Forecasting the Likely Success of the Centraal Register Uitsluiting Kansspelen Gambling Exclusion Register in the Netherlands - a Comparison with the ROFUS Self-Exclusion Register in Denmark

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ABSTRACT

The CRUKS exclusion register has been activated as of October 2021 by the Kansspelautoriteit, the gambling regulatory authority in the Netherlands. The register is aimed at tackling gambling addiction and protecting consumers. This study forecasts the likely success of CRUKS in meeting these public policy goals by way of comparison with the ROFUS self-exclusion register in Denmark, where a similar gambling regulatory environment exists, but which has also had its register in place for longer than in the Netherlands. Gambling exclusion registers such as CRUKS and ROFUS are examples of digital public sector innovation, with clear theoretical roots in behavioural economics, whereby the vulnerable gambler is offered a 'one stop shop' facility for (temporary) removal from gambling channels, while not prohibiting the less vulnerable and recreational player. The extension of the ROFUS register to land-based casinos in Denmark in late 2016 is employed as a cut-off point at which to test its effect on gambling activity in that sector. This policy intervention is shown to have a significant but steady downward effect on gambling activity, suggesting that such a register will likely have a similar effect on the gambling market in the Netherlands. This is particularly important to Dutch gamblers in light of the recent regulation of online gambling in the country, in light of the potential intensifying effects this channel has on problem gamblers.

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INTRODUCTION

On 1 October 2021, the Centraal Register Uitsluiting Kansspelen ('CRUKS') was made fully operational by the Kansspelautoriteit, the regulatory authority for gambling in the Netherlands. CRUKS is the national digital register allowing gamblers to self-exclude on a multi-venue basis, from any and all forms of gambling. The register is intended as a means of acting against the damage of gambling addiction, and for the protection of consumers. Further, it is the product of a wider legal and regulatory update in the Netherlands whereby, alongside the introduction of the register, online gambling products have become officially licensed in the country. Other concerned parties, such as family members, friends or work colleagues/employers may also seek to have a person excluded from all licensed gambling activity in the Netherlands (Kansspelautoriteit, 2021f).

At this juncture, it is not known how large a part the existence of CRUKS will play in the minimisation of gambling addiction (as part of a spectrum of gambling intensity, including 'problem gambling' and 'pathological gambling'). Indeed, it should be noted that in their meta-review of studies of gambling policy across 30 European jurisdictions, Planzer et al (2014) detected no statistically significant relationship between gambling policy and gambling disorder rates, albeit using small sample sizes and effects in their study (Ibid.).

This study answers the question of whether or not CRUKS can achieve its public policy goals, with reference to the effect of the availability of a similar register on the gambling market in Denmark.

An examination is undertaken of a similar digital exclusion platform instituted in Denmark, whose gambling regulatory authority also introduced this register while regulating (and effectively legalising) online gambling in the jurisdiction. Moreover, this analysis is carried out bearing in mind the existence of CRUKS as a public sector innovation operating according to principles of behavioural economics.

A comparison of the respective existing gambling markets in the Netherlands and Denmark sheds light on the important similarities and net differences between their regulatory

environments, and illustrates the outcomes brought about by Denmark's advancement along the same path being embarked upon by the Kansspelautoriteit. Further, an examination of the 2016 extension of the Danish ROFUS system to land-based casino venues in Denmark by way of time series regression and regression discontinuity design indicate a prima facie unobservable positive effect on gambling losses in that sector. Robustness tests of this design accentuate this effect. This effect can be mapped on to the Dutch gambling environment, and gives a good indication as to the likely positive effect of the availability of a register like CRUKS for gamblers in the Netherlands.

These tests indicate that it is likely that CRUKS will have some restraining effect – albeit not dramatic – on gambling activity in the Netherlands, and will act as a welcome facility for any gamblers vulnerable to an increasingly liberalised market.

The principal contribution of this study is to be the first to illustrate the likely effect of CRUKS on the gambling industry in the Netherlands, through the example of the application of a similar register in a comparable jurisdiction, together with a discussion of the 'good fit' of this example. In a wider sense, it is hoped that this research can go some way towards helping contribute to an understanding of how exclusion registers are associated with different sectors of a modern gambling market.

Section 1 expands on the principles undergirding the use of self-exclusion registers in gambling, and situates these principles in the theoretical environments of behavioural economics and public service innovation. Section 2 sets out the research design, focusing on the operationalisation of gross gambling revenue as the principal outcome variable used in this study, while justifying the choice of Denmark as the appropriate comparator for the Netherlands in terms of measuring the real-world impact of a centralised self-exclusion register on a liberalised gambling market. Section 3 shows the testing of the impact of the ROFUS self-exclusion register on the land-based casino sector in Denmark in 2016, and sets out and clarifies the findings arising therefrom. Section 4 discusses these results in the context of their applicability to the likely performance of CRUKS in meeting its stated public policy aims, and their theoretical applicability. Section 5 concludes this study.

1. THEORY

Gambling occupies a peculiar place in the area of regulated industries – ordinarily, market failures occur (and are accounted for via regulation) at the supply side. However, at the demand side of gambling markets (i.e., the players), market failures such as imperfect information, bounded rationality and behavioural traps can affect even the most astute of players (Kansspelautoriteit, 2021a). Such market failures have especially deleterious consequences for users of gambling products who develop chronic and progressive impulse control (Lesieur and Custer 1984). Given the addictive nature of gambling products, it is even more important that protections afforded by regulation to players serve to 'nudge' them away from harmful outcomes as effectively as possible. It is in this theoretical context that the putative effectiveness of CRUKS will likely emerge.

1.1 How CRUKS Works

If a gambler wishes to exclude themselves from gambling activity (both online and land-based), they may do so for a minimum period of six months[1], either digitally or in writing. Digital registration is carried out via the national DigiD system, and personal details of the requester are recorded either through one's citizen number (burgerservicenummer or 'BSN') or, in the case of non-residents, the upload of other identity documentation as well as further details. Registration can also take place in writing. Once registered, the self-excluded gambler has a specific code (a 'Crukscode') assigned to them, and to which licensed operators have access in order to exclude the gambler from their platform/product. Unless altered/extended in the interim, a self-exclusion period automatically lapses at the end of the requested exclusion period (Kansspelautoriteit, 2021e).

A concerned third party may also request that an individual be added to CRUKS (subject to, inter alia, the gambler themselves being individually informed in writing by the Kansspelautoriteit) (Kansspelautoriteit, 2021f). Licensed operators are also obliged to

[1] Maximum period of 99 years.

consider the addition of a gambler to CRUKS if they detect problematic play (Kansspelautoriteit, 2021g).

1.2 General Principles of Gambling Exclusion Registers

Self-exclusion agreements were historically driven by the industry (Gainsbury 2014; Auer et al 2015). Entering into a self-exclusion agreement with an operator generally entailed the foregoing of certain legal rights, including: non-entry into a venue; authorising photographs and other details for possible dissemination to other venues; waiving the right to sue on account of, *inter alia*, defamation or failure to provide duty of care; and, acknowledgement that venues and their staff incur no legal duty on account of a self-exclusion agreement (Gainsbury 2014). The duration of a self-exclusion period should be judged carefully, given the need not to turn the process into a 'revolving door', while not depriving the gambler of the right to exit the process (Napolitano 2003). Gambling self-exclusion programmes generally have been found to be successful in terms of helping decrease gambling spend, as well as allowing a gambler a public forum for the purposes of committing not to gamble. It should be recognised, however, that identification of such a causal link relies on whether or not positive results arise from a gambler's resolve not to gamble prior to entering into self-exclusion, as opposed to the self-exclusion system *per se* (Gainsbury 2014).

Part VII of the European Commission's 2014 *principles for the protection of consumers and players of online gambling services and for the prevention of minors from gambling online* (Regulation 478/2014) centres on the need to provide players the facility to opt out for sustained periods of time from online gambling platforms. This entails closure of an online account while self-exclusion is in force (Recommendation 35), putting rules in place for third parties requesting the exclusion of a player (36), the establishment of a national self-exclusion registry (37) and allowing access by operators to such registers in order to ensure prevention of entry by players to their platforms (38). It is notable that these Recommendations are aimed squarely at obligating the Member States, rather than individual operators, to put these different elements of a self-exclusion system in place. Further, the Commission recommends a minimum exclusion period of six months (33(b)). The centralised and State-level location of CRUKS, together with the strict minimum period of exclusion, appears to owe

much to these Recommendations. This also contributes to the compliance of CRUKS with Commission best practice in the area of public sector innovation, which will be discussed at later stages of this paper. It should also be noted, however, that the six-month minimum registration period for CRUKS has come in for some criticism for not following another of the Commission's Recommendations (33(a)) to allow for a shorter 'time-out' period of exclusion, such as 24 hours. The benefit of such a shorter period is thought to be particularly advantageous for anyone who may be particularly vulnerable to addiction at specific times (such as payday), and a centralised register for these shorter exclusion periods also has the advantage of operators not losing excluded customers to competitors, not to mention the protection this also endows on the vulnerable player (Kansspelautoriteit, 2021a).

1.3 Gambling Self-Exclusion as Behavioural Economics

This study situates CRUKS in the theoretical framework of behavioural economics. Specifically, it is a precommitment device for gamblers, whereby the State facilitates a commitment (either voluntary or enforced) to refrain from gambling for a designated period, while nominally not interfering with the enjoyment and utility derived from gambling by other citizens.

As a means of allowing a gambler the chance to overcome his/her action-intention gap (Gainsbury et al 2018b), without disturbing the play of non-problem gamblers, the CRUKS register forms part of the 'choice architecture' to be found in 'nudge' policies (Thaler and Sunstein 2008).

'Nudge' theory finds echoes in the 'asymmetric paternalism' concept introduced by Camerer et al (2003), whereby those making errors should receive benefit from policies while ensuring that those not making errors incur no cost as a result. Such policies ought to increase economic efficiency in terms of the sum of producer and consumer surplus, by helping boundedly rational consumers make better choices. A prime example of 'asymmetric paternalism' is the 'cooling-off' period instituted into rules surrounding major purchases, such as mortgages (Ibid.). A gambling self-exclusion tool provides the means to attain a similar 'cooling-off' period.

This is of a piece with 'libertarian paternalism' espoused by Thaler and Sunstein (2003a). This theory takes into account that while some people may need to adjust negative/destructive behaviour by desisting from, e.g., gambling, an apparatus ought to be in place to ensure the continued free enjoyment of a legal activity by those not affected so negatively (Ibid.). As noted earlier, CRUKS is also available to third parties seeking to have a gambler displaying problematic behaviour listed for exclusion. However, this provision does not necessarily place CRUKS outside of the libertarian paternalism framework, given that individual choices are not always axiomatically rational (Ibid.), and in any event, the putative excluded gambler is given advance notification of the intention to exclude them, as well as the identity of the party requesting the exclusion (Kansspelautoriteit, 2021f). Mitchell (2005), however, is of the view that for the individual who possesses neither stable preferences nor the ability to choose optimally for themselves in a particular setting (and this arguably encompasses the 'extreme' problem or pathological gambler), the 'nudge' is devoid of any libertarian trait (p.1254). Nevertheless, from the point of view of public policy interventions, paternalism aimed at influencing a person's choices in order to improve their welfare, is inevitable in circumstances where the revealed preferences of that person do not always add up to welfare *per se* (Thaler and Sunstein 2003b).

1.3.1 Gambling Self-Exclusion as Pre-Commitment

The first elementary question to ask in assessing the likely future success of CRUKS is whether or not self-exclusion *per se* is an effective method of limiting the activity of the vulnerable gambler, such that they can be spared the worst externalities of excessive gambling.

Self-exclusion from gambling represents a form of pre-commitment, defined by Elster (2003) as something requiring not just mental resolution, but also observable action, capable of being undone only with some cost or effort (p.1754). This corresponds with the enrolment requirements for CRUKS, incorporating the impossibility of cutting short the initial six-month period of self-exclusion (Kansspelautoriteit, 2021e)[2]. Individual pre-commitment is distinguished from more collective forms (such as constitutions binding successive

[2] *"Wilt u opzeggen? Dat kan alleen* ***als de eerste 6 maanden van uw inschrijving voorbij zijn. Niet eerder."*** ('Do you wish to terminate [the self-exclusion?] That is only possible once the first six months have passed. No earlier.')

governments), but the individual nevertheless may enlist the help of others in helping to meet their pledge (e.g., Ulysses bound to the mast by his sailors, signing up to 'Christmas Clubs' as a savings device, etc.), provided that such outside entities act so as to prevent a change of mind (Elster 2003). Time-inconsistency induced by hyperbolic discounting (e.g., last-minute backing out from a dental appointment) can be managed by pre-committing through, among different means, the deletion of options (Ibid.), in this case, prohibiting oneself from gambling venues and platforms. Gainsbury et al (2020) point out that some gambling operators exploit human behaviour that gives rise to the aforementioned hyperbolic discounting, causing the player to favour immediate gratification over long-term cost, even if this action is inconsistent with earlier plans (p.2).

A number of studies and experiments have yielded interesting results. Ladouceur et al (2007) observed in a study of around 160 self-excluding Quebecois gamblers (73% of whom tested as 'pathological' gamblers), significant improvements among the participants, on foot of the self-exclusion period (with respect to gambling urges and effects on aspects of daily life). However, this effect wore off with time, the majority of participants resuming gambling in some form or other in the course of a 6-month follow-up period. Caillon et al (2019), on the other hand, observed a positive medium-term impact on a group of French online gamblers, with self-exclusion contributing to a diminution in 'illusion of control' and inability to cease gambling. Catania and Griffiths (2021) note, on foot of a study carried out of customer data from one particular online gambling company, that depending on the duration of custom and/or self-exclusion, the use of such a pre-commitment tool may be as indicative of financial problems or even dissatisfaction with the operator, as it is of problem gambling (p.3).

The efficacy of self-exclusion tools is also dependent on their availability. Hayer et al (2020) carried out an analysis of around 12,000 excluded players from gaming halls in the German State of Hesse, and found low levels of detection of excluded individuals and lack of engagement with those displaying problematic gambling behaviour, reflective of inherent conflict between commercial concerns and adequate protection of players. Pickering et al (2019) canvassed opinion from a convenience sample of around 20 gamblers from clubs participating in a multi-venue self-exclusion programme in New South Wales, and they pointed to numerous problems including lack of public information on the programme, complexity in registration and laxity in the face of self-exclusion breaches.

Similar problems were identified in a survey of staff working in a club in Sydney carried out by Beckett et al (2020), with inadequate training, fear of defaming identified customers and management pre-occupation with profit identified as barriers to intervening in potential problem gambling cases. It should be noted that the staff members were of the view that a gambler setting limits for themselves were viewed as responsible gamblers (Ibid.). For the purposes of the present study, it should be noted that legislation requires all online players in the Netherlands to set their own limits (Kansspelautoriteit, 2021a). However, in a survey by Currie et al (2020) of around 10,000 Canadian gamblers, all of whom listed various strategies for gambling self-control, use of such strategies was found to be more common in players rating moderate to problematic in terms of gambling severity. Moreover, use of a variety of strategies was associated with a high gambling severity (Ibid.). Limit-setting, moreover, was judged by Nichols et al (2004) as likely less useful (particularly when applied generally and universally) than more focused anti-problem gambling measures such as exclusion. Markham et al (2015) go further, surmising that their own study of gambling losses indicated that the activity is akin to tobacco use, whereby any level of consumption tracks harm, with limit-setting ineffective in terms of bringing about 'responsible gambling' (p.327).

As a means of precommitment, CRUKS affords the benefit of a minimum mandatory period of self-exclusion (Kansspelautoriteit, 2021e). That the minimum period is mandatory ensures (as far as licensed and legal channels are concerned) compliance on the part of the gambler, and solidifies the public commitment implied in voluntary self-exclusion (Gainsbury 2014). Precommitment via self-exclusion should be distinguished from precommitment via stake limits, which is predicated on the theory that such limits will attenuate risky behaviour on the part of those may otherwise be emotionally aroused by losses (Ladouceur et al 2012). Indeed, simple limit-setting may not be effective in the case of problem/pathological gamblers, for whom gambling is less a leisure activity and more a means of income accrual (Nower and Blaszczynski 2010).

Gainsbury (2014) recommends, particularly in the context of self-exclusion from land-based venues, that information on schemes be made salient and available in a discreet setting (p.247). Moreover, exit from such schemes should only be permitted by operators upon completion of a reinstatement process, while the schemes themselves ought to be subject to ongoing review (p.248). Such a recommendation is at odds with the Kansspelautoriteit's

policy of automatically removing players from CRUKS in the event of no further extension being sought (Kansspelautoriteit, 2021e).

1.3.2 Loss Aversion

A significant observation in the field of behavioural economics is the scope for addressing the human bias of loss aversion (Thaler and Sunstein 2008), which was characterised by Kahneman and Tversky in their description of prospect theory, as 'losses looming larger than gains' (1979, p.279). In the area of gambling, Gainsbury et al (2018b) identify loss aversion as a key factor in the loss-chasing often witnessed in problem gamblers.

Thorgeirsson and Kawachi (2013) note (in a general paper on loss aversion) that the theory helps explain promising results arising from interventions based on pre-commitment (p.186). Further, Giorgetta et al (2014) found that pathological gamblers undergoing clinical treatment tended to be more sensitive to losses than non-problem gamblers. One striking experiment indicating a form of the loss aversion effect was conducted by Lole et al (2014), who found that problem gamblers subject to phasic skin conductance tests demonstrated hyposensitivity to rewarding stimuli (p.561). In other words, the problem gamblers experienced a high threshold to the joys of winning – it is a distinguishable form of loss aversion, in the sense that feelings of winning have been dampened, rather than fear of loss having been heightened.

However, loss aversion should not be considered to explain all motivations underpinning gambling. Sharot (2011) draws attention to the phenomenon of 'optimism bias', whereby humans have been found to overestimate the likelihood of positive outcomes, with even those harbouring negative expectations at the outset of an event, upgrading those expectations upon receipt of positive information. A negative outcome of optimism bias can manifest itself in reckless behaviour borne of excessive optimism (R941-R943), of which excessive gambling is surely an example. The 'illusion of control', for example, is tied by Gainsbury et al (2018b) to optimism bias, on the basis of increased gambling duration and expenditure, notwithstanding losses experienced by the gambler (p.610). Further, Conlisk (1993) points out that while standard economic theory has treated the intention of the gambler as the pursuit of enhanced wealth, aversion to risk ought to preclude gambling,

particularly when set against the likelihood that gambling individuals likely also harbour a simultaneous propensity towards investing in insurance, portfolio diversification and other similarly risk-averse decisions (p.255).

It should be noted that in recent years, the strength of loss aversion theory has been called into question. Gal and Rucker (2018) criticise loss aversion insofar as it has been more or less accepted at face value, devoid of context, and defined without regard to a specific psychological process, unusually for what is a psychological principle (p.498). Moreover, the authors consider that loss and gain in the loss aversion paradigm have been erroneously conflated with action and inaction (p.504), and go on to point to earlier studies of theirs indicating that at least in the case of low stakes, humans are more likely to make choices on the basis of gain-seeking (p.506). This is in line with Conlisk's conclusion that a 'tiny' utility of gambling may push an individual into risk-seeking behaviour in respect of small risks, notwithstanding that risk aversion will likely overcome such behavioural urges if risks become large (1993, p.270). Yechiam (2019) is similarly critical, also noting the relative absence of loss aversion in transactions/wagers involving low stakes (p.1327), and accusing supporters of the theory of using an overly general theoretical framework, indicative of a pessimistic view of the human mind (p.1337).

1.3.3 Limits of 'Nudge'

It should be recognised that CRUKS is a single policy instrument used to address the policy problems posed by excessive gambling. As pointed out by Gainsbury et al (2018b), gambling harm occurs in a wide social and political context, and behavioural economics is unlikely to tackle the most extreme cases, given (and as set out earlier) the aim of 'nudge' policies to benefit those who ultimately are motivated to make the appropriate choice, rather than acting on foot of coercion (p.613). This is illustrated in a survey carried out by Håkansson and Widinghoff (2020), who found that gambling while registered for a national self-exclusion tool in Sweden was a common occurrence among their sample (pp.6-8). Nevertheless, this is to overlook the value of CRUKS as a 'nudge' instrument that intervenes on behalf of those who may not be able to make good choices in the face of asymmetric information deficits and other disadvantages (Thaler and Sunstein 2003a; Kansspelautoriteit, 2021a).

1.3.4 Limits of Individual Operators

Continuing the theme of 'nudge', Gainsbury et al (2020) describe a range of such services that individual service providers could use in order to identify customers who may require protection (p.2). Aside from pre-commitment devices, these include (among others) dynamic messages encouraging breaks in play, ring-fencing winnings in order to prevent 're-gambling', minimising colour and graphics on websites, and mandatory manual input of amounts to be wagered. This identification process could also take place in the context of 'Know Your Customer' onboarding processes when dealing with new customers (Ibid.). Such interventions at operator level would be ideal, as pointed out by Håkansson and Henzel (2020), in a survey of Swedish gamblers enrolled in the national self-exclusion system, given that operators are the first point of contact in the event of worrying patterns manifesting (p.10). Catania and Griffiths (2021) also point out that internet-based gambling companies (including the one whose data was used in their study) possessed a significant amount of data that would be useful for the purposes of consumer protection (p.2).

Nevertheless, individual operators often favour commercial viability over attenuating problem gambling (Hayer et al 2020; Beckett et al 2020), while complaints concerning lack of information on self-exclusion options have been levelled at operators in other cases (Pickering et al 2019; Caillon et al 2019). However, it should also be noted that some industry stakeholders consulted by the Kansspelautoriteit were of the view that a centralised system was important for reasons of commercial fairness to those operators who may otherwise be in danger of the long-term loss of customers to operators where no individual exclusion agreement is in place (Kansspelautoriteit, 2021i, p.2). In this light, it is understandable that a centralised, publicly-located solution would be preferable to stakeholders.

1.4 One-Stop Shop

The European Commission (2017) recommends that in public service delivery, citizens' needs and requirements should be attended to by the availability of both physical and digital channels, via a single point of contact. In the context of facilitating those seeking to make a

rational choice, this can also be mediated through 'channel factors', whereby a solution to a problem may be made more attainable through the opening of channels. Thorgeirsson and Kawachi (2013) employ the example of the provision of a map to an injection clinic, increasing uptake among those needing a tetanus shot (but taking no previous action to get one) (p.188).

In the context of CRUKS as a public sector-based, centrally operated self-exclusion tool, it should be noted that a number of studies explicitly endorse this form of self-exclusion over individual, private ones (Pickering et al 2019; Caillon et al 2019; Hayer et al 2020). It is also apparent that such a system plays a part in relieving administrative and other pressure on staff in land-based venues (Beckett et al 2020). A centralised online self-exclusion system also minimises stigma brought about by in-person exclusion (Catania and Griffiths 2021), thus preventing any hesitation in recognising a burgeoning problem (Brown and Russell 2020).

1.5 CRUKS as Public Sector Innovation

The introduction of CRUKS for the purposes of tackling problematic gambling behaviour and addiction satisfies the OECD's criteria for reaching the standard of public sector innovation, set out in the 2018 Oslo Manual:

> "An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)"

(OECD/Eurostat 2018, p.20)

CRUKS, moreover, is a product designed to help those with problems help themselves (or be helped), and brings more innovation to public policy than has been the case in the Netherlands previously. Crucially, it is delivered through the public sector institution that regulates and licenses the industry, rather than through discrete parts of the industry (see earlier). Further, it provides this service on a centralised and convenient basis, an essential part of modern, digitally-based public service provision (European Commission 2017).

CRUKS operates as one element of a public solution to a collective action problem, whereby information provided by gambling operators and their customers can be harnessed for the benefit of the State (who would see externalities related to gambling harm minimised) as well

as the industry, its customers and those wishing to opt out (Axelson et al 2017; Dowding 2020). An innovation like CRUKS, moreover, will fail when the coordination between parties, both public- and private-sector, is absent (Axelson et al 2017). It is also important to remember that CRUKS can become an important component of a 'whole systems' approach to wider public policy problems touched by gambling-related externalities (Bovaird 2014). This is highlighted in the Kansspelautoriteit's dealings with industry stakeholders in the course of developing CRUKS (Kansspelautoriteit, 2021i, p.2).

While co-operation with non-State parties is essential to the likelihood of the success of CRUKS in terms of public policy innovation , it is free of the need for the types of product and process innovations required in the private sector, and can best be described as a product of 'governance innovation' (Moore and Hartley 2008). Such innovation is intended, *inter alia*, to help transform social conditions in socially desirable ways, facilitate governments, via regulatory authority, in mobilising private actors (e.g., gambling operators) to contribute to public purposes, and change the locus of decision rights, such that regulations re-condition formerly private power for public purpose (Ibid.) – in other words, CRUKS transfers (at least some of) the ability directly to aid the vulnerable gambler from the industry to the State.

2. RESEARCH DESIGN

Analysis by way of a comparison between the respective gambling markets and regulatory environments of the Netherlands and Denmark is carried out in Section 3.

Before this, however, it is important to note that this study is designed for specific reasons and amid a number of limitations. First, the choice of Denmark as the sole comparator is justified in this chapter. A Most Similar Systems design highlights similarities and filters out dissimilarities, while justifying Denmark's 'goodness of fit' as a comparator case for the Netherlands. The ruling out of alternative or additional jurisdictions as comparators is also justified herein. Further, the challenge in identifying appropriate dependent variables in the absence of systematically missing data is addressed, together with justification of the choice of alternatives.

2.1 Choosing a Comparator

In order to find a worthwhile comparator jurisdiction in considering the impact of CRUKS on the gambling landscape in the Netherlands, a number of criteria would have to be met.

First, the market would have to be located in Europe/the European Union.

Second, the jurisdiction would have to have an independent and dedicated regulatory authority overseeing a relatively wide range of licensable gambling activities, though not necessarily online gambling, given that this is a sector only recently regulated in the Netherlands.

By the same token, a comparator jurisdiction ought also to have a centrally supervised exclusion/self-exclusion register, operational for a reasonably long period of time (preferably as long as the Netherlands has had a gambling regulator in place).

A number of reasons exist for settling on Denmark as the sole comparator for the Netherlands gambling environment. The countries' respective gambling regulatory environments will be compared and distinguished in the next section, via a Most Similar Systems design, justifying

the choice of Denmark as the most suitable available comparator for the Netherlands, and isolating the factor that will help answer our research question.

2.2 Justification of Denmark as Comparator

For an inter-country case study, a Most Similar Systems Design is an appropriate method for justifying the choice of Denmark as a suitable comparator in the context of attempting to predict the likely effect of CRUKS on the gambling population of the Netherlands. However, this design also serves to isolate that which sets the two countries apart, and how this difference can be used to predict the future performance of CRUKS.

In this type of design, contesting (dependent) variables ought to be kept constant, with only an independent variable comprising the difference, i.e., the explanatory variable. When comparing countries, the requirement of constant contesting variables is likely met in the case of countries that are close to each other in terms of geography and culture. For our case study, it should be noted that the comparisons herein are not binary, with the similarity of characteristics listed in Table 1 overleaf, indicative of a looser application of the design (Anckar 2008).

Figures for GDP per capita have been sourced from the World Bank website. Other information has been sourced from the respective websites of the Kansspelautoriteit and the Spillemyndigheden, the gambling regulatory authority for Denmark.

Table 1: Most Similar Systems Design table, describing gambling regulatory environments of Netherlands and Denmark.

	Netherlands	**Denmark**
Independent Regulatory Authority?	Yes	Yes
Year Established	2012	2013
2020 Gross Domestic Product per Capita (in €)	46392.50	49986.43
Regulated Gambling Activities	- Betting - Gaming Machines (in arcades, horeca and Holland Casino venues) - Land-Based Casinos (monopoly) - Lotteries (National Lottery, Lotto, Private Good Cause, Charity) - ***Online Gambling (since 2021)***	- Betting - Gaming Machines (restaurants and arcades) - Land-Based Casinos (private) - Lotteries (monopolised and charity) - ***Online Gambling (since 2012)***
Exclusion Register?	Yes	Yes
Year Established	***2021***	***2012***

The above table yields the following similar dependent variables:

- An independent regulatory authority overseeing gambling has been in place in Denmark since 2013, around the same time as the establishment of the Kansspelautoriteit as the independent authority in the Netherlands;
- The economies of the two countries are similar (operationalised as GDP per capita), while the regulated gambling markets are based on largely the same products. The differences between the types of lotteries and casinos regulated in both jurisdictions

in a sense even themselves out, i.e., there are no monopoly lotteries in the Netherlands, while in Denmark, land-based casinos are permitted to be established privately;

- Further, both jurisdictions now regulate online gambling and betting, and introduced their respective exclusion registers in tandem with regulating this form of gambling product. However, the crucial distinction lies in the Spillemyndigheden having put in place and assumed responsibility for these areas since the time of its inception. The Kansspelautoriteit, on the other hand, has only introduced these almost a decade into its existence.

Thus, the explanatory variable on foot of this Most Similar Systems Design is the immediate adoption of a self-exclusion register accompanying a regulated online gambling environment in Denmark (as set out earlier, ROFUS had been established initially for the registration of online players). This also serves to set Denmark apart from other candidate comparator jurisdictions such as (among others) the United Kingdom, France and Portugal, where the exclusion systems in place have been put into action far too recently to acquire a sufficient amount of data with which to carry out meaningful analysis (see 2.4).

The key to answering our research question is the examination of the effect of the availability of ROFUS on the gambling environment in Denmark, and how this can help inform a view on the prospective view of the impact of CRUKS on the Dutch market. The explanatory variable in this case helps provide a proper foundation for such an examination.

The outcome of this design, therefore, is that Denmark acts as much as an exemplar as it does a comparator for the Netherlands.

2.3 The Role of Gross Gambling Revenue as a Proxy Variable

Gross gambling revenue ('GGR') is the measure used in reports on regulated gambling revenue in a number of countries, including the two focused on in this paper. Essentially, GGR is the difference between the amount of money received by an operator, and the amount paid out in prizes (Lock 2020), though it is also recognised as incorporating the additional value of commission accruing to an operator (Spillemyndigheden, 2019). With that in mind, it

is proposed that GGR assumes something of a dual role: it can be seen to indicate not only the level of activity in a particular gambling market, but also the level of losses occurred at the aggregate level by gamblers (Ibid.). This latter interpretation is an especially sharp lens through which to view the impact of gambling activity on social outcomes, with Markham et al (2015) finding through their study of the impact of gambling losses in four different countries, that no threshold existed whereby any level of gambling losses was not harmful (pp. 323-324).

For the most part, GGR is used in this paper as a dependent variable in assessing impact of the extension of the ROFUS register on the land-based casino sector in Denmark (see Section 3).

2.4 Alternative Comparators

Appendix C displays a chart of certain important details concerning the gambling regulatory regimes of all EU Member States (bar the Netherlands), together with the United Kingdom. The respective levels of regulation, including provision of a centralised exclusion register applicable to all licensed operators, varies considerably from country to country. Certain jurisdictions were given strong consideration, but rejected ultimately for a number of important reasons.

2.4.1 Belgium

Belgium was a strong candidate for inclusion, as it has a standalone regulatory authority (the Kansspelcommissie) and a register of its own (Excluded Persons Information System, or 'EPIS') since 1999 (Kansspelcommissie, 2006). However, problems arose in terms of being able to collect consistently measured and categorised data, as reported in the Annual Reports of the Kansspelcommissie. In any event, it appears that little change in the trajectory of the gambling environment in Belgium has occurred in the intervening years, even in light of the regulation (on a severely restricted basis) of the online gambling sector from 2012 (Kansspelcommissie, 2013). One further problem was that it was difficult to detect any causal patterns arising from the institution of EPIS, as it was brought in at a time when gambling markets were far different

from those today (in terms of new gambling products and attendant technology), with different challenges posed. In other words, no meaningful inflection point exists to help a researcher determine any causal effect of EPIS on the activity of the Belgian gambler.

2.4.2 United Kingdom

The regulatory authority in the United Kingdom has only recently established its own self-exclusion tool, GAMBAN (previously known as GAMSTOP), but this system has been subject to severe criticism on both sides of the regulatory divide since its 'unofficial launch' in 2018 (Davies, 2019). These background complications aside, the establishment of GAMBAN is too recent for the purposes of measuring its impact on problem gambling in the UK, notwithstanding its otherwise advanced regulatory apparatus.

2.4.3 France

The regulation of gambling in France is overseen by different authorities, with the Autorité Nationale de Jeux ('ANJ') covering online gambling, while casinos are licensed and regulated by the Ministry of Home Affairs. Also, ANJ has only recently rationalised its self-exclusion system, as of December 2020. Another self-exclusion system had been in place, but this was an extremely cumbersome process, requiring personal registration of a wish to self-exclude at a police station (Autorité Nationale des Jeux, 2021).

2.4.4 Germany

Germany is only now establishing its own centralised gambling regulatory authority, as of August 2021, the same time of the national launch of the online self-exclusion tool, OASIS, run by the German State of Hesse (Germany to Launch New Self-Exclusion OASIS System in August, 2021).

2.4.5 Austria

The Austrian Government plans on a centralised exclusion register as part of a wider plan to establish an independent regulatory authority, but it has not been established yet (Harrison, 2021). For now, Austria's regulatory body overseeing gambling is contained within the Ministry Finance (Federal Ministry of Finance Republic of Austria, 2022).

2.4.6 Malta

Malta is a very advanced gambling market (in terms of regulation), but is still in the course of establishing a centralised exclusion register (Formosa, 2019).

2.4.7 Portugal

Portugal has a well-functioning gambling regulatory environment, incorporating its own self-exclusion register, covering all forms of regulated gambling. However, this has only been in place since the establishment of the Serviços de Regulação e Inspeção de Jogos, the Portuguese gambling authority, in 2015 (Serviços de Regulação e Inspeção de Jogos, 2022).

2.4.8 Spain

Spain's regulation of gambling is divided between a national regulatory body (Directorate General) for online gambling, while other markets are supervised on a regional basis (Directorate General for the Regulation of Gambling, 2022). Further, while a national self-exclusion register exists, full integration of all regional self-exclusion registers has only recently been achieved (Narayan, 2021).

2.5 Limited Dependent Variable Options

As the main public policy goals of the Kansspelautoriteit in supervising CRUKS are consumer protection and the protection of vulnerable players, the question of the optimum outcome variable is raised. Given the aforementioned policy goals, one would expect to see a

corresponding effect of exclusion on the rate of problematic gambling behaviour (assuming that those excluded generally are not successful in finding alternative unregulated gambling channels). Unfortunately, the measurement of this variable is beset with problems (for this particular study at any rate), namely:

2.5.1 Paucity of Studies

It is extremely difficult to locate consistent time-series prevalence studies on problem gambling in most countries, including the Netherlands and Denmark. This is an ongoing problem lamented by researchers such as Mondriaan (2013).

2.5.1.1 Netherlands

The phrase 'problem gambling rate Netherlands' was inputted into Google, Google Scholar and the online library of Leiden University, with all sources essentially pointing to figures assessed on behalf of the Ministerie van Justitie en Veiligheid in the years 2005, 2011 and 2016. The collected prevalence figures were, as a percentage of the gambling population of the Netherlands in those years, 0.22%, 0.15% and 0.65% respectively (Kruize et al, 2016, p.70).

No other prevalence figures could be found. Further, only one of the above sample years (2016) falls within the period within which measurable, regulated gambling activity in the country has been recorded.

2.5.1.2 Denmark

There are even fewer reliable studies carried out in respect of problem gambling in Denmark. Bonke and Borregaard (2009) conducted a (mostly) telephone-based survey in 2006 among approximately 11,700 Danish adults, and found 0.42% of gamblers were 'problematic' and 0.26% were 'pathological' gamblers. Ekholm et al (2014) carried out comparative prevalence studies between approximately 11,000 Danish citizens in 2005, and over 23,400 in 2010, and the past-year problem gambling rates were found to be 0.9% in 2005 and 0.8% in 2006.

Again, the above studies suffer (for the purposes of this paper) from having been carried out in years prior to the liberalisation and regulation of the Danish gambling industry.

2.5.2 Disparate Measurement Methods for Problem Gambling

Notwithstanding the dearth of prevalence figures described above, it should also be noted that a comparison of a series of studies would likely be hindered to at least some degree by the varying methods used to measure the condition. These different methods are described below, together with a sample of pertinent criticism of each.

2.5.2.1 DSM-IV

This is a classification code contained in the Diagnostic and Statistical Manual of Mental Disorders published by the American Psychiatric Association, and is intended to help identify 'persistent and maladaptive gambling behaviour' corresponding with at least five from ten symptoms bearing similarity to substance abuse (Kessler et al 2008).

2.5.2.2 Problem Gambling Severity Index

This originated as a sub-set of items from the Canadian Problem Gambling Inventory, four of which are related to gambling behaviours, with assessment of these behaviours taking place on a frequency scale (Holtgraves 2008).

2.5.2.3 South Oaks Gambling Scale

The Gambling Treatment Team at the South Oaks Hospital in Amityville, New York developed SOGS, whereby score is determined by responses given to 20 questions concerning various gambling-related matters, with some questions binary, and others ranking gambling severity (Lesieur and Blume 1987).

2.5.2.4 Critique of Problem Gambling Screening Methods

Griffiths (2010) raises the problem of measuring problem/pathological gambling prevalence rates throughout Europe, on account of the considerable variation between screening instruments such as DSM-IV and SOGS (p.82). The screening methods have also each attracted significant critical scrutiny.

SOGS comes in for criticism from Holtgraves (2008) and Orford et al (2010) for its over-emphasis on means of attaining finance for gambling on the part of the gambler.

Holtgraves (2008) considers PGSI to be a superior psychometric tool to SOGS, given that it measures behaviour on a comparative continuum (rather than on a binary scale), but

Samuelsson et al (2019) note that it yields too many ambiguous responses from participants for accurate interpretation. Strong and Kahler (2006) criticise the dichotomous nature of the DSM-IV screening instrument, while Orford et al (2010) are of the view that this screening tool suffers in terms of internal reliability as a result of subsuming discrete factors of gambling dependence when measuring the singular phenomenon of problem gambling.

While these screening tools have been recognised as enjoying a certain level of overlap (Holtgraves 2008), it is clear from the foregoing critiques (of which only a small sample are set out herein) that comparison and interpretation of officially collected problem gambling prevalence rates would have been somewhat doubtful. This observation leaves aside the sheer lack of data described earlier.

2.6 Other Proxy Variables

A logical proxy for problem gambling, *prima facie*, would be the measurement of the social harms that can emerge as a result of problem gambling. Strong association has been noted in the past between problem gambling and numerous co-morbidities such as depression and alcohol abuse among others (Lorains et al 2010). Indeed, in light of these and other externalities, it is arguable that problem gambling is in fact a proxy for other social problems and addiction types. However, in spite of extensive searches of statistical databases and public health bureaux in the Netherlands and Denmark, it was not possible to acquire data related to substance abuse/addiction with sufficient frequency to amount to a meaningful number of observations. With this in mind, the analysis herein is carried out using gross gambling revenue as the best available proxy dependent variable, for the reasons set out at 2.3 of this study.

3. ANALYSIS

This section brings to light the likely effect of the implementation of CRUKS on the Dutch gambling market and population, mediated through observed effects of its Danish equivalent on that country's market. First, the respective markets and regulatory environments of the Netherlands and Denmark are described, compared and contrasted in detail.

Thereafter, analysis is carried out in respect of the effect of the extension of mandatory availability of the ROFUS system to consumers at land-based casinos in Denmark in the latter half of 2016. A time series regression of the effect of the imposition of the system on gambling activity (operationalised as gross gambling revenue) in the sector indicates a possible negative interaction. Further, a regression discontinuity design produces graphic evidence of a negative trajectory in gambling activity in the reference period, albeit one that indicates a steady rather than dramatic decline.

3.1 Market Comparison – Netherlands and Denmark

The following is a comparison of each respective component of the gambling markets and regulatory environments of the Netherlands and Denmark. The regulatory reach and extent of the markets are compared and contrasted. It is apparent that the respective markets have much in common, with the obvious exceptions (per the Most Similar Systems Design carried out in the last Section) being the relative novelty of the licensed online gambling sector in the Netherlands compared to that in Denmark, together with the pre-existence of the Danish ROFUS self-exclusion register. ROFUS is examined in light of its continuously increased participation level set against the backdrop of the overall trend of the wider regulated gambling market in Denmark. The bespoke 'Preventiebeleid Kansspel' exclusion system employed in Holland Casino venues is also examined in order to gauge likely appeal of exclusion systems in the Netherlands gambling market.

3.1.1 Regulatory Environment in Netherlands (pre-Legalisation of Remote Gambling in October 2021)

Games of chance are regulated in the Netherlands via the Gambling and Betting Acts, and supervision of such games has been performed by the Kansspelautoriteit since 1 April 2012 (Kansspelautoriteit, 2021a). The Kansspelautoriteit, whose Board of Directors reports to the Minister for Legal Protection, Justice and Security (Kansspelautoriteit, 2021k), has 3 main aims, namely:

1. Consumer protection
2. Gambling addiction prevention
3. Tackling illegality and criminality

The Kansspelautoriteit also has 5 legal tasks:

1. Regulation of the Dutch gambling market
2. Oversight and supervision of the market
3. Promotion of gambling addiction prevention
4. Education and information
5. Counteracting gambling-related match-fixing among licence-holders

(Kansspelautoriteit 2021j)

3.1.2 Regulatory Environment in Denmark

Supervision of gambling activities in Denmark is carried out by the Spillemyndigheden, which was formed originally as a division within the country's Ministry of Taxation in 2000. The initial duties of the Spillemyndigheden generally entailed supervising matters related to gaming machines, as well as land-based casinos and the monopoly Danske Spil lotteries, and issuing licences to charity lotteries and bingo events.

Upon enactment of the Act on Gambling in 2012, liberalising the Danish gambling market, the Spillemyndigheden became an independent regulatory authority as of 1 January 2013.

The Spillemyndigheden engages in a range of tasks related to the gambling market in Denmark, including the issuance of licences, carrying out inspections, and maintenance of

ongoing engagement with various stakeholders (Ibid.). Further, analysis is carried out on an ongoing basis in relation to market/industry developments, with information exchanges taking place with counterpart regulatory authorities in other jurisdictions (Spillemyndigheden, 2022a).

The main corporate aims of the Authority are:

- A well-regulated and fair gambling market
- Protection of players
- Protection of children, young persons and vulnerable persons
- Inform and guide in respect of a framework for legal gambling

(Spillemyndigheden, 2022a)

The corporate aims of the respective regulatory authorities are reasonably well-matched, with efficient regulation and oversight of the gambling market and protection of vulnerable gamblers both prioritised. The only distinguishing feature seems to be the Kansspelautoriteit's overt targeting of criminality in the gambling sector, reflecting the concerns of its 'parent' government ministry.

3.1.3 Licensed Gambling Activities in Netherlands

The Kansspelautoriteit issues licences for occasional lotteries with a minimum prize of €4500, licences for permanent lotteries, sports betting and casinos, together with model licences for gaming machines (Kansspelautoriteit, 2021a).

Further, *De Nederlandse Loterij* and Holland Casino both enjoy monopoly licences, with legislation to privatise the latter having been withdrawn in the Dutch parliament. The national Totalisator licence (for betting on horse-racing) belongs to a private entity, ZEbetting & Gaming Nederland B.V. (Kansspelautoriteit, 2021a).

Operators pay a levy to the Kansspelautoriteit to fund the authority, with the levy payable by particular sectors (casinos and online operators) determined on the basis of costs of supervision in accordance with the provisions of the Money Laundering and Terrorist Financing (Prevention) Act[3]. Moreover, operators of amusement arcades, casinos and online gambling must also pay a levy to contribute to an Addiction Prevention Fund (Kansspelautoriteit, 2021a).

3.1.4 Licensed Gambling Activities in Denmark

Licences are issued to the following gambling sectors seeking to provide services in Denmark:

- Danske Lotteri Spil
- Klasselotteriet
- Online casino
- Gaming machines
- Land-based casino
- Public poker tournaments
- Charitable lotteries

(Spillemyndigheden, 2022b)

Fees are payable by licence-holders to the Spillemyndigheden.

The Spillemyndigheden also helps oversee advertising and marketing materials and strategies of prospective licensees and ensures that they comply with Danish gambling legislation (Spillemyndigheden, 2022c). Further, the Spillemyndigheden vets licence applicants in respect of anti-money laundering/counter-financing of terrorism obligations (Spillemyndigheden, 2022d), and is part of the National Platform that coordinates joint efforts in Denmark to combat match-fixing (Spillemyndigheden, 2022e).

[3] Wet ter voorkoming van witwassen en financieren van terrorisme.

Aside from the monopoly status of casinos and the National Lottery in the Netherlands, there is very little difference in the licensing requirements of the two jurisdictions. Indeed, the only clear distinction is that Denmark has licensed online gambling since 2012.

3.1.5 Market Patterns and Statistics - Netherlands Land-Based Gambling Market

Aside from the above figures, numerous statistics were collected in respect of different sectors and different measurements within the Dutch gambling market, for which figures were available. These were comprised of numbers of venues (gambling halls/arcades and 'horeca') offering gaming machines, as well as the numbers of machines in these types of establishments. Aggregate amounts in fines levied by the Kansspelautoriteit were also collected. Total gambling figures were restricted to the 2013-2018 period (aside from figures relating to numbers and location of gaming machines, which statistics run to 2020, and total fines levied, which figures run to 2019). Figures not listed in this section are set out in Appendix A.

Table 2 indicates the available inflation-adjusted GGR figures (in million euro) in the Netherlands from 2013 to 2018. Figures have been taken from, variously, Annual Reports of the Kansspelautoriteit, the Kansspelautoriteit's 'Marktscan' documents reporting in the years 2013-2017 and 2020, the Annual Reports of the Postcode Loterij (encompassing good cause lotteries and Lotto) and the 2019 ZEbetting Annual Report. The figures have been adjusted to 2018 inflation levels in the Netherlands. Inflation was calculated with reference to the website of Triami Media BV (inflation.eu).

Unfortunately, at the time of this writing, no figures for the years 2019 and 2020 were available.

Table 2: Netherlands Inflation-Adjusted (to 2018 values) Gross Gambling Revenue in million euro, by regulated sector, 2013-2018

	2013	2014	2015	2016	2017	2018
National Lottery	323.9	305.2	290.3	280	232.6	245.7
Private Good Cause Lotteries	674.5	634.6	660.7	736.7	695	709.5
Non-Profit Lotteries	26	25.3	26.3	26.4	19.4	23.86
Lotto	171.8	170.9	173.8	178.3	147.1	148.3
Racing	6.6	6	6.3	6	6.1	5.33
Holland Casino (Table Games)	220.9	224.5	243.2	261.2	258	266
Holland Casino (Machines)	256.3	271.7	306.7	315.4	344.6	340
Gaming Hall Machines	813.2	657.7	761.9	744	736.2	763
Total	2493.2	2295.9	2469.2	2548	2439	2501.7

Figure 1: Total Inflation-Adjusted (to 2018 levels) Gross Gambling Revenue for Netherlands, 2013-2018

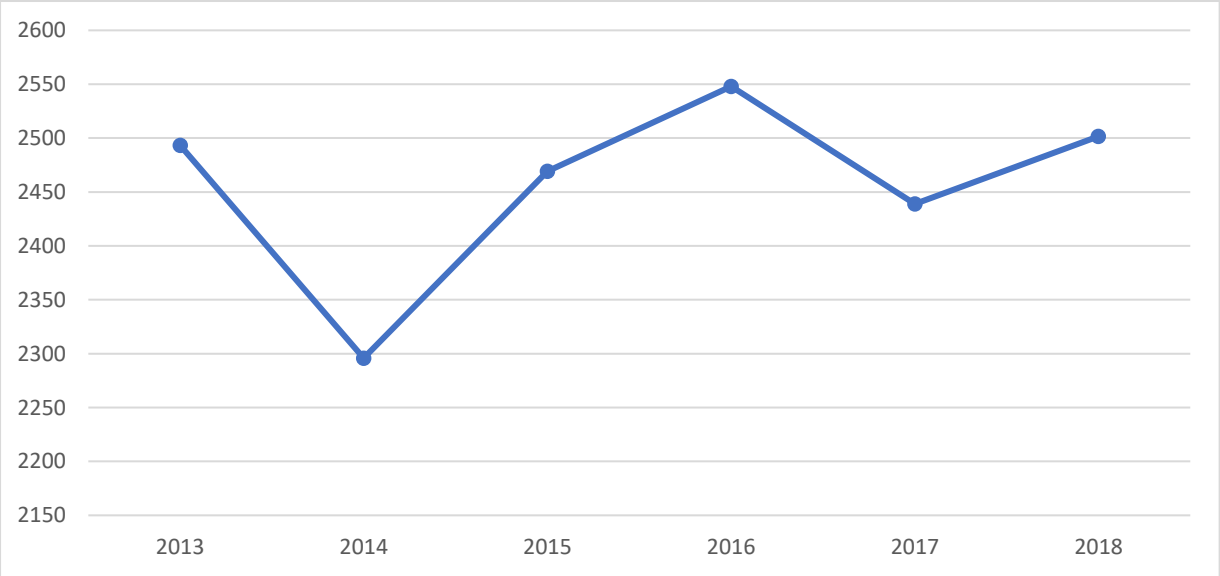


Figure 1 above indicates the broad recent trend of regulated gambling activity in the Netherlands, at least up to 2018. The apparent dip in GGR in 2014 was attributed (speculatively) to compensation for a possible overestimate of gaming machine revenue in 2013 (Kansspelautoriteit, 2016a, p.7). Otherwise, recent years indicate a continuous upward trajectory in revenue, and appetite for land-based gambling among Dutch players. A similar trajectory in the case of online gambling would necessitate the attenuation of public policy problems intended to be addressed in part by the operation of CRUKS.

3.1.6 Market Patterns and Statistics – Denmark Gambling Market

Table 3 sets out the inflation-adjusted GGR totals (in million Danish krone) of the various regulated sectors of the Danish gambling market from 2012 to 2020 inclusive. These figures are provided on the website of the Spillemyndigheden. Inflation (Consumer Price Index) is calculated at 2020 levels, and is sourced from the website of the World Bank.

It should be noted that from 2018, figures for betting on horse-racing were subsumed into total figures for betting generally (Spillemyndigheden, 2019).

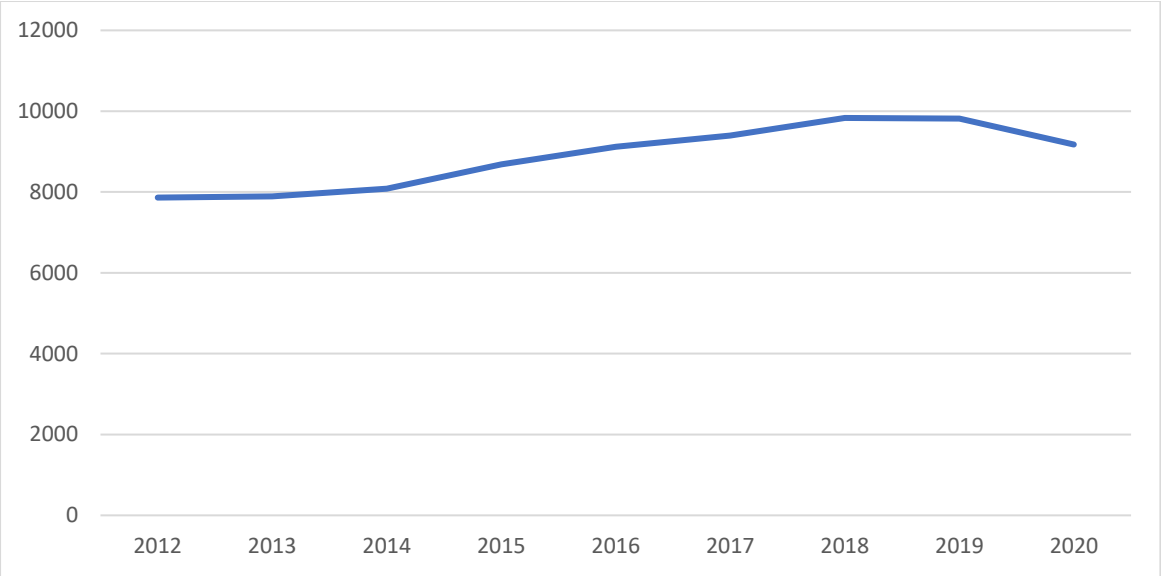
Table 3: Denmark Inflation-Adjusted Gross Gambling Revenue, Regulated Gambling Sector 2012-2020, (in million Danish Krone)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Betting	1,236	1,432	1863.1	2071.2	2235.1	2378.3	2559.2	2515.3	2290
Betting on Horseracing	152.5	141	135.2	124.3	121.7	118.4			
Gaming Machines	1,866	1,702	1609.3	1603.9	1552.6	1520.9	1431	1394.8	986
Land-based Casinos	361.8	352	343.3	361.6	390.7	382.8	358.5	350.7	239
Lotteries	3,316	3247.1	3029.2	3168.4	3207.3	3136.7	3286.3	3203.6	3205
Online Casinos	930.9	1019.3	1100.6	1355.2	1611.4	1858.8	2197.6	2355.5	2453
Inflation-Adjusted Total	7863	7894	8081	8685	9119	9396	9833	9820	9173
InflAdj GGR Per Capita*	1,406	1406	1432	1528	1592	1630	1697	1689	1573

***Based on population in given year - figure rounded up**

Figure 2 (overleaf) indicates the general trajectory of GGR in Denmark in the period since liberalisation of the market:

Figure 2: Denmark Inflation-Adjusted Gross Gambling Revenue 2012-2020 (in million DKK)



It is apparent that the gambling market has increased steadily over the reference period, with the only decreases experienced in land-based sectors in 2020 (viz., gaming machines and land-based casinos), attributable to Covid-19-related restrictions (Spillemyndigheden, 2020).

The figures in the preceding sections show a general increase in gambling activity in both the Netherlands and Denmark. It should be noted, however, that the growth in Denmark in the reference period is most pronounced in the online casino sector. It is therefore important that likely future patterns of online gambling in the Netherlands are assessed.

3.1.7 Remote Gambling in the Netherlands

As of 1 October 2021, remote gambling is licensable in the Netherlands (Kansspelautoriteit, 2021c). The Eerste Kamer (Dutch Senate) approved the legalisation of the remote gambling market in the Netherlands on 19 February 2019 (Eerste Kamer der Staten-Generaal, 2019); this approval was legislated for subsequently, and was enacted on 1 April 2021 (Kansspelautoriteit 2021e).

The following types of remote gambling are permitted:

- Casino games in which a player plays against a licence-holder (or virtual 'house'), e.g., bingo, roulette, slot machines

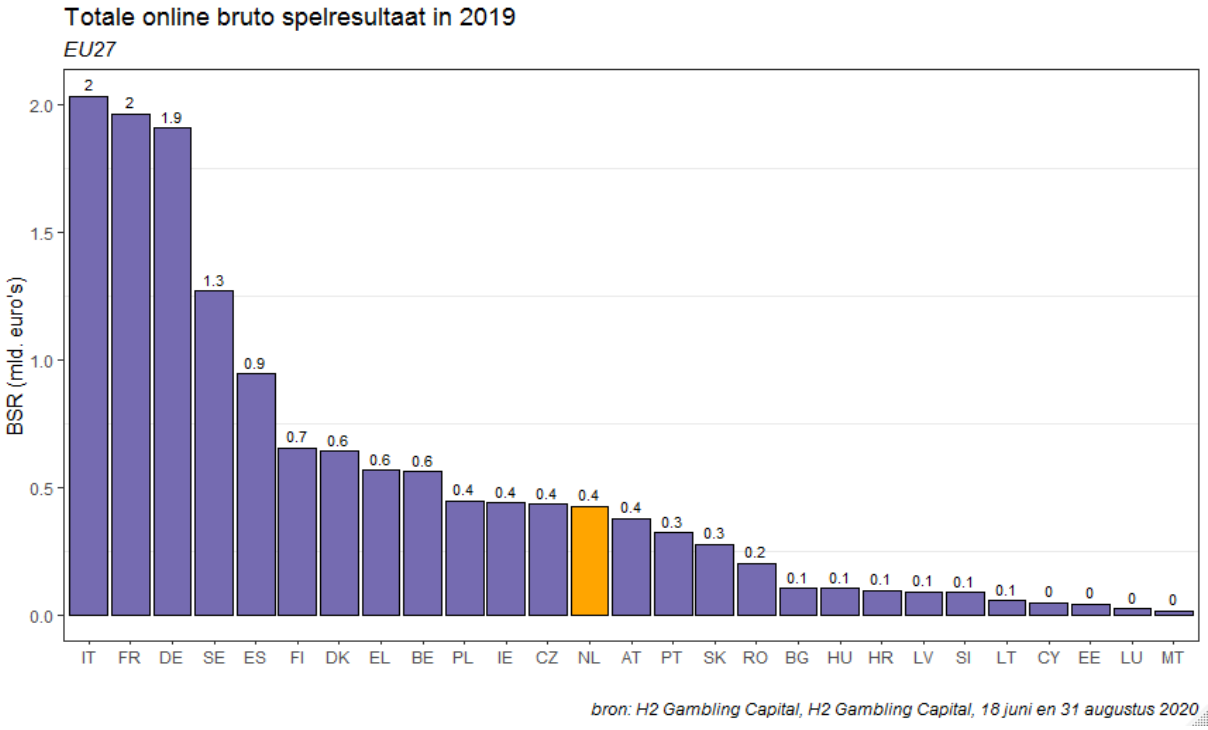
- Casino games in which a player plays against another player/s, e.g., poker, blackjack
- Bets on occurrences during or result of a sporting contest
- Bets on the outcome of horse-racing (and other types of racing)

Remote gambling licences are also available for products such as virtual sports, fantasy sports and esports betting (Article 31, Wet op de Kansspelen [Gambling Act] 1964 (as amended)).

3.1.7.1 Likely Pattern of Dutch Online Gambling Market

Figure 3 is reproduced from the Kansspelautoriteit's 'Omvang Online Kansspelmarkten' report on the likely size of the online market following the legalisation of that sector in the Netherlands. With an estimated gross gambling revenue of approximately €400 million, the share of the European online gambling market among Dutch residents in 2019 is relatively small. However, this is to be expected in light of the prohibition on online gambling products (aside from online betting and football pools) during the reference period (Kansspelautoriteit, 2021b).

Figure 3: Total estimated online gross gambling revenue for EU27 Member States, covering 18 June 2020 and 31 August 2020. Source: Kansspelautoriteit, 2021b



The Dutch Government has set a target for the Kansspelautoriteit of a 'channelling' rate of 80% in the online gambling sector within three years of the regulation of the sector (Kansspelautoriteit, 2021b) – in other words, it is expected that eight out of ten current online gamblers are diverted (or 'channelled' from illegal to regulated operators. The Kansspelautoriteit, however, is of the view that a 70% target is more realistic, in light of the propensity of the heavy gambler to be less sensitive to the legal provenance of an operator (Kansspelautoriteit, 2021b, p.5).

H2 Gambling Capital projected the following size of the Dutch online gambling market for the years 2019 to 2025 inclusive, per table 4 below.

Table 4: Projected gross gambling revenue for Netherlands online gambling market, 2019-2025. Source: Kansspelautoriteit, 2021b

Year	GGR (in million euro)
2019	424
2020	416
2021	513
2022	812
2023	994
2024	1084
2025	1274

While there is no way of interrogating H2 Gambling Capital's methodology, it is clear that an increase in online gambling activity is expected to take place in the short term. With this new channel officially open to the Dutch public, it is especially important that CRUKS acts as a pressure valve for those vulnerable players intended to be protected via the register, who may otherwise be susceptible to greater levels of problem gambling due to greater facility for convenience, frequency and anonymity (lessening feelings of stigma) provided by internet-based play (Griffiths et al 2006).

3.1.8 Voluntary and Involuntary Exclusion in the Netherlands - CRUKS

Article 33h of the Wet op de Kansspelen [Gambling Act] 1964 (as amended) sets out the rules governing registration of players on the CRUKS system. These include:

- The Board of Directors of the Kansspelautoriteit maintain the register, which is available to those playing land-based games of chance, in a land-based casino or gambling remotely (33h(1));
- Players may register voluntarily (33h(2)(a)) or be requested to be placed thereon by a concerned third party (33h(2)(b));
- The register maintains the following details: the registered persons; period of exclusion; the reasons for exclusion; the origin of the registered data (33h(3));
- The parties to whom details of the register are restricted, namely: license-holders (who will only be notified of the presence of a gambler on the register); civil servants (insofar as it is necessary for compliance with the law); the Board of Directors of the Kansspelautoriteit (33h(4));
- Use is made of personal details via BSN details (33h(5));
- Registration cannot be cancelled within a registration period of six months (33h(6));
- Details of exclusion are retained following lapse of the exclusion period, for use in the areas of policy development and statistical reasons (33h(7));

(Wet op de Kansspelen [Gambling Act] 1964 (as amended))

CRUKS is funded directly by the Kansspelautoriteit (Kansspelautoriteit, 2021i, p.3). The updated legislation incorporating CRUKS is due for review after three years of operation, while the Kansspelautoriteit plans on conducting user surveys and interviews for the purposes of assessing, *inter alia*, user-friendliness of the system (Ibid.).

Figures pertaining to Holland Casino's 'Preventiebeleid' exclusion programme from 2014 to 2020 were also collected, and an overview of the programme is set out below, in light of how indicative it may be of the general appeal of such exclusion programmes in the context of the Dutch gambling market.

3.1.8.1 Holland Casino Exclusion Scheme – 'Preventiebeleid Kansspelen'

Holland Casino provides a small foretaste of the roll-out of CRUKS throughout the entire Dutch gambling environment, with its own 'Preventiebeleid Kansspelen' ('PBK'), which has provided for both voluntary/requested and enforced exclusion since 2014. Self-exclusion lasts for a period of up to six months, prior to an 'aftercare interview' to decide on whether or not self-exclusion is to be renewed (Holland Casino, 2019). In the case of enforced exclusion, this period can be lengthened if the player's gambling behaviour appears high-risk (Ibid.). PBK will continue to operate in parallel with the CRUKS system (Holland Casino, 2020).

The intention of PBK is to allow the player to take responsibility for not playing longer or more often than is good for them, and/or is possible within their financial means. Moreover, Holland Casino wishes to employ PBK as a means of early recognition of signals of risky gambling behaviour on the part of customers, with those working in the venues helping implement PBK by acting as the system's 'eyes and ears' on the floor (Holland Casino, 2019).

PBK is based on four pillars:

1. Identification and Registration
2. Education and Awareness
3. Monitoring
4. Intervention

Figures 4a and 4b display the figures for self-exclusion and enforced exclusion (respectively) from Holland Casino for the years 2014 to 2020 inclusive.

Figure 4a: Holland Casino Requested Venue Exclusion Numbers 2014-2020. Source: Holland Casino, 2016-2021

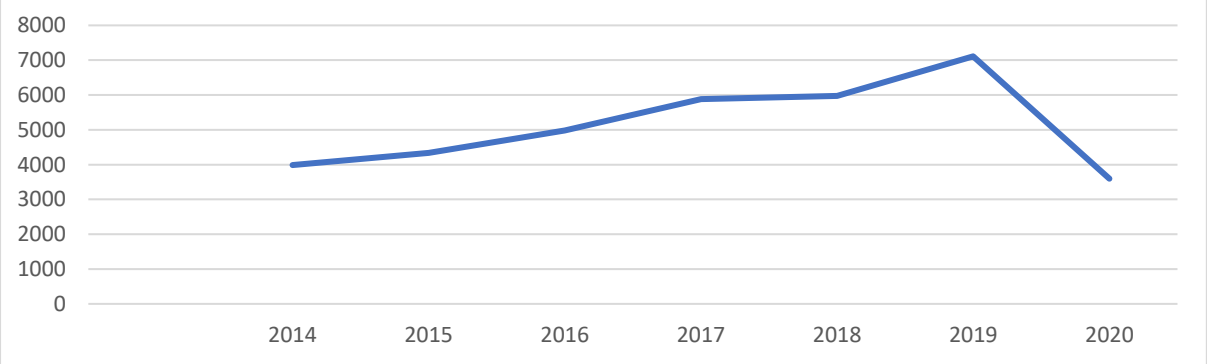
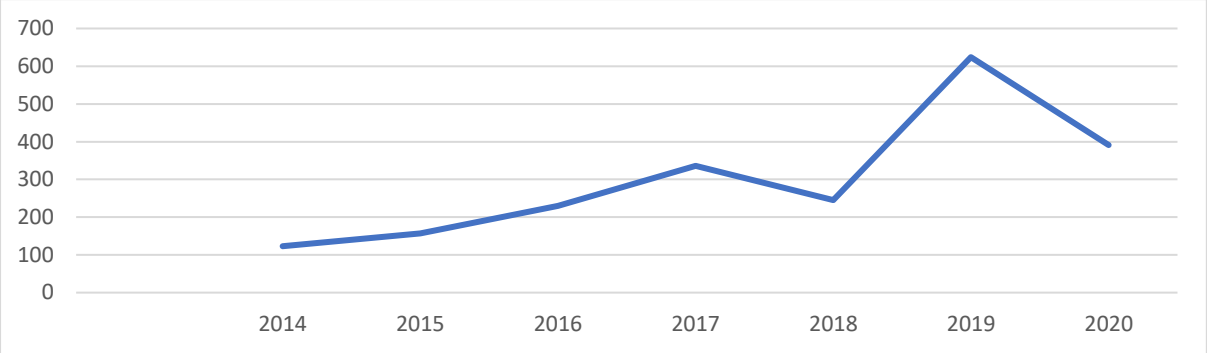


Figure 4b: Holland Casino Enforced Venue Exclusion Numbers 2014-2020. Source: Holland Casino 2016-2021



The above figures should be viewed in the context of restrictions related to Covid-19 throughout 2020, which likely accounts for the dips witnessed for that year. That caveat aside, it appears that take-up of the opportunity to self-exclude from Holland Casino venues has increased steadily since its introduction. Enforced exclusions also appear to have increased pre-2020, notwithstanding a brief dip in 2018. No explanation for this dip can be found in either the 2018 or 2019 Annual Reports of Holland Casino, though the latter year's publication notes a distinct improvement in monitoring procedures in venues (p.44).

Overall, while the reference period is short (spanning just seven years), the availability of PBK in Holland Casino venues has led to a steady increase in uptake, in the case of self-exclusion. Meanwhile, ongoing development of monitoring systems appears to have led to greater levels of enforced exclusion. The principal lesson to be drawn from PBK's short history, in the context of the likely future performance of CRUKS in the wider gambling market in the Netherlands, is that availability and awareness *per se* of an exclusion register leads to increased participation.

This finding is set against the backdrop of the commencement of regulated online gambling in the Netherlands as of October 2021, in which sector problem gambling has been found to have a disproportionate presence (Wood and Williams 2007), although it should be pointed out that this should be offset somewhat by the 'one-stop shop' aspect of CRUKS. An examination of the performance and use of Denmark's ROFUS system illustrates its use across all sectors of a liberalised gambling market.

3.1.9 Self-Exclusion in Denmark: ROFUS

As part of its 'responsible gambling' remit, the Spillemyndigheden runs (since January 2019) a national helpline for those reporting compulsive gambling, 'StopSpillet' (Spillemyndigheden, 2022f), in succession to the 'LudomaniLinjen' helpline run previously by Danske Spil (Danske Spil, 2020).

However, the key element in the Authority's efforts to inculcate responsible gambling is ROFUS, a voluntary register that allows players to exclude themselves from all online gambling venues as well as (since July 2016) land-based casinos in Denmark. The player may register via the national NemID system[4], or by post, and self-exclude for periods of 24 hours, 1, 3 or 6 months, or permanently. 'Permanent' exclusion entails the ability to make a request for removal from ROFUS to the authority after one year of exclusion. Only the player themselves may request their registration on ROFUS (Spillemyndigheden, 2022g).

Since 2017, registration on ROFUS also entails signing up to a 'No Thank You to Marketing' agreement, whereby operators may not send targeted marketed/advertising to self-excluding clients (Ibid.).

It is pertinent at this point to examine the performance of ROFUS in view of the generally increased activity in gambling in Denmark. Has ROFUS been ineffective in helping vulnerable customers find an alternative to participation in a possibly febrile market? Or has it helped minimise jeopardy for the would-be problem gambler in such an environment? Indeed, has the Danish gambling market merely risen in line with what one would expect of a market that has liberalised having been subject previously to artificial scarcity (cf Kingma 2007)?

Table 5 and Figure 6 (overleaf) display the total number of registrations on ROFUS from 2012 to 2020. No disaggregated data for the period 2012-2020 is available on the Spillemyndigheden website.

[4] Equivalent of the Dutch DigiD

Table 5: Registrations on ROFUS 2012-2020

Year	Number Registered
2012	1456
2013	2870
2014	4418
2015	6177
2016	8822
2017	12877
2018	17355
2019	21586
2020	26115

Figure 5: Registrations on ROFUS 2012-2020

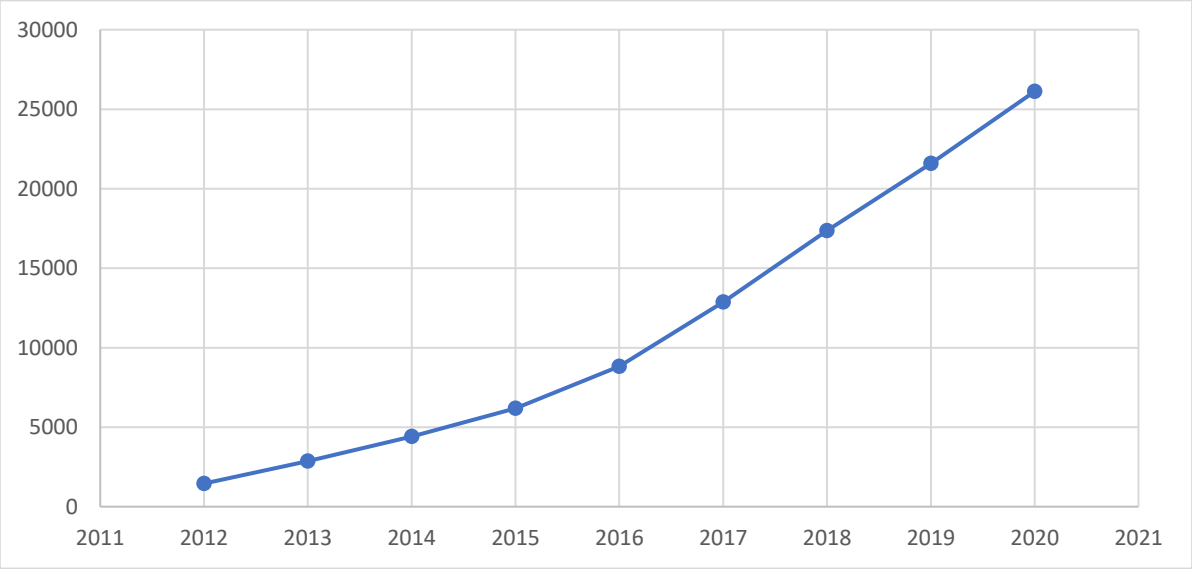


Figure 5 in particular is illustrative of the increased take-up of self-exclusion services in Denmark, with a particular inflection observed from 2016. The overall contrast with the relatively steady trajectory of overall GGR (see Figure 2) is notable. This inflection will be the focal point of the upcoming statistical analysis in this Section, in which the 2016 extension of the CRUKS system to the land-based casino sector in Denmark is analysed in order to observe any meaningful effects.

3.2 ROFUS and Land-Based Casino Gambling – a Test Case for Measuring the Effectiveness of an Exclusion Register

Statistical/econometric tests can give some clue as to the effectiveness or otherwise of ROFUS for vulnerable players in Denmark, and indeed all gamblers in that country. However, without a specific liminal point at which to measure the effect of ROFUS, these tests may never move beyond the level of speculation. This is an issue that is affecting the study of the effectiveness of exclusion registers such as CRUKS.

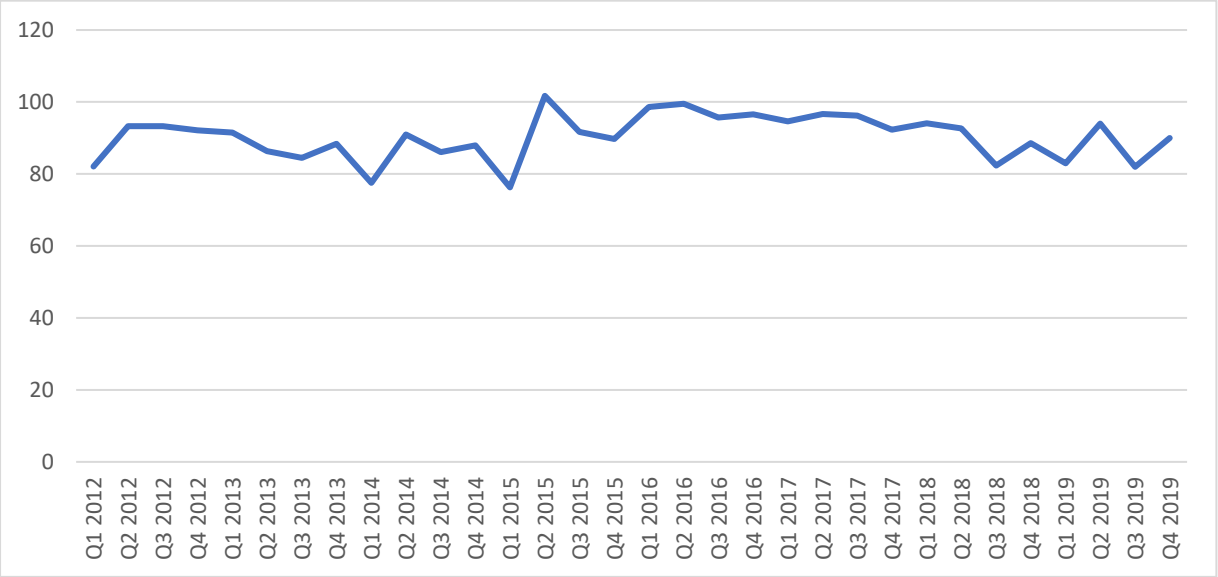
As set out earlier, most jurisdictions putting similar registers into action have either only done so relatively recently (thus providing little in the way of useful data as to performance of a register), or in the case of Belgium, have instituted a system of such long standing that it came about when the gambling market was far different from its present iteration (particularly in light of technological advancements and the advent of gambling channels such as esports and fantasy sports).

In the case of ROFUS, it is difficult to gain an overall picture of its impact on gambling generally, mainly as it was instituted at more or less the same time that the market in Denmark was liberalised to include online casino gambling, for which sector ROFUS has always been available.

One notable development, however, came about in 2016, when a Governmental Executive Order in July of that year made it mandatory for operators of land-based casinos in Denmark to make CRUKS available to players (Spillemyndigheden, 2017). It is instructive, therefore, to investigate any possible change in gambling activity in that sector.

Figure 6 (overleaf) shows the quarterly pattern of GGR from the first quarter of 2012 to the final quarter of 2019 (with early 2020 figures unavailable, and likely meaningless in light of restrictions relating to Covid-19, as alluded to earlier in this paper).

Fig. 6: Denmark - Inflation-Adjusted Land-Based Casino Gross Gaming Revenue (in million DKK), per Quarter - Q1 2012-Q4 2019



A peak appears to have been reached between the second quarters of 2015 and 2016, with a slight downward trend thereafter. This effect is magnified by bifurcating the time period and noting the trajectory of casino GGR either side of the Q3 2016 inflection point. The graphs below (Figures 7a and 7b) emphasise the slight decline in inflation-adjusted GGR mirroring the initial steady increase from the first quarter of 2012.

Figure 7a: Denmark – Inflation-Adjusted Land-Based Casino Gross Gambling Revenue (in million DKK), Q1 2012-Q3 2016

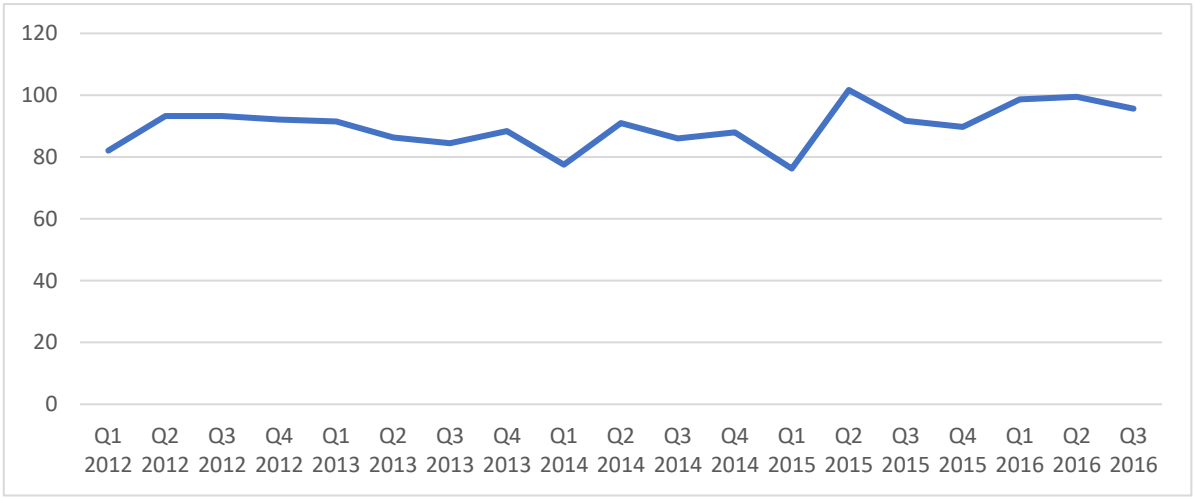
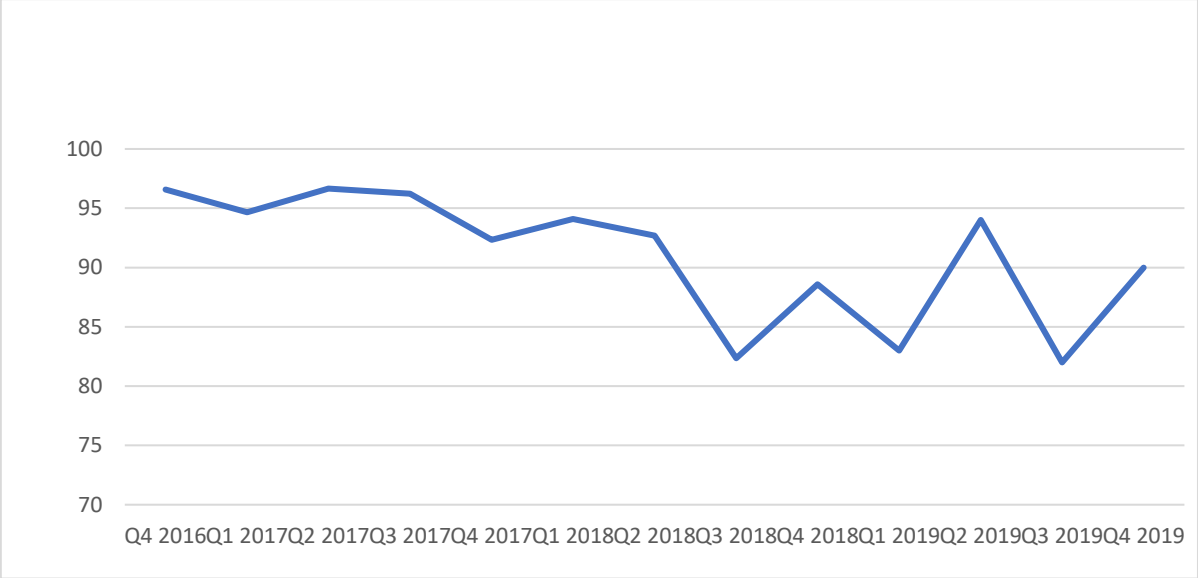


Figure 7b: Denmark - Inflation-Adjusted Land-Based Casino Gross Gambling Revenue (in million DKK), Q4 2016-Q4 2019



3.2.1 Time Series Regression

An appropriate test of the effect of the introduction of ROFUS registrations on land-based casino GGR can be carried out via a time series design. Such a design works ideally as a heuristic source of feedback in respect of the consequences of a policy intervention, allowing for post hoc hypothesis on the basis of observed changes in variables under study (Gottman et al 1969).

The time series design in this case was mediated via ordinary least squares regression on the STATA™ programme, with time series data consisting of:

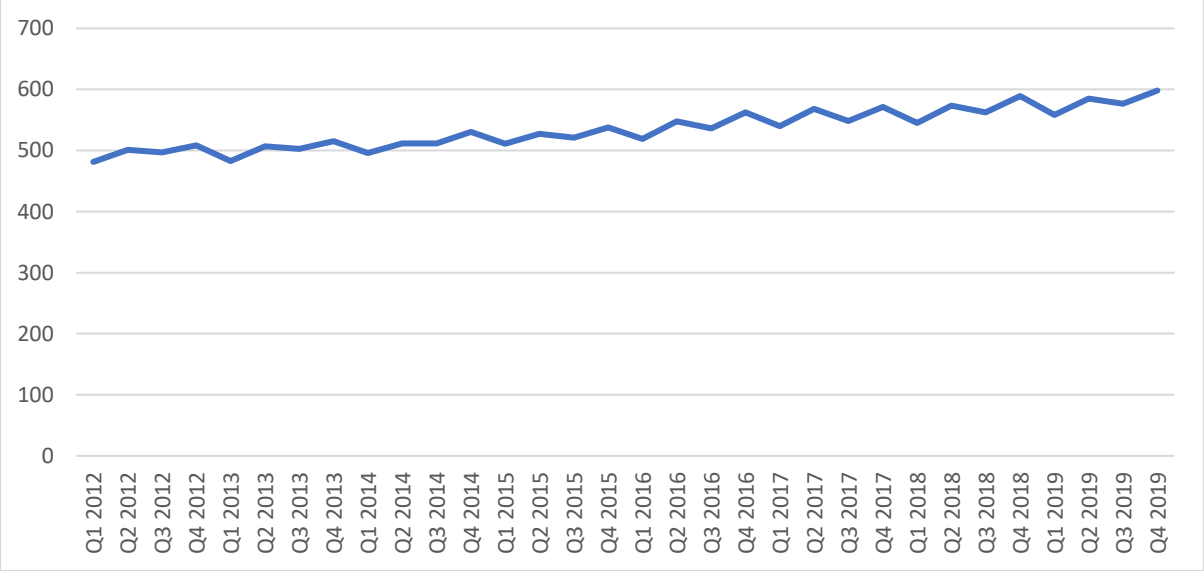
Dependent Variable: this is based on quarterly figures for land-based GGR (in million Danish krone) in the Danish land-based casino sector (adjusted for inflation to 2019 values) from the first quarter of 2012 up to and including the fourth quarter of 2019. The above GGR figures were then re-configured as a first difference series, using lags from one quarter to the next, in order to reflect the periodic change in GGR through the time series. This reconfiguration helps attach significance to and/or remove 'noise' from a series that otherwise could be dismissed as occurring randomly (Working 1934; Gottman et al 1969);

Independent Variable: a dummy variable corresponding to quarters also running from Q1 2012 until Q4 2019, with all year quarters denoted by zero up to and including Q3 2016 (corresponding roughly with the July 2016 Executive Order by the Danish Government imposing the ROFUS facility on casinos), and 1 for all periods thereafter;

Control Variable: this is based on quarterly figures for Danish gross domestic product (in billion Danish krone) from Q1 2012 up to and including Q4 2019 (see Figure 8, below). This particular variable has been chosen on the basis of the potentially potent role for gambling in adding to a nation's GDP, even if its addictive outcomes contribute to redistribution than to income ultimately (Raspor et al 2019). As with the dependent variable, these figures have also been re-configured as a first-difference series. Further, these figures have also been inflation-adjusted to 2019 values.

Inflation was calculated using data from the website of the OECD.

Figure 8: Denmark - Inflation-Adjusted Gross Domestic Product (in billion DKK), per Quarter, Q1 2012-Q4 2019



In carrying out the regression test, the null hypothesis is that the application of ROFUS to the land-based casino sector in the second half of 2016 ought to have had a statistically significant and negative impact on the trajectory of GGR in the sector, operationalised as the first-difference series for this figure.

Per Table 6 below, the outcome of this regression is as follows:

Table 6: Time Series Regression Showing Effect of ROFUS Implementation on Inflation-Adjusted Danish Land-Based Casino Gross Gambling Revenue (in million DKK), Q1 2012 to Q4 2019

First Difference Gross Gambling Revenue Land-Based Casinos	
ROFUS Implementation	-1.48989
	(2.77444)
GDP First Difference	0.17674*
	(0.06877)
Respective t-statistics	-0.54 & 2.57
Observations	31
Adjusted R^2	0.1377

Standard Error in Parentheses

*p<0.05

The above table shows a statistically significant association between the trajectory of GGR in Danish casinos and the implementation of ROFUS during the reference period for the time series. The overall p-value for the regression was 0.0479. Further, the coefficient denoting the interaction of ROFUS implementation and the trajectory of GGR over the time series is strikingly negative. In light of the foregoing, the null hypothesis is not rejected.

While it is reasonable to hypothesise the negative effect of the implementation of ROFUS on gambling activity in the Danish land-based casino sector, a more precise illustration of the nature of this effect is desirable. On that basis, it is worth pursuing a regression discontinuity design as a means of clarifying the impact of this policy intervention.

3.2.2 Regression Discontinuity Design as a Policy Intervention Monitor

Regression discontinuity design modelling has been used increasingly in studies as a means of determining policy interventions in different economic contexts, given the ability it confers in observing a policy effect at a given threshold (Lee and Lemieux 2010), whereby a 'running variable' runs through a specified cut-off point, representing a policy intervention or decision or other event (Ibid.). It is also a method that is capable of accounting for potential unobserved factors in arriving at an association between land-based gambling in Denmark and its subjection to the ROFUS system (Ganguli 2017).

The Spillemyndigheden provides quarterly GGR data for its main gambling sectors from 2012 onwards, which is helpful in expanding the range of the running variable in this case, being the passage of time either side of the cut-off point, which occurs in July 2016, and which will be operationalised at the third quarter of 2016 for our purposes. Year quarters are re-coded such that Q3 2016 is now '0', and everything similarly re-coded either side of that ('QuarCode'), giving us a range of -18 (Q1 2012) to 13 (Q4 2019). Quarterly figures for 2020 have not been provided in their entirety by the Spillemyndigheden, and in any event would have distorted this test, given the necessity of shutting down land-based gambling venues at the early stage of Covid-19 restrictions. This test was also run via the STATA™programme. The result is contained in Figure 9:

Figure 9: Regression Discontinuity Design of Land-based Casino GGR (in million DKK) in Denmark at Approximate Point of Subjection to ROFUS in 2016 – Q1 2012 to Q4 2019

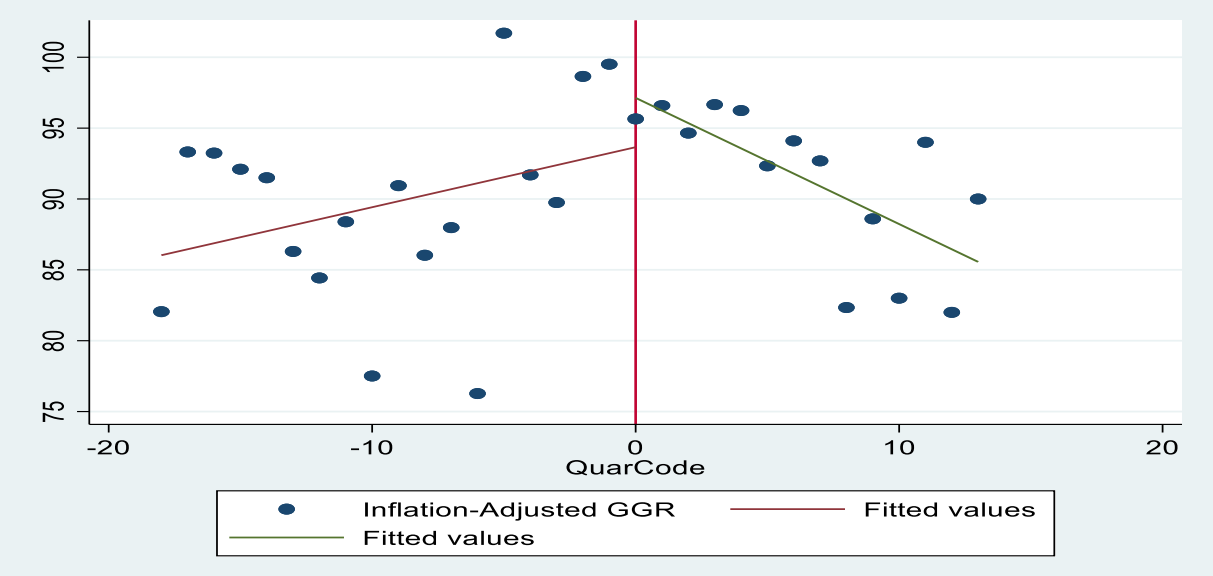


Figure 9 illustrates a definite discontinuity at the assigned cut-off point, corresponding approximately with the connection of the land-based casino sector with the ROFUS system in late 2016. *Prima facie*, the cut-off point gives rise to a temporary spike in activity in the sector, before reversing its previous upward trajectory. The aforementioned spike may also be attributable to any necessary adjustment period the casinos would have experienced in implementing availability of the register (e.g., staff training, IT issues, etc.). It may also have been that operators intensified advertising and other promotional activities in order to attract new custom and bolster existing clientele, in order to offset any possible future loss arising from the introduction of ROFUS to the sector. Such efforts could have the effect of exacerbating the losses of problem gamblers, whose contribution to operator profits tend to outstrip that of regular players (Fielder et al 2019), to what is considered in some quarters as a disproportionate level (Williams and Wood 2004). However, in the absence of data in respect of advertising and implementation spend (on the part of operators), and problem gambling prevalence rates of course, these observations only amount to conjecture, as no explanation for this spike as part of the apparent treatment effect has been made public.

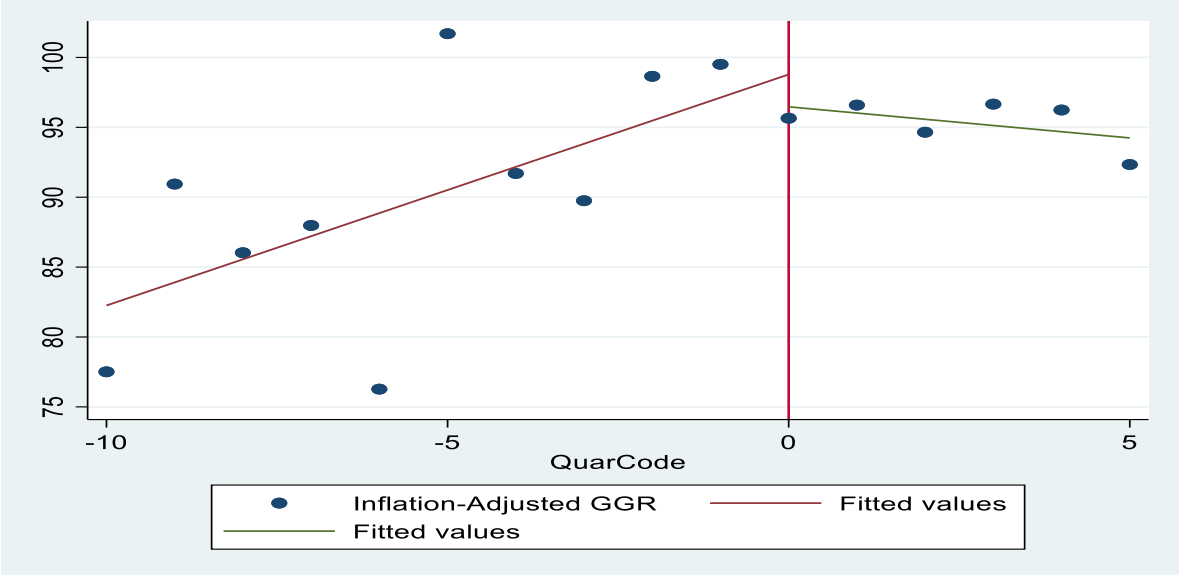
An indirect explanation for this pattern of activity in land-based casinos (and any effect that could be credited to ROFUS) was the Spillemyndigheden's stated belief that a relatively sharp increase in ROFUS registrations after 2016 (see Figure 5) came about because of a particularly heavy campaign of advertising and promotion of ROFUS and its newly developed app (Spillemyndigheden, 2018).

3.2.2.1 Robustness Test – Smoothing the Discontinuity

In order to test the previous regression discontinuity design, which had used the entire possible range of recorded figures for land-based casino activity/gambling losses either side of the policy intervention, one must proceed on the intuitive basis that all factors relating to this variable are proceeding 'smoothly' outside of the implementation of ROFUS, and thus a look at estimates closer to (either side of) the cut-off/policy intervention, though taking place at the expense of sacrificed data, will yield a less sharp discontinuity (Lee and Lemieux 2010).

The test period range is adjusted, to take account of the period Q1 2014 to Q4 2017, and yields the following:

Figure 10: Regression Discontinuity Design of Land-based Casino GGR (in million DKK) in Denmark at Approximate Point of Subjection to ROFUS in 2016 – Q1 2014 to Q4 2017



This time, it appears that no spike in land-based casino activity has taken place following the policy intervention. Nevertheless, the cut-off point continues to act as an inflection leading to a downward shift in trajectory of gambling losses/activity. In light of this, , it is likely that the availability of the ROFUS register to users of land-based casinos who wished to self-exclude for certain periods had a (slightly) diminishing effect on heavy participation in gambling at these venues.

4. DISCUSSION

The main finding is that an intervention in a regulated sector where activity/gambling losses had been measured for a sustained period of time but not previously subject to an exclusion register, saw a slight but visible dip in activity after the point of intervention. Notwithstanding other factors that may have had a direct or indirect effect on the Danish gambling environment during this period, the time series regression analysis did not reject the null hypothesis of the dummy independent variable (signifying the application of ROFUS in late 2016) correlating negatively with the trajectory of GGR over the course of the reference period. Moreover, the regression discontinuity design that essentially used the passage of time as a running variable, and the point of implementation of ROFUS as a cut-off point, showed (immediately after that cut-off point) a reversal of a previously stable upward slope in gambling activity. This downward effect on GGR was maintained on foot of closer scrutiny at the cut-off point. Had more frequent reporting periods for gross gambling been publicly available (say, via monthly figures), a regression discontinuity design could have provided an even sharper illustration of the effect, and given a more accurate impression of how quickly both operators and consumers reacted to the new availability of ROFUS (cf. González 2013, pp.163-164).

It is important to note that in the course of researching this matter and seeking to obtain useable data, where it has been possible to measure the effects of a policy intervention on dependent variables that have been recorded prior thereto, an effect has been apparent that is 'positive' in the sense of helping achieve a stated public policy goal, namely, the tackling of gambling addiction. The regression discontinuity design model helped account for potential unobserved alternative explanations for the downturn in gambling losses in the Danish land-based casino sector post-2016 (Lee and Lemieux 2010).

That said, it is also important not to overstate the degree to which activity in the sector declined, and it is likely that ROFUS provided the means by which vulnerable customers could safely remove themselves from a hazardous situation, while allowing more recreational but budget-adherent gamblers continue to enjoy the activities on offer, a state of affairs that is firmly in line with the desired outcomes of interventions based on 'nudge' theory (Nower and

Blaszczynski 2010; Thaler and Sunstein 2003a). The relatively steady decline in gambling activity indicated by the design indicates that other, less vulnerable customers are unaffected by the availability of ROFUS in the meantime, provided that the choice of whether and how to enrol on the register is relatively simple (Camerer et al 2003, p.1225). Indeed, it is likely that many gamblers, even if they do not believe that such a protective measure is necessary for themselves individually, appreciate its value for others (Gainsbury et al 2018a). This appears to be the case with CRUKS also, with little in the way of personal data or indeed general interaction required for the purposes of registering on the system (Kansspelautoriteit, 2021i).

In terms of the performance of ROFUS, and its foreshadowing role for CRUKS (the central element of this paper), a first glance at the trajectory of self-exclusion registrations (see Figure 5) and the overall Danish gambling market from 2012 onwards, (see Figure 2) suggests the over-performance of ROFUS relative to growth in the market, indicating the possibility of a cooling effect on the level of activity in the market. This would be in line with the function of the register in helping normally less risk-averse gamblers use pre-commitment as a platform for refraining from risk-taking behaviour (Brevers et al 2016), even if it is for a relatively short period. With particular regard to the latter point, it is regrettable that disaggregated data for ROFUS (reflecting proportions of those self-excluding for 1 month, permanently, etc.) was not available from the Spillemyndigheden, at least for years prior to 2021.

Analysis of the Netherlands market prior to 2021 indicates that the public appetite for gambling in the country has increased steadily over the period for which figures are available (see Table 2/Figure 1). However, it must be noted that while figures have been available where possible, this has not occurred over a large time series (most are restricted to the 2013-2018 period at the time of writing). Further, explicit connections between various forms of addiction (including gambling) and activity and losses incurred in the course of gambling, will have to await more regular prevalence studies than have been carried out heretofore.

Indeed, it would be remiss not to point out (per Section 2 of this study) that problem gambling prevalence is the ideal data point that could be used to measure the efficacy of CRUKS in future, in light of its public policy remit. In this spirit, more frequent and comprehensive prevalence studies need to take place, be it sponsored by the Dutch Government and/or the Kansspelautoriteit, or carried out via independent academic research. While GGR is a good

proxy for gambling activity and losses, the professional diagnosis of problematic (as opposed to heavy) gambling gives the Kansspelautoriteit and other stakeholders with an interest in the future performance of CRUKS, a proper reference point. It is to be hoped that such further studies will be highlighted through, among other things, post-implementation review due at both at legislative and stakeholder level (Kansspelautoriteit, 2021i).

CRUKS is a public sector innovation in its infancy, and how it adapts to future developments (in gambling products and technology) is crucial. However, centralised government rules focused on strict probity in the public sector, togther with media and public opprobrium at and general hostility towards the public sector and servants are capable of dissuading the public sector from pursuing inefficient but innovative processes, even though 'trial and error' innovation processes work through learning from, rather than avoiding error (Borins 2001). The pursuit of efficiency 'crowds out' innovation, and the two concepts generally cannot co-exist (Potts 2009). This conflict is crucial to how CRUKS can be utilised to explain and help resolve future, evolving problems, and should inform the planned post-implementation review of the system (Kansspelautoriteit, 2021i).

Gainsbury et al (2020) point out that in a gambling environment increasingly dominated by online offerings, Government regulators will have to remain vigilant in creating regulations and policies that are not just effective, but future-proofed, given evolving technology, and CRUKS will likely have to be adjusted to meet future challenges that vulnerable gamblers will face.

Such future developments and their potential effects on vulnerable gamblers ought to be captured in the more frequent problem gambling prevalence testing recommended earlier herein. A further recommended area of study would be to examine the impact of the 'No to Marketing' obligation introduced as a feature of enrolment on ROFUS from 2017, as this could provide another pertinent comparison for possible future incorporation by the Dutch authorities into the existing CRUKS system.

It should also be noted that further research in respect of the effectiveness of exclusion systems in tackling gambling addiction and strengthening consumer protection (and any other relevant public policy concerns that may be raised) will be possible in the coming years in respect of many of the European jurisdictions deemed not suitable for use as comparators in

this study. While the performance of CRUKS will be capable of being measured upon collection of anonymised data in the coming years (Kansspelautoriteit, 2021i), the cases of Germany and Spain, with their federalised systems, will make for interesting 'within case' studies in their own right.

4.1 Limitations

While regression discontinuity design models such as those set out in this study are powerful in terms of the visual evidence provided by a discontinuity, it is likely that these models have been compromised by the lack of availability of observations occurring with any more frequency than quarterly. It is likely that this has led to a certain amount of imprecision at the cut-off point, and accounted for jumps at certain points thereafter (Lee and Lemieux 2010; González 2013).

The findings of this paper are further limited by the fact that the late application of ROFUS to the land-based casino sector in Denmark was the only inflection point that could be located in order to determine any type of effect of the system, in order to provide any kind of useful proxy forecast of the likely future performance of CRUKS in the Netherlands. Had there been regulation of the main gambling sectors in Denmark before the instigation of ROFUS, it is likely that a regression discontinuity design model (for example) could have been applied to that hypothetical intervention point also.

Another possible inflection point was the marketing drive by the Spillemyndigheden some time in 2016 (see Section 3.2.2), to which they attributed an uptick in ROFUS registrations from that point. Had there been any information with which to quantify the declared success of this drive (say, monies spent on campaigns, how sustained these campaigns were, etc.), this could have provided an alternative explanation for the downward trend in land-based casino gambling losses in the reference period. However, no such data could be found. Other matters not taken into account include the possibility that the internet penetration rate may have tracked a general decline in land-based casino use versus its online equivalent, but no quarterly data was available under this metric, including from sources such as Statista, the World Bank and Statistics Denmark.

5. CONCLUSION

Exclusion registers such as CRUKS are important tools affording vulnerable gamblers the opportunity to remove themselves (or be removed) from the harmful effects of the modern gambling market, with its wide array of products, both online and land-based. The comparison of the respective gambling environments in the Netherlands and Denmark provides something of an ideal control/treatment dichotomy. Denmark, with its well-established and fully liberalised gambling market, has sought to minimise the negative effects of the market on its vulnerable users through the availability of its ROFUS self-exclusion register. The Kansspelautoriteit in the Netherlands, on the other hand, while a mature independent regulatory authority, is taking something of a step into the unknown as it rolls out simultaneous regulation of the online gambling sector with CRUKS, a product with the equivalent public policy aims of ROFUS. However, it is clear that the two countries' markets have been shown to be similar enough in order to make a reasonable forecast as to the likelihood of success on the part of the Kansspelautoriteit in achieving its stated public policy aims via CRUKS, while also managing an inevitable expansion in the legal gambling market under its supervision.

This study was designed for the purposes of answering the question of whether or not CRUKS can achieve its underpinning public policy goals of tackling gambling addiction and protecting consumers.

Combining behavioural economics and public sector innovation theory as a theoretical backdrop, the respective gambling markets of the Netherlands and Denmark were assessed and compared, prior to statistical analysis of an inflection point in the Danish regulatory environment, whereby obligation to incorporate the ROFUS system was extended to the land-based casino sector in the latter half of 2016. A time-series regression tested the association between the trajectory of sectoral GGR (representing gambling losses and activity) and a dummy variable denoting the immediate periods before and after the policy intervention.

The time-series regression yielded a statistically significant but negative association between the two variables, as hypothesised. A more direct illustration of the effect of the extension of ROFUS to the sector was produced via a regression discontinuity design model, showing a

steady but significant downward turn in gambling activity during the time period. The earlier comparison of the markets makes it possible to map this effect on to the likely performance of CRUKS in the gambling market in the Netherlands. The 'nudge' quality of a register like CRUKS means that it ought to be able to compensate for the likely increase in uptake of online gambling products (in light of the sector's recent liberalisation) while not unduly hampering the enjoyment of non-problematic gamblers. It will also meet a crucial criterion of successful public service innovation, which is the convenience and general benefit (for all stakeholders) of a centrally controlled 'one stop shop'.

As far as is known, this is the first study dedicated to forecasting the likely success of CRUKS in meeting its public policy goals, albeit it has of necessity had to be mediated through a comparator. In a wider context, it is hoped that this study helps predict the benefit of a centralised, user-friendly exclusion register in the context of a modern, liberal gambling market.

This study is limited in a number of areas, however. The regression discontinuity design models used herein have likely been compromised by lack of frequency of observations causing imprecision at the cut-off point. The study was also limited by the existence of no more than a single inflection point with which to measure the impact of ROFUS on any part of the Danish gambling sector. Inability to find data in respect of the Spillemyndigheden's marketing drive of ROFUS in 2016 (credited with driving an increase in registrations), as well as properly disaggregated data in respect of internet penetration in Denmark also prevents proper accounting for alternative reasons for the observed decline in land-based casino activity following implementation of ROFUS in July 2016.

It is likely, notwithstanding the features distinguishing ROFUS from CRUKS such as the entirely voluntary nature of exclusion inherent in the former, that the latter will provide a welcome remedy for vulnerable users of licensed gambling products in the Netherlands. The extension of ROFUS to Danish land-based casinos while not having a dramatic impact on gambling losses in that sector, did seem to have a welcome attenuating effect. On this basis, and in light of the other similarities highlighted herein, it is likely that CRUKS also will help bring some stability to potential heavy, problem or pathological gamblers in the Netherlands, many of whom are likely to be exposed more regularly to online gambling channels from now on,

which poses its own challenges in terms of provoking risk-taking behaviour (Brevers et al 2016).

SOURCES

Anckar C. 2008, 'On the Applicability of the Most Similar Systems Design and the Most Different Systems Design in Comparative Research', *International Journal of Social Research Methodology*, vol.: 11, no.: 5, pp. 389-401.

Auer M., Littler A. & Griffiths M.D. 2015, 'Legal Aspects of Responsible Gaming Pre-commitment and Personal Feedback Initiatives', *Gaming Law Review and Economics*, vol.: 19, no.: 6, pp. 444-456.

Autorité Nationale des Jeux (2021, January 10). *Gambling self-exclusion: The French Gambling Authority (ANJ) offers an online service to simplify the registration process and reduce delays.* https://www.anj.fr/gambling-self-exclusion-french-gambling-authority-anj-offers-online-service-simplify-registration

Axelson M., Netz J. & Sandström C. 2017, 'Collective action problems in public sector innovation: A business model perspective', *Creativity and Innovation Management*, no.: 26, pp. 370-378.

Beckett M., Keen B., Swanton T.B. & Blaszczynski A. 2020, 'Staff Perceptions of Responsible Gambling Training Programs: Qualitative Findings', *Journal of Gambling Studies*, no.: 36, pp. 405-419.

Bettendorf L.J.H., Jongen E.L.W. & Muller P. 2015, 'Childcare subsidies and labour supply – Evidence from a large Dutch reform', *Labour Economics*, no.: 36, pp. 112-123.

Bonke J. & Borregaard K. 2009, 'The prevalence of problematic gambling behaviour: A Scandinavian comparison', *Scandinavian Journal of Public Health*, no.: 37, pp. 654-660.

Borins S. 2001, 'Encouraging innovation in the public sector', *Journal of Intellectual Capital*, vol.: 2, no.: 3, pp. 310-319.

Bovaird T. 2014, 'Attributing Outcomes to Social Policy Interventions – 'Gold Standard' or 'Fool's Gold' in Public Policy and Management?', *Social Policy & Administration*, vol.: 48, no.: 1, pp. 1-23.

Brevers D., Noel X., Clark L., Zyuzin J., Park J.J. & Bechara A. 2016, 'The impact of precommitment on risk-taking while gambling: A preliminary study', *Journal of Behavioral Addictions*, vol.: 5, no.: 1, pp. 51-58.

Brown K.L. & Russell A.M.T. 2020, 'Exploration of Intervention Strategies to Reduce Public Stigma Associated with Gambling Disorder', *Journal of Gambling Studies*, no.: 36, pp. 713-733.

Caillon J., Grall-Bronnec M., Perrot B., Leboucher J., Donnio Y., Romo L. & Challet-Bouju G. 2019, 'Effectiveness of At-Risk Gamblers' Temporary Self-Exclusion from Internet Gambling Sites', *Journal of Gambling Studies*, no.: 35, pp. 601-615.

Camerer C., Issacharoff S., Loewenstein G., O'Donoghue T. & Rabin M. 2003, 'Regulation for Conservatives: Behavioral Economics and the Case for "Asymmetric Paternalism"', *University of Pennsylvania Law Review*, vol.: 151, no.: 3, pp. 1211-1254.

Catania M. & Griffiths M.D. 2021, 'Understanding Online Voluntary Self-Exclusion in Gambling: An Empirical Study Using Account-Based Behavioral Tracking Data', *International Journal of Environmental Research and Public Health*, no.: 21, pp. 1-11.

Conlisk J. 1993, 'The Utility of Gambling', *Journal of Risk and Uncertainty*, no.: 6, pp. 255-275.

Currie S.R., Brunelle N., Dufour M., Flores-Pajot M.-C., Hodgins D., Nadeau L. & Young M. 2020, 'Use of Self-control Strategies for Managing Gambling Habits Leads to Less Harm in Regular Gamblers', *Journal of Gambling Studies*, no.: 36, pp. 685-698.

Danske Spil. (2016). *Ansvarlighedsrapport* [Annual/'Responsibility' Report] *2015*. Retrieved from https://danskespil.dk/om.

Danske Spil. (2018). *Ansvarlighedsrapport 2017: "Spil er underholdning. Spil med omtanke."* Retrieved from https://danskespil.dk/om.

Danske Spil. (2020). *CSR-Rapport 2019: "Vi Leder Efter Mønstre. Kan U De Sem?"* Retrieved from https://danskespil.dk/om.

Davies, R. (2019, September 1). Regulator approves self-exclusion system for problem gamblers. *Guardian*. https://www.theguardian.com/society/2019/sep/01/problem-gamblers-block-themselves-one-click-gamstop-betting

Directorate General for the Regulation of Gambling (2022, Janaury 9). *General Register of Gaming Access Bans (RGIAJ).* Directorate General for the Regulation of Gambling. https://www.ordenacionjuego.es/en/rgiaj

Dowding, K. 2020, *It's The Government, Stupid – How Governments Blame Citizens for Their Own Policies*, Bristol University Press, Bristol.

Eerste Kamer der Staten-Generaal. (2019, February 19). *Kamer stemt voor Wet kansspelen op afstand.* Eerste Kamer der Staten-Generaal. https://www.eerstekamer.nl/nieuws/20190219/kamer_stemt_voor_wet_kansspelen_op

Ekholm O., Eiberg S., Davidsen M., Holst M., Larsen C.V.L. & Juel K. 2014, 'The Prevalence of Problem Gambling in Denmark in 2005 and 2010: A Sociodemographic and Socioeconomic Characterization', *Journal of Gambling Studies*, no.: 30, pp.1-10.

Elster J. 2003, 'Don't Burn Your Bridge Before You Come To It: Some Ambiguities and Complexities of Precommitment', *Texas Law Review*, vol. 81, no.: 7, pp. 1751-1788.

European Commission Regulation No. 478/2014 of 14 July 2014 on principles for the protection of consumers and players of online gambling services and for the prevention of minors from gambling online. [Online]. [Accessed 5 November 2021]. Available from: <https://eur-lex.europa.eu/eli/reco/2014/478/oj>

European Commission 2017, *Quality of Public Administration A Toolbox for Practitioners Theme 5: Service delivery and digitisation*, Publications Office of the European Union, Luxembourg, viewed 15 October 2021, < file:///C:/Users/CIARN~1/AppData/Local/Temp/07%20T2017%20Theme%205%20Service%20delivery_web.pdf>

Federal Ministry of Finance Republic of Austria (2022, January 9). *Regulation of Games of Chance*. Federal Ministry of Finance Republic of Austria. https://www.bmf.gv.at/en/topics/taxation/regulation-of-games-of-chance.html

Fiedler I., Kairouz S., Costes J.-M. & Weiβmüller K.S. 2019, 'Gambling spending and its concentration on problem gamblers', *Journal of Business Research*, no.: 98, pp. 82-91.

Formosa, C. (2019, March 21). *The MGA publishes a Preliminary Market Consultation Document to request information on projects for a Unified Self-Exclusion System*. Malta Gaming Authority. https://www.mga.org.mt/the-mga-publishes-a-preliminary-market-consultation-document-to-request-information-on-projects-for-a-unified-self-exclusion-system

Gainsbury S.M. 2014, 'Review of Self-Exclusion from Gambling Venues as an Intervention for Problem Gambling', *Journal of Gambling Studies*, no.: 30, pp. 229-251.

Gainsbury S.M., Jakob L. & Aro D. 2018a, 'Understanding end-user perspectives to enhance perceived value uptake of harm-minimization tools: considering gambler's views of a pre-commitment system', *International Gambling Studies*, vol.: 18, no.: 1, pp. 22-38.

Gainsbury, SM, Tobias-Webb, J & Slonim, R 2018b, 'Behavioral Economics and Gambling a New Paradigm for Approaching Harm-Minimization', *Gaming Law Review*, no. 22, pp. 608-617.

Gainsbury SM, Black N, Blaszczynski A, Callaghan S, Clancey G, Starcevic V and Tymula A 2020, 'Reducing Internet Gambling Harms Using Behavioral Science: A Stakeholder Framework', *Frontiers in Psychiatry*, Vol. 11, Article 598589, pp. 1-7.

Gal D & Rucker DD 2018, 'The Loss of Loss Aversion: Will It Loom Larger Than Its Gain?', *Journal of Consumer Psychology*, vol.: 28, no.: 3, pp. 497-516.

Ganguli I. 2017, 'The Impact of Grants When Government R&D Funding Disappears', *American Economic Journal: Applied Economics*, vol.: 9, no.: 2, pp. 165-201.

Germany to launch new self-exclusion OASIS system in August (2021, July 26). *Agechecked*. https://www.agechecked.com/germany-to-launch-new-self-exclusion-oasis-system-in-august/ [Author not disclosed]

Giorgetta C, Grecucci A, Rattin A, Guerreschi C, Sanfey AG & Bonini N 2014, 'To play or not to play: A personal dilemma in pathological gambling', *Psychiatry Research*, no.: 219, pp. 562-569.

González L 2013, 'The Effect of a Universal Child Benefit on Conceptions, Abortions, and Early Maternal Labor Supply', *American Economic Journal: Economic Policy*, vol.: 5, no.: 3, pp. 160-188.

Gottman JM, McFall RM & Barnett JT 1969, 'Design and Analysis of Research Using Time Series', *Psychological Bulletin*, vol.: 72, no.: 4, pp. 299-306.

Griffiths M, Parke A, Wood R & Parke J 2006, 'Internet Gambling: An Overview of Psychosocial Impacts', *UNLV Gaming Research & Review Journal*, vol.: 10, no.: 1, pp. 27-39.

Griffiths M 2010, 'Problem Gambling in Europe: What Do We Know?', *Casino & Gaming International*, vol.: 6, no.: 2, pp.81-84.

Håkansson A & Henzel V 2020, 'Who chooses to enroll in a new national gambling self-exclusion system? A general population survey in Sweden', *Harm Reduction Journal*, no.: 17, article: 82, pp. 1-12.

Håkansson A & Widinghoff C 2020, 'Gambling Despite Nationwide Self-Exclusion – A Survey in Online Gamblers in Sweden', *Frontiers in Psychiatry*, vol.: 11, article: 599967, pp. 1-10.

Harrison, R. (2021, February 24). Austria to establish new gambling authority in regulatory overhaul. *iGB*. https://igamingbusiness.com/austria-to-establish-new-gambling-authority-in-regulatory-shake-up

Hayer T, Brosowski T & Meyer G 2020, 'Multi-venue exclusion program and early detection of problem gamblers: what works and what does not?', *International Gambling Studies*, vol.: 20, no.: 3, pp. 556-578.

Hodgins DC 2004, 'Using the NORC DSM Screen for Gambling Problems as an outcome measure for pathological gambling: psychometric evaluation', *Addictive Behaviors*, no.: 29, pp. 1685-1690.

Holland Casino. (2016). *2015 Jaarverslag Holland Casino*. Retrieved from https://corporate.hollandcasino.nl/nl/over-ons/onze-publicaties/jaarverslagen.

Holland Casino. (2017). *2016 Jaarverslag Holland Casino*. Retrieved from https://corporate.hollandcasino.nl/nl/over-ons/onze-publicaties/jaarverslagen.

Holland Casino. (2018). *Holland Casino Jaarverslag 2017: Het Enige Échte Casino*. Retrieved from https://corporate.hollandcasino.nl/nl/over-ons/onze-publicaties/jaarverslagen.

Holland Casino. (2019). *Holland Casino Jaarverslag 2018*. Retrieved from https://corporate.hollandcasino.nl/nl/over-ons/onze-publicaties/jaarverslagen.

Holland Casino. (2020). *Holland Casino Jaarverslag 2019*. Retrieved from https://corporate.hollandcasino.nl/nl/over-ons/onze-publicaties/jaarverslagen.

Holland Casino. (2021). *Holland Casino Jaarverslag 2020*. Retrieved from https://corporate.hollandcasino.nl/nl/over-ons/onze-publicaties/jaarverslagen.

Holtgraves T 2008, 'Evaluating the Problem Gambling Severity Index', *Journal of Gambling Studies*, no.: 25, pp. 105-120.

Kahneman D & Tversky A 1979, 'Prospect Theory: An Analysis of Decision under Risk', *Econometrica*, vol.: 47, no.: 2, pp. 263-292.

Kansspelautoriteit (2014, October). *"Marktscan Analyse van de Nederlandse kansspelmarkt 2013"*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2015a, April). *Jaarverslag* [Annual Report] *2014: "Op stoom & op koers – Voor het bewaken van een veilig en betrouwbaar kansspelaanbod."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2015b, December). *"Marktscan landgebonden kansspelen 2014."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit (2016a, April). *Jaarverslag 2015: "Drie jaar kansspelen onder een nieuwe toezichthouder."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2016b, September). *"Marktscan landgebonden kansspelen 2015."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit (2017a, April). *Jaarverslag 2016: "Veilig spelen op een eerlijke markt."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2017b, October). *"Marktscan landgebonden kansspelen 2016."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit (2018a, April). *Jaarverslag 2017: "Toezicht & handhaving in kader van Wet op de kansspelen."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2018b, November). *"Marktscan landgebonden kansspelen 2017."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit (2019, April). *Jaarverslag 2018: "Extra aandacht voor jongeren.",* Kansspelautoriteit: Den Haag.

Kansspelautoriteit (2020, April). *Jaarverslag 2019: "Start Modernisering Kansspelbeleid."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit (2021a, January). "*Market Vision on gambling: Market regulation and market supervision in the public interest"*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2021b, February). "*Omvang online kansspelmarkten: Schattingen, prognoses en kwalificatie van cijfers"*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit (2021c, March). *Jaarverslag 2020: "Jaarverslag Kansspelautoriteit 2020."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2021d, March 22). *Ksa wijst op verplichting Centraal Register Uitsluiting Kansspelen*. Kansspelautoriteit. https://kansspelautoriteit.nl/nieuws/2021/maart/ksa-wijst/

Kansspelautoriteit. (2021e, June 8). *Inschrijven in Cruks*. Kansspelautoriteit. https://kansspelautoriteit.nl/veilig-spelen/gokproblemen/inschrijven-in-cruks/

Kansspelautoriteit (2021f, June 8). *Een ander inschrijven in Cruks.* Kansspelautoriteit. https://kansspelautoriteit.nl/veilig-spelen/gokproblemen/ander-inschrijven/

Kansspelautoriteit (2021g, July 14). *Kennisgeving problematisch speelgedrag – inschrijven Cruks door gokbedrijf*. Kansspelautoriteit, https://kansspelautoriteit.nl/zakelijke-aanbieders/uitsluitregister/kennisgeving-problematisch-speelgedrag/

Kansspelautoriteit. (2021h, November). *"Marktscan landgebonden kansspelen 2014."*, Kansspelautoriteit: Den Haag.

Kansspelautoriteit. (2021i, November 22). *Notes from Video Meeting of 22 November 2021, with Annet Meijer and Roderick Huizing of the Kansspelautoriteit.*

Kansspelautoriteit. (2021j, December 9). *Onze strategie 2020 – 2024.* Kansspelautoriteit. https://kansspelautoriteit.nl/over-ons/onze-strategie-2020-2024

Kansspelautoriteit. (2021k, December 23). *Bestuur & organisatie.* Kansspelautoriteit. https://kansspelautoriteit.nl/over-ons/bestuur-organisatie-samenwerking/bestuur-organisatie

Kansspelcommissie (2006, September). *Activiteitenverslag* [Activity/Annual Report] *2005,* Kansspelcommissie: Brussels.

Kansspelcommissie (2013, May). *Activiteitenverslag 2012*, Kansspelcommissie: Brussels.

Kessler RC, Hwang I, LaBrie R, Petukhova M, Sampson NA, Winters KC & Shaffer HJ 2008, 'The prevalence and correlates of DSM-IV Pathological Gambling in the National Comorbidity Survey Replication', *Psychological Medicine*, Vol.: 38, No.: 9, pp. 1351-1360.

Kingma S. 2004, 'Gambling and the risk society: the liberalisation and legitimation crisis of gambling in the Netherlands', *International Gambling Studies*, vol.: 4, no.: 1, pp. 47-67.

Kruize, A., Boendermaker, M., Sijtstra, M. & Bieleman, B. (2016, June). *Modernisering Kansspelbeleid: Nulmeting 2016*. Intraval Onderzoek en Advies: Groningen.

Ladouceur R, Sylvain C & Gosselin P 2007, 'Self-Exclusion Program: A Longtitudinal Evaluation Study', *Journal of Gambling Studies*, no.: 23, pp. 85-94.

Ladouceur R, Blaszczynski A & Lalande DR 2012, 'Pre-commitment in gambling: a review of the empirical evidence', *International Gambling Studies*, Vol.: 12, No.: 2, pp. 215-230.

Lee DS & Lemieux T 2010, 'Regression Discontinuity Designs in Economics', *Journal of Economic Literature*, no.: 48, pp. 281-355.

Lesieur HR & Blume SB 1987, 'The South Oaks Gambling Screen (SOGS): A New Instrument for the Identification of Pathological Gamblers', *American Journal of Psychiatry*, vol.: 144, no.: 9, pp. 1184-1188.

Lesieur HR & Custer RL 1984, 'Pathological Gambling: Roots, Phases, and Treatment', *The Annals of the American Academy of Political and Social Science'*, vol.: 474, no.: 1, pp.146-156.

Lock, S. (2020). Gross Gaming Revenue (GGR) in select European countries in 2019. [Data file]. Retrieved from https://www.statista.com/statistics/586185/gross-gambling-revenue-europe-by-country.

Lole L, Gonsalvez CJ, Barry RJ & Blaszczynski A 2014, 'Problem gamblers are hyposensitive to wins: An analysis of skin conductance responses during actual gambling on electronic gaming machines', *Psychophysiology*, no.: 51, pp. 556-564.

Lorains FK, Cowlishaw S & Thomas SA 2010, 'Prevalence of comorbid disorders in problem and pathological gambling: systematic review and meta-analysis of population surveys', *Addiction*, no.: 106, pp. 490-498.

Markham F, Young M & Doran B 2015, 'The relationship between player losses and gambling-related harm: evidence from nationally representative cross-sectional surveys in four countries', *Addiction*, no.: 111, pp. 320-330.

Mitchell G 2005, 'Libertarian Paternalism is an Oxymoron', *Northwestern University Law Review*, vol.: 99, no.: 3, pp. 1245-1277.

Mondriaan AE 2013, 'Gambling and problem gambling in the Netherlands', *Addiction*, no.: 109, pp. 1066-1071.

Moore M & Hartley J 2008, 'Innovations in governance', *Public Management Review*, vol.: 10, no.: 1, pp. 3-20.

Napolitano F 2003, 'The Self-Exclusion Program: Legal and Clinical Considerations', *Journal of Gambling Studies*, vol.: 19, no.: 3, pp. 303-315.

Narayan, N. (2021, June 24). Spain Moves Closer Towards a Shared Self-exclusion System. *European Gaming. https://europeangaming.eu/portal/compliance-updates/2021/06/24/94965/spain-moves-closer-towards-a-shared-self-exclusion-system*

Nationale Postcode Loterij (2016). *Jaarverslag 2015*. Retrieved from https://www.postcodeloterij.nl/over-ons/jaarverslagen.

Nationale Postcode Loterij (2017). *Jaarverslag 2016*. Retrieved from https://www.postcodeloterij.nl/over-ons/jaarverslagen.

Nationale Postcode Loterij (2018). *Jaarverslag 2017*. Retrieved from https://www.postcodeloterij.nl/over-ons/jaarverslagen.

Nationale Postcode Loterij (2019). *Jaarverslag 2018*. Retrieved from https://www.postcodeloterij.nl/over-ons/jaarverslagen.

Nationale Postcode Loterij (2020). *Jaarverslag 2019*. Retrieved from https://www.postcodeloterij.nl/over-ons/jaarverslagen.

Nationale Postcode Loterij (2021). *Jaarverslag 2020*. Retrieved from https://www.postcodeloterij.nl/over-ons/jaarverslagen.

Nederlandse Loterij. (2015). *Jaarverslag 2014.* Retrieved from https://jaarverslagnederlandseloterij.nl.

Nederlandse Loterij. (2016). *Jaarverslag 2015.* Retrieved from https://jaarverslagnederlandseloterij.nl.

Nederlandse Loterij. (2017). *Jaarverslag 2016: Waar heel Nederland wint.* Retrieved from https://jaarverslagnederlandseloterij.nl.

Nederlandse Loterij. (2018). *Jaarverslag 2017: Kansen Voor Succes.* Retrieved from https://jaarverslagnederlandseloterij.nl.

Nederlandse Loterij. (2019). *Jaarverslag 2018: Investeren in een kansrijke toekomst.* Retrieved from https://jaarverslagnederlandseloterij.nl.

Nederlandse Loterij. (2020). *Jaarverslag 2019: Waarde creëern door sterk samenspel.* Retrieved from https://jaarverslagnederlandseloterij.nl.

Nederlandse Loterij. (2021). *Midden in de samenleving: Jaarverslag 2020.* Retrieved from https://jaarverslagnederlandseloterij.nl.

Nichols MW, Stitt BG & Giacopassi D 2004, 'Changes in Suicide and Divorce in New Casino Jurisdictions', *Journal of Gambling Studies*, vol.: 20, no.: 4, pp. 391-404.

Nower L & Blaszczynski A 2010, 'Gambling Motivations, Money-Limiting Strategies, and Precommitment Preferences of Problem Versus Non-Problem Gamblers', *Journal of Gambling Studies*, no.: 26, pp. 361-372.

OECD/Eurostat. (2018) *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, OECD Publishing: Paris/Eurostat: Luxembourg.

Orford J, Wardle H, Griffiths M, Sproston K & Erens B 2010, 'PGSI and DSM-IV in the 2007 British Gambling Prevalence Survey: reliability, item response, factor structure and inter-scale agreement', *International Gambling Studies*, vol.: 10, no.: 1, pp. 31-44.

Organisation for Economic Co-operation and Development. (2022). Quarterly GDP. [Data file]. Retrieved from https://data.oecd.org/gdp/quarterly-gdp.htm#indicator-chart

Pickering D, Nong Z, Gainsbury SM & Blaszczynski A 2019, 'Consumer Perspectives of a Multi-Venue Gambling Self-Exclusion Program: A Qualitative Process Analysis', *Journal of Gambling Issues*, vol.: 41, pp. 20-39.

Planzer S, Gray HM & Shaffer HJ 2014, 'Associations between national gambling policies and disordered gambling prevalence rates within Europe', *International Journal of Law and Psychiatry*, no.: 37, pp. 217-229.

Potts J 2009, 'The innovation deficit in public services: The curious problem of too much efficiency and not enough waste and failure', *Innovation: management, policy & practice*, vol.: 11, no.: 1, pp. 34-43.

Raspor A, Bulatović I, Stranjančević A & Lacmanović D 2019, 'How Important is Gambling in National GDP: Case Study from Austria, Croatia, Italy and Slovenia', *Economics-Časopis Za Inovacijska I Ekonomska Istraživanja*, vol.: 7, no.: 1, pp. 31-49.

Samenwerkende Non-Profit Loterijen. (2018). *Jaarverslag Stichting Samenwerkende Non-profit Loterijen 2017*. Retrieved from https://www.ssnl.nl.

Samenwerkende Non-Profit Loterijen. (2019). *Jaarverslag Stichting Samenwerkende Non-profit Loterijen 2018*. Retrieved from https://www.ssnl.nl.

Samuelsson E, Wennberg P & Sundqvist K 2019, 'Gamblers' (mis-)interpretations of Problem Gambling Severity Index items: Ambiguities in qualitative accounts from the Swedish Longitudinal Gambling Study', *Nordic Studies on Alcohol and Drugs*, vol.: 36, no.: 2, pp. 140-160.

Serviços de Regulação e Inspeção de Jogos (2022, January 9). *Autoexclusão e Proibição*. Serviços de Regulação e Inspeção de Jogos. https://www.srij.turismodeportugal.pt/pt/jogo-responsavel/autoexclusao-e-proibicao

Sharot T 2011, 'The optimism bias', *Current Biology*, vol.: 21, no.: 33, pp. R941-R945.

Spillemyndigheden (2013, March). *Annual Report 2012*, Spillemyndigheden: Odense.

Spillemyndigheden (2014, March). *Annual Report 2013*, Spillemyndigheden: Odense.

Spillemyndigheden (2015, March). *Annual Report 2014*, Spillemyndigheden: Odense.

Spillemyndigheden (2016, March). *Annual Report 2015*, Spillemyndigheden: Odense.

Spillemyndigheden (2017, April). *Annual Report 2016*, Spillemyndigheden: Odense.

Spillemyndigheden (2018, April). *Annual Report 2017*, Spillemyndigheden: Odense.

Spillemyndigheden (2019, May). *Annual Report 2018*, Spillemyndigheden: Odense.

Spillemyndigheden (2020, August 24). *Q2 2020 statistics affected by corona lockdown.* Spillemyndigheden. https://www.spillemyndigheden.dk/en/news/q2-2020-statistics-affected-corona-lockdown

Spillemyndigheden (2022a, January 9). *Who is the Danish Gambling Authority?* Spillemyndigheden. https://www.spillemyndigheden.dk/en/who-danish-gambling-authority

Spillemyndigheden (2022b, January 9). *Issuance of licences and continuous supervision.* Spillemyndigheden. https://www.spillemyndigheden.dk/en/issuance-licences-and-continuous-supervision

Spillemyndigheden (2022c, January 9). *Advertising.* Spillemyndigheden. https://www.spillemyndigheden.dk/en/advertising

Spillemyndigheden (2022d, January 9). *Anti-money laundering.* Spillemyndigheden. https://www.spillemyndigheden.dk/en/anti-money-laundering

Spillemyndigheden (2022e, January 9). *Match-fixing.* Spillemyndigheden. https://www.spillemyndigheden.dk/en/match-fixing

Spillemyndigheden (2022f, January 9). *The Danish Gambling Authority ensures responsible gambling.* Spillemyndigheden. https://www.spillemyndigheden.dk/en/danish-gambling-authority-ensures-responsible-gambling

Spillemyndigheden (2022g, January 9). *ROFUS.* Spillemyndigheden. https://www.spillemyndigheden.dk/en/rofus

Strong DR & Kahler CW 2006, 'Evaluation of the continuum of gambling problems using the DSM-IV', *Addiction*, no.: 102, pp.713-721.

Thaler R & Sunstein C 2003, 'Libertarian Paternalism Is Not an Oxymoron', *The University of Chicago Law Review*, vol.: 70, no.: 4, pp. 1159-1202.

Thaler R & Sunstein C 2003b, 'Libertarian Paternalism', *The American Economic Review*, vol.: 93, no.: 2, pp. 175-179.

Thaler, R & Sunstein, C 2008, *Nudge – Improving decisions about health, wealth and happiness*, Penguin, London.

Thorgeirsson T & Kawachi I 2013, 'Behavioral Economics: Merging Psychology and Economics for Lifestyle Interventions', *American Journal of Preventive Medicine*, vol.: 44, no.: 2, pp. 185-189.

Triami Media B.V. (2022). Historic inflation – CPI inflation year pages. [Data file]. Retrieved from https://www.inflation.eu/en/inflation-rates/historic-cpi-inflation.aspx

Wet op de Kansspelen [Gambling Act] 1964 (as amended) (NL). Retrieved from Overheid.nl Wettenbank.

Williams RJ & Wood RT 2004, 'The Proportion of Gaming Revenue Derived from Problem Gamblers: Examining the Issue in a Canadian Context', *Analyses of Social Issues and Public Policy*, vol.: 4, no.: 1, pp. 33-45.Wood, R.T. & Williams, R.J. 2007, 'Problem Gambling on the Internet: Implications for Internet Gambling Policy in North America', *New Media & Society*, vol.: 9, no.: 3, pp. 520-542.

Working H 1934, 'A Random-Difference Series for Use in the Analysis of Time Series', *Journal of the American Statistical Association*, vol.: 29, no.: 185, pp. 11-24.

World Bank. (2022). Inflation, consumer prices (annual %) – Denmark. [Data file]. Retrieved from https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=DK

Yechiam E 2019, 'Acceptable losses: the debatable origins of loss aversion', *Psychological Research*, no.: 83, pp. 1327-1399.

ZEbetting & Gaming Nederland B.V. (2019). *Financieel verslag 2018*. Retrieved from https://runnerz.nl.

ZEbetting & Gaming Nederland B.V. (2020). *Financieel verslag 2019*. Retrieved from https://runnerz.nl.

APPENDIX A

MISCELLANEOUS GAMBLING STATISTICS – NETHERLANDS

Table A.1 – Number of Gaming Halls 2013-2020

2013	2014	2015	2016	2017	2018	2019	2020
262	270	271	280	276	293	268	295

Fig. A.1 - Netherlands - No. of Gaming Halls 2013-2020

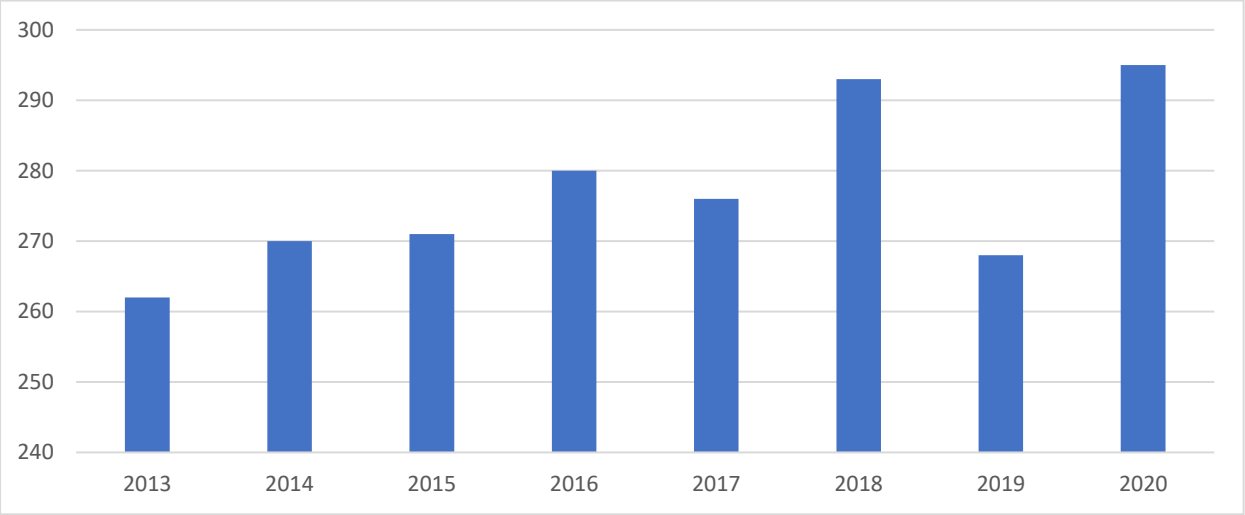


Table A.2 – Number of Machines in Gaming Halls 2013-2020

2013	2014	2015	2016	2017	2018	2019	2020
15685	15606	17018	17126	16755	17429	17884	14973

Fig. A.2 – No. of Machines in Gaming Halls 2013-2020

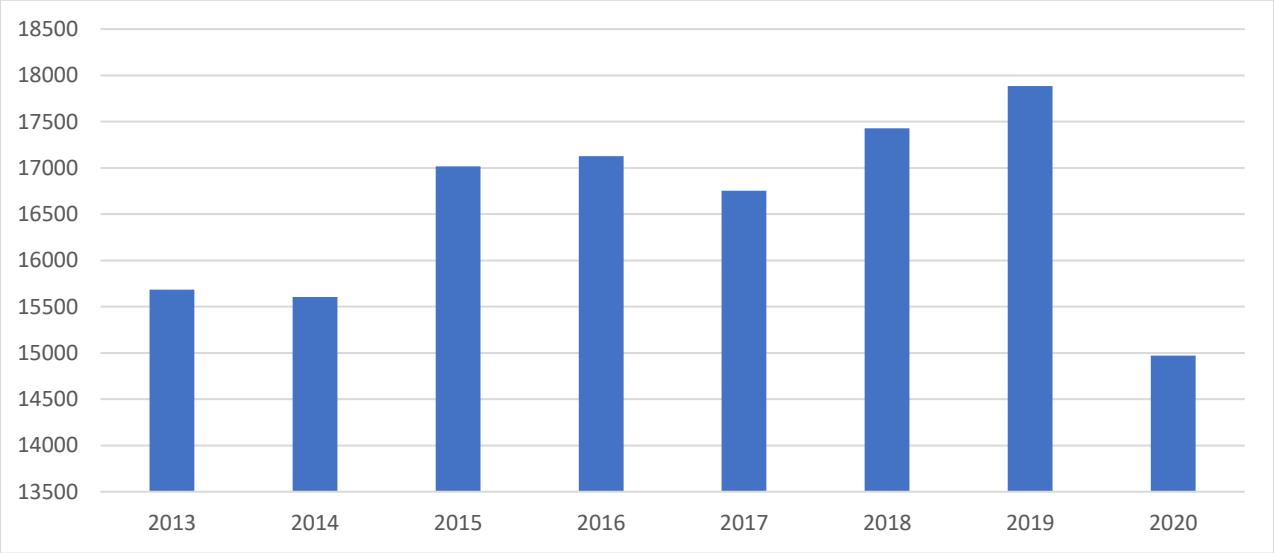


Table A.3 – Number of Horeca with Gaming Machines 2013-2020

2013	2014	2015	2016	2017	2018	2019	2020
10887	10165	9609	8982	8603	8361	7577	6963

Fig. A.3 – No. of Horeca Locations with Gaming Machines 2013-2020

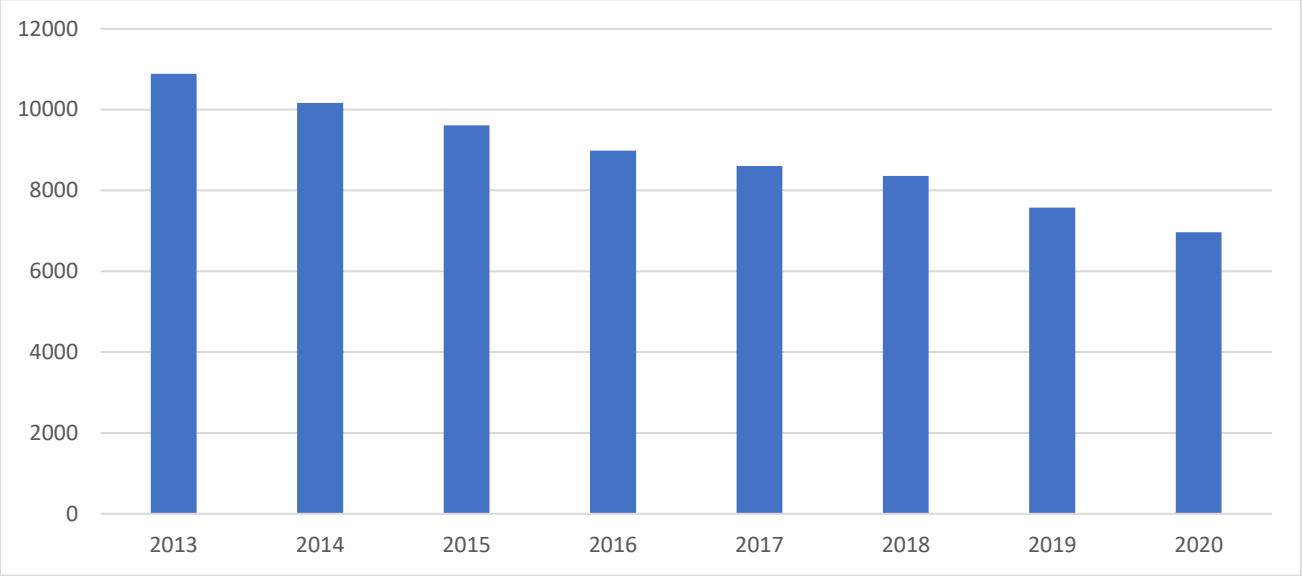


Table A.4 – Number of Gaming Machines in Horeca Locations 2013-2020

2013	2014	2015	2016	2017	2018	2019	2020
20498	19613	18692	18880	17276	16389	15005	11871

Fig. A.4 – No. of Gaming Machines in Horeca Locations 2013-2020

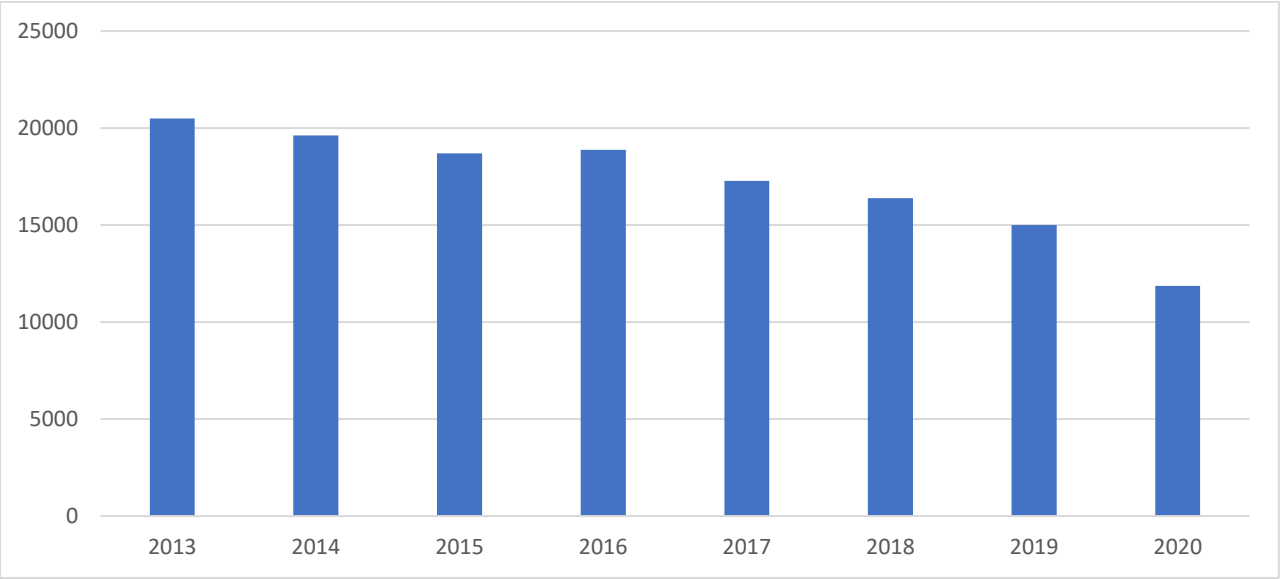


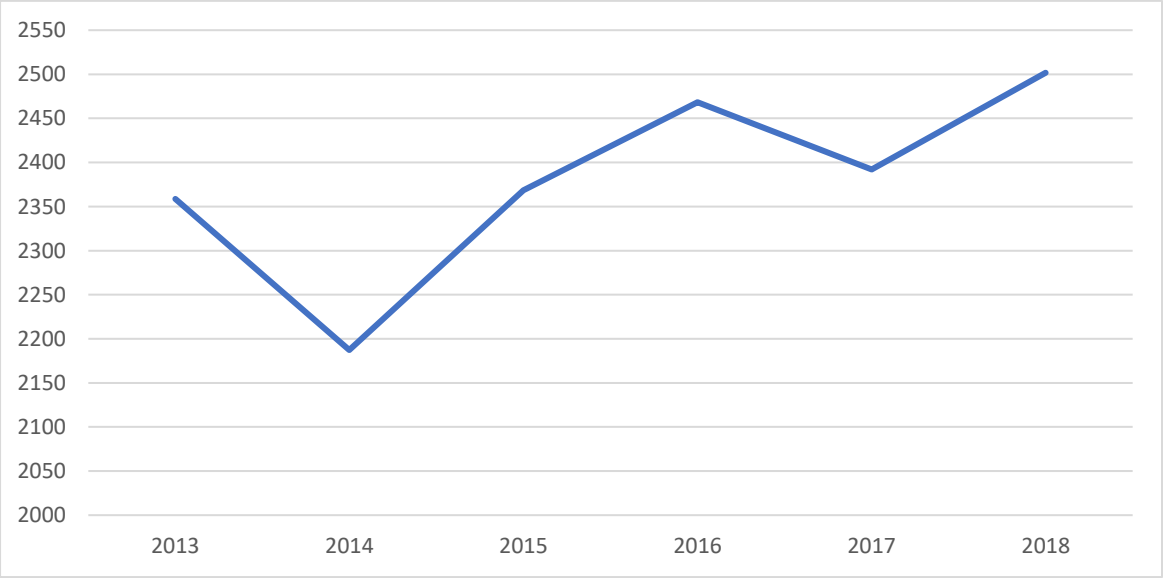
Table A.5 - Total Fines Levied (Across All Forms of Gambling) in Netherlands, in €, 2013-2019

2013	350000
2014	821500
2015	529000
2016	373750
2017	1007000
2018	1709800
2019	3500000

Table A.6 – Gross Gambling Revenue Across All Licensed Gambling Activity in Netherlands 2013-2018, not adjusted for Inflation.

	2013	**2014**	**2015**	**2016**	**2017**	**2018**
National Lottery	306.4	290.8	278.5	271.2	228.15	245.7
Private Good Cause Lotteries	638.1	604.6	633.8	713.6	681.6	709.5
Non-Profit Lotteries	24.6	24.1	25.2	25.6	19.03	23.86
Lotto	162.5	162.8	166.7	172.7	144.24	148.3
Racing	6.2	5.7	6	5.8	6.01	5.33
Holland Casino (Table Games)	209	213.9	233.3	253	253	266
Holland Casino (Machines)	242.5	258.8	294.2	305.5	338	340
Gaming Hall Machines	769.3	626.6	730.9	720.7	722	763
Total	2358.6	2187.3	2368.5	2468.1	2392	2501.7

Fig. A.5 – Netherlands Total Gross Gambling Revenue 2013-2018, in € million, not adjusted for inflation.



APPENDIX B

MISCELLANEOUS GAMBLING STATISTICS – DENMARK

Table B.1 – Quarterly Data for Gross Gambling Revenue in Betting, Gaming Machine, Land-Based and Online Casino Sectors, (in million DKK) Q1 2012 to Q2 2021

	Betting	Gaming Machines	Land-based Casinos	Online Casinos
Q1 2012	293	434	78	200
Q2 2012	276	488	89	234
Q3 2012	259	431	89	216
Q4 2012	347	420	88	234
Q1 2013	389	415	88	239
Q2 2013	314	425	83	244
Q3 2013	294	390	81	234
Q4 2013	374	400	85	258
Q1 2014	437	386	75	252
Q2 2014	441	404	88	248
Q3 2014	494	374	83	267
Q4 2014	420	382	85	290
Q1 2015	416	377	74	303
Q2 2015	487	413	99	337
Q3 2015	548	376	89	319
Q4 2015	548	382	87	349
Q1 2016	565	379	96	376
Q2 2016	523	391	97	395
Q3 2016	529	365	93	382
Q4 2016	550	371	94	410
Q1 2017	519	371	93	419
Q2 2017	522	388	95	462
Q3 2017	576	369	95	457
Q4 2017	713	361	91	482
Q1 2018	561	359	93	524
Q2 2018	649	354	92	540
Q3 2018	653	347	82	548
Q4 2018	664	353	88	558
Q1 2019	619	351	83	566
Q2 2019	635	365	94	636
Q3 2019	628	337	82	568
Q4 2019	621	344	90	575
Q1 2020				
Q2 2020				
Q3 2020	558	337	87	555
Q4 2020	724	267	69	666
Q1 2021	588	0	0	717
Q2 2021	657	163	37	715

Table B.2 – Betting Activity Distribution Across Channels, in %, Q1 2014 to Q3 2020

	Computer	Land-based	Mobile
Q1 2014	34.02	31	34.98
Q2 2014	33.87	28.04	38.09
Q3 2014	32.67	21.84	45.49
Q4 2014	31.97	23.65	44.38
Q1 2015	33.45	24.46	42.09
Q2 2015	31.23	22.58	46.19
Q3 2015	29.68	23.93	46.39
Q4 2015	28.08	24.06	47.86
Q1 2016	29.95	21.86	48.19
Q2 2016	28.87	20.8	50.33
Q3 2016	24.74	23.17	52.09
Q4 2016	23.29	23.49	53.22
Q1 2017	24.07	22.49	53.43
Q2 2017	22.86	21.35	55.79
Q3 2017	22.68	21.44	55.88
Q4 2017	21.9	23.91	54.19
Q1 2018	22.01	23.76	54.23
Q2 2018	24.2	21.99	53.81
Q3 2018	24.34	20.89	54.77
Q4 2018	25.53	21.82	52.65
Q1 2019	27.35	21.32	51.33
Q2 2019	28.22	20.22	51.56
Q3 2019	31.58	19.13	49.28
Q4 2019	33.09	19.52	47.39
Q1 2020	32.33	20.04	47.63
Q2 2020	36.11	16.22	47.67
Q3 2020	35.53	18.87	45.6

Table B.3 – Online Casino Gross Gambling Revenue by Game Type, 2012-2020 - %

	Gaming Machine	Commission	Roulette	Blackjack	Other
2012	42.06	25.6	15.31	9.71	7.31
2013	60.1	20.11	7.8	4.92	7.08
2014	64.53	15.76	7.78	4.64	7.29
2015	65.26	12.58	9.95	5.66	6.54
2016	69.24	9.5	4.96	4.72	11.59
2017	70.65	7.89	8.16	5.64	7.65
2018	71.42	7.23	11.08	6.84	3.43
2019	72.54	5.63	10.4	8.24	3.19
2020	75.32	4.81	9.75	6.93	3.18

Table B.4 - Online Casino Gross Gambling Revenue by Game Type, 2012-2020 – DKK

	Gaming Machine	Commission	Roulette	Blackjack	Other
2012	372395495	226692361	135565854	86010333	64689903
2013	586537272	196217852	76079176	47989998	69117609
2014	682611992	166666469	82343615	49035143	77123151
2015	853739769	164558247	130214987	74097738	85539465
2016	1082117401	148418438	77540302	73709906	181091839
2017	1286364254	143577343	148595985	102767559	139350742
2018	1549654053	156825635	240318673	148499860	74340309
2019	1700468639	132072134	243765395	193152971	74882485
2020	919780943	58763908	119077833	84672249	38865871

Table B.5 – Online Casino - % of Transactions on Days of Week – Q1 2012 to Q4 2020

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Q1 2012	11.93	12.3	14.43	15.01	16.5	16.92	12.91
Q2 2012	13.37	13.91	13.25	11.06	17.54	15.2	15.68
Q3 2012	10.45	10.98	10.61	16.44	25.6	13.76	12.16
Q4 2012	12.88	12.94	13.22	14.55	16.63	14.06	15.72
Q1 2013	11.82	13.02	13.71	15.22	15.48	15.37	15.39
Q2 2013	13.42	13.66	13.59	14.04	16.02	14.87	14.4
Q3 2013	15.59	13.34	13.94	13.92	14.76	14.39	14.07
Q4 2013	13.97	14.16	12.92	13.98	15.35	15.2	14.41
Q1 2014	14.02	11.97	13.51	13.93	16.09	15.8	14.69
Q2 2014	13.51	13.51	14.92	14.87	15.2	14.5	14.27
Q3 2014	13.23	15.29	13.38	14.19	15.43	14.4	14.08
Q4 2014	13.06	13.87	14.32	13.42	15.11	14.52	15.69
Q1 2015	13	14.17	12.03	13.97	16.21	15.89	14.74
Q2 2015	13.2	13.95	14.07	14.91	15.02	14.79	14.05
Q3 2015	13.58	13.66	15.19	13.81	15.21	14.49	14.08
Q4 2015	13.26	13.63	14.08	14.98	15.01	14.81	14.23
Q1 2016	13.48	13.44	13.65	14.27	15.32	15.3	14.54
Q2 2016	13.21	14.03	13.62	14.42	15.56	15	14.16
Q3 2016	13.03	13.25	13.58	13.81	17.49	14.66	14.17
Q4 2016	13.05	13.42	13.77	14.11	15.51	16	14.15
Q1 2017	13.1	14.69	14.1	14.16	15.64	13.69	14.62
Q2 2017	13.26	13.52	14.25	14.22	15.87	14.72	14.15
Q3 2017	13.49	13.35	12.88	14.4	15.51	16.22	14.14
Q4 2017	12.88	13.57	13.23	14.26	15.81	15.3	14.96

Q1 2018	13.07	13.36	15.39	15	15.53	15	12.65
Q2 2018	15.12	13.78	13.31	14.32	15.45	14.32	13.71
Q3 2018	13.05	13.83	13.2	13.81	15.61	14.96	15.54
Q4 2018	13.89	12.91	13.32	13.83	16.03	15.18	14.84
Q1 2019	11.88	13.05	13.11	15.33	16.29	15.67	14.67
Q2 2019	13.24	14.08	14.43	14.47	15.58	14.5	13.7
Q3 2019	15.3	13.52	13.68	13.7	15.29	14.59	13.92
Q4 2019	14.04	14.51	13.07	13.95	15.35	14.8	14.28
Q1 2020	13.34	14.15	13.01	13.49	15.86	15.46	14.67
Q2 2020	13.22	13.59	13.6	14.66	16.11	14.91	13.91
Q3 2020	13.75	13.73	15.35	13.5	15.33	14.42	13.92
Q4 2020	13.66	13.49	13.71	14.9	15.36	14.87	14.02

Table B.6 - Online Casino - % of Value of Stakes on Days of Week – Q1 2012 to Q4 2020

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Q1 2012	11.3	11.58	14.59	15.01	17.05	18.23	12.24
Q2 2012	12.66	12.06	12.17	13.17	20.14	16.31	13.49
Q3 2012	11.93	12.91	12.11	14.92	22.23	13.13	12.79
Q4 2012	13.03	13.3	13.35	15.76	17.05	14.09	13.42
Q1 2013	11.66	13.03	14.47	16.1	15.77	14.99	13.98
Q2 2013	13.06	14.34	13.85	14.43	16.52	14.18	13.62
Q3 2013	15.77	13.24	14.39	14.18	15.12	13.84	13.45
Q4 2013	14.21	14.66	13.42	14.46	15.45	14.15	13.65
Q1 2014	14.13	12.64	13.29	14.1	16.92	15.15	13.77
Q2 2014	13.82	14.01	15.75	14.78	15.16	13.51	12.96
Q3 2014	13.34	16.04	13.82	14.53	15.65	13.65	12.97
Q4 2014	13.05	14.36	14.59	13.85	15.63	14.3	14.22
Q1 2015	13.26	14.91	12.22	14.26	16.47	15.45	13.42
Q2 2015	13.06	14.47	14.41	15.3	15.66	14.17	12.92
Q3 2015	13.03	13.82	15.69	14.25	15.97	14.16	13.08
Q4 2015	13.49	13.64	14.44	15.42	15.53	14.07	13.41
Q1 2016	13.25	13.53	13.98	15.36	15.39	14.92	13.56
Q2 2016	13.18	14.26	13.87	14.83	15.68	14.7	13.49
Q3 2016	13.14	13.29	13.77	14	18.17	14.2	13.43
Q4 2016	13.55	13.4	14.13	14.3	15.62	15.93	13.06
Q1 2017	13.25	15.43	14.26	14.49	15.91	13	13.65
Q2 2017	13.22	13.9	14.93	14.53	15.99	14.23	13.2
Q3 2017	13.44	13.46	13.24	15.02	15.77	15.9	13.17
Q4 2017	13.08	14.27	13.37	14.42	16.17	14.43	14.27

Q1 2018	12.78	13.67	16.19	15.52	15.37	14.52	11.94
Q2 2018	15.25	14.12	13.69	14.8	15.97	13.73	12.45
Q3 2018	13.14	14.34	13.59	14	15.83	14.42	14.67
Q4 2018	13.92	13.3	13.88	13.78	16.32	15.08	13.73
Q1 2019	11.91	12.84	13.25	15.98	16.45	15.48	14.08
Q2 2019	13.34	14.5	14.87	14.74	15.74	13.82	13
Q3 2019	15.48	13.55	13.91	13.99	15.58	13.94	13.54
Q4 2019	14.23	14.68	12.91	14.27	15.33	14.69	13.89
Q1 2020	13.43	14.47	12.94	13.31	16.18	15.5	14.17
Q2 2020	13.2	13.63	13.84	15.1	16.02	14.87	13.34
Q3 2020	13.95	13.69	15.58	13.53	15.22	14.31	13.72
Q4 2020	13.75	13.44	13.93	14.82	15.5	14.84	13.72

Table B.7 – Gross Gambling Revenue by Licensed Sector 2011-2020 (in million DKK), not adjusted for inflation

Year	Betting	Betting on Horseracing	Gaming Machines	Land-based Casinos	Lotteries	Online Casinos	Total
2011	750	**145**	**1785**	**320**	**3545**		**6545**
2012	1,175	145	1,774	344	3,153	885	7,476
2013	1,371	135	1,630	337	3109	976	7558
2014	1791	130	1547	330	2912	1058	7768
2015	1999	120	1548	349	3058	1308	8383
2016	2168	118	1506	379	3111	1563	8845
2017	2330	116	1490	375	3073	1821	9204
2018	2527		1413	354	3245	2170	9709
2019	2503		1388	349	3188	2344	9772
2020	2290		986	239	3205	2453	9173

Table B.8 – Gaming Machine Gross Gambling Revenue (in million DKK), 2012-2020, Divided by Location

	Restaurant	Arcade
2012	418.49	1355.51
2013	416.14	1213.86
2014	360.76	1186.24
2015	354.34	1193.66
2016	341.41	1164.59
2017	340.76	1149.24
2018	321.03	1091.97
2019	334.09	1053.91
2020	217.91	768.09

Table B.9 – Calls to LudomaniLinjen, 2013-2020 (Sources: Danske Spil 2015, 2017, 2019; Spillemyndigheden, 2018-2020)

2013	205
2014	310
2015	437
2016	721
2017	717
2018	738
2019	828
2020	512

Table B.10 – Calls to StopSpillet, January 2019 to June 2021

Jan-19	104
Feb-19	68
Mar-19	55
Apr-19	47
May-19	33
Jun-19	41
Jul-19	62
Aug-19	60
Sep-19	71
Oct-19	62
Nov-19	57
Dec-19	68
Jan-20	75
Feb-20	60
Mar-20	39
Apr-20	29
May-20	39
Jun-20	30
Jul-20	44
Aug-20	36
Sep-20	60
Oct-20	37
Nov-20	38
Dec-20	25
Jan-21	37
Feb-21	45
Mar-21	39
Apr-21	29
May-21	40
Jun-21	50

Table B.11 – ROFUS Registrations June 2021, per Specific Classification

Number Registered	28221
Permanently Registered	18612
Temporarily Registered	9609
Male (Permanent and Temporary)	21264
Female (Permanent and Temporary)	6957
6 Months Registered	5609
3 Months Registered	2703
1 Month Registered	1297

Table B.12 – Illegal Gambling Websites Found and Blocked – 2012-2020

	Found	Blocked
2012	180	20
2013	7	0
2014	280	5
2015	0	0
2016	246	0
2017	328	0
2018	742	18
2019	559	10
2020	1317	9

Table B.13 – Inflation-Adjusted Gross Domestic Product (in billion DKK), per Quarter, Q1 2012 – Q4 2019

Q1 2012	481.351
Q2 2012	500.855
Q3 2012	496.715
Q4 2012	508.241
Q1 2013	482.742
Q2 2013	506.89
Q3 2013	502.602
Q4 2013	515.512
Q1 2014	495.664
Q2 2014	511.757
Q3 2014	511.654
Q4 2014	530.684
Q1 2015	511.093
Q2 2015	527.52
Q3 2015	521.178
Q4 2015	537.608
Q1 2016	518.714
Q2 2016	547.938
Q3 2016	536.388
Q4 2016	562.524
Q1 2017	540.016
Q2 2017	568.118
Q3 2017	548.153
Q4 2017	571.217
Q1 2018	544.993
Q2 2018	573.565
Q3 2018	562.519
Q4 2018	589.197
Q1 2019	558.19
Q2 2019	584.951
Q3 2019	576.718
Q4 2019	598.183

APPENDIX C

TABLE OF GAMBLING PROFILE OF EU MEMBER STATES PLUS UK

Country	2020 Population	2020 GDP per capita in euro	Independent Gambling Regulator?	All Gambling Activities Legal/Regulated?	Centralised National Self-Exclusion Register?	If yes, who maintains register?
Austria	8,917,205	33,664.55	No – Tax Office at federal level, while state governments regulate gaming machines.	Yes.	No.	N/A
Belgium	11,555,997	36,967.44	Yes – Kansspelcommissie, since 1999	Yes.	Yes – EPIS	Kansspelcommissie
Bulgaria	6,934,015	8,250.83	No – National Revenue Agency.	Yes.	No.	N/A
Croatia	4,047,200	11,570.22	No – Ministry of Finance.	Yes.	No.	N/A
Cyprus	1,207,361	21,794.24	No – separate bodies for betting and casinos, with all other activities regulated by local government.	Yes.	No.	N/A
Czech Republic	10,698,896	18,772.32	No – Ministry of Finance.	Yes.	Yes.	Ministry of Finance.
Denmark	5,831,404	49,986.43	Yes – Spelmyndigheden	Yes.	Yes – ROFUS.	Spelmyndigheden
Estonia	1,331,057	18,849.93	No – Tax and Customs Board.	Yes, except lotteries.	Yes.	Tax and Customs Board.
Finland	5,530,719	39,893.06	No – Ministry of Interior and Gambling Department of National Police Board.	Yes.	No.	N/A
France	67,391,582	31,950.25	No – ANJ regulates online gambling and betting, as well	Yes.	Yes, since 31/12/2020.	ANJ.

			as sports betting, but casinos are regulated by Ministry of Home Affairs			
Germany	83,240,525	37,826.22	No – gambling regulated on a state-by-state basis, usually by the relevant Ministry of the Interior.	Varies from state to state.	Yes.	State Government of Hesse.
Greece	10,715,549	14,425.81	Yes – Hellenic Gaming Commission	Yes.	No.	N/A
Hungary	9,749,763	13,081.83	Yes – Gambling Supervisory Board	Yes.	Yes, since 2016.	Gambling Supervisory Board.
Ireland	4,994,724	69,800.20	No – betting licensed by Revenue Commissioners.	No – online gambling (aside from betting) and casinos not regulated.	No.	N/A
Italy	59,554,023	25,961.26	Yes – ADM (Agenzia delle Dogane e dei Monopoli)	Yes.	Yes, since 2018.	ADM.
Latvia	1,901,548	14,510.71	Yes – Lotteries and Gambling Supervisory Inspection.	No – 'fantasy' betting not regulated.	Yes, in 2020.	Lotteries and Gambling Supervisory Inspection.
Lithuania	2,794,700	16,555.07	No – Gaming Control Authority under Ministry of Finance.	No – 'fantasy' betting not regulated.	Yes, since 2017.	Gaming Control Authority.
Luxembourg	632,275	94,969.55	No – Ministry of Justice.	Yes.	No.	N/A
Malta	525,285	22,826.37	Yes – Malta Gaming Authority	Yes.	No.	N/A
Poland	37,950,802	12,869.21	No – Ministry of Finance and regional Tax Administration Chambers (for lotteries).	Yes.	No.	N/A
Portugal	10,305,564	18,153.52	Yes – SRIJ (though betting	Yes.	Yes, since 2015.	SRIJ.

			and lotteries also supervised by social security ministry)			
Romania	19,286,123	10,556.74	Yes – National Gambling Office.	No – 'fantasy' betting not regulated.	No.	N/A
Slovakia	5,458,827	15,771.57	No – Gambling Regulatory Authority operates within Ministry of Finance.	Yes, though there is no online portal.	Yes.	Gamban.
Slovenia	2,100,126	20,888.49	No – Ministry of Finance	Yes.	Yes, but after 2018.	Ministry of Finance.
Spain	47,351,567	22,153.93	No – Directorate General for the Regulation of Gambling supervises online gaming and betting, but local and federal authorities supervise land-based gambling.	Yes.	No – self-exclusion registers maintained on autonomous regional basis.	N/A
Sweden	10,353,442	42,791.83	Yes – Spelinspektionen.	Yes.	Yes, since 2019.	Spelinspektionen
United Kingdom	67,215,293	33,664.55	Yes – Gambling Commission	Yes.	Yes, since 2018.	Gambling Commission.

APPENDIX D

REGRESSION TABLE FOR TIME SERIES REGRESSION AT TABLE 6

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. reg trajinflggr dinflGDP RofusDum
```

Source	SS	df	MS	Number of obs	=	31
				F(2, 28)	=	3.39
Model	393.770162	2	196.885081	Prob > F	=	0.0479
Residual	1624.02877	28	58.0010274	R-squared	=	0.1951
				Adj R-squared	=	0.1377
Total	2017.79893	30	67.2599643	Root MSE	=	7.6158

trajinflggr	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
dinflGDP	.1767373	.0687706	2.57	0.016	.0358672	.3176074
RofusDum	-1.489891	2.774437	-0.54	0.596	-7.173067	4.193285
_cons	.2151616	1.807345	0.12	0.906	-3.487016	3.917339

Trajinflggr = First difference re-configuration of inflation-adjusted land-based casino GGR in Denmark, Q1 2012 to Q4 2019

DinflGGR = First difference re-configuration of inflation-adjusted GDP in Denmark, Q1 2012 to Q4 2019

RofusDum = Dummy variable denoting time period pre- and post-implementation of ROFUS in land-based casino sector in Denmark, where 0<=Q3 2016 and 1>Q3 2016

APPENDIX E

Notes from Video Meeting of 22 November 2021, with Annet Meijer and Roderick Huizing of the Kansspelautoriteit.

Preliminary Discussion concerning my research and CRUKS in general

- CRUKS designed as something to operate in addition to exclusion/restriction services already offered by licence-holders
- CRUKS also brought in to satisfy certain politicians (including conservative CU/CDA as well as SP) concerned about the opening-up of regulation to include online gambling; For an example, check: https://www.rijksoverheid.nl/documenten/rapporten/2020/05/07/tk-bijlage-antwoorden-verslag-ontwerpbesluit-kansspelen-op-afstand
- Online operators are required, even if operating 'off-shore', to have a representative located in the Netherlands, who must be answerable to Government/parliamentary committees and so forth, and must contact addiction experts/player representative groups when developing policy

Question 1 – When was CRUKS first proposed?

Advice is to track the proposal according to available parliamentary records in the Netherlands.

Question 2 - Are there any documents (or other sources of information) available concerning the design of CRUKS from the point of view of the customer/user? Were elements of beahvioural economics employed in the design of CRUKS?

- CRUKS was built with the primary aim of operability *per se*. The timeline from the start of the process to implementation was apparently ambitious according to Mr. Huizing, with the focus on workability. Later on, the focus moved to 'softer' matters such as user-friendliness, etc.
- For any person registering on CRUKS, the amount of interaction required is very little. Indeed, as the process is carried out via DigiD, the system does not require the user to input personal details themselves, though the user may also input extra data themselves, as is the case with foreign nationals using the system
- The actual development of CRUKS was carried out by a team of external programmers and other IT professionals
- External consultants had been brought in to advise on matters such as user privacy
- The CRUKS development team is small, consisting of around 5-6 people at development phase, and currently numbering 4 staff
- A tendering process was carried out for the purposes of hosting CRUKS

Question 3 - Was a specific business model constructed for the development of CRUKS? If so, are there any relevant documents you could direct me to?

- 'Scrum' methodology was employed
- The development team for CRUKS was small, and therefore easy to coordinate
- 3 guiding principles ran through the development process:
    - The final product had to comply with the governing legislation
    - Attention had to be paid especially to potential privacy concerns, given the sensitive nature of the data to be handled by CRUKS
    - Scalability – the system is designed to handle millions of cases over the course of one year (approx. 50-100 million), and needs to be capable of operating during likely 'surge'/peak periods, such as the World Cup, for example
- Another important element in the development of CRUKS is the matter of involuntary exclusion, whereby an operator or other concerned third party may seek the listing of a player on the register

Question 4 - Could you outline the process for development of CRUKS from first proposal to implementation stage? Again, are there any relevant documents you could direct me to?

- Question somewhat redundant at this stage, as the matter was discussed earlier, though Mr. Huizing did indicate he would revert with relevant documentation if available

Question 5 - Was there a Cost Benefit Analysis carried out in relation to CRUKS prior to development?

- Not likely to have arisen in this case, as CRUKS was mandated by legislation, and the likely benefits arising will be non-monetary

Question 6 - What were the most commonly raised concerns from industry representatives in relation to the operability of CRUKS?

- Two main concerns of industry stakeholders:
    - Privacy – customers potentially having to identify themselves in land-based casinos
    - Cost of implementing the system. Kansspelautoriteit, while available for technical support, do not provide supports for the purposes of meeting costs of implementation
- Ms. Meijer also noted that some industry representatives had felt that a system such as CRUKS went too far, with the fear expressed that some customers may resort to illegal operators
- However, some operators are happy with the system, as excluding from just one operator/premises (as had been the case previously) would lead to a player to resume gambling at another premises
- It was emphasised that operators were required not only to offer a pathway to CRUKS, but also to continue to offer restriction options on a separate basis (time restrictions, etc.) – the legislation mentions this distinction

Question 7 - Does the Kansspelautoriteit have any available data in relation to problem gambling and/or self-exclusion in gaming/gambling activities regulated in the Netherlands

prior to the enactment of the current legislation governing online gambling and the launch of CRUKS?

- Pointed to prevalence study carried out by/on behalf of Ministerie van Justitie en Veiligheid in relation to gambling addiction (among other types of addiction) – the most recent study was carried out in 2016, with the next one likely to be published very soon
- Annual Reports of Holland Casino may contain relevant statistics in respect of the self-exclusion system run at their venues

Question 8 - Will there be an evaluation of the performance of CRUKS at some point in the future? If so, how often will such evaluation take place post-evaluation?

- A review is mandated via legislation, with the first to take place after 3 years
- No review is mandated specifically for the system itself, though user interviews and surveys will likely be carried out in this respect (with respect to user-friendliness and so forth)

Question 9 - What are the main statistics that will be recorded from CRUKS in the future (for the purposes of KSA Annual Reports, other sources of publicly available data, etc.?)

- Anonymised data concerning all events happening on the system
- Change in registrations
- Change in registration duration
- Ending of registrations
- Number of checks carried out
- What types of check (1st-time registration or returning)
- Tracking responses on the KSA side (whether or not player is excluded, and error messages)

Question 10 - How is CRUKS funded? Is it from public money, or via fees from licence-holders?

- CRUKS is paid for from Kansspelautoriteit's general income. There is no special hypothecated fee charged to licence-holders.