Breaking Ban: Belgium’s ineffective gambling law regulation of video game loot boxes

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Abstract

Loot boxes in video games are gambling-like mechanics that players buy to obtain randomised rewards of varying value. Loot boxes are conceptually and psychologically similar to gambling, and loot box expenditure is positively correlated with self-reported problem gambling severity. Citing consumer protection concerns, the Belgian Gaming Commission opined that such mechanics constitute gambling under existing law and effectively ‘banned’ loot boxes by threatening criminal prosecution of non-compliant companies implementing paid loot boxes without a gambling licence. The effectiveness of this ban at influencing the compliance behaviour of video game companies (and, by implication, consumers’, including children’s, exposure to and consumer protection from loot boxes) was assessed. Paid loot boxes remained widely available amongst the 100 highest-grossing iPhone games in Belgium: 82.0% continued to generate revenue through a randomised monetisation method, as did 80.2% of games rated suitable for young people aged 12+. The Belgian ‘ban’ on loot boxes has not been effectively enforced. Although the initial imposition of this measure promoted public discussion and debate about loot box regulation (both domestically and internationally) and likely provided better consumer protection in relation to specific games operated by well-known companies, an unenforced ‘ban’ has many negative consequences, including (i) giving consumers, parents, and policymakers a false sense of security and (ii) allowing non-compliant games to replace games that have been removed from the national market by more socially responsible companies. On a theoretical level, indeed, even an effectively enforced ban also has several potential disadvantages, including (i) stigmatisation; (ii) promoting the ‘forbidden fruit effect’; (iii) curtailing companies’ commercial interests; (iv) unfairly distributing more revenue to non-compliant companies; (v) restricting players’ choices and accessibility to video games; (vi) negatively affecting the gameplay experience; (vii) unfairly disadvantaging Belgian players; and (viii) damaging the country’s eSports industry. Finally, technical measures taken by companies to comply with the ban were easily circumvented, and some highly dedicated players (who are likely to be the highest spending and most vulnerable) could reasonably be expected to do so. Therefore, the complete elimination of the loot box mechanic from a country is may not be practically achievable. Belgium should re-evaluate its regulatory position. A blanket ban approach to loot box regulation cannot be recommended to other countries. Other less restrictive approaches to loot box regulation should be considered.
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Keywords (10 Max):

Loot boxes; Gambling law; Video gaming regulation; Consumer protection; Belgium
1. Introduction

Paid loot boxes are randomised monetisation methods in video games that are purchased by players to obtain randomised rewards of varying value \[1\]. Loot boxes are prevalent in video games internationally and across different hardware platforms \[2–5\]. The loot box purchasing process hides what rewards the player will actually receive (and their value) until after the purchase decision and payment have already been made, which is why paid loot boxes have been identified as being structurally similar to gambling \[6–8\] and why they have been considered ‘predatory’ and potentially abusive of consumers \[7,9–11\]. Loot boxes have also been identified as sharing certain psychological similarities with gambling \[12,13\]. Indeed, loot box purchasing has been found to be positively correlated with problem gambling severity in 16 studies in various countries \[14,15\], including the US \[16,17\], Canada \[18\], the UK \[19,20\], Spain \[21\], Germany \[22\], Denmark \[23\], Australia \[16,24\] and Aotearoa New Zealand \[16\], and internationally in general \[25–31\]. Specifically, players that self-reported higher scores on problem gambling severity scales tend to buy more loot boxes, and the theorised implication of which is that video game companies are likely disproportionally profiting from such potentially at-risk players \[32\]. The same correlation has also been found within samples of underage players, and it has been suggested that young people might be a group that is particularly vulnerable to potential harms \[20\]. Many countries have considered, or are considering, whether to regulate loot boxes because of their potentially harmful link to problem gambling, and because of consumer protection concerns, particularly in relation to vulnerable groups, such as children \[11,33–40\].

The predominant regulatory approach, adopted by gambling regulators \[41–45\] and policymakers \[46–50\] in many countries, has been to consider whether to regulate paid loot boxes as gambling: particularly, whether different types of loot boxes that have already been implemented in various video games fall afoul of existing gambling law \[10,11,38\]. If paid loot boxes constitute gambling, then video game companies would be prohibited from offering loot boxes for sale unless they possess a gambling licence (and therefore be regulated under gambling laws, and would be prohibited from selling them to underage players in most countries even with a licence). Regulators in different countries have come to divergent conclusions on this
particular legal point because the definitions for gambling in law varies from
county \[10,11,38\].

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which can be transferred to other players (and therefore possess real-world
monetary value) and, secondly, those containing rewards which cannot be
transferred to other players (and therefore does not possess direct real-world
monetary value) \[1,7,10\]. The first type constitutes gambling under existing law in
many countries, as recognised by various European national gambling regulators,
including in the UK, Denmark, and Belgium \[41–44\], although only the Belgian
regulator has actively enforced the law \[11\]. In contrast, the Dutch gambling regulator
also previously opined that the first type constitutes gambling \[45\] and has enforced
the law by imposing a financial penalty on Electronic Arts for allegedly illegal loot
box implementation in its FIFA games \[51,52\]; however, that interpretation has since
been successfully appealed and was overruled by the highest Dutch administrative
court. Therefore, the Netherlands is the first country where the first type of loot
boxes has been confirmed not to constitute gambling.

However, as far as can be discerned, the second type constitutes gambling only
under existing Belgian law \[44\] and Manx law \[53,54\] and not in other jurisdictions \[11,38\].
Belgium has been popularly referred to as a country that has ‘banned’ both types of
loot boxes \[55\]; this is technically incorrect because the law did not change and the
Belgian gambling regulator merely announced its interpretation of the law and
declared an intention to enforce it by criminally prosecuting non-compliant video
game companies for contravening existing gambling law \[44\]. Offering either type of
paid loot boxes would be illegal under the gambling law of the Isle of Man unless
licensed because the definition for of ‘money’s worth’ differs between Manx and UK
law \[53,54\]. However, this paper does not focus on further Manx law
discussion because it is effectively identical to the Belgian position but practically it
appears that video game companies simply treats the Isle of Man as the UK and
have not taken dedicated Manx compliance action, in contrast to taking exclusive
compliance action in Belgium, as discussed in detail below.
In order to comply with Belgian gambling law (the Gambling Act of 7 May 1999), as interpreted by the Belgian gambling regulator (which the academic literature recognises as the correct legal interpretation [10,11,38], even though video game companies have expressed their disagreement with this interpretation [56–58] but have not attempted to appeal it), a number of prominent video game companies have reported either disabling player’s ability to purchase both types of loot boxes in Belgium [56–58] or even removing their games from the jurisdiction outright and having stopped providing the video gaming service (including the sale of loot boxes) to Belgian players [59]. These are demonstrations of how enforcement of Belgian gambling law has caused at least some video game companies to behave differently in Belgium as they do in other countries. Therefore, Belgian players will likely find it more difficult to purchase loot boxes (if they are able to do so at all) than players from other countries who continue to have unrestricted access. Belgian consumers are thereby likely better protected from the potential harms of loot boxes: players who cannot spend any money at all on loot boxes could not ‘overspend’ and would not suffer potential financial harms.

However, the restrictive course of action taken by Belgium policy is potentially overregulation because not all consumers will be harmed by loot boxes, yet now all Belgian players, both children and adults alike, cannot buy loot boxes. Loot boxes and other newer monetisation methods, compared to the old model of selling the software, allow for many players (including some who might not be able to afford purchasing the software) to gain access to entertainment and play certain games for free [11]. The Belgian ban has arguably infringed upon the freedom and right to choose of players who would never have been harmed [60]. Indeed, in contrast to this prohibiting approach, other alternative regulatory approaches that better ensure consumer choice (although potentially providing less consumer protection) are available. For example, China legally requires video game companies to disclose the probabilities of obtaining randomised loot box rewards, thus providing a degree of transparency and consumer protection, whilst not restricting the player’s freedom to purchase loot boxes, nor the video game companies’ commercial interests in selling loot boxes [3,61]. Researchers have also suggested restricting loot box sales only

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1 Wet van 7 mei 1999 op de kansspelen, de weddenschappen, de kansspelinrichtingen en de bescherming van de spelers [Act of 7 May 1999 on games of chance, betting, gaming establishments and the protection of players].
to a certain extent by limiting players’ spending on loot boxes to a ‘reasonable’ amount, e.g., US$50 [62,63], and designing more ‘ethical’ loot boxes that players are less likely to overspend on [61,64,65].

Despite a loot box ‘ban’ being (arguably overly) paternalistic, two UK parliamentary committees have recommended that the second type of loot boxes (currently only illegal in Belgium) should also be regulated in the UK through an amendment of its gambling law by expanding the definition of what constitutes gambling [47,49], and this is presently being considered by the UK Government [66]. Other countries are also considering adopting a similar prohibition of the second type of loot boxes that would mirror the current restrictive position in Belgium: as demonstrated by Bills proposed in the US that have since failed [67] and by a Bill that an Australian Member of Parliament intended to propose [68] that would restrict loot box sales to underage players.

Given that there is significant interest in emulating this regulatory approach, it is important to assess whether this Belgian ‘ban’ on loot boxes has been effective. One objective measure is to assess whether loot boxes have been effectively removed from games marketed in Belgium. A preliminary examination of the top-grossing iPhone games list in Belgium (more than three years after the ban was confirmed by the Belgian Gaming Commission [44]) revealed that a number of games occupying prominent positions on the top-grossing list, which were found to contain loot boxes in the UK [4,5] and in the People’s Republic of China [3] and whose revenue likely mostly derived from loot box sales, occupy prominent positions on the top-grossing list. It is not known whether these games are monetising using methods which do not involve loot boxes in Belgium, or whether these games are continuing to sell loot boxes in Belgium. If the latter is true, then these video game companies are either operating contrary to Belgian gambling law and liable for criminal prosecution or operating under a gambling licence (which appears unlikely as none has been known to have been granted to video game companies at the time of writing).

Belgium is the appropriate jurisdiction to study in this context because the other two candidate jurisdictions (the Isle of Man and the Netherlands) are less suitable. Firstly, in relation to the Isle of Man, the jurisdiction is a Crown Dependency of the
UK that, although it has its own laws, is not necessarily recognised as a separate jurisdiction in practice by video game companies. The jurisdiction’s small population of approximately only 80,000 residents and geopolitical status potentially give rise to certain idiosyncrasies. It is unlikely that video game companies would actively seek to comply with Manx law by making a special ‘national’ version of their software. Indeed, for example, there is no Manx Apple App Store (where such an adapted ‘national’ version of the game could potentially be published) based on which a highest-grossing list might be captured for research purposes. This is in contrast to Belgium which has a much larger population of more than 11.5 million legal inhabitants and where video game companies have reportedly taken dedicated, national compliance action.

Secondly, the legal position in relation to loot boxes in the Netherlands changed in March 2022. Previously, the Dutch gambling regulator incorrectly interpreted the law and has actively enforced existing gambling law to regulate the first type of loot boxes by sanctioning allegedly non-compliant companies (specifically, imposing a financial penalty on Electronic Arts for allegedly illegal loot box implementations in its FIFA games). This is unlike other countries (e.g., the UK) whose regulators came to the same interpretation of their gambling laws but have not sought to take enforcement actions against potential contraventions. The present Dutch position is that the first type of loot boxes are confirmed to be generally lawful. The Dutch Apple App Store would therefore likely be experiencing change to reflect that new regulatory position, which would render it inappropriate to study for answering the present research question. Even assuming that the regulatory change did not take place, it would not have been appropriate to study the Netherlands because the previously enforced Dutch regulation focused on the presence of the ability for players to transfer loot box rewards to other players in exchange for real-world money. A previous loot box prevalence study attempted to assess the presence and prevalence of this so-called ‘cashing out’ process: however, Zendle et al. (2020) importantly failed to reliably do so, possibly due to video game companies actively preventing this from happening such that the availability of third-party cashing out platforms is extremely transient. Even if the presence of cashing out features could have been reliably assessed, the previous Dutch regulatory position meant that only a reduction in the prevalence of ‘cashing out’ features would have been observable and that a reduction in paid loot box prevalence was not necessarily
observable and, indeed, highly unlikely to have been true because the removal of paid loot boxes was not legally required. This is contrasted with Belgium, where a reduction in paid loot box prevalence should be observable as an outright removal of the feature is required to comply with the law, as compared to only amendments to a certain aspect of some loot boxes’ implementation that Dutch law previously required. This is demonstrated by how the same video game company removed paid loot boxes entirely from a game in Belgium [56], but did not remove paid loot boxes from the same game in the Netherlands and only changed them such that cashing out is no longer possible [72].

Therefore, a survey replicating the methodology of previous loot box prevalence studies [3–5] was conducted in Belgium to assess: (i) the effectiveness of the Belgian Gaming Commission’s threat to criminally prosecute video game companies for implementing paid loot boxes without a gambling licence (i.e., the Belgian ‘ban’) [44] and (ii) whether the loot box prevalence rate in Belgium is consequently lower than in other Western countries where no loot box regulation has been enforced, e.g., the UK. Doing so sheds light on whether the Belgian ban has effectively changed video gaming companies’ behaviour. In addition, potential circumventions of the Belgian ban on paid loot boxes were attempted: specifically, the UK version of certain games that are known to contain paid loot boxes was downloaded and loot box purchasing using those games within geographical and jurisdictional Belgium was attempted.

The following research questions were addressed.

Research Question 1: Has the Belgian ban succeeded in eliminating paid loot boxes from mobile games?

Research Question 2: Has the Belgian ban on paid loot boxes been effective?

Research Question 3: Is it possible for a player to circumvent the Belgian ban on paid loot boxes and purchase them from within the country?

Because loot boxes have been effectively banned by the Belgian Gaming Commission’s public pronouncement of its interpretation of Belgian gambling law [44], no loot boxes should be found amongst video games available in Belgium:
Hypothesis 1: None of the 100 highest-grossing iPhone games in Belgium will contain paid loot boxes.

Hypothesis 2: None of the games within the 100 highest-grossing iPhone games in Belgium that received an Apple Age Rating of 4+, 9+, or 12+ \( (i.e., \text{not } 17+) \) will contain paid loot boxes.

Notably, the results of Hypothesis 1 cannot be conclusive proof that any of those games that were found to contain paid loot boxes infringed Belgian gambling law and were operating illegally, because the companies operating those games might possess a gambling licence granted by the Belgian Gaming Commission. The list of games and their operating companies was sent to the Belgian Gaming Commission to request that the Commission confirm whether any of those companies were duly licensed. Permission to publish the Commission’s response is described in the Results section, if any is received, was sought and, a summary will be made available at the data deposit link (<https://doi.org/10.17605/OSF.IO/7KJS9>).

Hypothesis 2 is included because in case the Commission may have not responded (although it in fact did): the offering of gambling services to young people under the age of 18 or 21 is illegal depending on the type of gambling, per Article 54 of the Belgian Gambling Act of 7 May 1999. Therefore, the offering of paid loot boxes in any game that is rated to be suitable for children aged 4+, 9+ and 12+ \( (i.e., \text{not rated } 17+) \) should be illegal and a stronger case of suspected criminality can be put against any such games found to contain paid loot boxes.

Assuming that the Belgian ban on loot boxes has been effective to some perceivable degree, then the availability of loot boxes in Belgium should be lower than previously observed in other countries that have not actively regulated this mechanic \( (\text{e.g., the UK}) \):

Hypothesis 3: Of the highest-grossing iPhone games, fewer will contain paid loot boxes in Belgium than in countries that have not banned loot boxes.

The 100 highest-grossing games were chosen to form the sample for Hypotheses 1–3, following the methodology of previous studies \(^{[3-5]}\), because these are the most
popular games that generate the most amount of revenue for video game companies. Globally, the 100 highest-grossing mobile games reportedly accounted for 53.5% of all player spending on those platforms in 2020. Generally, players are most likely to encounter and engage with these games, and the Belgian Gaming Commission should be most heavily scrutinising these games when undertaking compliance actions. Relevant stakeholders, including players, parents and regulators, would be most interested in the compliance situation amongst these best commercially performing games. Previous studies have noted that the highest-grossing games should be the most compliant and therefore do not necessarily reflect the compliance situation with lower grossing games (and this limitation is recognised in the Discussion section); however, the 100 highest-grossing games do represent the most objective and reasonably practicable sample. For Hypothesis 3 in particular, a sample size of 100 games allowed for the present study to be directly comparable to the Zendle et al. (2020), the Xiao et al. (2021), and the Xiao et al. (2021) samples of the 100 highest-grossing iPhone games and remove any potential biases that might arise from choosing a differently justified and constituted sample of a potentially different size.

For the Belgian ban on loot boxes to be deemed fully effective, it must not only reduce loot box availability through the usual domestic channel of downloading iPhone games from the Belgian Apple App Store but also prevent potential technical circumventions (e.g., downloading the games from the UK Apple App Store from within Belgium and purchasing loot boxes in that version of the game). Preventing such circumventions appears technically difficult and is therefore unlikely to have been accomplished:

Hypothesis 4: UK iPhone games known to contain paid loot boxes will continue to offer them for sale even when the phone is within geographical and jurisdictional Belgium.

The contribution from the present study also has wider implications to other regulatory domains because it empirically examines and assesses companies’ compliance with criminal law, specifically in relation to the challenging regulation of novel technologies and new media: have companies changed their corporate behaviours because of a specific legal development? Such an exercise is nearly
impossible to do objectively in most other contexts. However, the highest-grossing list of video games provides for an impartial way to assess compliance with gambling law amongst the best commercially performing companies that would be far more difficult, if not impossible, to do in relation to, e.g., physical, traditional gambling venues or online (including cryptocurrency) gambling websites (whose relative popularity and financial performance are more difficult to measure and compare).

2. Method

Replicating the established methodology of Xiao et al. (2021) and aiming to collect data from a relatively diverse range of video games, the 100 highest-grossing iPhone games on the Belgian Apple App Store on 28 May 2022 as reported by App Annie (since rebranded to data.ai), an authoritative independent analytics company, were selected to form the sample. If a game on the captured list is (i) no longer available for download by the data collection period or (ii) a duplicate of a higher-ranked game whose data was already collected (two exclusion criteria applied in Xiao et al. (2021)), then it was excluded from the sample and replaced with the next highest-ranking game, e.g., the 101th highest-grossing game in the first instance. In total, 100 games were coded.

The Country/Region setting of the Apple ID that was used on the coder’s iPhone was set to Belgium to ensure that the Apple App Store that loads is the Belgian Apple App Store. This guarantees that the game that was downloaded from then on was the Belgian version of the game specifically uploaded to and made available on the Belgian Apple App Store (whether or not the video game company actually made it different from the version(s) uploaded to other country’s Apple App Stores). In addition, the coder physically travelled to Belgium to ensure that they were within the Belgian geographical and legal jurisdiction when conducting the data collection. This is preferable to, for example, using a VPN (Virtual Private Network) to spoof the coder’s IP (Internet Protocol) address to be in Belgium even though the coder has remained physically in a non-Belgian jurisdiction, because such a coder would technically not be under the jurisdiction of Belgian gambling law (as they is not physically within the country), even if they is playing the Belgian version of the game downloaded from the Belgian Apple App Store.
The following variables were measured:

*Apple age rating*

This variable was coded using the relevant age rating information displayed on the game’s Belgian Apple App Store page.

*Presence of paid loot boxes*

A ‘paid loot box’ was defined as being either an Embedded-Isolated random reward mechanism (which are video game mechanics that players must pay real-world money to activate and which provide randomised rewards that do not possess direct real-world monetary value) or an Embedded-Embedded random reward mechanism (whose activation also must be paid for by players with real-world money but which do provide randomised rewards that possess direct real-world monetary value), as defined by Nielsen & Grabarczyk (2019) [7]. An amendment must be made to the methodology of Xiao et al. (2021) [3], which assessed this variable based firstly on 40 minutes of gameplay and, if no such mechanic was found within that time, then based on up to 2 hours of internet browsing of video streams and screenshots. This is because it is not possible to rely upon internet browsing at all for the present study as the coder cannot know whether the video streams or the screenshots that they observe were captured from a Belgian version of the game. Only by playing a Belgian version of the game can the coder be confident that they are coding the correct, national version of the game that was possibly amended to comply with the law. Therefore, to avoid video streams and screenshots of non-Belgian versions of the games from biasing the results, the coder spent up to an hour playing the video game instead. If a paid loot box cannot be identified within that timeframe, then the game was coded as not containing paid loot boxes.

This design decision may cause the Belgian loot box prevalence rate that was found by the present study to be lower than the true value. However, this is unavoidable and justifiable. Firstly, the present study is more concerned with finding a non-zero value rather than the true value: the presence of paid loot boxes in even one high-grossing game severely challenges the effectiveness of the Belgian ban. Secondly, in the most recent loot box prevalence research of Xiao et al. (2021), of the 77 games amongst the 100 highest-grossing UK games that were found to contain loot boxes, 73 games’ loot boxes were identified through gameplay (94.8%), whilst only 4
games’ were determined through internet browsing (5.2%), so the potential bias caused by coding games that must be coded through internet browsing as not containing loot boxes would be very minor. Thirdly, it was always potentially possible for a game to have been thusly inaccurately coded as not containing paid loot boxes even when it did because the coder could always have been unable to identify such a mechanic even during the combined 40 minutes of gameplay and 2 hours of internet browsing. This was accepted as a justifiable inaccuracy because this meant that a new player engaging with the game (whose experience the previous literature attempted to replicate) would highly likely have not encountered a paid loot box either. Fourthly, this approach is also ‘fairer’ towards the video game industry in the sense that if games whose paid loot box presence could not be determined would instead be excluded from the sample and replaced with the next highest-grossing game until a game whose loot boxes could be found is assessed, then the loot box prevalence rate would be artificially inflated to be higher than the true value.

Further, if a so-called ‘sand box’ game, such as Minecraft (Mojang, 2011) or Roblox (Roblox Corporation, 2012), that contains a significant amount of third-party user-generated content is included in the sample, then that game was assumed by the coder to contain paid loot boxes without the need for the coder to identify and screenshot such a mechanic (because choosing to base the coding on which specific third-party content would be subjective). However, the game was deemed compliant with the law and coded as not containing paid loot boxes if an official online post can be found where the developer or publisher of that game specifically states that user-generated content that is paid loot boxes should not be offered in Belgium, similar, for example, to the guidelines requiring loot box probability disclosures that Roblox Corporation published.

Finally, it is noted that the coder only accessed and screenshots the loot box purchase screen and the Apple App Store payment pop-up screen for the paid loot box. The coder did not go through with the transaction by paying real-world money in exchange for paid loot boxes and confirm that the sale would indeed process. This is because doing so would be illegal under Belgian gambling law. Article 4(2) of the Belgian Gambling Act of 7 May 1999 states that: ‘It is prohibited for anyone to participate in a game of chance … when the person involved knows that it concerns
the operation of a game of chance or a gaming establishment which is not licensed in accordance with this Act.’ The coder, being an academic researcher of loot box regulation, possessed the knowledge that the relevant video game company likely did not have a gambling licence and therefore would arguably have been committing a crime if they he completed the loot box purchasing transaction.

Date and time of data collection
The date and time, based on Central European Summer Time (or Central European Time, depending on which was used by Belgium at the data collection period), on and at which paid loot boxes were searched for was recorded.

Two previous studies, whose methodology the present study is replicating, calculated for inter-rater reliability by dual-coding 15% of the sample [3,5]. The methodology has therefore been previously refined and been found to be reliable (near-perfect or perfect agreement was achieved). Therefore, the present study did not calculate for inter-rater reliability. The raw data and a full library of screenshots showing, inter alia, the Apple App Store age rating and in-game loot box purchase pages for each game will isbe available via <https://doi.org/10.17605/OSF.IO/7KJS9> for public scrutiny.

Hypothesis 1 will would have been accepted if zero, one, or two of the 100 highest-grossing games that will bewas coded contained paid loot boxes.

Hypothesis 2 will would have been accepted if zero, one, or two of the games, within the 100 highest-grossing games that will wasbe coded, that received an Apple Age Rating of 4+, 9+, or 12+ (i.e., not 17+) contained paid loot boxes.

A Belgian loot box prevalence rate of 0% should be found amongst all games studied and amongst those games studied that were deemed suitable for underage players. However, considering that one previous loot box prevalence study identified an 1% false positive rate through its data collection process [4], to provide for type 1 error control, Hypotheses 1 and 2 will would have been accepted even if up to two Belgian games studied are identified as containing paid loot boxes (i.e., a prevalence rate of up to 2% will would have been deemed as effective elimination of loot boxes from the Belgian market). Considering that some video games might contain loot
boxes which are duly licensed by the Belgian Gaming Commission (whose
confirmation will bewas sought by the present study, as explained below), any
of the sample for the purposes disconfirming Hypotheses 1 and 2.

Hypothesis 3 will bewas tested using a binomial test (two-sided test, p = .05) to
identify whether the percentage of the 100 highest-grossing iPhone games
containing loot boxes in Belgium that will bewas found by the present study will
bewas significantly different from a hypothetical loot box prevalence rate of 65.0%,
which a Western country that has not restricted loot box sales is assumed to have.

The hypothetical 65.0% figure is derived from a holistic consideration of historical
loot box prevalence rates in other countries found by the prior literature. Zendle et
al. (2020) found the UK iPhone loot box prevalence rate amongst the 100 highest-
grossing games in February 2019 to be 59.0%[4]; Rockloff et al. (2020) found the
Australia loot box prevalence rate amongst the 82 ‘best selling’ games on various
platforms (e.g., PC, console, and mobile) between August and October 2019 to be
62.0%[3]; Xiao et al. (2021) found the Chinese iPhone loot box prevalence rate amongst
the 100 highest-grossing games in June 2020 to be 91.0% [3]; and Xiao et al. (2021)
found the UK iPhone loot box prevalence rate amongst the 100 highest-grossing
games in June 2021 to be 77.0% [5]. The comparatively high Chinese 91.0% prevalence
rate appears to be an outlier that has been influenced by Far East Asian cultural
factors that would not affect a hypothetical Western country that has not regulated
paid loot boxes; therefore, little reliance is placed on that datum. The Rockloff et al.
Australian 62.0% is derived from games on various consoles, whilst it is known that
games on mobile platforms (e.g., the iPhone platform which the present study
assessed) tend to contain more loot boxes[4]; therefore, the 62.0% value might not
reflect the contemporaneous Australian loot box prevalence rate amongst mobile
games specifically, which likely would have been higher. A comparison of Zendle et
al.’s 2019 UK data with Xiao et al.’s 2021 UK data suggest that the loot box
prevalence rate have increased due to a variety of reasons, including that the 2019
59.0% datum might have been an underestimation, due to certain paid loot box
implementations not having been recorded [5]. Xiao et al.’s 2021 77.0% figure is the
closest comparator for the present study, in terms of data collection time; however,
in context, it is comparatively higher than other values previously observed in
Western countries. Accordingly, a hypothetical value of 65.0%, which is slightly higher than the previously observed Zendle et al. UK 59.0% and Rockloff et al. Australian 62.0% values (which were likely slight underestimations), but which is lower than the comparatively high Xiao et al. UK 77.0% value, was used. This 65.0% value errs on the side of caution and avoid potentially overestimating the reduction effect of the Belgian ban, although unavoidably it is possible that the effect might consequently be underestimated.

In the absence of any prior guidance on what effect size would constitute a ‘legally meaningful’ and ‘socially beneficial’ regulatory measure, a smallest effect size of interest of Hedges’ $g = -.15$ is proposed based on the potential usefulness of the results to the end users [76]. The intended end users would be the policymakers in other countries who might be considering taking the same regulatory action that Belgium has already taken: importantly, besides the Belgian Gaming Commission having issued its interpretation of Belgian gambling law and thereby threatened criminal prosecution of non-compliant companies implementing paid loot boxes, little else appears to have been done by the Belgian Gaming Commission in terms of enforcement; therefore, thus far, the costs that have been incurred by Belgium in its attempt to regulate loot boxes have been relatively low. Accordingly, realistic policymakers seeking to expend a similarly low amount of resources to regulate loot boxes would likely not expect a particularly high reduction to loot box prevalence in Belgium (e.g., for the loot box prevalence rate to be reduced by at least 50 percentage points, i.e., to 15.0% or lower). Nonetheless, these policymakers would likely still expect some perceivable reduction (e.g., for the loot box prevalence rate to be reduced by at least 10 percentage points, i.e., to 55.0% or lower) before being persuaded to emulate the Belgian ban, considering that some regulatory costs have been incurred by Belgium and that Belgian consumers have been given the (potentially incorrect) impression that loot boxes have been effectively eliminated from the market. Recognising that some policymakers might be more hesitant to restrict players’ freedom to purchase loot boxes and video game companies’ commercial interests and therefore be more cautious when relying on the results (e.g., they might view a reduction of 10 percentage points or less as being insufficiently persuasive), it is proposed, conservatively, that the vast majority of policymakers would likely consider a reduction of at least 15 percentage points (i.e., for the loot box prevalence rate to be 50.0% or lower) as demonstrating the
effectiveness of Belgium’s loot box ban (as implemented in its relatively low-cost manner) and be persuaded to potentially emulate the Belgian regulatory actions in their own countries. Accordingly, setting the Hedges’ $g$ at $-0.15$, a priori power analysis using G*Power has determined, given an $\alpha$ value of 0.05: the present sample of 100 games would achieve 0.86 power in a two-sided test for finding a statistically significant difference between the Belgian and the hypothetical 65.0% prevalence rates (see Fig. A1).

As to interpretation, if the Belgian value is significantly lower than 65.0%, then Hypothesis 3 would have been accepted and the present study would have concluded that it is possible that the Belgian ‘ban’ may have been effective at reducing paid loot box prevalence in Belgium and that this measure could be considered for adoption in other countries, although it must also be recognised that national differences between Belgium and the previously assessed Western countries (i.e., the UK and Australia), and the passage of time between the data collection points, may also have contributed to the results. The present study would have then recommended other countries’ policymakers and regulators to consider adopting a similar measure if they desire to reduce paid loot box prevalence rates in their country: how strongly this recommendation would have been put by the present study in the Discussion section would have depended on the Belgian loot box prevalence rate that would have been identified (a reduction to below 50% would have been deemed as effective, whilst a reduction to below 25% would have been deemed as very effective). In contrast, if the Belgian value is significantly higher than 65.0%, then Hypothesis 3 would have been rejected and the present study would have concluded that the Belgian ban has been ineffective, noting the same abovementioned limitations. The present study would have then cautioned against other countries’ policymakers and regulators from making the assumption that a loot box ban will necessarily be effective, and concluded that the Belgian measure should not be adopted by other countries unless effective enforcement can be guaranteed or some other improvements are made. Further, reasoned criticism of the apparent lack of enforcement actions by the Belgian Gaming Commission would also have been made. However, if no significant difference is found, then the present study would have stated that no sufficient evidence that the Belgian ban affected paid loot box prevalence in Belgium has been found, thus Hypothesis 3 can be neither confirmed nor disconfirmed.
Alternative research methodologies for future studies will have been discussed.

For Hypothesis 4, firstly, the coder arrived in geographical and jurisdictional Belgium with an iPhone pre-installed with UK versions of the following three popular and high-grossing games (known to contain paid loot boxes in the UK) that reflect operating companies from various regions of the world: *Hearthstone* by the US company Blizzard Entertainment, *Brawl Stars* by the European, Finnish company Supercell Oy, and *Genshin Impact* by the Chinese company miHoYo Co., Ltd.. The sample size was limited to three highly popular games due to practical constraints on research resources. These three popular games were chosen because they have been widely published across the world (including in both the UK and China) and have consistently performed well financially. Importantly, engagement with loot boxes is a fundamental and arguably unavoidable and inalienable aspect of all three games’ gameplay and monetisation because the vast majority of in-game content (*e.g.*, playable characters) requires engagement with loot boxes to unlock (at least in the UK version of the games). These three games also represent how companies from three different regions of the world might have taken technological steps to comply with Belgian law and prevent potential circumvention. In the unlikely event that any of these three games becomes unavailable for download and online gameplay (*e.g.*, removed from the Apple App Store), another popular game developed by a company from the same region as the unavailable game; known to contain paid loot boxes in the UK; and in which paid loot boxes represent a fundamental aspect of the game’s gameplay and monetisation would be chosen to replace that game. With the Country/Region setting of the Apple ID initially set to the UK, the coder then attempted to access the paid loot box purchase screen and the Apple App Store payment pop-up screen and record their experience from within Belgium. Then, the Country/Region setting of the Apple ID was changed from the UK to Belgium, and the coding process was repeated. Thusly, the two potential possibilities of setting the phone’s geographic location to either Belgium or a non-Belgian country were tested. Subsequently, the three games were deleted from the iPhone. Secondly, whilst within geographical and jurisdictional Belgium, the coder changed the Country/Region setting of the Apple ID to the UK and attempt to access the UK Apple App Store to download the UK versions of those three games within Belgium. Then, the coder attempted to access the loot box purchase paid loot box purchase
screen and the Apple App Store payment pop-up screen and record their experience again. Therefore, two potential ways to circumvent the Belgian ban were tested: firstly, by bringing non-Belgian version of the games into the country and using them to purchase loot boxes, and, secondly, by downloading non-Belgian version of the games from within Belgium and using them to purchase loot boxes. Hypothesis 4 would have been accepted, if loot box purchase was possible within one or more of the games using any of the abovementioned methods. The interpretation would have been that the law can be easily circumvented by dedicated players; the Belgian Gaming Commission should therefore consider ways to force video game companies to better enforce compliance with the law. However, if loot box purchase is not possible within one or more of the games using any of the abovementioned methods, then the interpretation would have been that the law could not be circumvented in the simple ways that have been attempted, although other potential circumventions remain untested and possible. The present study would have concluded that companies might have taken some technological measures to prevent circumventions of the Belgian ban, although further evidence would be required to confirm this (e.g., contacting the relevant company to request for confirmation of the compliance actions that have been taken).

In accordance with the Danish Code of Conduct for Research Integrity[78], as adopted by the IT University of Copenhagen, the present study did not require research ethics assessment and approval because no human participants or personal data were involved and only publicly available information was examined and recorded.

The Stage 1 Registered Report for the present study was granted in-principle acceptance by Peer Community in Registered Reports on 7 April 2022 and is openly available in the Open Science Framework at https://doi.org/10.17605/OSF.IO/5MXP6.
3. Results

Statistical analysis was conducted using Stata, version 15.1.

3.1. Confirmatory analysis

3.1.1. Paid loot box prevalence in Belgium and effectiveness of the ‘ban’

Of the 100 highest-grossing Belgian iPhone games on 28 May 2021, 82 games contained loot boxes (82.0%). Their Apple App Store age ratings are summarised in Table 1.

<table>
<thead>
<tr>
<th>Apple App Store Age Rating</th>
<th>Total number of games (cumulative)</th>
<th>Number of games that contain loot boxes (cumulative)</th>
<th>Percentage containing loot boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4+</td>
<td>24</td>
<td>13</td>
<td>54.2%</td>
</tr>
<tr>
<td>9+</td>
<td>42</td>
<td>29</td>
<td>69.0%</td>
</tr>
<tr>
<td>12+</td>
<td>86</td>
<td>69</td>
<td>80.2%</td>
</tr>
<tr>
<td>17+</td>
<td>100</td>
<td>82</td>
<td>82.0%</td>
</tr>
</tbody>
</table>

Game 36 (The Lord of the Rings: War (NetEase, 2021)) could no longer be downloaded by the time of data collection and was therefore replaced with the next highest-grossing game, Game 101 (Bingo Frenzy-Live Bingo Games (Gluon Interactive, 2020)), as preregistered. Further discussion of how the commencement of the present study may have caused the removal of Game 36 is set out in Appendix 3. It is likely overly presumptuous and self-important to suggest that the commencement of the present study’s data collection may have caused Game 36’s removal from the Belgian Apple App Store. However, for full disclosure and context, the stage 1 registered report for the present study setting out the methodology was published on 7 April 2022, and the author did publish various online content about this then upcoming study, including publishing one Twitter post on 30 June 2022 implying that data collection has begun.[29] Game 36 appears to have been removed from the Belgian Apple App Store between 31 May 2022 and 1 June 2022 as the game appeared on the highest-grossing list on 31 May 2022 but did not do so on 1 June 2022. It is also curious that the game has been removed only from the Belgium store and remained available (and high-grossing) in all other countries checked, specifically, Denmark, France, the Netherlands, the UK and the US, according to data.ai, as shown in Figure 1. NetEase, the company operating Game 36, also operated another relatively popular game,
Identity V, that was not within the highest-grossing list studied. Identity V was known to contain loot boxes in the UK and in the PRC but has not been removed from any countries’ Apple App Store as of 7 June 2022. Exploratory analysis revealed that the Belgian version of Identity V continued to contain paid loot boxes in Belgium.
Figure 1. A series of screenshots of the grossing rank of Game 36 (The Lord of the Rings: War) in various countries demonstrating the removal date of said game from the Belgian Apple App Store.
(between 31 May and 1 June 2022) and how said game was curiously not removed from the Apple App Stores of Denmark, France, the Netherlands, the UK and the US. © 2022 data.ai.
Game 8 (Roblox) was duly coded as containing loot boxes as preregistered because, although loot boxes were not encountered through gameplay, it is known that loot boxes are implemented by third parties as user-generated content in this game and the developer and publisher of Roblox did not explicitly require that such user-generated loot boxes be blocked from purchase in Belgium.

Game 50 (Governor of Poker 3 – Friends (Youda Games & Azerion, 2016)) and Game 78 (DRAGON BALL Z DOKKAN BATTLE (Akatsuki & Bandai Namco Entertainment, 2015)) implemented Isolated-Isolated random reward mechanisms, as defined by Nielsen & Grabarczyk (2019), that provided randomised rewards, but the player did not have to pay real-world money to engage with them. These mechanics would have been capable of constituting a paid loot box (specifically, an Embedded-Isolated random rewards mechanism); however, both games took technical measures to prevent loot box purchase from within Belgium using real-world money. Specifically, the coder was prevented from spending real-world money to purchase the ‘premium’ virtual currency that would then be used to purchase loot boxes. The Apple App Store payment pop-up screen was rendered inaccessible. In Game 50, a pop-up window appeared indicating that ‘Buying virtual items is no longer possible in Belgium,’ as shown in Figure 12. In Game 78, the in-game shop simply did not display any premium currency as being purchasable without providing any explanation, as shown in the left pane of Figure 23. These two games were therefore compliant with Belgian law (due to the inability of the coder to purchase loot boxes using real-world money) and accordingly coded as not containing paid loot boxes. Exploratory analysis was conducted to attempt to circumvent the technical measures implemented in both games, as detailed below.
Figure 12. A pop-up window appeared to prevent any in-game purchase in Game 50 (Governor of Poker 3 – Friends) when this was attempted in geographical and jurisdictional Belgium without attempting any circumvention. © 2022 Youda Games & Azerion.

Hypothesis 1 was rejected because 82 (which is more than two) of the 100 highest-grossing Belgian iPhone games contained paid loot boxes.

Hypothesis 2 was rejected because 69 (which is more than two) of the 86 highest-grossing Belgian iPhone games that received an Apple Age Rating of 4+, 9+, or 12+ (i.e., not 17+) contained paid loot boxes.

In response to the author asking for the Belgian Gaming Commission to confirm whether any of the games found to contain loot boxes were duly licensed in an email dated 20 June 2022, the Commission stated in a meeting with the author on 24 June 2022 that this could be manually checked by the author and referred the author to Using public resources provided by the Belgian Gaming Commission (specifically, an exhaustive list of companies that are licensed to provide gambling services in Belgium). Using that list, it was determined that none of the 82 games found to be offering loot boxes for sale in Belgium (0.0%) were duly licensed. Identity V, the game operated by the same company as the removed Game 36, was also not licensed. Indeed, under the current gambling law regulatory regime in Belgium, the Belgian Gaming Commission is not legally empowered to be able to approve and license the provision of loot boxes or any randomised monetisation methods in video games as gambling (given that these cannot fit under any recognised licence categories), so no video game company can even apply for a licence, let alone successfully obtain one. The Belgian Gaming Commission has confirmed this legal point in the same meeting with the author on 24 June 2022.

Hypothesis 3 was rejected using a binomial test (two-sided test, $p = .05$), which revealed that the Belgian loot box prevalence rate of 82.0% was significantly higher ($p < .001$) than the hypothetical 65.0% prevalence rate.

In relation to Hypothesis 3, to err on the side of caution, a non-preregistered test was conducted to address the potential concern that the considerable prevalence of ‘social casino games’ or ‘simulated casino games’ (which are video games in which ‘players can spend real-world money to buy more stakes to continue participating in simulated gambling’) amongst the sample may have overly exaggerated the
prevalence of ‘loot boxes’ (widely defined) in Belgium. The Belgian Gaming
Commission does recognise the randomised monetisation methods in ‘simulated
casino games’ games as constituting ‘gambling’ (i.e., there is no distinction between
the two concepts in Belgium in contrast to in most other countries where the two are
treated differently in law as ‘simulated casino games’ are not seen as gambling and
not recognised as legally constituting ‘gambling’ elsewhere). However, there is
debate within the academic literature as to whether ‘simulated casino games’
should, by definition, be deemed as ‘containing loot boxes’ or an Embedded-Isolated
random reward mechanism\[75,81\]. The coder deemed 15 of the 100 games to be
‘simulated casino games’ (15.0%). Amongst the other 85 non-‘simulated casino
games’, 68 contained loot boxes (80.0%). A binomial test (two-sided test, \(p = .05\))
revealed that the Belgian loot box prevalence rate amongst non-‘simulated casino
games’ of 80.0% was still significantly higher (\(p = .003\)) than the hypothetical 65.0%
prevalence rate.

3.1.2. Potential circumvention of the ban

Hypothesis 4 was accepted because all three preregistered potential circumventions
of the Belgian ban in the three examined games were successful. Pre-downloaded
UK versions of the games worked without any hindrance and allowed loot box
purchase within geographical and jurisdictional Belgium, regardless of the Apple
ID’s Country/Region settings being set to the UK or Belgium. The coder was also
able to download the UK versions of the games from within Belgium and access the
in-game loot box purchase pages and Apple App Store payment pop-up screens.

One further potential circumvention was attempted successfully through
exploratory analysis. The three games that were preregistered to be examined all
continued to be available on the Belgian national Apple App Store. Some games (e.g.,
Fire Emblem Heroes (Nintendo, 2017) and Animal Crossing: Pocket Camp (Nintendo,
2017)) were known to have been removed from the Belgian store entirely. It was not
known whether such games could still be downloaded from within geographical
and jurisdictional Belgium by setting the Apple ID’s Country/Region settings to a
country where those games remain available, e.g., the UK. During the data collection
period, Blizzard Entertainment decided not to publish Diablo Immortal (Blizzard
Entertainment & NetEase, 2022) in Belgium and the Netherlands, citing ‘the current
operating environment for games in those countries’\[82\], which can reasonably be
inferred to mean these two countries’ loot box regulation\textsuperscript{[84]}. The coder was indeed unable to find or download \textit{Diablo Immortal} from the Belgian Apple App Store. However, the coder was able to do so by setting the Apple ID’s Country/Region settings to the UK and downloading the game from the UK Apple App Store whilst within geographical and jurisdictional Belgium. The premium currency used to purchase the loot boxes implemented in \textit{Diablo Immortal} was also purchasable using real-world money from within Belgium. This shows that any corporate actions to remove or not publish a certain game containing loot boxes in Belgium specifically can be easily circumvented if that game continues to be available on another country’s Apple App Store.

3.2. Exploratory analysis

3.2.1. Another game operated by the same operator as the removed Game 36

NetEase, the company operating Game 36, also operated another relatively popular game, \textit{Identity V} (NetEase, 2018), that was not within the highest-grossing list studied. \textit{Identity V} was known to contain loot boxes in the UK and in the PRC but has not been removed from any countries’ Apple App Store as of 7 June 2022. Exploratory analysis revealed that the Belgian version of \textit{Identity V} continued to contain paid loot boxes in Belgium.

3.2.2. Excluding social casino games from the analysis for Hypothesis 3

In relation to Hypothesis 3, to err on the side of caution, an exploratory test was conducted to address the potential concern that the considerable prevalence of ‘social casino games’ or ‘simulated casino games’ (which are video games in which ‘players can spend real-world money to buy more stakes to continue participating in simulated gambling’\textsuperscript{[75]}) amongst the sample may have overly exaggerated the prevalence of ‘loot boxes’ (widely defined) in Belgium. The Belgian Gaming Commission does recognise the randomised monetisation methods in ‘simulated casino games’ games as constituting ‘gambling’ (\textit{i.e.}, there is no distinction between the two concepts in Belgium in contrast to in most other countries where the two are treated differently in law as ‘simulated casino games’ are not seen as gambling and not recognised as legally constituting ‘gambling’ elsewhere). However, there is debate within the academic literature as to whether ‘simulated casino games’ should, by definition, be deemed as ‘containing loot boxes’ or an Embedded-Isolated random reward mechanism\textsuperscript{[75,80]}. The coder deemed 15 of the 100 games to be

\textsuperscript{2} For the Dutch law position on loot boxes in video games, see Xiao & Declerck (2022)\textsuperscript{[84]}. 

'simulated casino games' (15.0%). This was defined as any games that allowed the player to spend real-world money to participate in simulated traditional gambling activities, i.e., 'games of chance' or 'mixed games of chance and skill,' such as slot machines, poker, bingo, belote, and craps. Particular attention is drawn to Game 77 (UNO™ (Mattel, 2018)), which was coded as a social casino game because it involved players competing against each other to win or lose premium virtual currency (similarly to social casino games involving poker) whilst playing a simulated version of the tabletop game UNO (1971, Robbins), which itself is a mixed game of chance and skill that has reportedly been played physically as a form of gambling[81]. Amongst the other 85 non-'simulated casino games,' 68 contained loot boxes (80.0%). A binomial test (two-sided test, \( p = .05 \)) revealed that the Belgian loot box prevalence rate amongst non-'simulated casino games' of 80.0% was still significantly higher (\( p = .003 \)) than the hypothetical 65.0% prevalence rate.

3.2.3. Circumvention of the removal of games from the Belgian market

One further potential circumvention was attempted successfully through exploratory analysis. The three games that were preregistered to be examined all continued to be available on the Belgian national Apple App Store. Some games (e.g., Fire Emblem Heroes (Nintendo, 2017) and Animal Crossing: Pocket Camp (Nintendo, 2017)) were known to have been removed from the Belgian store entirely. It was not known whether such games could still be downloaded from within geographical and jurisdictional Belgium by setting the Apple ID's Country/Region settings to a country where those games remain available, e.g., the UK. During the data collection period, Blizzard Entertainment decided not to publish Diablo Immortal (Blizzard Entertainment & NetEase, 2022) in Belgium and the Netherlands, citing ‘the current operating environment for games in those countries,’[82] which can reasonably be inferred to mean these two countries’ loot box regulation[83]. The coder was indeed unable to find or download Diablo Immortal from the Belgian Apple App Store. However, the coder was able to do so by setting the Apple ID’s Country/Region settings to the UK and downloading the game from the UK Apple App Store whilst within geographical and jurisdictional Belgium. The premium currency used to purchase the loot boxes implemented in Diablo Immortal was also purchasable using real-world money from within Belgium. This shows that any corporate actions to remove or not publish a certain game containing loot boxes in Belgium specifically

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3 For the Dutch law position on loot boxes in video games, see Xiao & Declerck (2022)[84].
can be easily circumvented if that game continues to be available on another
country’s Apple App Store.

3.2.4. Exploratory analysis: Games that actively prevented loot box purchase

Of the 84 games that were potentially capable of selling loot boxes in exchange for
real-world money (the 82 games containing paid loot boxes plus Games 50 and 78),
only two games (2.4%) took technical measures to prevent loot box purchase with
fiat currency.

Game 50 prevented all in-game purchases: cosmetic items that were entirely
unrelated with any randomised monetisation methods were also not purchasable
with real-world money. Attempts to make any in-game purchases in Game 50 failed.
This state-of-affairs was illogical, because if all in-game purchases were blocked,
then this game could not therefore gross any money at all and so surely should not
be capable of being the 50th high-grossing game on the Belgian Apple App Store.
The present study could not determine what exact technical measures were taken to
block in-game purchase from within Belgium. However, two methods to circumvent
the technical measures were attempted to make an educated guess. Firstly, using a
VPN from within Belgium to spoof one’s IP address to be non-Belgian, and secondly,
taking the Belgian version of the game outside of the country. Whilst within
geographical and jurisdictional Belgium, Proton VPN was used to change the
coder’s IP address to Japan. Purchases for the premium currency were then
attempted on the same Belgian Apple ID and user account, and these were not
blocked (as the pop-up window shown in Figure 12 did not appear) and were
instead allowed to advance to the Apple App Store payment pop-up screen. Turning
off the VPN promptly made virtual items unpurchasable again. Secondly, the phone
containing the Belgian version of the game and with Belgian Apple App Store
settings was physically brought outside of geographical and jurisdictional Belgium.
When the coder was in Warsaw, Poland, in-game purchasing was possible similar to
when a VPN was turned on. Game 50 did not ask for, and did not have, permission
to access the coder’s phone’s geographical location. Therefore, it is likely that the
technical measure that has been taken was a simple IP address check to confirm
whether the player is within Belgium. This block on in-game purchase being easily
circumventable may partially explains why Game 50 still managed to gross money
through the Belgian Apple App Store, despite Belgian players being (in theory)
prevented from purchasing anything. The fact that Game 50 remains a high-grossing game suggests that a considerable number of Belgian players are likely circumventing this technical measure, although also note that the technical measure did work to a certain degree\footnote{Figure 4 shows a number of reviews left by users on the Belgian Apple App Store for Game 50 that clearly indicates that at least some players were frustrated by the inability to purchase premium currencies in Belgium (and it seems that these players were unable to, or did not want to, circumvent the technical measure), as detailed below. Regardless of its imperfect efficacy, Game 50 should still be commended for at least attempting to implement a technical block on loot box purchase from within Belgium because it might have successfully prevented some players from spending money; analysing user reviews of the game, which is beyond the ambit of the present study, may shed further light on that point. Turning on a Japanese VPN and being physically in Poland similarly allowed the coder to purchase the premium currency required to buy loot boxes in Game 78, as shown in the right pane of Figure 23.\footnote{}}.

Immediately prior to the coder’s physical departure from geographical and jurisdictional Belgium on 2 July 2022, in-game purchasing was attempted again in both Games 50 and 78 whilst at Brussels International Airport. For reasons unknown, in-game purchase was possible in Game 50 temporarily without any attempted circumventions (e.g., no VPN was switched on). The pop-up window shown in Figure 12 did not appear, and the coder was able to access the Apple App Store payment pop-up screen. Relevant screenshots are available at the data deposit link. This again demonstrates that the technical measures taken might fail at times. In-game purchasing was again rendered not possible in Game 50 when attempted 10 and 40 minutes after the initial successful attempt at Brussels International Airport. In-game purchasing remained not possible in Game 78 when no circumvention was attempted. Temporary failures of the technical measures, without the player intentionally trying to circumvent them, represent another potential reason why these two games have continued to nonetheless generate revenue from Belgium.
Figure 23. Left pane: The premium currency used to purchase loot boxes did not appear in the in-game shop and could not be bought using real-world money in Game 78 (DRAGON BALL Z DOKKAN BATTLE) when the coder was physically in geographical and jurisdictional Belgium with a Belgian IP (Internet Protocol) address. Right pane: The premium currency appeared in the in-game shop and became purchasable when a Japanese VPN (virtual private network) was used to spoof the coder’s IP address to be non-Belgian. © 2022 Akatsuki Inc. & Bandai Namco Entertainment
Figure 4. Reviews left by users on the Belgian Apple App Store for Game 50 (Governor of Poker 3 – Friends). The translation for the third review originally written in Flemish is as follows: ‘We in Belgium can’t buy anything in the app but we have to wait a long time for ships [recte chips; referring to the game’s premium currency] while other players can buy millions for this game’. © 2022 Apple & the relevant users and customer support agents, if applicable.
3.2.5. Exploratory analysis: Comparability with previous studies in other countries

Peer review comments of the present study’s stage 1 registered report manuscript suggested that context should be provided as to how comparable the present results are to those of previous studies. The 100 highest-grossing iPhone games in the UK on 28 May 2022 was compared with the Belgian list (including Game 36, which was, however, excluded from the present study’s sample): 71 games (71.0%) appeared on both lists. Amongst the 50 highest-grossing games, the overlap of 42 games (84.0%) was even more apparent. This demonstrates that there is a substantial degree of similarity between the two countries’ highest-grossing lists, and that the results from these two countries are reasonably comparable, if done with some caution.

Additionally, the 50 highest-grossing list of Android games in Belgium on 21 June 2021 (Xiao et al. (2021)’s UK data collection date) and the list on 28 May 2022 were compared: 35 games (70.0%) appeared on both lists. This further supports the direct comparison of the UK results of Xiao et al. (2021) with that of the present study. Data for the Android platform was used because the relevant historical iPhone data were no longer accessible. Zendle et al. (2020) has previously found near identical loot box prevalence rates on the Android and iPhone markets in 2019. For reference, 70% of the 100 and 88.0% of the 50 highest-grossing games on the iPhone and Android platforms in Belgium overlapped on 28 May 2022.

In relation to Hypothesis 3, to err on the side of caution, a non-preregistered test was conducted to address the potential concern that the considerable prevalence of ‘social casino games’ or ‘simulated casino games’ (which are video games in which ‘players can spend real-world money to buy more stakes to continue participating in simulated gambling’) amongst the sample may have overly exaggerated the prevalence of ‘loot boxes’ (widely defined) in Belgium. The Belgian Gaming Commission does recognise the randomised monetisation methods in ‘simulated casino games’ games as constituting ‘gambling’ (i.e., there is no distinction between the two concepts in Belgium in contrast to in most other countries where the two are treated differently in law as ‘simulated casino games’ are not seen as gambling and not recognised as legally constituting ‘gambling’ elsewhere). However, there is debate within the academic literature as to whether ‘simulated casino games’ should, by definition, be deemed as ‘containing loot boxes’ or an Embedded-Isolated
random reward mechanism. The coder deemed 15 of the 100 games to be ‘simulated casino games’ (15.0%). Amongst the other 85 non-‘simulated casino games,’ 68 contained loot boxes (80.0%). A binomial test (two-sided test, \( p = .05 \)) revealed that the Belgian loot box prevalence rate amongst non-‘simulated casino games’ of 80.0% was still significantly higher (\( p = .003 \)) than the hypothetical 65.0% prevalence rate.

4. Discussion

4.1. No reduction to Belgian loot box prevalence

As of mid-2022, 82.0%, the vast majority, of the highest-grossing iPhone games in Belgium continued to sell loot boxes for real-world money and seemingly continued to heavily rely on such randomised mechanics to monetise and generate revenue. For the avoidance of doubt, in each of these 82 games, players were able to either directly spend real-world money, or indirectly spend premium currency that is purchasable using real-world money, to engage in a randomised monetisation method whose results are unknown at the point of purchase. The Belgian Gaming Commission has confirmed that ‘loot boxes’ as defined by the present study’s Method section would legally be recognised as ‘gambling’ in Belgium according to the Commission’s interpretation in a meeting with the author on 24 June 2022.

The Belgian ‘ban’ on loot boxes, as instituted by the Belgian Gaming Commission through the pronouncement of its interpretation of the law and its threat of criminal prosecution of non-compliant companies in April 2018, did not appear to have an effect on the prevalence of paid loot boxes four years after the event. Certain well-known companies have taken compliance actions by either removing the ability to purchase loot boxes with real-world money from their games or removing their games (that rely on loot boxes to generate revenue) from the Belgian market entirely. As recently as June 2022, Blizzard Entertainment actively complied with the ban by not publishing Diablo Immortal in Belgium. However, these widely reported instances of compliance by well-known companies appear to be the exceptions rather than the rule. Other companies have had four years to comply with the law and evidently have yet to do so.
The mid-2022 Belgian loot box prevalence rate of 82.0% is numerically higher than the mid-2021 UK loot box prevalence rate of 77% (where no effective loot box regulation has been imposed or enforced). However, this could simply be due to loot boxes becoming increasingly more prevalent due to the passage of time, which is a general trend that has previously been observed amongst UK iPhone games. Therefore, no point is taken in relation to this higher value in Belgium. It should not be suggested that loot box prevalence has somehow become higher due to, or despite, the ban. The present study provides evidence that the Belgian ban does not appear to have effectively reduced loot box prevalence.

In short, the Belgian ‘ban,’ as implemented, has not been effective at reducing the broad availability of opportunities to purchase loot boxes. The high loot box prevalence rate on the Belgian Apple App Store shows evidence that loot boxes continue to be widely available and easily accessible to video game players, including children. Table 1 shows a trend that games are more likely to contain loot boxes as their age ratings increase; however, notably 54.2% of the games rated deemed suitable for children aged 4+ (the lowest available age rating) still contained loot boxes. Importantly, although the ban may have caused some games containing loot boxes to be removed, those removed games’ positions on the highest-grossing list appear to have simply been replaced by non-compliant games from other companies that continue to contain loot boxes. This represents the first negative consequence of this unenforced ‘ban.’ The (generally more well-known) companies that did comply with the law by removing or not publishing their games likely cared more about protecting their reputations and ensuring compliance with the law than lesser-known companies. It would seem that the since ‘vacated’ positions on the highest-grossing list were then replaced with games from more unscrupulous (or at least less well-resourced) companies that either actively decided not to comply with the law or were unaware of their legal responsibilities to comply with the ban. It is not unreasonable to suggest that the since removed and unpublished games likely would have been more compliant with other legal requirements (e.g., data protection law) and offered better consumer protection measures in relation to loot boxes than the non-compliant games currently do, for example, in terms of potentially making more prominent and accessible loot box probability disclosures and providing better customer service (e.g., being more responsive to parents’ refund requests for unpermitted spending by children). Whether more established video game
companies (e.g., those that have international legal, compliance, and localisation
teams and are more heavily scrutinised by players, policymakers, and the press)
might generally offer better consumer protection than smaller companies should be
assessed by future research.

In summary, contrary to improving the consumer protection provided to Belgian
players as intended, the ‘ban’ might have had the unintended, opposite effect of
creating a more dangerous environment for players. The market has shifted towards
higher risk illegal providers. Compliant companies are making less or no revenue:
assuming that the amount of money spent by players on video games did not
change following the ban, the non-compliant companies have dishonestly taken a
share of that revenue away from compliant companies by implementing illegal loot
boxes, when that revenue should have now gone to the compliant companies’ non-
loot box-related monetisation methods. Crime must not pay; the law should never
put companies in a position whereby breaking the law becomes more profitable than
following it.

Other variables, such as the operators’ country of origin, might also affect whether a
company is more or less likely to comply: for example, it is worth noting that Game
50 (one of two games that took technical measures to prevent loot box purchase in
Belgium) was developed and published by Youda Games and Azerion, both of
which are based in Amsterdam, the Netherlands, a neighbouring country that shares
close cultural and linguistic links with Belgium, and in which the potential illegality
of loot boxes has been recently highlighted. These two Dutch companies might have
more actively complied with the Belgian ban because they were more aware of the
regulatory environment in Belgium. Note, however, that Game 78 (the other game
that blocked loot box purchase in Belgium) was developed and published by
Japanese companies, although the publisher, Bandai Namco Entertainment, is one of
the largest multinational video game companies in the world in terms of revenue
and therefore likely was well-resourced and had a knowledgeable compliance team.
It is worth noting here that maybe some (or even many) of the companies found to
still be selling loot boxes in Belgium did not maliciously and knowingly chose not to
comply with the law but simply lacked sufficient local awareness and resources to
be aware of the ban. Follow-up research on the individual companies as to their
compliance decisions (or lack of which) might prove fruitful at revealing what
measures could be taken to ensure that they become better informed of, or better able to comply with, their legal responsibilities.

Finally, a previous study has also noted that the likelihood and effectiveness of the companies’ compliance might also be affected by game ‘genre’ and the relative importance of loot boxes as a monetisation method when compared to other in-game microtransactions in a particular game (both financially and in relation to the ‘core game loop’ \[^87\] \(i.e.,\) the essential sequence of actions that are repeated by the player over and over again to engage with the game)) \[^5\]. Player communities might expect more from, and exert more pressure on, certain games. Game 50 is a simulated casino game in which using the purchased premium currency to engage with simulated gambling activities (\textit{i.e.}, the ‘loot boxes’) forms the core game loop. (As an aside, besides the fact that Game 50 is still grossing a significant amount of money from Belgium despite the technical block, one reason why the game remains available in the market and was not removed despite technically not being able to generate any revenue from Belgium is that this game is a multiplayer game. The non-paying Belgian players do provide something of value to the company: these players’ presence and participation allow other paying players \textit{in from} other countries to compete against human players (rather than bots) and potentially have more ‘fun.’). Game 78 is a so-called ‘gacha’ game in which loot boxes are the principal monetisation method and the player’s gameplay progression revolves around engaging with the loot box mechanic \[^88\]. Loot box mechanics are fundamental to these two games’ designs, which might explain why the companies operating these two games were more mindful about complying with the Belgian ban. However, note also that many of the non-compliant games identified by the present study would also fall broadly within the definition of a simulated casino game or a gacha game.

\[4.2.\textbf{A toothless ‘ban’ that is not really a ‘ban’ in practice}\]

The Belgian ‘ban’ on loot boxes is not, at its essence, a true ‘ban’ of the product. The Belgian Gaming Commission did issue a report opining that loot boxes that require payment of real-world money to purchase constitute gambling and are illegal if offered without a gambling licence \[^44\]. However, that report was issued only on the basis of the in-depth examination of four then-popular video games \[^44p. 18\]. The Belgian Gaming Commission has not reportedly taken any further action in relation
to loot boxes since then, which means that the Belgian courts have not had the opportunity to confirm whether that interpretation is indeed valid. Contrast here with how the Dutch gambling regulator’s previous interpretation of the law, which sought to outlaw certain implementations of loot boxes, has been applied in practice but has since been overruled by the Dutch court[84]. The Dutch regulatory position on loot boxes is therefore certain. In contrast, the Belgian Gaming Commission’s interpretation has neither been enforced nor challenged in court, which means that its correctness is uncertain, despite popular support by the academic legal literature[10,11,38]. Besides merely pronouncing its interpretation of the law and threatening criminal prosecution of non-compliant companies[89], the Belgian Gaming Commission has not attempted to actively enforce that interpretation in practice by actually criminally prosecuting non-compliant companies for implementing loot boxes or seeking to otherwise remove loot boxes from the national market. The Belgian Gaming Commission has only passively waited for companies to comply: a few did, but most did not. It is entirely unsurprising that merely stating that the sale of a product (in this case, loot boxes) is illegal under existing law, without also actively taking enforcement actions, did not lead to widespread compliance. Consider here, in contrast, how enforcement actions are actively taken by the police of many countries in relation to criminalised or otherwise controlled products and services, e.g., psychoactive drugs and weapons. Indeed, the Belgian Gaming Commission does take active enforcement actions against websites offering more traditional forms of illegal gambling (e.g., blackjack) by identifying them on a published list in addition to threatening a fine[90,91]. Loot boxes, however, were not subjected to similar enforcement actions.

4.3. The positives: drawing attention to the issue and encouraging public debate and providing some protection

In terms of the benefits of the Belgian regulatory approach as it stands, the initial publication of the Belgian ‘ban’ on loot boxes by the Belgian Gaming Commission led to popular reporting and public discussion and debate of the loot box issue in Belgium and in other countries[92], which were of benefit to the consumers of all countries by facilitating better awareness of this issue and the potential harms of loot boxes. Indeed, policymakers[47(pp. 33, paras 92–93)][49(p. 111, para 427)] regulators,[93(p. 6)] the media,[55] and some players[see 94] in other countries often pointed to Belgium as a good example of taking proactive action to address loot box harms and argued for
their own countries to emulate the Belgian approach. Undoubtedly, the Belgian ‘ban’ has advanced the international debate on whether loot boxes should be regulated as gambling or otherwise, and this positive impact of the ‘ban’ should be duly recognised.

Further, it must be recognised that (i) loot boxes have been removed from Belgian versions of some popular games\[e.g., 56\] and (ii) a number of other popular games have been removed from, or were not published in, the Belgian market\[e.g., 59,82,83\]. Some Belgian players might therefore have been successfully prevented from being able to purchase loot boxes from these games and potential opportunities to be exposed to loot boxes generally (particularly in relation to children and young people) may have been reduced, despite other games containing loot boxes continuing to be available. However, although what percentage of Belgian players that represents is unknown and by how much (if any) average loot box spending has reduced remains the subjects of further research. Although referred to as a ‘ban,’ perhaps the complete elimination of the product from the Belgian market is not necessarily a goal that the measure must achieve for it to be deemed ‘successful.’ Even when imperfectly enforced, a ‘ban’ that potentially leads to reduced exposure to loot boxes and thereby provides better protection is still arguably of a benefit to many consumers.

4.4. The negatives: a false sense of security

However, the manner in which the ‘ban’ was then subsequently enforced (or rather, not enforced at all) has a number of potential negative consequences that arguably render the ban worse than doing nothing at all. Firstly, by supposedly imposing a ‘ban,’ the Belgian Gaming Commission gave video game consumers (including children and parents of young players) the false impression that Belgian players are now safe from loot boxes because the mechanic has been deemed illegal under gambling law, ‘banned,’ and therefore eliminated from the Belgian market. In reality, loot boxes are evidently still widely available for purchase, and their potential harms have not been removed from the country and may have reduced only to a limited extent (which is due to the actions of the finite number of complaint companies). Indeed, it seems that their potential harms have not even been reduced at all. This unfortunate state of affairs is potentially harmful because consumers might have been lulled into a false sense of security because they might think that
the loot box ‘problem’ has been completely resolved by the ‘ban’ imposed by the
Belgian Gaming Commission. For example, a player choosing to be less careful with
their in-game spending or a parent deciding not to educate their child about loot
boxes because they have been falsely assured that there is no longer any risk of
harm.

More concerningly, Belgian policymakers and the Belgian Gaming Commission
itself might also have been under the same wrong impression that Belgian
consumers are already adequately protected. For example, Belgian legislators might
be less willing to update the country’s gambling law to specifically regulate loot
boxes because they might deem the situation as having already been resolved. The
Belgian Gaming Commission might also have not been more active with enforcing
the law because it has not monitored whether its ‘ban’ has been effective, potentially
because of the same incorrect assumption.

As an aside, this regulatory approach of merely pronouncing an interpretation of the
law that recognises certain loot box implementations as illegal but then not actively
enforcing that interpretation against non-compliant companies (and thereby
potentially creating a false impression that the law has been duly enforced) is what
the relevant gambling regulators have done in the UK and Denmark (and other
countries) in relation to loot boxes that require real-world money to purchase and
provide rewards that can be transferred to other players in exchange for real-world
monetary value. This lack of enforcement actions is likely why certain games, e.g.,
Magic: The Gathering Online (Wizards of the Coast, 2002), containing loot boxes that
arguably infringe relevant gambling laws as interpreted by the national regulators
remain available and have not been forcibly removed from those markets.

4.5. Criminalisation: the ‘forbidden fruit effect’ and stigmatisation
Moving beyond how the ‘ban’ has been practically applied in Belgium, consideration
should also be given to the negative consequences of this restrictive approach on a
theoretical level, even if the ban is perfectly enforced. The very act of prohibiting a
product potentially leads to a number of adverse effects. The so-called ‘forbidden
fruit effect’ has been identified in relation to media content, including video
games specifically. Products that are prohibited becomes more appealing to young
people precisely because they are deemed ‘forbidden.’ This might apply to loot
boxes in the sense that some Belgian children might now be more interested in purchasing loot boxes because these products have been deemed ‘illegal’ or ‘banned.’ The same might even be true in relation to adults because no video game loot boxes have been duly licensed as regulated gambling by the Belgian Gaming Commission (as the regulator is not legally empowered to approve and license any randomised monetisation methods in video games, specifically) and therefore all video game loot boxes remain unlicensed and technically ‘illegal,’ even when engaged with only by adults.

Indeed, the criminalisation of the purchasing of loot boxes is problematic. It must be recalled that Article 4(2) of the Belgian Gambling Act of 7 May 1999 states that: ‘It is prohibited for anyone to participate in a game of chance … when the person involved knows that it concerns the operation of a game of chance or a gambling establishment which is not licensed in accordance with this Act.’ In relation to unlicensed websites offering more traditional forms of illegal gambling, the Belgian Gaming Commission warns would-be punters that ‘Gambling on an illegal gambling site is even punishable by law! Players can be fined between €26 and €25,000 (multiplied by a multiplication factor) if they knowingly played on an illegal gambling site[90].’ Most Belgian loot box purchasers can likely escape liability by arguing that they were not aware of the video game company not having been duly licensed to provide gambling services, and it would appear highly unlikely for any Belgian loot box purchaser to be criminally prosecuted simply for fairness reasons (due to the unclarity and uncertainty of the Belgian legal position on loot boxes, given that the law does not explicitly say that loot boxes constitute illegal gambling and that the Belgian Gaming Commission merely provided its, as yet unchallenged, interpretation of the law that has not been confirmed by the court).

However, given that any and all loot box purchasing is technically criminalised, players experiencing excessive loot box engagement and suffering harms from overspending might be less willing to seek help and treatment. This stigmatisation of loot box purchasing potentially increases the severity of the harms that at-risk players might experience. Finally, although this has yet been empirically tested, loot boxes in video games potentially teach children about the potential harms of engaging with gambling or gambling-like products (i.e., the risks of losing money to random chance). Note here how collectible and trading card packs (which...
many children did engage with in the past number of decades) have generally been deemed as socially acceptable and not constituting gambling, in contrast to loot boxes\[^{[100,101]}\]. Not having been exposed to this ‘educational tool’ and arguably safer form of ‘gambling’ (due to it being rather difficult to truly lose large sums of money on loot boxes) during childhood development might mean that the video game player becomes more easily harmed by traditional gambling upon reaching the legal gambling age and suddenly have access to those regulated but nonetheless available products. How gambling behaviours will now potentially develop differently in Belgian young people and emerging adults especially, as compared to those of other countries, due to Belgium’s unique regulatory position, should be studied. Other potential disadvantages of an effectively enforced ban should be subject to future studies (e.g., the potential loss and unfair distribution of economic opportunities for companies and negative impacts on players’ gameplay experience, including rendering Belgian players uncompetitive particularly in relation to esports games that require loot box purchasing to gain gameplay advantages) should be subject to future studies.

4.6. An overly restrictive approach is worse for both companies and players

From a public health perspective, a complete ban of the product or ‘eliminate choice’ is the most restrictive regulatory intervention for addressing potential harms\[^{[95]}\]. Compared to other less restrictive approaches, such as guiding better choices through incentives and disincentives or by changing the default option or simply providing information to better inform consumers, the only advantage of a ‘ban’ is that it should, in theory, provide the highest degree of consumer protection in the sense that all or nearly all risks of harm should have been removed. Unfortunately, in relation to the Belgian ‘ban,’ it has not achieved this intended perfect or near-perfect elimination of the risks of the product (which would have been the only advantage of this extreme regulatory approach as compared to other less restrictive options). There are many shortcomings to this most restrictive approach in relation to both video game companies and players.

4.6.1. Loss of revenue and inequitable distribution of revenue

Many companies’ primary (if not only) source of revenue, the loot box mechanics, has been completely restricted. It is reasonable to suggest that Game 50 is now making less money than it did prior to the ban because it imposed that technical measure to prevent player purchase from Belgium. The market might also shift
towards higher risk illegal providers, which arguably appears to be occurring in Belgium when non-compliant companies’ games replaced compliant companies’ games on the highest-grossing list. The compliant companies’ commercial interests have been unfairly curtailed: assuming that the amount of money spent by players on video games did not change following the ban, the non-compliant companies have dishonestly taken a share of that revenue away with their illegal loot boxes, when that revenue should have now gone to the compliant companies’ non-loot box-related monetisation methods. Crime must not pay; the law should never put companies in a position whereby breaking the law becomes more profitable than following it.

4.6.2. Fewer choices, less financially accessible, and worse gameplay experience

Players’ consumer experience is also negatively impacted by the ban. In addition to generating revenue for companies, video game loot boxes also benefit players in the sense that the amount of financial investment into a game can be more personalised. In many games that rely on loot boxes to monetise, players can choose how much to spend and whether or not to spend any money at all. Many players are able to enjoy these games for free or for very little money because high-spending players are effectively financing those video games. The possibilities of enjoying these games cheaply or trying a wider variety of games before deciding which one to spend money on have been curtailed following the Belgian ban considering that some games that are highly popular in other countries have indeed been removed from Belgium. Had the ban worked perfectly, then the curtailment would have been even more severe. The gameplay experience of the individual games that have not been removed and remain available is also potentially negatively impacted, as demonstrated by the three reviews left by users for Game 50 shown in Figure 4. It is evident from those reviews that at least some players are finding the gameplay experience to now be worse specifically due to the unique regulatory situation in Belgium causing them to be unable to purchase more premium currency, which would have allowed them to play the game more often and for longer periods of time (as the premium currency in this game is casino chips that are used to participate in simulated casino games).

It is true that the Belgian ‘ban,’ or rather the technical measure that Game 50 has taken to prevent the purchase of premium currency in Belgium, has effectively
protected these players (who did not circumvent the measure) from overspending 
money on the loot box mechanics in this game. However, it is not known what 
percentage of these players would have actually overspent money on this game and 
suffered wider negative social consequences as a result. At least some players would 
have been able to spend money wisely and would not have overspent\[88\]. For these 
players, their enjoyment of Game 50 has diminished, as the Apple App Store reviews 
in Figure 4 shows, because they were unable to spend small sums of money to 
enhance their gameplay experience. All Belgian players (unless they circumvent the 
technical measures that prevent them from purchasing loot boxes in Belgium) are 
forced to experience only the ‘free-to-play’ version of the game, which is often 
designed in these games employing this monetisation model to provide a 
comparatively poor experience (especially further into the game) in order to 
encourage purchase and to convert free-to-play players into paying players. The 
gameplay difficulty of many of these games is often also balanced around a player 
that would spend at least some money. It is therefore almost inevitable that Belgian 
players will have a worse gameplay experience in these games, unless the Belgian 
version of the games is specifically designed to provide a superior free-to-play 
experience (e.g., by giving players more free loot boxes than in other countries); 
however, that is unlikely to happen because companies are not financially 
incentivised to improve the gameplay experience of non-paying players who can 
never convert into a paying player. Beyond Game 50, this discussion is difficult to 
have in a generalisable manner because loot boxes and other in-game purchases are 
implemented in widely varied ways in different games (e.g., these games differ as to 
how central or peripheral the loot boxes are to the core game loop), and so the ‘free-
to-play’ experience of some games might remain sufficiently enjoyable and 
satisfactory to many players. Individual players’ judgement as to whether a given 
monetisation strategy (e.g., loot boxes) is ‘predatory’ or ‘just and reasonable’ and 
whether they find a certain type of gameplay experience to be enjoyable is also 
subjective and varied\[102\]. Player research should be conducted on Belgian players 
and parents of child players using qualitative methods, e.g., open-ended interviews.

4.6.3. Belgian players are competitively disadvantaged: implications for eSports 
The third review shown in Figure 4 suggesting that Belgian players and players from 
other countries are experiencing the game differently and how that might be unfair 
to Belgian players is also an interesting point that should be considered by future 
research. Particularly in relation to competitive eSports games in which the
purchasing of loot boxes provides undisputed gameplay advantages (e.g., obtaining stronger player-characters in *FIFA* games through ‘player packs’), Belgian players are arguably at an inherent disadvantage and can no longer compete on an equal footing with players from other countries. This may also lead to diversity and inclusion issues within the Belgian esports scene because more financially advantaged players might be able to afford going to a neighbouring country to play and purchase loot boxes, whilst more disadvantaged players cannot. One might even argue that loot boxes containing rewards that are capable of granting competitive advantages (a type of ‘pay-to-win’ mechanism or ‘monetized rivalries’ per Zagal *et al.* [105]) should not be allowed to be included in esports games as doing so renders the supposedly ‘sporting’ games no longer games of skill in which everyone has a fair chance to win, but monetarily-gated games that only players that have made significant financial investments can compete in with suffering major disadvantages. Therefore, this present unfairness that Belgian esports players experience could be resolved not only by allowing Belgian players to purchase loot boxes but also by disallowing players from other countries to purchase loot boxes or by disallowing the implementation of loot boxes that can grant competitive advantages in esports games as a matter of principle. Future research could more systematically examine the app reviews left by players on Belgium app stores to consider what players themselves think about Belgium’s uniquely restrictive regulatory position: how widely supported is a complete ‘ban,’ and would players change their opinions if they are informed that the ‘ban’ has been ineffective at reducing loot box prevalence? How the Belgian esports scene develops against the backdrop of the country’s loot box ban is also worthy of specific attention.

4.67. How can the Belgian Gaming Commission do better?

Despite the aforementioned disadvantages of a loot box ban (both in terms of as it has been implemented in Belgium and, theoretically, if the ban was ‘successful’), Belgium might wish to double down on this restrictive approach (as it does presently appear to have popular support, although that might dissipate when the approach’s various disadvantages and the heavy financial costs of fully enforcing the law are brought to the electorate’s attention).

Recognising that some companies might have failed to comply only due to not knowing about their responsibilities (rather than maliciously), it has to be...
questioned whether the Belgian Gaming Commission has promoted the fact that a loot box ban is in effect in the country sufficiently widely, especially to video game companies in distant countries, e.g., China. A promotional campaign, where the Belgian Gaming Commission collaborates with major hardware and platform providers (e.g., Nintendo, Microsoft, Sony, Apple, and Google), could attempt to highlight the ban prominently (e.g., a pop-up warning as part of the process for submitting a game to the Apple App Store, if the company chooses Belgium as a national store where the game should be published). Apple, for example, already asks companies to self-declare how frequently some certain content appears in a game in order to provide an Apple Age Rating. As part of that process, specifically in Belgium, Apple could ask the question of whether loot boxes are sold in a game. If the company responds positively, Apple should inform the company about Belgium’s ban on loot boxes and reject the game from the submission process. Apple already requires loot box probability disclosures[100], so evidently it is concerned by and willing to address the issue to some extent (albeit that Apple has seemingly not enforced its own self-regulation to ensure games do make probability disclosures[5]).

Regardless, to achieve a better compliance rate, the Belgian Gaming Commission must then need to carry out its threat of criminal prosecution of non-compliant companies. Doing so would likely forcibly remove many loot boxes from the market. Note that actually enforcing the law here is likely to lead to a legal challenge of the Belgian Gaming Commission’s interpretation of the law by one of the prosecuted companies. That legal challenge might be decided either way. The court might approve the Commission’s position or reject it. If the former happens, then the Belgian Gaming Commission can continue to enforce its interpretation. However, even if the latter happens, this will resolve the current confusion as to what the Belgian regulatory position on loot boxes truly is. If existing Belgian law cannot be interpreted as outlawing all paid loot boxes, then the Belgian Gaming Commission cannot be allowed to purport to take enforcement actions ultra vires or beyond its powers and without legal authority. An amendment of gambling law by the legislature to criminalise paid loot boxes should then follow if the ban is to truly be imposed. Indeed, even if the ban can no longer be maintained, this would provide legal certainty and likely lead to the more compliant companies re-entering the market and thereby providing players with more game options and likely better
consumer protection as compared to what is currently being offered by non-compliant companies.

The main problem with enforcing the law is, however, whether it would be practical or cost effective to do so. This undertaking requires significant financial resources, manpower, and technical expertise, which the Belgian Gaming Commission arguably does not sufficiently possess, particularly in relation to non-traditional forms of gambling like video game loot boxes. This is evident in the lack of enforcement action, despite obvious loot box contraventions being widely available and highly popular. The recovery of any costs incurred by the Commission’s enforcement actions through fines is likely difficult in relation to international companies with little to no corporate presence in Belgium. Further, it does not seem realistic to expect the Belgian Gaming Commission to examine every single video game on every platform (and every subsequent update to those games) and then to criminally prosecute each non-compliant case. As of June 2022, there are already over 1,000,000 individual games on the Apple App Store alone[^101]. Note, however, that direct criminal prosecution of all illegal loot box implementations is only one (very costly) potential approach to enforcement. Less direct approaches, such as issuing correspondence addressed to individual companies prior to litigation requesting changes to game design and threatening prosecution might be sufficient at ensuring compliance and be more cost effective.

The regulator could perhaps work in closer collaboration with academic researchers: the present study’s results have been shared with, and were indeed of great interest to, the Belgian Gaming Commission and was ironically funded by ‘regulatory settlements applied for socially responsible purposes’ received by the UK Gambling Commission. Enforcement could also potentially be ‘crowdsourced’ in the sense that players are provided with a channel to report non-compliant games, thus reducing the Commission’s workload. What the Belgian Gaming Commission could alternatively consider is an *ex ante* whitelisted licensing system, rather than an *ex post* blacklist, enforcement system, similar to the regulatory approach taken by China in relation to the publication of video games. Instead of allowing any games to be published on these app stores or hardware platforms and then seeking to remove and prosecute non-compliant games *afterwards*, only games on a pre-approved list are allowed to be published in the first place. The relevant Chinese regulator, the
National Press and Publication Administration (国家新闻出版署), therefore has the opportunity to review any video games, both domestic and international, before they are published and allowed potentially to potentially cause harm to players. Indeed, charging a fee for this pre-approval process and for maintaining a licence would allow the regulator to recoup the costs associated with reviewing the game and taking enforcement actions. Such a system would also provide opportunities to assess companies’ compliance with other obligations (e.g., whether probability disclosures were made).

Another manner by which the Belgian Gaming Commission could seek to enforce the law is to place the burden on ensuring compliance on platform providers, such as Apple, rather than going after individual video game companies. Apple, for example, is arguably facilitating the sale of illegal loot boxes by providing a platform for this to happen on a large scale. Indeed, loot box sales would not generally be possible through Apple’s propriety iOS platforms, unless Apple allows it. Further, Apple generally receives a 30% commission on most in-app purchase made (although this is lower in some limited cases). In Belgium, Apple is therefore profiting on the illegal sale of loot boxes whenever a purchase is made. This could arguably be recognised as Apple aiding and abetting the commission of a criminal offence and its receiving and handling of criminal proceeds, which may fall within the ambit of money laundering regulation. The Belgian Gaming Commission could consider enforcing the law against Apple (as an accessory to the crime, arguably), or if that is not yet legally possible, impose new laws to require Apple and other platform providers to ensure that only games without loot boxes can be published.

There are even precedents on this point. When put under regulatory pressure, Apple removed all unlicensed and non-whitelisted games from China at the end of 2020: reportedly, only 0.5% of the top paid games were duly licensed and ‘survived the purge’. Apple also specifically implements the national video game age rating system in Brazil, in addition to its own age rating. Evidently, Apple is capable of and willing to take national compliance actions when required.

Seeking to regulate more strictly or asking the platform providers to assist in regulating might work in most cases to prevent players from unknowingly encountering loot boxes and being potentially harmed (although it should be queried what percentage of these players could actually potentially be harmed and...
whether a vast majority of them can enjoy loot boxes ‘safely’\textsuperscript{\textsuperscript{[107]}}. However, on other more open hardware platforms, such as PC and Android, an installation file that does not need to be downloaded from ‘official’ app stores and can be easily obtained by potential players through any online channels, such as an .apk (Android Package) file, could be used to play games. These games would be even more difficult to monitor and enforce against, as platform-based regulation would not be possible.

Therefore, besides identifying and prosecuting non-compliant companies still offering loot boxes in Belgium, consideration should also be given to the separate issue of how to deal with players that knowingly try to circumvent the ban. The negative stigmatisation-related, negative consequences of individually prosecuting players for purchasing loot boxes have already been addressed. Indeed, even if the Belgian national versions of the platforms, such as the Apple App Store, are hypothetically scrubbed clean of any games containing loot boxes, either through the Commission’s actions or the platforms’ actions, players who wish to do so would still be able to easily circumvent these technical measures using extremely basic and free methods (e.g., changing the Apple App Store’s country setting to another country or activating a VPN), as the present study has shown. For context, research on underage online pornography use has found that 46\% of 16- and 17-year-olds use VPNs and similar age-verification circumvention tools\textsuperscript{[108]}. When a Belgian player seeking to actively circumvent the ban has managed to download, play, and pay for loot boxes in a video game that the company has purposefully chosen not to publish in Belgium due to the country’s loot box ban, it cannot be said that the company or platform provider should still be deemed culpable in such cases, provided that reasonably strong technical measures have been implemented to prevent such circumvention. Belgium should therefore consider requiring companies and platform providers to implement sufficiently difficult-to-circumvent technical measures. Any regulation should also be cautious as to not mistakenly identify a player against whom the technical measures have failed without said player intending to attempt circumvention (e.g., the author’s experience at Brussels International Airport in relation to Game 50 detailed in the Method section) as a player who has intentionally tried to circumvent the technical measures.

Importantly, the most dedicated and highest-spending loot box purchasers, who are arguably most at risk of harm and therefore most in need of consumer protection,
would likely always choose to circumvent any ‘ban.’ If a player actively and knowingly wants to purchase loot boxes, it does not seem practical or possible to truly prevent them from doing so. Therefore, it must be duly noted that any approach that seeks to forcibly remove loot boxes is may be unlikely to be of assistance to the most vulnerable players. This is similar to how technical bans of online gambling in many countries can be easily circumvented by dedicated gamblers and how an effective blanket ban is not feasible\textsuperscript{[109]}. Further research should consider the perspectives of high-spending Belgian players and, in particular, their views on circumvention and whether they have attempted to do this so.

4.8. Some reflections for the Belgian public and Belgian policymakers

The Belgian Gaming Commission instituted the ban through applying pre-existing gambling law that did not envisage technological developments, such as video game loot boxes. This means that, technically, the Belgian ‘ban’ on loot boxes was applied executively by the regulator (albeit based on duly passed legislation). Therefore, it cannot be said that the ban itself was truly approved through a democratic process. Neither the Belgian electorate nor their representatives specifically voted on this policy question. It is not known whether the ban has popular support, especially if the present evidence \textit{(inter alia)} on the ineffectiveness of the ban as currently applied; the impossibility of completely banning loot boxes; and the benefits of this monetisation model for players) is made known. Importantly, Belgian policymakers should not consider the loot box issue as having been ‘solved’ and should not be dissuaded from updating existing gambling law to address current and developing issues. Indeed, other gambling-like products are being actively invented, including video game loot boxes that contain NFTs (non-fungible tokens) that can be freely bought and sold between players for real-world monetary value in Gods Unchained (Immutable, 2021)\textsuperscript{[110]} and virtual packs of NFTs that do not even relate to a video game, such as NBA Top Shot\textsuperscript{[111]}. Some consideration should also similarly be given to older gambling-like products that have seemingly escaped regulatory scrutiny despite literally contravening gambling law, \textit{e.g.}, booster packs of randomised collectible and trading cards\textsuperscript{[111,112]}. The uneven manner by which loot boxes have been targeted with a ban and physical card packs (real-life loot boxes) have not been addressed at all is arguably discriminato\textit{oryive of against} the video game industry\textsuperscript{[107]}. 51
Indeed, the Belgian public should not assume that their consumer protection is now guaranteed: it is not. The Belgian consumers should continue to demand policy change in relation to loot boxes, other gambling-like products and gambling regulation in general, if they deem these appropriate and necessary. Finally, note that Belgian policymakers and consumers should consider the economic benefits of providing duly licensed video game loot boxes to adults (e.g., tax revenue), given that duly licensed traditional gambling is permitted. Presently, Belgian gambling law does not allow loot boxes to be licensed at all; the Belgian Gaming Commission is not empowered to do so. There is therefore a discrimination against the video game industry as compared to the traditional gambling industry, which is allowed to provide products and services costing real-world money and involving ‘randomisation.’ If video game companies are willing and technologically able to provide verifiably ‘fair’—in the sense of being transparent and reliable, and not necessarily in the sense of ethical loot box design—loot boxes (and this does appear to be the case), then Belgium should consider legalising licensed loot boxes (at least for sale to adults) as long as traditional gambling remains lawful.

4.9. Should other countries emulate Belgium’s ‘ban’ on loot boxes?

Many stakeholders have argued that other countries should also follow Belgium’s lead and ban loot boxes. However, doing so might not work as well as intended. Notably, as the present study has proven, the Belgian ‘ban’ on loot boxes has not been actively enforced. Another country emulating the Belgian regulatory position as it currently stands is unlikely to achieve a significantly better result. The present study cannot provide empirical evidence on whether an actively enforced ban could be effective at reducing loot box prevalence. However, any country considering also banning loot boxes should consider whether its gambling regulator (or relevant enforcer of the law) is capable of ensuring that the ban is actually effectively enforced. Unless another country has a regulator that is much better resourced than the Belgian Gaming Commission, it also does not appear likely that a loot box ban would work in that country. Further, regardless of whether a ban works in that country, potential circumventions similarly cannot be realistically would be similarly difficult to prevented, and the negatives consequences of this restrictive approach and the economic benefits of legalising loot boxes detailed above must be duly considered (particularly in territories where traditional gambling is legal).
4.9.1. What if loot boxes cannot realistically be ‘banned’? Alternative harm-reduction approaches to a ‘ban’

Given that a ban is costly to enforce; does not seem to be may notable to work effectively against the most dedicated and highest-spending players that who will likely circumvent it; and leads to a number of potential negative consequences for all stakeholders, other countries should consider adopting a less-restrictive approach to loot box regulation[^107]. Loot boxes cannot easily be banned, and they are likely to remain an important aspect of video game monetisation for years to come[^112]. Citing the ‘significant limitations’ (including financial strains on the gambling regulator and the need to amend other laws) of a restrictive approach to loot box regulation[^113(paras 34–36)], the UK Government has, for example, decided against regulating loot boxes as gambling (and outlawing their sale to children) and is instead exploring a non-restrictive, industry self-regulatory approach (whose success remains to be assessed)[^113(paras 232, 241–243)]. Some stakeholders might find this inevitability might this to be unsatisfactory and difficult to accept, but one ought to consider how to regulate loot boxes in light of this. A public health approach to the issue allows for a whole range of other potential approaches of varying levels of restriction to be considered[^95]. The adoption of ‘ethical game design’ has been one suggested approach: specifically, (i) particularly harmful aspects of loot box design could be removed (as Japan has done in relation to the so-called ‘kompu gacha,’ which required players to collect a complete set of loot box rewards to then obtain a further reward[^114(pp. 311–312)]) and (ii) other loot box designs that appear less likely to be harmful could be trialled (as some companies have done, albeit perhaps more for commercial reasons, rather than to provide better consumer protection[^61,64,65]). However, such an approach that seeks to mandate ethical game design by law or industry self-regulation still faces the same enforcement issues as attempting to implement a ban[^65]. Crowdsourcing (e.g., player activism) and obtaining support from academic researchers, as previously recommended to the Belgian Gaming Commission for enforcing the ban, might help.

Further or alternatively, recognising the enforcement limitations of any consumer protection measure, countries should consider dedicating resources to educational campaigns and other preventative programmes that would better inform consumers to be mindful of the potential harms of loot boxes, e.g., classes in school (not only for
Just young people, but also for their parents and guardians) dedicated to enhancing ‘ludoliteracy’ (or knowledge about video games). Previous experience from other industries providing potentially harmful products, e.g., alcohol, tobacco, and traditional gambling, has suggested that these educational programmes might be at risk of being ‘hijacked’ by industry interests and thereby fail to promote an unbiased narrative, e.g., normalising alcohol use[115]. Therefore, when designing and implementing such programmes, countries ought to be mindful of potential industry influences and ensure that the relevant audience is not potentially misled. For example, how much and what kind of (potentially valuable) input the video game industry should be allowed to provide to such programmes should be carefully considered.

4.10. Limitations

The present study interpreted ‘loot boxes’ broadly as including any in-game transaction involving randomised elements. For example, in relation to Game 100, League of Legends: Wild Rift (Riot Games, 2020), a loot box was positively identified because the player was able to spend real-world money to purchase a ‘season pass’[116], which allowed the player to obtain additional rewards through gameplay[117], and some of the rewards obtained through the paid season pass allowed to player to engage with a loot box mechanic. There is debate within the academic literature as to how broadly the term ‘loot boxes’ should be interpreted[75,cf 80]. Had a more restrictive definition for ‘loot boxes’ been applied, a lower prevalence rate would have been observed.

Inversely, similarly to previous loot box prevalence studies adopting the same methodology, the present study might have observed a loot box prevalence rate that was lower than the true value because some games might have implemented loot boxes that could only be encountered after a significant length of gameplay, beyond the time limit (i.e., one hour) that the present study’s methodology allowed for. It is highly likely, for example, that Game 96, DomiNations (Nexon & Big Huge Games, 2015), contained loot boxes (specifically, the Council Recruitment system) that were accessible only after a few dozen hours of gameplay given that suspected loot box probability disclosures were found in said game.
In addition, as with previous loot box prevalence studies, the present study examined the highest-grossing video games and so the results might differ if the sample was selected randomly amongst all available iPhone games. On one hand, it is possible that the highest-grossing games are more likely to comply because they are the most popular and frequently scrutinised by players, fellow companies and the regulator. On the other hand, it is possible that more compliant games that removed loot boxes are now performing worse financially and not appearing in the highest-grossing list. The present results should be treated as a snapshot of the situation as it stands with the most popular games and not as a reflection of the whole situation on the Belgian Apple App Store.

In addition, the present study and previous loot box prevalence studies have treated the country that the specific Apple App Store belongs to as reflecting the national situation. However, the present study has shown that it is easy to switch to a different country’s store and also to spend money in a country different from the store’s national identity (and still have the revenue count towards the national store’s total revenue). Therefore, a due amount of caution must be exercised when interpreting the present results as perfectly reflecting the Belgian national situation because it is possible that many Belgian players are spending money in other countries’ Apple App Store (e.g., the Dutch or French Apple App Stores) and that Belgian players, when abroad, might also be contributing towards the Belgian Apple App Store’s revenue even though they are in a different country. The national store cannot be used to determine the actual location of players but merely what Country/Region settings were used by the player at the relevant time. Finally, the present study examined only iPhone games. The situation on other hardware platforms might be different: the ‘big three’ home console providers (Nintendo, Microsoft, and Sony), as platform providers, likely exercise stricter control on the availability of loot boxes in the limited number of console games published in Belgium, as compared to Apple, which cannot realistically individually assess the more than 1,000,000 games available on its market.

5. Conclusion

Many video game companies are ‘breaking the ban’ in Belgium (maliciously or unknowingly) by continuing to offer loot boxes for sale in exchange for real-world money. Players in Belgium are able to ‘break the ban’ by easily circumventing any
technical measures put into place to prevent loot box purchase (e.g., IP address checks and removal of games from the Belgian national market). Belgian’s loot box ‘ban’ is ‘breaking’ because it has not been effective at reducing the prevalence of loot boxes in the country as the national gambling regulator has not actively enforced the law and merely passively waited for companies to comply. Finally, a blanket ‘ban’ approach to loot box regulation is may be inherently ‘broken’ as it has many disadvantages that arguably outweigh its one supposed advantage of providing better consumer protection (complete protection from harm, which, as argued, is in fact impossible to achieve).

The Belgian ban on loot boxes is not working at present due to its poor implementation. With better enforcement, this approach could potentially be more effective and reduce loot box prevalence, thus enhancing consumer protection from potential harms. However, even if the ban had been perfectly enforced domestically, it would not have realistically blocked highly dedicated players, who are arguably most at risk of potential harms and in need of consumer protection, from easily circumventing the ban. One must ask the question: whom is the law targeting? If the target is those highly dedicated players, then the measure is evidently not working (and realistically cannot ever work) and only likely making the situation worse. If the target is the majority of ‘average players’ (assuming that they will not attempt to circumvent the ban), then one must consider whether those players benefit more from or suffer more disadvantages from this measure. What percentage of those ‘average players’ will actually overspend? Are those players truly in need of such a restrictive regulatory approach to ‘protect’ them when the majority will likely suffer little to no harm? Perhaps, the ‘average players’ derive more benefits from the loot box monetisation model than suffer harm from it. If that is the case, then a ban is not justified. Therefore, it would seem that a ban cannot be justified regardless of its target. Belgium should re-evaluate its current regulatory position: either enforce the law as promised or repeal this in-name-only ‘ban,’ and pursue alternative regulatory options. Put simply, either ‘buff’ enforcement or ‘nerf’ the ban. Other countries are recommended to consider adopting other less restrictive approaches to loot box regulation that more effectively balances the potential harms and benefits of loot boxes.

6. Postscript
For context, since the publication of the preprint version of the present study on 28 July 2022, several media websites have reported the findings. A Flemish piece published in both *Het Nieuwsblad*[^118] and *Gazet van Antwerpen*[^119] on 13 August 2022 included an official response from the Belgian Minister of Justice, Vincent Van Quickenborne. A relevant translated excerpt of that piece is provided below for context:

> The Gaming Commission admits that there is a problem, but says it has too few resources. “It is not possible to control for all small-scale games of chance.” Furthermore, the [compliance checking procedure] was said to be too slow.

> ...Van Quickenborne ... emphasizes that ... strict action [was taken] in the past... FIFA18 had to get on its knees and remove loot boxes. “But taking action against disguised games of chance such as these is not obvious. We want to better arm the Gaming Commission by reforming the law.” [...]

In addition, since publishing the preprint, in relation to Game 8, ‘a Roblox-led program to comply with laws in The Netherlands and Belgium,’ has reportedly caused the removal of user-generated content involving loot boxes from *Roblox in Belgium*[^120].
Data Availability Statement

The raw data, a full library of video game screenshots showing, *inter alia*, any identified loot boxes, and the data analysis script and output are openly available in the Open Science Framework at https://doi.org/10.17605/OSF.IO/7KJS9.

Positionality Statement

When drafting and revising the stage 1 registered report and when conducting fieldwork in Belgium, the author was open to the idea that a ‘ban’ approach to loot box regulation might potentially be effective and worth pursuing, although he was slightly sceptical. However, after the results have been analysed and the disadvantages of a ‘ban’ were considered and after meeting with the Belgian Gaming Commission to discuss the (im)practicalities of enforcing a ban, in drafting and revising the stage 2 registered report, he wrote with the perspective that a ‘ban’ approach to loot box regulation is unlikely to be worth pursuing economically. As he subsequently wrote in a guest post on GamesIndustry.biz on 20 September 2022: ‘As to exactly how loot boxes should be regulated more broadly, I personally advocate for a more middle-ground approach to loot box regulation. Doing nothing fails to adequately recognise and address the potential harms, but banning the mechanic is likely going too far and removing the economic benefits of loot boxes (for both companies and players)’. In terms of the author’s personal engagement with loot boxes, he plays video games containing loot boxes but he has never purchased any loot boxes with real-world money.

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**Conflict of Interest**

L.Y.X. was employed by LiveMe, a subsidiary of Cheetah Mobile (NYSE:CMCM) as an in-house counsel intern from July to August 2019 in Beijing, People’s Republic of China. L.Y.X. was not involved with the monetisation of video games by Cheetah Mobile or its subsidiaries. L.Y.X. undertook a brief period of voluntary work experience at Wiggin LLP (Solicitors Regulation Authority (SRA) number: 420659) in London, England in August 2022. L.Y.X. has met with and discussed policy, regulation, and enforcement with the Belgian Gaming Commission [Belgische Kansspelcommissie] (June 2022), the Danish Competition and Consumer Authority [Konkurrence- og Forbrugerstyrelsen] (August 2022) and the Department for Digital, Culture, Media and Sport (DCMS) of the UK Government (August 2022). L.Y.X. has been invited to provide advice to the DCMS on the technical working group for loot boxes and the Video Games Research Framework. L.Y.X. was the recipient of an AFSG (Academic Forum for the Study of Gambling) Postgraduate Research Support Grant that was derived from ‘regulatory settlements applied for socially responsible
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Fig. A1: A priori power analysis for Hypothesis 3 using G*Power, given an $\alpha$ value of .05 and assuming an effect size of Hedges’ $g = -.15$. A sample size of 100 games achieves .86 power.
Appendix 3: Discussion of the Removal of Game 36

The commencement of the present study’s data collection may have caused Game 36’s removal from the Belgian Apple App Store. For full disclosure and context, the stage 1 registered report for the present study setting out the methodology was published on 7 April 2022, and the author did publish various online content about this then upcoming study, including publishing one Twitter post on 30 June 2022 implying that data collection has begun.[122] Game 36 appears to have been removed from the Belgian Apple App Store between 31 May 2022 and 1 June 2022 as the game appeared on the highest-grossing list on 31 May 2022 but did not do so on 1 June 2022. It is also curious that the game has been removed only from the Belgian store and remained available (and high-grossing) in all other countries checked, specifically, Denmark, France, the Netherlands, the UK, and the US, according to data.ai, as shown in Figure S1.
Figure S1. A series of screenshots of the grossing rank of Game 36 (*The Lord of the Rings: War*) in various countries demonstrating the removal date of said game from the Belgian Apple App Store.
(between 31 May and 1 June 2022) and how said game was curiously not removed from the Apple App Stores of Denmark, France, the Netherlands, the UK, and the US. © 2022 data.ai.