https://www.ird.govt.nz/income-tax/income-tax-for-individuals/tax-codes-and-tax-rates-for-individuals/tax-rates-for-individuals>

³ <https://taxsummaries.pwc.com/united-states/individual/taxes-on-personal-income>

associated with loot box spending and if income interacts with a known predictor of loot box spending: problem gambling.

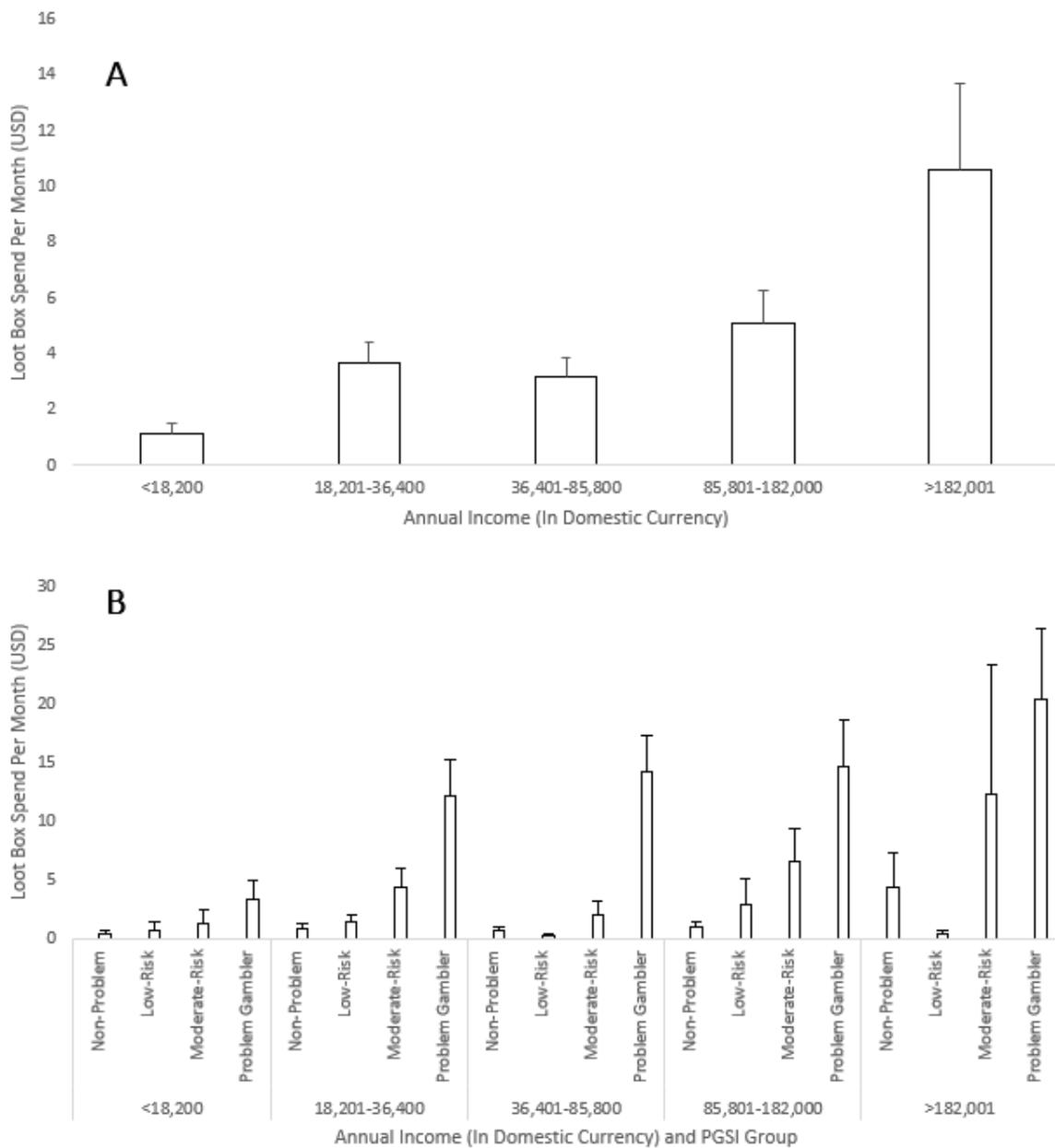
We performed a series of Bayesian independent samples t-tests, interpreting Bayes factors based on Lee & Wagenmakers' (2013) guidelines. A Bayes factor of 1-3 is considered anecdotal evidence, 3-10 is moderate evidence, 10-30 is strong, 30-100 is very strong and >100 is extreme evidence for the alternative hypothesis. Effect size measures are reported by δ , provided by the JASP software, which is the population equivalent of Cohen's d (effectively the standardised mean difference between groups). We first compared loot box spending (in USD) for each sequential income bracket (e.g., <\$18,200 and \$18,201-36,400), to explore if there is a marked increase in spending as income increases. We also compared the top income bracket (>\$182,001) to all lower brackets, to examine if there is an overall increase in spending related to income.

Our reanalysis revealed a number of important findings. First, individuals who reported a greater income (> \$182,001), spent more (in USD) on loot boxes ($M = \$10.62$, $SD = \$22.75$) than those in lower income brackets (< \$18,200, $M = \$1.12$, $SD = \$4.68$; \$18,201-36,400, $M = \$3.68$, $SD = \$13.10$; \$36,401-85,800, $M = \$3.18$, $SD = \$12.22$; \$85,801-182,000, $M = 5.11$, $SD = \$15.04$; Figure 1). Bayesian t-tests determined that there was decisive evidence ($BF_{10} = 7435.19$) that participants in the top income bracket (>\$182,001) reported greater loot box spending than those in the lowest income bracket (<\$18,200), with a moderate to large effect ($\delta = 0.74$). There was strong evidence ($BF_{10} = 17.25$) for higher spending in the top income bracket compared to the \$18201-36,400 bracket, with a small to moderate effect ($\delta = 0.43$), and strong evidence of higher loot box spending ($BF_{10} = 82.72$) compared to the \$36,401-85,800 bracket, with a moderate effect, ($\delta = 0.50$). Finally, there was anecdotal evidence ($BF_{10} = 1.24$) for a difference in spending between people in the top income bracket and people who reported incomes of \$85,801-182,000, with a small effect (δ

= 0.30). When comparing income brackets sequentially, evidence for differences between consecutive brackets was typically weaker. There was anecdotal evidence ($BF_{10} = 1.54$) for a difference between people who reported incomes of $< \$18,200$ and $\$18,201-36,400$, with a small effect ($\delta = 0.22$). However, there was strong evidence for equivalent spending ($BF_{01} = 10.12$) between people who reported incomes of $\$18,201-36,400$ and $\$36,401-85,800$, with a negligible effect ($\delta = 0.04$), and anecdotal evidence ($BF_{01} = 2.87$) for equivalent spending between people who reported incomes of $\$36,401-85,800$ and $\$85,801-182,000$, with a negligible effect ($\delta = 0.14$). Finally, loot box spending was higher for problem gamblers compared to their lower risk counterparts across every income bracket (e.g., problem gamblers who earned $< \$18,200$ per year spent more on loot boxes than moderate-risk, low-risk, and non-problem gamblers who earned $< \$18,200$; Figure 1).

Figure 1

Average spending on loot boxes (per month) separated by annual income brackets (Panel A) and by PGSI categories and annual income brackets (Panel B)



Note. A higher PGSI score indicates greater problem gambling symptomology. Error bars represent standard errors.

This reanalysis demonstrates that, although there was no observed increase in loot box spending from any income bracket compared to the next highest bracket, there was clear evidence that people in the highest income bracket spend more than people in the three lowest income brackets. Thus, previous conclusions that income is not important in

predicting loot box spending (Close et al., 2021) may be premature. However, the key finding of this research is that the relationship between gambling symptomology and loot box spending is not limited to the individuals within the highest income brackets (with the greatest disposable income). Across income brackets, problem gamblers were the highest spenders on these mechanisms. Thus, concerns that games are profiting from individuals higher in gambling symptomology, and not just high-income individuals may be valid.

Finally, tentative considerations must be given to those participants who were excluded from the sample due to reporting loot box spending of greater than 3.29 SDs higher (\$104.20 USD) than the mean, but did not fail mischievous responding checks. The mean spend of these individuals ($n = 12$) was \$260.05 USD ($SD = \122.54) compared to the average of all other participants ($n = 1049$) of \$3.75 USD ($SD = \13.15). Of these 12 participants (~1% of the sample), eight were classed as problem gamblers. Of these problem gamblers, three reported incomes greater than \$85,800 per year, the remaining five reported incomes between \$18,201-85,800. Some of these outliers may be mischievous responders. Alternatively, they may represent accurate and relevant patterns of behaviour. This small percentage of the sample may represent those most at-risk of overspending on these mechanisms. Therefore, identification of the specific factors separating these individuals from the majority of spenders on loot boxes is an important avenue of research.

In conclusion, consistent with traditional patterns of gambling spending in other domains (Fiedler et al., 2019; Armstrong & Carroll, 2017), and with findings reported by Close et al. (2021), loot boxes appear to be disproportionately purchased by problematic gamblers, irrespective of income. However, counter to Close et al.'s conclusions, we found that spending on loot boxes was related to income, with the highest income gamers spending considerably more on loot boxes than those in the lowest income brackets. Although quantities of spending are not excessive, problem - and to a lesser extent moderate-risk -

gamblers appear to be overrepresented among big spenders on loot boxes. This substantiates concerns that the potential risk of overspending on loot boxes is present for all problem gamblers, regardless of income. Several possibilities exist: greater loot box spending may increase an individual's gambling severity, or greater gambling severity could result in increased loot box spending, or a combination of both. This represents an important topic of future research. However, as findings are correlational we cannot infer causality. Finally, exploratory findings suggest a subset of gamers spend a considerably higher amount of money on loot boxes, with two-thirds of these individuals being problem gamblers. Ultimately, loot box mechanisms appear to appeal disproportionately to a specific demographic of individuals (i.e., problem gamblers), with potentially harmful, albeit currently unknown financial and psychological consequences.

Data Availability

The data that support the findings of this study are available on the Open Science Framework Page at DOI: [10.17605/OSF.IO/B87PM](https://doi.org/10.17605/OSF.IO/B87PM).

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