

# Loot Boxes – A Game Changer?

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## *Abstract*

Loot boxes are a growing feature in the business models of video game production. They can be obtained through in-game purchases ranging from \$0.5 to over \$100 and contain chance-based virtual items that may offer an advantage in a video game making them gambling-like products.

This study seeks to fill the current research gap with the analysis of a representative survey among 46,136 Internet users. Within this sample 1,508 are Pay2Win users and more specifically, 586 of those Pay2Win users (38.9%) purchase loot boxes. Loot box users are an average age of 36.7 years and are predominantly male (55.3%). A high number (45.9%) meet the criteria for problem gambling measured by the PGSI. A significant negative age-effect exists, and a lower level of education has strong positive impacts on loot box participation. Loot box participation and purchasing frequency are positively associated with gambling problems and we argue that loot box purchasers are profoundly at risk of experiencing gambling problems.

*Keywords:* gaming, pay to win, pay2win, problem gambling, game purchases, microtransactions, gambling

## 1 Introduction

Traditionally, video games promise an entertainment value that – apart from the purchase price – used to be cost-free no matter how often a player decided to play. Both the digital platform and the growing interconnectivity of video games provide game publishers with additional ways of generating revenue that are oftentimes in contrast to free entertainment.

Within traditional game forms but also in newly created games, differentiated business models with individual price structures were established to allow users to spend real money for in-game purchases. These payments do not serve as a prerequisite to participate in the game and are not comparable to wagers in gambling. Instead, they are earmarked for gaining virtual benefits within the game. Such benefits can vary from aesthetics, to stronger avatars (user profiles), to shortening waiting times or advancement to a new level. When such purchases are related to acquiring an in-game advantage (e.g. progress to a new level), they are often called Pay2Win elements. If these elements dominate over the skill components within the game, these games can be considered as Pay2Win games.

A recent phenomenon in digital games introduces randomness to in-game purchases: so-called loot boxes. To date, loot boxes are an under-researched element often connected with Pay2Win games that present a lottery-like component. Players do not directly purchase virtual items, but rather, the chance to obtain virtual goods. Essentially creating uncertainty about which items the player will receive. Loot boxes often contain various digital items and players can purchase them with either virtual in-game currency or real money. By integrating an element of randomness, game developers add gambling-like mechanisms to the game.

Gambling is defined as risking money or something of value on the outcome of an event involving an element of chance when the probability of winning is less than certain (Korn and Shaffer, 1999). Loot boxes share a pattern similar to classic games of chance. That is, a payment is made (real money or virtual currency), and a mechanism – supposed to rely on chance – generates a selection of virtual objects to be received. The outcome, i.e. the obtained items, either have a symbolic value or benefit for the buyer, or they offer a financial equivalent. Meaning, the items have different levels of benefit for the individual user. For example, a player purchases loot boxes because they want to get a particular item with high value for themselves but receives another one with low

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usefulness. This illustrates the gambling-like character of loot boxes.

Gambling games are highly regulated in many countries, and therefore face stricter requirements than general games for entertainment. For example, gambling operators require a license and are obliged to ban underage participation. While loot boxes are yet to be classified as gambling, regulators across the globe are re-examining popular gambling-like elements such as ‘loot boxes’ and ‘gacha’ (Belgium Gaming Commission, 2018; Environment and Communications References Committee, 2018; Koeder et al., 2017; Netherlands Gaming Authority, 2018). To date, Belgium and the Netherlands are the only countries to state that loot boxes can contravene jurisdictional gaming laws (Belgium Gaming Commission, 2018; Netherlands Gaming Authority, 2018).

However, due to the lack of research, this topic urgently requires further scientific examination. One notable exception in the literature is a recent survey among loot box users by Macey and Hamari (2018, 2019). While they provide ground-breaking work on the phenomenon of loot boxes, their survey lacks a representative sample that allows inferences to the whole population. This study builds on the research by Macey and Hamari and addresses questions related to the demographic and socioeconomic profile of loot box users as well as analyses on the demand of loot box usage based on a representative sample of the German adult Internet population. Specifically, a group of 1,508 respondents were classified as Pay2Win users by spending real money for obtaining an advantage within a video game of which 586 players reported to have purchased at least one loot box in the past twelve months. The group of loot box users is analyzed in detail in regards to demographics, socioeconomic variables, the status of problem gambling, and comparisons to the group of Pay2Win users that do not purchase loot boxes.

## 2 Literature Review

Gambling is a loaded term, often associated with unethical operational practices and individuals who experience significant harms. Traditionally, gambling has been considered to be a boundary case under the larger rubric of gaming (Juil, 2003); however, the two fields have had relatively little to do with each other. Tensions exist between the two fields; both are trying to separate themselves from the stigmatized “dirty secret” that is gambling (Reynolds, 2016).

Technology is now changing that, despite legal and regulatory concerns. This can be witnessed by game designers commonly using gambling elements, such as the mechanics of randomness (e.g. loot boxes, dice, or the dealing of cards), to make a game more uncertain for players, and casino-style games using social mechanics found in online games, such as leaderboards, chat features, and use of social graphs to capitalize on emerging unregulated gaming platforms (Reynolds, 2016). Not only is technology changing the content of both video games and gambling, but the

convergence between the two has led to more diverse platforms for more sophisticated, immersive environments (Macey and Hamari, 2018). While we can witness the convergence of gambling and gaming on many different levels, loot boxes have received significant attention as of late.

Worldwide commentary typically centres around the question, if loot boxes should be considered as gambling (Abarbanel, 2018; Drummond and Sauer, 2018; Griffiths, 2018; King and Delfabbro, 2018). This classification holds significant implications. However, not only is the process of defining a difficult one, but it is also not a neutral one, always carrying with it questions of power (Arjoranta, 2014).

To get an overview of the academic literature regarding loots boxes, we conducted a systematic literature search. The selected keywords for all of the following searches were: “lootbox” OR “lootboxes” OR “loot box” OR “loot boxes”. To ensure a complete spectrum of published works the following databases were used: Web of Science Core Collection Database, all databases on Web of Science, all databases on EBSCOhost and Springer. We filtered the papers by reading the abstracts to check the relevancy to the specific topic of loot boxes. In total, our searches revealed only eight papers relevant to the subject of loot boxes. Specifically, three studies, four commentary and/or editorial pieces, and one non-English paper.

Zendle and Cairns (2018) conducted a large-scale, online survey (N=7,422) of gamers aged 18 and older. Using the Problem Gambling Severity Index (PGSI; Ferris and Wynne, 2001), the authors asked participants about their spending on loot boxes and other in-game microtransactions. Eighty-nine percent of respondents identified as male, with nearly half (48%) of participants between the ages of 18-24 years. Findings revealed a strong link between the severity of problem gambling and the amount that gamers spend on loot boxes. Specifically, the more severe a participants’ problem gambling was, the more money they spent on loot boxes. The strength of the relationship appears to be specific only to loot boxes. Meaning, spending on other microtransactions in games was found to be more than ten times smaller than the effect of problem gambling on spending on loot boxes between these two groups. However, the authors caution that findings are unclear to whether buying loot boxes acts as a gateway to problem gambling, or whether spending significant amounts of money on loot boxes appeals more to problem gambling (Zendle and Cairns, 2018).

Finally, two papers were identified by Macey and Hamari (2018, 2019) who conducted an international online survey to examine relationships between eSports spectators, participation in video gaming, and gambling and gambling-like activities (e.g. loot boxes). Respondents were predominantly males (91%) between the ages of 14 to over 50+, with the majority (31%) reporting between 18-21 years, and a further 27% being under the age of 18 years. The survey included two measures: Game Addiction Scale (GAS;

Lemmens et al., 2009) and the PGSI (Ferris and Wynne, 2001).

In the first paper (Macey and Hamari, 2018), the study (N=613) found no strong association between video game consumption or eSports and gambling activity. Further, they found a small but significant negative relation with gambling and problem gambling. The authors conclude that video games are not associated with increased risk of problem gambling. The second paper (Macey and Hamari, 2019) examined loot boxes specifically, reporting that a total of 67% of individuals who were spectators of eSports report purchasing loot boxes. Using the PGSI (Ferris and Wynne, 2001), problematic and potentially problematic gambling were found to be 50.34%. However, it should be noted that this problem gambling rate consists of respondents categorized as 'low risk', 'moderate-risk' and 'problematic' gamblers.

In sum, the small number of studies indicate to us, that the current state of academic literature is minimal and the importance of further work to understand the phenomenon of loot boxes, its users and its relationship to gambling and problem gambling. Especially, representative studies among the population are missing. Moving forward, adequate regulations require a profound understanding of the loot box phenomenon that considers the diversity, complexity, and idiosyncrasy of the different forms of loot boxes, as well as an overall picture of loot box users.

## 3 Methods

### 3.1 Definitions

To date, there is a lack of consistency in the terminology of specific terms that we use throughout our study. We thus define some terms for clarification but without the intention of general applicability, since a different definition might be justified in a different setting.

#### 3.1.1 Pay2Win

Pay2Win games are a type of Free-to-Play-Games, in which money can be spent to receive advantages in the game. We characterize Pay2Win gaming by free access to the game combined with the possibility to make payments during the game to significantly increase the chances of winning compared to players not paying. Players do not need to spend money during the game, but they can pay to receive privileges increasing the chances of winning or advancing higher levels in the game. For example, money can be spent to obtain a sought-after item, progress to a higher level, or increase the power of an avatar. Pay2Win is a matter of degree: Payment can either have a tiny or significant impact on competitiveness. The games can be accessed via a website or an application, on a computer, mobile, tablet or social networks.

#### 3.1.2 Loot box

Loot boxes are virtual crates commonly found in Pay2Win games. They are virtual boxes which can be obtained for real money and contain virtual items to gain benefits in the game. However, players do not know in advance which items they will receive. Thus, loot boxes contain gambling-like mechanisms. The virtual items collected can either offer functional advantages to players, such as winning time in the game or cosmetic in nature, where the virtual objects support the image of the players by adding new skins etc.

#### 3.1.3 Real Money Gambling

Variables used in this study were created to differentiate between gambling with real money and gambling with virtual currency. Real Money Gambling concerns games where the results depend predominantly on chance and for which players wager real money for the chance to win real money. Examples are slot machines, Poker, lotteries etc.

#### 3.1.4 Play Money Gambling

Play Money Gambling is almost identical to Real Money Gambling; however, players do not wager real money. Instead, players wager with in-game digital currency, which can be game-specific or be wagered across different games from the same provider. Methods of acquisition of play money and its distribution among players vary across game providers. As in some instances play money can be purchased with real money, the significant differentiation to traditional gambling is that players cannot win a prize of monetary value.

## 3.2 Hypotheses

### 3.2.1 Gambling (Hypotheses bundle 1)

In the Macey and Hamari (2019) study on loot boxes, they found that a total of 67% of individuals who were spectators of eSports report purchasing loot boxes. We witness a similar link between different types of gambling in another online questionnaire completed by Italian students; where only 28% of the players said they exclusively use games of skill. In contrast, only 37% used gambling (Gandolfo and Debonis, 2014). The transition between different forms of gaming and gambling, as well as their parallel use, plays an important role.

McBride and Derevensky (2009) found that 77% of a sample of adult Internet gamblers had also played simulated gambling games. This finding is similar to the results of a cross-sectional survey of 8,017 British students aged 12 to 15 years. Already at that age, among those who reported participating in national lottery Internet gambling (e.g., lotto, scratch-off), about one-third also played social gambling games (Griffiths and Wood, 2007). A study of 1,103 social gambling players showed that more than two-thirds of this group (68%) are interested in real money gambling, and 67% of respondents said they had an interest in trying online

gambling (Super Data Research, 2013). These findings reveal a strong interest of younger players in other forms of gambling, even with a payment structure, which could be of high relevance concerning loot boxes.

Gupta, Derevensky and Wohl (2013) found in six focus groups, with a total of 51 18 to 24-year-old students, that participants have a clear migration pattern, starting with participation in simple social games, progressing to casino-style social gambling, and ending with wagering money in online gambling. Another study provides important empirical evidence for a possible causal link between gaming and real money Internet gambling (Kim et al., 2015). Here, the authors surveyed 409 participants about their social gaming and gambling behaviour. Those respondents, who according to their own disclosure had never participated in Internet gambling repeated after six months (n = 99). Among those who had participated initially just in social gambling, 26% said they had started gambling online. The only predictor of the migration behavior was the making of previous microtransactions.

Table 1: Hypotheses bundles

	Assumed effect on loot box usage	Assumed effect on frequency of loot box usage
<b>Hypotheses bundle 1</b>		
a) Higher spending in real money gambling	positive	
b) Participation in real money gambling	positive	
c) Participation in play money games	positive	
d) Higher spending in real money gambling		positive
e) Participation in real money gambling		positive
f) Participation in play money games		positive
<b>Hypotheses bundle 2</b>		
a) Higher age	negative	
b) Gender male	positive	
c) Higher age		negative
d) Gender male		positive
<b>Hypotheses bundle 3</b>		
a) Higher income	negative	
b) Lower level of education	positive	
c) Unemployment	positive	
d) Higher income		negative
e) Lower level of education		positive
f) Unemployment		positive
<b>Hypotheses bundle 4</b>		
a) Gambling related problems	positive	
b) Pay2Win related problems	positive	
c) Gambling related problems		positive
d) Pay2Win related problems		positive

In general, we expect to verify that the use of different forms of gaming and gambling by one person is common. Thus, the primary question becomes: how similar are loot boxes to gambling? If there is a similarity, we expect that the user groups will also

overlap. Therefore, the findings from other forms of gambling and gaming can inform similar conclusions about loot boxes. Loot boxes are products which seem to have a gambling-like nature. It is likely that participants of other forms of gambling will purchase loot boxes more often. Likewise, a relation with the use of games for play money is to be expected. For this reason, we hypothesize that participation in real money gambling and spending higher in real money gambling, as well as involvement in play money games, will have positive effects on players investing in loot boxes and their frequency of purchasing loot boxes (Hypotheses bundle 1; see Table 1).

### 3.2.2 Demographics (Hypotheses bundle 2)

In an online survey of gamers aged 18 and older, taking part in loot box purchases and other in-game microtransactions, 89% of the participants were male while 48% of the respondents were between 18 and 24 years old. (Zendle and Cairns, 2018). Similarly, the survey by Macey and Hamari (2018, 2019) shows that respondents were also predominantly males (91%), with the majority participants between 18 and 21 years old (31%); and 27% under the age of 18 years. With respect to social game players, a survey of 1,201 US and UK players (Information Solutions Group, 2011) further indicates that men are making more frequent purchases. Another study with 465 Canadian students, conducted by McBride and Derevensky (2012), found that significantly more men used demo sites of real gambling. Moreover, a survey among British adolescents (Ipsos MORI, 2012) also identifies that the majority of simulated gambling users are male. In terms of real money poker, Gainsbury, Russel and Hing (2014) illustrate that this segment of gambling is also strongly male-dominated.

Given this literature, we expect that loot box users are more likely to be young and male and that these players also purchase loot boxes more frequently. Concerning these findings, this group is thus expected to be primarily among the survey respondents who purchase loot boxes, and the hypotheses are aligned accordingly (Hypotheses bundle 2; see Table 1).

### 3.2.3 Socioeconomic status (Hypotheses bundle 3)

Due to the limited knowledge about loot box users, examining the structure of social gambling can be helpful to discern an idea about the socioeconomic status of loot box purchasers. First, a cross-sectional survey in Australia with a particular focus on social gambling (Gainsbury et al., 2014) speaks for a lower socioeconomic status of the users by showing that they are often involved in smoking, the use of illegal drugs and increased stress. A survey of British adolescents (Ipsos MORI, 2012) shows that social gambling is more commonly used by single parent children or in households with two unemployed parents, and also by children who rated their school performance rather poorly. A lower socioeconomic status measured by a lower level of education and unemployment as a

predictor for buying loot boxes, therefore, can be assumed. Since loot box users, according to Macey and Hamari (2018, 2019), tend to be younger, a comparatively lower income level in general can be expected. It can also be assumed that loot box users have a lower level of education what is related to a comparatively lower rate of employment and a lower income as well. Subsequently, this group of users also might have more time for taking part in Pay2Win games and for dealing with loot boxes. The same expectations apply to the frequency of use. We present the associated hypotheses in Hypotheses bundle 3 in Table 1.

### 3.2.4 Gambling Problems (Hypotheses bundle 4)

Gambling-related harms are likely to influence the use of loot boxes because loot boxes represent a form of gambling-like products since they can be used to make a profit in different marketplaces. One can argue that due to the structural similarity of traditional gambling and loot boxes, it is possible that players experiencing gambling-related harms also purchase loot boxes. Previous research indicates a strong link between the severity of problem gambling and the amount that gamers spend on loot boxes (Zendle and Cairns, 2018). Specifically, that the severity of problem gambling increases alongside the money spent on loot boxes. This is in fact just the case for loot boxes; the effect is much smaller on spending money for other microtransactions than problem gambling has on spending money for loot boxes (Zendle and Cairns, 2018). We categorize the respondents in groups of low risk, moderate risk and problematic gamblers, in total 50.3% fulfilled these criteria using the PGSI (Ferris and Wynne, 2001). Therefore, the hypotheses assume positive effects of gambling- and gaming-related problems on the use of loot boxes (Hypotheses bundle 4; see Table 1).

### 3.3 Dataset

The dataset was part of the larger e-GAMES (Electronic Gam(bling): Multinational Empirical Surveys) starting with a first data collection in 2017. e-GAMES is a cross-national survey currently underway in France, Italy, Switzerland, Poland, and Germany. Surveys in Canada, and Australia are in fruition. With a core standardized questionnaire, the aim is to explore the overlap between gaming and gambling, as well as similarities and differences between the countries from a large number of respondents. The German dataset is the only one containing additional questions on loot boxes.

Overall, between 07/16/2018 and 09/10/2018 a panel of 82,985 internet users representative of the German population of internet users in regards to age and gender were invited to take part in the study. In total, 46,136 (55.6%) of the invited panel participated in the survey and 6,000 respondents completed the survey while 38,064 respondents were excluded as they did not participate in online gambling or Pay2Win gaming (categorized by making payments in Pay2Win

games for increasing the chances of winning, gaining time or keeping the game going on) and 1,387 were excluded as gamblers. The remaining 685 were either dropouts and aborted the survey (631) or excluded for speeding through the survey (54).

### 3.4 Screening tools

The American Psychiatric Association defines problem gambling in its Diagnostic Statistical Manual of Mental Disorders. The prevalence of gambling problems is widely used as an indicator of the addictiveness of gambling in general and specific forms of gambling in particular. A validated standard screening tool in surveys to identify problem gamblers is the Problem Gambling Severity Index (PGSI) where the overall score is used to assess the severity of gambling problems in adults (18+ years) (Ferris and Wynne 2001). The PGSI consists of 9 items with answers reported on a 4-point Likert scale ('never'; 'sometimes'; 'most of the time'; 'almost always'). Respondents are categorized as non-problem gamblers (PGSI score = 0); low-risk gamblers (score = 1-2); moderate-risk gamblers (score = 3-7); and problem gamblers (score = 8+). We note that the screening instrument is not a relative measure (comparing a gambler to a reference population) but an absolute measure. This is important because a relative measure would lead to circular reasoning in the analysis.

Recently, the 11th revision of the International Classification of Diseases recognizes a gaming disorder for the first time. This disorder focuses on the video games sector, which is a much broader category than Pay2Win games and especially larger than the use of loot boxes, which are one part of Pay2Win games. Thus, it might not suit the screening of problems within Pay2Win gaming that shares many similarities with gambling that traditional video gaming does not (Fiedler, 2016). To screen for potential problems of Pay2Win gamers and loot box users, we adapted the PGSI rather than use a screening tool for gaming disorders. For example, the PGSI was extended to incorporate the dimension of time by including the question "Have you spent more time than you intended?". Scores were then normalized to the PGSI scale of 27 by multiplying the score with 9/10. This procedure allows for posing these questions to Pay2Win gamers that do not gamble and addresses for the importance of a temporal dimension in gaming. It is important to note that this is not a new screening tool but should instead be seen as an indicator of potential problems. Future research needs to validate whether this adapted measure can be used as a screening tool.

### 3.5 Descriptions of variables

#### 3.5.1 Personal status

The variable *Age* represents the absolute age in the year of a survey participant, and the variable *Gender* is a dummy variable that signals the participants as masculine or feminine. We use five different dummy variables that describe an individual's personal

relationship status, which is *Single*, *Married*, *Partnership*, *Other* (*widowed* or *divorced*). The variable *Employed* is a dummy that represents if a person is employed, while the dummy *Outside labour force* indicates if an individual is not working but also not seeking employment (e.g. retirees, students, stay-at-home individuals). The variable *Unemployed* signals that a person is not employed but does not belong to the subset of individuals *Outside labour force*. We use six different dummy variables to classify the level of education for individuals: *No graduation*, *Middle school graduation*, *A-Level*, *apprenticeship (craftsman)*, *apprenticeship (merchant)* and *University*. Respondents were only able to mark one educational level and were asked to mark their highest achievement. The variable *Income* describes different monthly household income categories, classified in the thousands. The variable consists of the categories for the monthly household income ranges of less than €500, €500-€999, €1,000-€1,499, €1,500-1,999, €2,000-€2,999, €3,000-€4,999, €5,000 and above. Due to the statistical methods we applied, the following averages for the household income ranges above are used: €750, €1250, €1750, €2500 and €4000. For the open ranges less than €500 and €5000 and above we set the average ranges of €450 and €6500 respectively. Participants had the chance to refuse to answer.

### 3.5.2 Real Money Gambling

*Cumulative Spending Online Gambling* describes the amount of money spent on online gambling throughout one month. The overall amount is divided by 1000. We use eight different dummy variables to test if an individual made use of various forms of online gambling during the last 12 months. The different types of gambling are *Lotteries and Scratchcards*, *Slot machines*, *Poker*, *(Other) Casino games*, *Betting on Horseraces*, *Sports betting*, *eSports betting* and *Financial betting*, the latter of which describes buying financial products with gambling character, i.e. binary options.

Additionally, we introduce variables for the frequency of participation for these eight different types of online gambling. The variables are named just like the respective dummies and have the extension (*freq*) after its first phrase (e.g., *Lotteries (freq)*). The variable is calculated by the yearly level of participation in the game forms. The levels of involvement in days are 365 (every day), 274 (nearly every day), 156 (multiple times a week), 52 (once a week), 36 (multiple times a month), 12 (once a month) and 3 (less than once a month).

### 3.5.3 Play Money Gambling

Based on the same logic as the online gambling types, we use the dummy *Play money* and the frequency variable *Play money (freq)* to account for the participation in play money games and the frequency of play. The *PGSI gambling* is a dummy variable classifying an individual as a high-risk gambler based

on an individual's PGSI-score (8+). Similarly, *PGSI Pay2Win* signals if an individual classifies as a high-risk Pay2Win user based on the PGSI criteria previously introduced.

## 3.6 Analysis

Standard statistical procedures were used to analyze the dataset. Specifically, descriptive statistics describe the dataset of the two groups (loot box users and Pay2Win users) with regard to age, gender, personal status, employment status, education etc. to differentiate between these two groups. Furthermore, six different regression models were used to assess the effects of a set of predictors (e.g., demographic factors, gambling behavior, gambling issues) on two outcome variables. Namely, the purchasing loot boxes and the frequency of loot box purchasing. SPSS was used for the analysis.

## 4 Results

### 4.1 Descriptive Statistics

In total, 586 respondents or 38.9% out of the sample of 1,508 Pay2Win users have purchased at least one loot box in the past 12 months. This corresponds to 9.8% of all 6,000 persons being surveyed (including non-Pay2Win users and non-loot box users). Table 2 shows that loot box users have an average age of 36.7 years and are slightly more often male than female (55.3% compared to 44.7%). Further, 83.8% are employed and only 3.1% unemployed, while 13.1% are outside the labour force, that is, retired, a student or a houseman/-wife. A relatively large number of loot box users (8.4%) have not graduated from any school. Nearly every second loot box user (48.3%) is a gambler and nearly all of them (95.0%) meet the criteria for problem gambling according to their PGSI score. A bit more than two-thirds of loot box users (68.9%) can be classified as problem gamblers according to our adapted PGSI-score for Pay2Win gaming.

In comparison, 61.1% (n=922) of the total sample are Pay2Win players that have not purchased a loot box within the last 12 months. This represents 15.4% of all 6,000 individuals surveyed. These players are older than loot box users with an average age of 47.2 years (significantly different to loot box purchasers at 0.001 level) and are more often female than male (55.2% compared to 44.8%). These players are much less often employed (67.0% compared to 83.8%) and much more often unemployed (7.2% compared to 3.1%) and unoccupied (25.8% compared to 13.1%). These results are significantly different to loot box purchasers. Pay2Win players have slightly less often a University degree (20.9% compared to 23.4%) but also less often no school degree (3% compared to 8.4%; significantly different to loot box purchasers at 0.001 level).

Table 2: Descriptive results

	Loot box purchaser	Pay2Win user, but no loot box purchaser	Δ loot box purchaser vs. no loot box purchaser	Every day loot box purchaser	Loot box purchaser, but not every day	Δ every day loot box purchaser vs. not every day purchaser
<b>n</b>	586	922		88	498	
Average age in years	36.7y	47.2y	-10.5y***	35.0y	37.0y	-2y
<b>Age groups in years</b>						
18-24	15.9%	7.2%	8.7%***	19.3%	15.3%	4.0%
25-34	33.8%	16.9%	16.9%***	44.3%	31.9%	12.4%*
35-49	35.7%	29.7%	6.0%*	23.9%	37.8%	-13.9%**
50+	14.7%	46.2%	-31.5%***	12.5%	15.1%	-2.6%
<b>Gender (% male)</b>	55.3%	44.8%	10.5%***	68.2%	53.0%	15.2%**
<b>Personal status</b>						
Single	30.9%	23.1%	7.8%***	25%	31.9%	-6.9%
Married	38.6%	41.3%	-2.7%	45.5%	37.3%	8.2%
In partnership	22.9%	24.2%	-1.3%	13.6%	24.5%	-10.9%*
Other <sup>a</sup>	7.7%	11.4%	-3.7%	15.9%	6.2%	9.7%
<b>Employment status</b>						
Employed	83.8%	67.0%	16.8%***	87.5%	83.1%	4.4%
Unemployed	3.1%	7.2%	-4.1%***	2.3%	3.2%	-0.9%
Outside labor force <sup>b</sup>	13.1%	25.8%	-12.7%***	10.2%	13.7%	-3.5%
<b>Education</b>						
University	23.4%	20.9%	2.5%	21.6%	23.7%	-2.1%
Apprenticeship	24.1%	28.0%	-3.9%*	17.0%	25.3%	-8.3%*
A-level	21.0%	22.2%	-1.2%	13.6%	22.3%	-8.7%*
Main- or middle school	23.2%	25.8%	-2.6%	17.0%	24.3%	-7.3%
No graduation	8.4%	3.0%	5.4%***	30.7%	4.4%	26.3%***
<b>Net household income</b>						
>€5,000	6.5%	5.9%	0.6%*	9.1%	6.0%	3.1%
€3,000-4,999	19.1%	22.8%	-3.7%	14.8%	19.9%	-5.1%
€2,000-2,999	19.5%	22.9%	-3.4%	11.4%	20.9%	-9.5%
€1,500-1,999	19.8%	16.6%	3.2%	36.4%	16.9%	19.5%***
€1,000-1499	17.7%	15.8%	1.9%	13.6%	18.5%	-4.9%
€500-999	7.7%	7.9%	-0.2%	6.8%	7.8%	-1.0%
<€500	4.8%	4.7%	0.1%	5.7%	4.6%	1.1%
n/a	4.9%	3.5%	1.4%	2.3%	5.4%	-3.1%*
<b>Gambling participation</b>	48.3%	18.0%	30.3%***	65.9%	45.2%	20.7%***
<b>Play money gambling</b>	84.8%	62.6%	22.2%***	96.6%	82.7%	13.9%***
<b>Problem Gam(b)ling</b>						
Problem Gamer	68.9%	39.2%	29.7%***	81.8%	66.7%	15.1%***
Problem Gambler	45.9%	13.2%	32.7%***	64.8%	42.6%	22.2%***

<sup>a</sup> The category Other includes widows and people that are divorced.

<sup>b</sup> Outside labor force is defined as a status of non-working but not seeking to work, e.g. retirees, students, housemen/-women.

\*\*\* significant at 0.001 level; \*\* significant at 0.01 level; \* significant at 0.1 level

In terms of income, only one significant difference at 0.1 level can be found (net household income >€5,000). Pay2Win gamers that do not use loot boxes are much less often gamblers (18.0% compared to 48.3%) but nearly three out of four (73.3%) are problem gamblers. Compared to loot box users, much fewer Pay2Win gamers that do not purchase loot boxes can be classified as problem gamers according to our adapted PGSI-score (39.2% compared to 68.9%; significantly different to loot box purchasers at 0.001 level).

In terms of age groups, it appears that loot box users are more likely to be in younger age groups than Pay2win players. The 18-24-year olds make up 15.9% of the loot box users, while of the Pay2Win players are just 7.2% in this age group. The corresponding figures for the 25-34-year olds are 33.8% of the loot box users and 16.9% of the Pay2win players. The over-50s account for only 14.7% of the loot box users, while the Pay2win players account for 46.2%.

When it comes to the frequency of loot box usage the group that spends money every day is most interesting (the results for all frequency groups can be found in the appendix). While the difference of average age between loot box users and P2W players is rather small (35 years compared to 37 years) when looking at every day loot box users, the group of the 25-34-year olds has the largest share with 44.3%, among non-daily users these are the 35-49-year olds with 37.8%. The gender effect is stronger compared to the simple use of loot boxes: 18.5% of males who spend money on loot boxes do so every day compared to 10.7% of females. Or to put it differently, more than two thirds (68.2%) of every day loot box users are male (significantly more than not every day loot box purchasers at 0.01 level). An exceptionally interesting result is the education of every day loot box users. While these have not much less often a university degree (21.6%), nearly every third (30.7%) has no graduation from any kind of school, a figure much higher than in any of the groups using loot boxes less often (4.4%; significantly

different at 0.001 level). This is especially surprising given that 87.5% of everyday loot box users are employed, a figure that is higher than the average of loot box users (83.1%). In regard to household income, the major difference is that every day loot box users have much more often an income in the lower mid-range (€1,500-1,999) than those who do not spend money on loot boxes every day (significantly different at 0.001 level). In regard to problem gaming and gambling, more than 4 out of 5 (81.8%) every day loot box users can be categorized as having problems and around two out of three (64.8%) are problem gamblers. These figures are much higher than for those loot box users, who do not spend money on them every day (66.7% for problem gaming and 42.6% for problem gambling; significantly different at 0.001 level).

## 4.2 Regression analyses

To test our hypotheses, we ran six regression models: three with the dependent variable loot box purchase yes (=1) or no (=0) and three with the dependent variable of loot box purchasing frequency (see Table 3). The different models are used to account for different control variables, like general participation in online gambling forms (M1 and M4) and the frequency of participation in different gambling forms (M2 and M5). In models 3 and 6, we test for different employment statuses and account for a potential effect of participant's age on employment by removing the age variable. In some cases, variables were dropped for statistical reasons by the software.

Regarding real money gambling spending, we found a significant positive relation to loot box purchasing yes/no (M1 and M3), as well as loot box purchasing frequency (M4 and M6). For example, spending 1000 EUR, representing the cumulative spending of average gambling sessions across all forms of online gambling, increases the likelihood of purchasing a loot box by 4% and increases the frequency of purchases by 12-16 times in a given year. Therefore, hypotheses H1a and H1d cannot be rejected.

### 4.2.1 Gambling (Hypotheses bundle 1)

For hypotheses H1b and H1e we found mixed results: participation in real money gambling per gambling form is unrelated to loot box participation except for online sports betting and eSports betting that is negatively related. Participation in casino gaming is the only game form that is positively related to *loot box purchasing frequency*; all other gambling forms are insignificant. No frequency of gambling participation of any game form has a significant effect on *loot box purchasing yes/no*, but the frequencies of playing lotteries and casino gambling are positively related to *loot box purchasing frequency* (see Table 4).

Results for hypotheses H1c and H1f on the effect of play money gambling are strong. Participation in gambling for play money, as well as frequency of such participation, are both positively related to *loot box purchasing yes/no* as well as *loot box purchasing frequency*. Participation in play money gambling

increases the likelihood of being a loot box user by 14.2% and the number of loot box purchases by 70.3%. Engaging in play money gambling one time more often increases the likelihood of loot box usage by 0.1% and *loot box purchasing frequency* by 0.455 (see Table 4).

### 4.2.2 Demographics (Hypotheses bundle 2)

In regard to demographics being young and male, we found that age is significantly negatively correlated with the likelihood of ever purchasing a loot box with one additional year reducing the likelihood by 0.9% (M1) or 0.8% (M2) and thus cannot reject hypothesis H2a. However, we did not find a significant effect on the *loot box purchasing frequency* among those who purchased at least one loot box and have to reject hypothesis H2c. In regard to gender, we find mixed results for *loot box purchasing yes/no* with a significant positive relationship of being male increasing the probability of being a loot box purchaser by 8.7% in model 1 but no significant relationships in model 2 and 3. We did not find any significant gender effect on *loot box purchasing frequency* and can thus reject hypothesis H2d (see Table 4).

### 4.2.3 Socioeconomic status (Hypotheses bundle 3)

Income as part of the socioeconomic status is unrelated to both *loot box purchasing yes/no* and *loot box purchasing frequency* in all our models. We can therefore reject hypotheses H3a and H3d. A low level of education has strong and significant positive impacts on *loot box purchasing yes/no* in four out of the six models. Thus, we cannot reject hypotheses H3b and H3e. We found the third socioeconomic factor unemployment to have a strong negative impact on *loot box purchasing yes/no* in model 3. This is also true for people outside the labor force. There is no significant effect of unemployment or being outside the labor force on *loot box purchasing frequency*. Furthermore, we identified strong and positive effects of employment on *loot box purchasing yes/no* and *loot box purchasing frequency* in all four models containing this variable. Hence, hypotheses H3c and H3f clearly have to be rejected (see Table 4).

### 4.2.4 Gambling problems (Hypotheses bundle 4)

The effect of problem gambling and Pay2Win related problems that we investigated in hypotheses H4a-H4d are also significant positive at the 0.05-level but not consistent through all models. Being a problem gambler yields a significant positive effect on *loot box purchasing yes/no* in model 3 and *loot box purchasing frequency* in model 6 but not in other models. Having problems with Pay2Win gaming has strong and very significant positive effects on *loot box purchasing yes/no* in all three tested models but has no significant effect on *loot box purchasing frequency*. Hence, we have mixed results for H4a and H4c, cannot reject H4b but H4d (see Table 4).

Table 3: Regression results

Dep. variable Model	Loot box purchasing yes/no						Loot box purchasing frequency					
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coeff.	P> t	Coeff.	P> t	Coeff.	P> t	Coeff.	P> t	Coeff.	P> t	Coeff.	P> t
Constant	0.346	0.000	0.362	0.000	0.298	0.000	35.202	0.468	19.389	0.573	109.151	0.000
Age	-0.009	0.000	-0.008	0.000			-1.243	0.111	-0.414	0.513		
Gender (% male)	0.087	0.013	0.064	0.070	0.052	0.135	3.475	0.806	-2.108	0.853	-0.381	0.977
<b>Personal status</b>												
Single							-23.200	0.177	-9.055	0.528	-15.734	0.334
Married	0.048	0.270	0.033	0.455	-0.007	0.879						
In Partnership	0.034	0.469	0.041	0.386	0.032	0.508	-41.154	0.025	-16.729	0.264	-31.263	0.074
Widowed	0.234	0.044	0.208	0.077	0.202	0.089	27.407	0.452	9.478	0.753	46.950	0.189
Divorced	0.135	0.174	0.149	0.140	0.007	0.945	-61.887	0.146	-39.741	0.245	-72.687	0.074
<b>Employment status</b>												
Employed	0.169	0.001	0.165	0.001			47.964	0.048	40.205	0.048		
Outside labor force <sup>a</sup>					-0.187	0.002					-36.109	0.235
Unemployed					-0.195	0.026					-64.913	0.079
<b>Education</b>												
No graduation	0.217	0.005	0.094	0.270	0.267	0.001	100.642	0.000	42.528	0.051	117.146	0.000
<b>Main- or middleschool</b>												
A level	-0.075	0.131	-0.07	0.171	-0.049	0.331	-43.027	0.029	-16.704	0.311	-41.029	0.035
Apprenticeship (crafts)	0.059	0.356	0.063	0.330	0.085	0.191	-29.595	0.216	-11.198	0.571	-29.517	0.215
Apprenticeship (commercial)	-0.103	0.058	-0.114	0.039	-0.116	0.037	9.636	0.695	6.282	0.754	-5.702	0.814
University	0.047	0.369	0.023	0.670	0.054	0.306	-9.726	0.646	4.819	0.782	-4.885	0.811
Income	-0.014	0.267	-0.011	0.388	-0.021	0.108	-1.019	0.838	-2.652	0.52	-4.511	0.356
Cumulative Spending Online Gambling (in €1,000 per month)	0.039	0.002	0.015	0.277	0.041	0.001	12.859	0.001	-0.098	0.977	15.946	0.000
<b>Online Gambling participation</b>												
Lotteries	0.017	0.687					16.325	0.312				
Slot machines	0.023	0.540					-10.360	0.481				
Poker	0.006	0.882					-6.676	0.656				
Casino games	-0.051	0.204					34.505	0.026				
Horseshoe betting	0.098	0.063					-13.109	0.499				
Sports betting	-0.081	0.033					-7.622	0.622				
eSports betting	-0.105	0.028					8.389	0.636				
Financial betting	0.026	0.643					8.550	0.673				
<b>Online Gambling frequency</b>												
Lotteries			0.000	0.835					0.154	0.003		
Slot machines			0.000	0.287					0.032	0.524		
Poker			0.000	0.405					-0.001	0.986		
Casino games			0.000	0.613					0.196	0.001		
Horseshoe betting			0.000	0.364					-0.051	0.449		
Sports betting			0.000	0.826					-0.073	0.387		
eSports betting			0.000	0.633					0.060	0.402		
Financial betting			0.000	0.574					0.022	0.783		
Participation in play money games	0.142	0.003					70.251	0.015				
Frequency play money games			0.001	0.000					0.455	0.000		
<b>Problem Gam(bling)</b>												
High Risk Gambler	0.102	0.072	0.083	0.152	0.163	0.004	39.131	0.080	12.968	0.489	50.272	0.022
High Risk Gamer	0.187	0.001	0.182	0.001	0.216	0.000	12.327	0.591	2.184	0.907	16.17	0.474
adj. R <sup>2</sup>	0.30		0.29		0.25		0.28		0.51		0.26	
n	674		657		674		337		334		337	

<sup>a</sup> Outside labor force is defined as a status of non-working but not seeking to work, e.g. retirees, students, housemen/-women.

Table 4: Evaluation of hypotheses

	Effect on loot box purchasing yes/no	Effect on loot box purchasing frequency
<b>Hypothesis bundle 1</b>		
a) Higher spending in real money gambling	(A)	
b) Participation in real money gambling	(M)	
c) Participation in play money games	(A)	
d) Higher spending in real money gambling		(A)
e) Participation in real money gambling		(M)
f) Participation in play money games		(A)
<b>Hypothesis bundle 2</b>		
a) Higher age	(A)	
b) Gender male	(M)	
c) Higher age		(R)
d) Gender male		(R)
<b>Hypothesis bundle 3</b>		
a) Higher income	(R)	
b) Lower level of education	(A)	
c) Unemployment	(R)	
d) Higher income		(R)
e) Lower level of education		(A)
f) Unemployment		(R)
<b>Hypothesis bundle 4</b>		
a) Gambling related problems	(M)	
b) Pay2Win related problems	(A)	
c) Gambling related problems		(M)
d) Pay2Win related problems		(R)

A: Hypothesis accepted; R: Hypothesis rejected; M: Mixed results

## 5 Discussion

Our assumptions in regards to the effect of age and gender were only partly met by our results. Loot box users indeed tend to be younger than other Pay2Win players and there is a negative relationship between age and loot box usage – but not in regards to the frequency of loot box purchases when controlling for household income. With respects to gender, the findings were even more complex with mixed results in regards to loot box purchasing yes/no and without an effect on loot box purchasing frequency. These results are surprising insofar as theory and empirical observations would suggest that age is negatively related and male gender positively related to risky behavior (Zendle and Cairns, 2018; Macey and Hamari, 2018, 2019). We can interpret age having a negative effect on using loot boxes as younger people, in general, are more tech savvy and open to try something new. However, once someone has come into contact with loot boxes age is not a moderating variable that reduces the frequency of loot box usage.

A lower socioeconomic status is only a partial predictor for loot box usage and loot box purchasing frequency. Household income has no effect on loot box usage or on frequency of purchasing when controlling for age, education and employment status. This is surprising, as a higher income may increase players’ budgets on leisure activities, which in turn, could increase the likelihood and frequency of purchasing loot boxes. We interpret this effect as loot boxes being

attractive to the general public independent of personal income. This leads to the new hypothesis that lower income groups spend a higher percentage of their available income on loot boxes – an effect that is long known in gambling (Clotfelter and Cook, 1989).

Our findings indicate that a higher level of education has a significant negative effect on both loot box usage and frequency of loot box purchases. The results show that this effect is driven by the group of individuals that report not having any kind of school graduation: among the users who purchase loot boxes every day, every third person does not have a school degree. We see it as a significant finding that the lowest educated people are much more attracted to loot boxes and especially to high frequency purchases. It is thus especially surprising that, contrary to our hypothesis, we did not find a positive effect of unemployment but instead a negative effect. This is at first glance is intriguing, because there is an assumption that busy people basically have less time to play games. However, at the same time, having less time to spend can actually help explain the very reason why employed people buy loot boxes more often. Loot boxes could be seen as a short cut to advance and succeed in the game without putting in the playing hours required to achieve the same progress. Specifically, in Pay2Win games, players can achieve progress by investing money for purchasing virtual items that strengthen their avatars or by paying for direct access to an advanced game state. In order to compete on a high level, players with less time need to spend money to reach the same status as users spending more time. For participants who have plenty of time due to their unemployment, a fast progress by spending money in the game may not be required. Our results are congruent with this line of thinking - employed gamers have less time to play than those who are out of the labor market and thus might feel the urge to spend money on the game by purchasing loot boxes and to do so more frequently. We deem this relationship between time and money as very important to understand the demand for loot boxes that are part of many Pay2Win games. Essentially, loot boxes represent a lottery mechanism to decide whether players may win virtual items that would allow them to advance in the game.

As expected, involvement in real money online gambling is positively associated with the likelihood of being a loot box user as well as with the frequency of loot box purchases. Results show that especially sports and eSports bettors, as well as users of online casino games and online lotteries, tend to purchase loot boxes. This is in line with Macey and Hamari (2019) who found that a total of 67% of individuals who were spectators of eSports report purchasing loot boxes. The relationship of betting on eSports might be related to the competitive nature in video games, while the relationship with casinos and lotteries might be explained by the underlying mechanisms of randomness and chance. With respect to play money gambling, our findings reveal that involvement also has

a strong, positive relation to both loot box participation and frequency of loot box purchases. Thus, we conclude that the demand for gambling products and demand for loot boxes are closely related.

Gaming and gambling problems are partially related to the demand for loot boxes. Specifically, our findings show that 46% of loot box users and 65% of everyday loot box users can be categorized as problem gamblers, a rate much higher than what Macey and Hamari (2019) via an international online survey found. Further, nearly 70% of loot box users and over 80% of everyday loot box purchasers can be categorized as problem gamers according to our adapted Pay2Win PGSI score. Given the high ratios of problem gaming and gambling status among loot box users, it is surprising to see significant regression results where we found a positive, statistically significant effect of problem gambling on the likelihood of being a loot box user in one model and on the frequency of loot box purchases in one model. In all models, we found that showing signs of problem gaming, measured by our adapted PGSI score for Pay2Win games, has a positive effect on loot box usage. Although there does not seem to be an additional effect on loot box purchasing frequency, which can likely be explained by the high rate of problem gamers among loot box users. We can thus argue that loot boxes are in close relationship with gaming and gambling problems.

While it seems premature for regulators to treat loot boxes similar to gambling, or even to ban them all together, these results clearly indicate the need for further research on the addictive potential of loot boxes and the possible harms they may create for users and their environment. Additionally, because of loot boxes' proximity to real money gambling our results support the raising of questions in regard to the regulation of play money gambling.

Previous research highlights how play money gambling is reminiscent of the history of candy cigarettes (Reynolds, 2016). Candy cigarettes were considered to be "so real looking it's startling" (Surgeon General's Report, 1964; as cited in Klein and St. Clair, 2000: page 363), prompting the World Health Organization Framework Convention on Tobacco Control to recommend the prohibition of the production and sale of candy and toy tobacco products that appeal to minors (World Health Organization, 2003; as cited in Klein et al., 2007). In essence, claiming that candy cigarettes provide opportunities for children to engage in smoking-related play, and in turn, selling the social acceptability of smoking. With respect to loot boxes and play money gambling, the question then becomes, at what stage does "practicing" become a problem, particularly for vulnerable populations such as children and adolescents? Could loot boxes and play money gambling be a preliminary stage for real money gambling?

Regulators could, similarly to candy cigarettes, consider of interpreting loot boxes and play money gambling not only as a form of advertising but as a preliminary stage for real money gambling. In

consequence of trying out these products, this behavior of gambling could be perceived as normal by target groups and possibly has to be restricted for children and adolescents.

The low-threshold payment structure provides an easy and affordable opportunity to get in touch with loot boxes that start from as cheap as \$0.5 while some cost over \$100. In many games loot boxes can be obtained multiple times and after a purchase that did not lead to the anticipated results, a player might feel the urge to buy more and potentially more expensive loot boxes to succeed in obtaining a wanted item. This can potentially lead to high spending for loot boxes. It is an open question whether randomly selected items in loot boxes are comparable to monetary prizes in gambling and loot boxes would thus fulfill the criteria of gambling and be regulated as such. The growing importance of specialized secondary markets that allow players to trade virtual items for real money could be seen as an indicator of value of such items. Closely connected to loot boxes' proximity to gambling is the question of how gambling-associated addictiveness relates to loot box usage. However, loot boxes are far too diverse to give a general answer and there certainly exist loot boxes that cannot be considered gambling – especially when they are gained with in-game currency that is obtained through continuous playing.

Our findings set the stage for us to reconsider the appropriateness of the term „microtransactions“. Finally, this previously common term for payments within video games resulted from the former payment structure and pricing models of digital items, which included commonly low prices. Meanwhile, however, these payments reach higher dimensions that have nothing to do with the original minimal amounts. For example, with loot boxes high prices above \$100, resulting from trading on different platforms, are common. Even if certain loot boxes can be purchased at low cost, significant higher amounts are usual as well. In addition, these payments can also take place outside the respective gaming platform and often grow to three-digit dollar amounts, which undermines former structures. Therefore, the term "microtransactions", which suggests low-threshold payment structures in the cent range, is meanwhile no longer appropriate for such transactions, because it trivializes the actual magnitude of usual payment amounts.

## 6 Limitations

Various limitations of the study must be noted. First, it is important to mention the use of survey methods, which was conducted exclusively online. This method does not allow for personal instructions and possible queries posed by the participants. Furthermore, some participants could have had the intention to run quickly through the questionnaire in order to receive the incentive for participation. The survey provider had precautionary measures to account for this problem by sorting out subjects who have gone through the questionnaire unusually quickly. However, these measures might not have protected from all

respondents with such intention. Second, in the absence of a validated tool for game-related problems due to Pay2Win usage, the PGSI has been adapted and extended for game-related issues. In this context, a mathematical adjustment of the cut-off values was made. The adaptation of the cut-off values in the PGSI measuring game-related problems can be regarded as problematic. For example, a calculated value of more than 7 can lead to decimal places resulting in a more sensitive classification. In contrast, for the original gambling related PGSI, the equivalent classification would start from a value of 8.

Finally, it should be noted that only the complete household income was requested by the questionnaire without the additional information on the total number of persons (including children) living in the same household. This information would be of interest in relation to the credit available to the player. The knowledge about other persons living in the household could play an important role in terms of the available game time. Moreover, household income and frequency of game participation were recorded in interval scales, so we had to calculate averages for the regression.

## 7 Future Research

The limited research knowledge currently available on loot boxes sets the stage for future research to build on these findings. For example, the risk of loot boxes must be verified by analyzing the points of contact and the motivations for purchasing. Qualitative studies seeking to understand the lived experiences of players who purchase loot boxes could help clarify players' purchasing motivations.

Further, research activities should investigate how social networks offered via the internet might influence the probability of using loot boxes and the frequency of purchasing. It is conceivable that, in addition to word of mouth, the transmission of information, via Facebook or YouTube videos, takes place and amplifies a wide spread influence within a relatively short period of time. In this way, the distribution of loot boxes is multiplied by different access paths which should be examined more closely.

Moreover, future research should verify whether loot boxes themselves generate a risky situation, or whether they represent an accessory for people at risk of addiction? This question is significant and speaks to the need to have a validated game-related problem-screening tool specifically designed for Pay2Win related issues.

Finally, the connection between playing time (as a whole or within a game session) and players' available money is particularly worthy of investigation. Further research understanding this relationship is needed. For example by using additional instruments and further developed surveys.

## 8 Conclusion and Outlook

Our study illustrates that the typical loot box users are young, employed, have a low level of education but an average household income. They gamble with both real and play money and are likely to be problem gamblers/gamers. Further, loot boxes seem to be associated with problem gambling. Due to their combination of gambling-like elements with a permanent availability and potentially unlimited number of purchases, potential harms might be related to the consumption of loot boxes. Overall, we argue that loot boxes are an important social and economic phenomenon that needs further examination by researchers, regulators and Public Health to generate reliable knowledge for public discussion. Meanwhile, regulators should consider, if a regulatory intervention is needed to reduce associated risks for vulnerable players, such as underage gamers, while keeping the benefits of this new form of entertainment.

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## Appendix

Table 5: PGSI (Problem Gambling Severity Index)

	Never	Sometimes	Most of the time	Almost always
1. Have you bet more than you could really afford to lose?				
2. Have you needed to gamble with larger amounts of money to get the same feeling of excitement?				
3. When you gambled, did you go back another day to try to win back the money you lost?				
4. Have you borrowed money or sold anything to get money to gamble?				
5. Have you felt that you might have a problem with gambling?				
6. Has your gambling caused you any health problems, including stress or anxiety?				
7. Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?				
8. Has your gambling caused any financial problems for you or your household?				
9. Have you felt guilty about the way you gamble or what happens when you gamble?				

Table 6: PGSI adapted for Pay2Win gaming

	Never	Sometimes	Most of the time	Almost always
1. Have you spent more money than you could really afford to lose?				
2. <i>Have you spent more time than you intended?</i>				
3. Have you needed to play <i>longer</i> to get the same feeling of excitement?				
4. When you played and lost, did you <i>increase your playing time to regain your initial position?</i>				
5. Have you borrowed money or sold anything to get money to <i>game</i> ?				
6. Have you felt that you might have a problem with <i>gaming</i> ?				
7. Has your <i>gaming</i> caused you any health problems, including stress or anxiety?				
8. Have people criticized your <i>gaming</i> or told you that you had a <i>gaming</i> problem, regardless of whether or not you thought it was true?				
9. Has your <i>gaming</i> caused any financial problems for you or your household?				
10. Have you felt guilty about the way you <i>game</i> or what happens when you play?				

Changes to original PGSI in italic

Table 7: Frequency of loot box purchasing

	Everyday	Almost everyday	Multiple times per week	Once per week	Multiple times per month	Once per month	A few times per year	n/a
n	88	82	101	111	77	56	59	12
Average age in years	35.0y	37.7y	35.3y	35.9y	39.0y	39.2y	35.8y	37.2y
% male	68.2%	56.1%	59.4%	43.2%	48.1%	57.1%	57.6%	58.3%
<b>Personal status</b>								
Single	25%	39.0%	32.7%	22.5%	32.5%	33.9%	37.3%	25%
Married	45.5%	37.8%	45.5%	40.5%	36.4%	28.6%	23.7%	50%
In partnership	13.6%	20.7%	17.8%	29.7%	22.1%	26.8%	32.3%	25%
Other	15.9%	2.4%	4.0%	7.2%	9.1%	10.7%	6.8%	0%
<b>Employment status</b>								
Employed	87.5%	87.8%	90.1%	86.5%	72.7%	76.8%	76.3%	91.7%
Unemployed	2.3%	2.4%	0.0%	3.6%	7.8%	1.8%	5.1%	0.0%
Unoccupied <sup>a</sup>	10.2%	9.6%	9.9%	9.9%	19.5%	21.4%	18.6%	8.3%
<b>Education</b>								
University	21.6%	19.5%	29.7%	18.0%	22.1%	28.6%	25.4%	33.3%
Apprenticeship	17.0%	21.9%	20.8%	29.7%	33.8%	19.7%	27.1%	8.3%
A-levels	13.6%	17.1%	21.8%	20.7%	19.5%	25.0%	30.5%	41.7%
Main- or middleschool	17.0%	32.9%	21.8%	28.8%	22.1%	23.2%	13.6%	16.7%
No graduation	30.7%	8.5%	5.9%	2.7%	2.6%	3.6%	3.4%	0%
<b>Net household income</b>								
>€5,000	9.1%	8.5%	5.9%	2.7%	5.2%	8.9%	8.5%	0.0%
€3,000-4,999	14.8%	14.6%	19.8%	21.6%	16.9%	23.2%	27.1%	8.4%
€2,000-2,999	11.4%	24.4%	28.7%	19.8%	18.2%	21.4%	10.2%	8.3%
€1,500-2,000	36.4%	15.9%	8.9%	16.2%	20.8%	21.4%	20.3%	33.3%
€1,000-1499	13.6%	15.9%	20.8%	22.5%	18.2%	10.7%	18.6%	16.7%
€500-999	6.8%	9.8%	7.9%	7.2%	10.4%	5.4%	6.8%	0.0%
<€500	5.7%	6.1%	2.0%	5.4%	5.2%	3.6%	6.8%	0.0%
n/a	2.3%	4.9%	5.9%	4.5%	5.2%	5.4%	1.7%	33.3%
Gambling participation	72.7%	58.5%	63.4%	61.3%	54.5%	55.4%	54.2%	66.7%
Play money gambling	96.6%	85.4%	92.1%	90.1%	81.8%	78.6%	55.9%	75.0%
<b>Problem Gam(bl)ing</b>								
Problem Gamer	81.8%	73.2%	83.2%	76.6%	71.4%	42.9%	28.8%	58.3%
Problem Gambler	64.8%	47.6%	56.4%	54.1%	37.7%	19.6%	20.3%	33.3%