AUT

CAPPING GAMBLING IN NZ:
THE EFFECTIVENESS OF LOCAL GOVERNMENT POLICY INTERVENTION

2020

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ACKNOWLEDGEMENTS

PUBLISHED

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EXECUTIVE SUMMARY

The overarching aim of this research is to understand the impact of public policy interventions on gambling in New Zealand. For this purpose, we focus on Class 4 gambling (i.e. pokies). The Gambling Act 2003 mandates baseline restrictions regarding the number of electronic gaming machines (EGMs) per Class 4 venue. However, many territorial authorities (TAs) have adopted stronger regulations in recent years, including absolute caps on number of EGMs and / or venues; per capita caps on number of EGMs and / or venues; and sinking lid policies (restricting transfer of Class 4 licenses in order to slowly reduce availability over time). We use quasi-experimental methods to assess the impact of these local government policies on the number of EGMs, venues, and machine spending. We also assess the indirect impact on use of gambling intervention services, as well as personal bankruptcy rates. Our analysis is at the TA-level over the period 2010 to 2018.

Key findings include:

➢ All three forms of policy intervention are effective in reducing Class 4 venues and EGMs relative to the reference group (i.e. TAs with no restrictions beyond those in the Gambling Act 2003). **All impacts described below are in comparison to the reference group.**

➢ Absolute caps are estimated to reduce the number of EGMs by 67 (15 percent) and the number of venues by 7 (16.9 percent), on a per 100,000 population basis over one year. Estimated reductions are similar for per capita caps (85 EGMs and 8 venues, respectively).

➢ Sinking lids and per capita caps are equally the most effective at reducing machine spending. The sum of contemporaneous and lagged effects equate to a drop in machine spending of 13 percent for the sinking lid, while for the per capita cap, the 14 percent reduction in machine spending is wholly contemporaneous.

➢ There are mixed findings with respect to the impact of gambling policies on use of intervention services. For example, an increase in service use is found a year after implementation of per capita caps; whereas a decrease is detected in the year of implementing a sinking lid policy.

➢ In modelling personal bankruptcy rates, we tested various indicators of accessibility. These indicators approximated proportion of the TA population within 0.5km; 1km; and 2km of an EGM. None of these accessibility indicators were statistically significant in explaining bankruptcy.

➢ There is limited evidence linking policy interventions to lower levels of bankruptcy. For only one out of three specifications trialled was there weak evidence that a sinking lid reduces bankruptcies.

1 Introduction

Problem gambling is a significant public health concern in New Zealand (NZ), affecting approximately 11 percent of New Zealanders each year (Department of Internal Affairs, 2008).[2] Class 4 gambling, defined as non-casino electronic gaming machines (EGMs) and commonly referred to as 'pokies,' contributes the most harm to NZ compared to other types of gambling (Ministry of Health, 2019).[3] According to the National Gambling Study of 2014, over half of the total Class 4 gambling expenditure comes from individuals considered to be high risk or problem gamblers (Abbott et al., 2016).

The Gambling Act 2003 mandates the baseline set of restrictions regarding number of EGMs per Class 4 venue. However, many territorial authorities (TAs) have adopted stronger regulations in recent years, including absolute caps on the number of machines, the number of venues, or both; per capita caps on the number of machines, the number of venues, or both; and sinking lid policies restricting the transfer of Class 4 licenses in order to slowly reduce availability over time.

The main aim of this study is to assess the impact of these local government responses to problem gambling using quasi-experimental methods. We first focus on the direct impact of the aforementioned local government policy instruments on number of EGMs, venues, and gambling expenditure. We find that all forms of Class 4 gambling policy interventions are effective in reducing venues and EGMs, relative to the reference group of TAs that only employ the baseline restrictions outlined in the Gambling Act 2003. Our key finding is that reduction in access to Class 4 gambling is estimated to reduce gambling expenditure from EGMs by between 10 and 14 percent, relative to the reference group.

We also examine the indirect effect of TA policies on gambling intervention services. There are mixed findings here. For TAs that have implemented per capita caps, results suggest an increase in service use a year after implementation, relative to the reference group. In contrast, implementing a sinking lid policy results in a decrease in service use in the current year, relative to the reference group.

Finally, we examine the impact on personal bankruptcy rates. For this purpose we create three distance variables that approximate access for population within each TA over time: being within 0.5km; 1km; and 2km of an EGM. Regardless of which distance indicator is utilised in our regression model, we do not find these variables to be significant in explaining bankruptcy. Furthermore, for only one of the three specifications used do we find weak evidence that a sinking lid policy reduces bankruptcies.

The remainder of this report is organised as follows: Section 2 lays out the legislative background in NZ; the theoretical understanding regarding problem gambling; and a brief summary of the international

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[2] Based on population estimates from the 2018 Census.

[3] There are four main types of gambling that contribute to harm in NZ: non-casino electronic gaming machines (EGMs); table games and EGMs at casinos; sports and race betting at Totalisator Agency Board (TAB) outlets; and lottery products from the NZ Lotteries Commission (Ministry of Health, 2019).

literature. Section 3 illustrates the core data, while Section 4 describes the methodology used. Section 5 reports results of the analysis. Sections 6 and 7 provide additional analysis that examines the impact on the use of gambling intervention services and personal bankruptcies. Finally, Section 8 concludes along with outlining some limitations and directions for future research.

2 Background

2.1 Legislative background

Problem gambling has been recognised as a significant issue in NZ since the early 2000s, when the Gambling Act 2003 (hereafter "the Act") significantly changed the industry's regulatory environment and declared gambling to be a public health concern (Adams, Raeburn & De Silva, 2009). The Act has several explicit purposes, including controlling growth in gambling; minimising community harm; clarifying legal versus prohibited gambling; and ensuring that gambling proceeds benefit the community.

Importantly, the Act also clarified regulatory agency roles. The Department of Internal Affairs (DIA) is responsible for all forms of gambling law enforcement, while the Ministry of Health (MoH) is tasked with organising and funding NZ's approach to addressing problem gambling. As part of their role, the MoH is required to regularly develop strategic plans focused on preventing and minimising gambling harm in NZ. This study is intended to contribute to the scientific research and evaluation requirement of the latest strategic plan.

The Act defined Class 4 gambling as operating EGMs in a non-casino venue, such as in pubs and clubs.[4] Several studies have found that Class 4 gambling is the most common form of gambling associated with pathological or problem gambling behaviour (Dowling, Smith & Thomas, 2005; Abbott, 2006; Storer, Abbott & Stubbs, 2009).

Most relevant to the present analysis, the Act established limits on the number of EGMs that could be licensed within any Class 4 venue. Specifically, the Act limits the number of EGMs to 18 per venue if a gambling license was granted before 17 October 2001, and 9 per venue if a license was granted later. These restrictions provide a baseline level of Class 4 regulations applying to all TAs in NZ.

Since the introduction of the Act, many TAs have put in place stricter limits on EGMs and Class 4 venues. There are three types of such policies: absolute caps on the number of EGMs or Class 4 venues within a TA; per capita caps on EGMs or Class 4 venues within a TA; and sinking lid policies, wherein EGM licenses are non-transferable, and so Class 4 venue closures or relocations serve to permanently lower the absolute cap on EGMs within the TA. Sinking lid policies are the strictest of these measures.

TAs are also required to revisit their Class 4 gambling policies every three years. Consequently, NZ provides a good case study to understand the impact of local government policy responses to problem

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[4] Classes of Gambling, NZ Department of Internal Affairs, online at https://www.dia.govt.nz/diawebsite.nsf/wpg_URL/Services-Casino-and-Non-Casino-Gaming-Classes-of-Gambling (accessed 18 July 2019). Note that although TAB outlets are regulated under TAB policies at the TA level, TABs that operate EGMs are considered Class 4 venues.

gambling, as there is both geographical and time variation in policies. This permits the use of quasi-experimental methods to estimate the causal impacts of these policies on the number of Class 4 venues, number of EGMs and machine spending.

2.2 Theoretical framework

There are four main theories that seek to understand gambling behaviour, its harm to the community, and potential interventions to reduce the prevalence of problem gambling. These are: 1) availability theory; 2) adaptation theory; 3) the mental health theory of addiction; and 4) the public health model of problem gambling. These theories have shaped NZ's public policy strategies for minimising harm associated with problem gambling and are detailed below.

The earliest theory of gambling behaviour is known as "availability theory" or as the "availability hypothesis". This theory holds that problem gambling is positively linked to exposure. Early research examining the state-level legalisation of several new types of gambling in the United States during the 1980s and 1990s supported this hypothesis (Volberg, 1994). As the opportunity to gamble increases, rates of pathological gambling also increase. Availability theory therefore predicts that restrictions on Class 4 gambling, including a reduction in venues and/or EGMs (on a per capita basis), will indefinitely decrease rates of problem gambling and associated harms. This theory drives our hypothesis that Class 4 gambling policies that lower or restrict the number of gaming machines will ultimately lower the rates of problem gambling in the affected community.

However, research in NZ suggests other mechanisms are also at work (Abbott, 2006; Abbott, 2017). Abbott notes that three new types of gambling were legalised in NZ in the late 1980s: a national lottery, instant lotteries (commonly known as scratch tickets), and EGMs. Data suggests that availability of new venues and forms of gambling was associated with increased participation in gambling initially. However, this increase only continued for up to two years, after which gambling participation declined. This finding is consistent with the "adaptation theory" or "adaptation hypothesis". This theory argues that gambling behaviour is influenced by several psychosocial and economic factors beyond availability, and that problem gambling behaviour may be influenced by public health interventions (Abbott, 2006).[5]

Abbott (2017) further notes that since 2000, gambling participation in NZ has continued to decrease, but rates of problem gambling have remained relatively constant. The author speculates that observed declines in gambling participation paired with steady rates of problem gambling may be driven by accumulation of the stock of problem gamblers over time, many of whom are at high risk of

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[5] Abbott (2006) studies EGM prevalence in Australia, noting that the positive relationship between the prevalence of EGMs and gambling participation appears to break down between six and ten EGMs per 1,000 adults. He also finds that caps on EGMs and a reduction in EGMs have no effect on gambling participation. Problem gambling associated with an increase in EGMs appears to be short-term in nature.

relapse. Abbott concludes that since the 1980s, patterns of gambling and problem gambling in NZ are at odds with features of both the availability and adaptation hypotheses. The implication is that reducing EGMs or venues won't be enough to prevent problem gambling and gambling related harms associated with EGMs, and other policy responses may also be necessary.

The third and fourth theories of gambling—the mental health and public health models, respectively— are also important drivers of public intervention strategies. With the publication of the Diagnostic and Statistical Model of Mental Disorder (DSM III) in 1980, the American Psychiatric Association first recognised "pathological gambling as a disorder of impulse control" (Lesieur & Rosenthal, 1991; American Psychiatric Association, 2013). Since then, this theory has become widely recognised as a successful approach to diagnosing and treating pathological gambling. While the mental health theory of addiction has been a useful lens through which to examine pathological gambling, it is not without its criticisms, due to its focus on the individual.

The public health model of gambling, first described by Korn and Shaffer (1999), recognises the importance of the mental health model, but seeks to offer a more holistic approach, including harm minimisation. This model targets the individual (problem gambler), the activity (gambling), the mechanism (EGMs) and the relevant environment (family, community and society, among others) which contribute or could abate problem gambling and its related harms (Abbott et al., 2017).

The broad scope of the public health model directly informed the MoH's NZ Strategy to Prevent and Minimise Gambling Harm 2016/17 and 2018/19.[6] The model also permits policy makers to approach problem gambling minimisation from multiple levels. For instance, by creating policies that help individual problem gamblers and by implementing community-wide policies and programmes. The Class 4 gambling policies, enacted at the TA-level, are a community approach to minimising gambling related harm associated with pokies.

In terms of relevant NZ literature, there is little evidence regarding the effectiveness of Class 4 gambling policies. In a descriptive analysis of sinking lid policies by the Sapere Research Group in 2018, the authors note that reductions in EGMs are not strongly correlated with reduced expenditure in high deprivation neighbourhoods, which may be due to the small magnitude of reductions relative to their existing numbers (Rook et al., 2018). The authors plot the change in EGMs against the change in gambling expenditure for each TA over fiscal years 2014 to 2017. Although some TAs showed reductions in both EGMs and gambling expenditure, many did not. In fact, many TAs (especially those with high levels of deprivation) exhibited increased gambling expenditure despite a reduction in EGMs.

In another study of Class 4 venues and EGMs, Cox and Hurren (2017) investigate why nominal gross gaming machine proceeds suddenly increased in late-2013 after a steady decline since the Act came

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[6] Strategy to Prevent and Minimise Gambling Harm 2016/17 to 2018/19, Ministry of Health, online at https://www.health.govt.nz/publication/strategy-prevent-and-minimise-gambling-harm-2016-17-2018-19 (access 24 July 2019).

into force. The authors use time series models that predict machine spending based on lagged values of machine spending, personal income, venue numbers, gross domestic product (GDP), population, and tourism visitor numbers. Additional lags of the right-hand side variables are also included in the model as covariates. However, the models were not successful in predicting gaming machine proceeds. The authors stated that promising avenues for future research include consideration of micro-level data, which directly highlights our main contribution to this literature.

2.3 International literature

Many international jurisdictions implement policies that limit access to EGMs. These restrictions vary in both intensity and reach. Regulatory coverage can be at the national-level, such as in Norway, or at the regional-level. Examples of the latter occur in Canada, where regulations vary provincially, and in the U.S. and Australia, where regulations are determined at the state-level. In this section we provide an overview of common policies utilised internationally and a summary of relevant policy evaluations in this space.[7]

2.3.1 COMMON POLICIES THAT LIMIT EGM ACCESS

Policies limiting access to EGMs cover a broad range, from the extreme (e.g. total bans) to those that are lower coverage in nature (e.g. age restrictions).[8] Table 1 presents a brief overview of the most common policy categories internationally.

Table 1. Common policies that limit access to EGMs

Policies	Definitions
Bans	
Blanket ban	No EGMs allowed to operate anywhere in the jurisdiction.
Venue ban	EGMs permitted in specific venues types only.[9]
Caps	
Per capita caps	A cap on number of EGMs and / or venues on a per capita basis within a jurisdiction.
Absolute caps	A cap on number of EGMs and / or venues within a jurisdiction.
Per venue caps	A cap on number of EGMs per venue within a jurisdiction.
Sinking lid	A limit on number of EGMs and venues within a jurisdiction that is permanently lowered with each reduction of EGMs or venues.
Individuals	
Age restrictions	Minimum gambling age.
Intoxication	Individuals banned from using machines while intoxicated.

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[7] Most policies referred to in this section are with respect to EGMs outside of casinos, given the focus of our analysis. A few relate to the combined group of casino and non-casino EGMs.

[8] Note that not all jurisdictions use the term 'EGM'. For example, gaming machines are referred to as VLTs (Video Lottery Terminals) in Canada. We use the collective term of EGMs to encompass gambling machines internationally.

[9] One variant of bans is a temporal restriction with respect to access hours. For example, regulation restricting opening hours.

Bans

By far the most extreme policies limiting access to EGMs are blanket bans. Although rare, blanket bans have been implemented in several jurisdictions, including NZ where EGMs were banned until their legalisation in 1988 (Abbott, 2017). In Norway, in 2007, in response to rising concern regarding the harm caused by problem gambling, the government banned all EGMs (Lund, 2009). Before the ban, EGM revenue had risen substantially from NOK 9 billion in 2001 to NOK 27 billion in 2005 and EGMs were available in a wide range of locations, including shopping centres and train stations (Norsk Tipping, 2010). While new EGMs were reintroduced into Norway in 2009, the new machines are under the control of a government operator and have particular features aimed at making them less harmful such as mandatory play breaks, lower prizes, limits on gambling amount, and inability to insert cash (Engebø, 2010).

Other examples include: blanket bans in the three U.S. states of Alaska, Hawaii and Utah (Friedl, 2020), and bans on EGMs in Hungary and Western Australia, apart from those within casinos (Szczyrba, Fiedor & Smolová 2016; Stevens & Livingston, 2019).

Venue bans are a more common policy. For instance, in 2015, Poland banned EGMs in convenience locations, restricting them to casinos and gaming halls (Sulkunen et al., 2018). Similarly, in the Canadian province of British Columbia, EGMs are only permitted in casinos, gaming centres, and co-located racetrack casinos (Gaming Policy and Enforcement Branch, 2019).

Caps

A less intensive way of restricting access to EGMs, compared to bans, involves capping EGMs and / or venues in some form. Australia is a good example on this front. Each Australian state sets some form of cap on EGMs (Livingstone et al, 2019). This is similar to the reference policy in NZ that was created by the Gambling Act 2003, whereby each TA faces a cap on number of EGMs per venue. The point of difference is that this base policy is the same across all TAs in NZ, whereas the base cap in Australia is state-specific.

Furthermore, and again in a similar fashion to NZ, Australian states can undertake additional regulation. For instance, in the state of Victoria, in 2000, a per capita cap was introduced (over and above the base cap of 27 500 non-casino EGMs). [10] The cap was specifically targeted at disadvantaged communities and was 11.7 EGMs per 1,000 adults (McMillen, J. & Doran, B., 2006). Municipalities within Victoria that didn't meet this threshold were given three years to become compliant.

Other selected examples of per venue caps which illustrate differing regulations dependent on the type of venue include the following: hotels in Australian's Northern Territory are permitted up to 20 EGMs, while clubs in the same state may have up to 55 (Livingston et al, 2019); most non-casino venues in

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[10] See Australian Productivity Commission (2010).

Alberta (Canada) are permitted up to 14 EGMs, while gaming entertainment centres in the same province may have up to 49 (AGLC, 2020); and in the U.S. state of Nevada, up to 7 EGMs are allowed in each convenience store, with a limit of 4 EGMs in liquor stores, and other venue types assessed individually (Nevada Gaming Commission & Nevada Gaming Control Board, 2020).

Finally, to the best of our knowledge, the only jurisdiction with use of a sinking lid regulation is NZ. As indicated earlier, a sinking lid policy prohibits transferring EGM licenses. As such, venue closures serve to permanently lower the number of non-casino EGMs within the relevant TA.

Individuals

Most jurisdictions have a minimum gambling age, usually varying between 18 - 21 years, with limits often depending on the form of gambling (Sulkunen et al., 2018).[11]

In many jurisdictions, the minimum gambling age is set with reference to the minimum drinking age, especially since most gambling venues are often liquor-licenced. In Canada, for example, gambling and alcohol consumption are regulated under the same legislation, the Gaming, Liquor and Cannabis Act. While access to EGMs and liquor are often co-located, jurisdictions often regulate against intoxicated individuals gambling. Using another example from Canada (from the province of Alberta), individuals who "appear to be intoxicated" are not allowed to engage with EGMs (AGLC, 2020).[12]

In Europe, the most common gambling age is 18. Across much of the U.S., the gambling age is 21, although it is set at 18 in a number of states for casino gambling (American Gambling Association, 2020). In NZ, the gambling age is 20 for casinos, and 18 for EGMs outside of casinos.

2.3.2 INTERNATIONAL LITERATURE FINDINGS

Policy evaluations in this space are scant. This is likely due to lack of relevant data, and a scant number of quasi-experimental settings to draw from. As such, many of the studies referred to in this sub-section refer to cross-sectional analysis. Table 2 presents a summary of selected studies.[13]

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[11] There are few exceptions to this age range. For example, according to section 48 of the UK Gambling Act 2005, 16-year olds can participate in the lottery, football pools, and use Category D gaming machines (UK Gambling Act, 2005).
[12] The penalty options for violating AGLC policies and guidelines include termination of the Video Lottery Agreement by AGLC, as well as suspension of the venue's ability to operate the EGM equipment (AGLC, 2020).
[13] Given the focus of this research, we do not delve into the vast literature on the impact of availability of casinos.

Table 2. Summary of selected international studies

Region	Availability change	Year	Key findings
Australia			
Queensland	Allowed EGMs in hotels	1991	The increase in EGM availability was associated with an increase in problem gambling (Australian Institute for Gambling Research, 1995).[14]
Victoria	Absolute cap of 27,500 EGMs	1995	The decrease in EGM availability was associated with no impact on EGM expenditure (South Australian Centre for Economic Studies, 2008).
Victoria	Per capita cap of 11.7 EGMs per 1,000 adults	2000	The reduction in the number of EGMs resulted in no impact on gambling expenditure and little change in the spatial distribution of gambling expenditure (McMillen & Doran, 2006).[15]
U.S.			
Louisiana	Allowed EGMs in parishes	1992	The increase in EGM availability was associated with an increase in gamblers anonymous groups (Campbell & Lester, 1999).
South Dakota	Blanket ban	1995	The reduction in EGMs was associated with a reduction in demand for problem gambling treatment services (Carr et al., 1996).[16]
South Carolina	Blanket ban	2000	The reduction in the number of EGMs was associated with a reduction in gambling anonymous groups and a long-term reduction in demand for problem gambling help (Bridwell & Quinn 2002, Williams, West & Simpson 2012).
Others			
Switzerland	Venue ban – no EGMs permitted outside casinos	2005	The reduction in EGMs was associated with no change in problem gambling, but a clear drop in problem gamblers with probable alcohol problems (Bondolfi et al. 2008).[17]
Norway	Blanket ban	2007	The reduction in EGMs was associated with no increase in other forms of gambling by either high, or low-intensity EGM players (Lund, 2009).
Nova Scotia (Canada)	Reduction in EGM venue opening hours	2005	The decrease in EGM availability was associated with a 5 – 9% reduction in gambling revenue and 18% reduction in spending by problem gamblers (Nova Scotia Gaming Corporations, 2005).

As shown in Table 2, there are two main types of results regarding a change in EGM availability and the resulting impact on gambling behaviour. First, there are a number of studies that find a positive association, and thus align with the availability hypothesis put forward in the theoretical framework description. For example, evidence points to a rise in problem gambling following EGMs being permitted in hotels in Queensland (Australia) in 1991. Further, past research also shows a drop in

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[14] Measured by expenditure as a percentage of total income.

[15] One area had an increase in the number of machines during the study period, the hotspot in that locality also experienced a decline in relative gambling intensity.

[16] The ban lasted only 3 months.

[17] It is notable that while non-casino EGM numbers decreased as a result of the ban, the number of casino licences increased by 19, possibly confounding the results.

availability in the U.S. states of South Dakota and South Carolina, as well as Nova Scotia in Canada, decreased gambling activity. Here it is important to note the range of measures employed to proxy for gambling behaviour: in South Dakota and South Carolina, the outcome of interest was the demand for problem gambling help services; while in Nova Scotia it was spending by problem gamblers and gambling revenue.

The second type of result in Table 2 is that of no impact. For instance, both the absolute cap in 1995 and the per capita cap in 2000 introduced in Victoria (Australia) were not found to be associated with any changes in gambling outcomes as measured by EGM expenditure. Similarly, in Switzerland, the drop in EGM availability was not empirically linked to a change in problem gambling. However, Bondolfi et al. (2008) did find the policy change in Switzerland was associated with a drop in the number of problem gamblers with alcohol problems.

There are a range of arguments put forward to explain finding no impact. The South Australian Centre of Economic Studies (2005) argued that there was likely poor enforcement of the policy changes to reduce EGM availability in Victoria. There are also confounding influences to consider in these analyses where the research cannot draw on all relevant data requirements. It was also noted that in the case of Australia, the machines which were removed were the least profitable and least popular (Vasiliadis et al. 2013) indicating another potential reason for finding no impact in some Australian studies.

One final study to highlight is Storer et al. (2009). This study used data from 34 surveys on availability of EGMs and prevalence of gambling activity across Australia and NZ to perform a meta-analysis. One of their key findings was that each additional EGM introduced into an area was associated with 0.8 new problem gamblers, on average. This finding concurs with the availability hypothesis, which posits that increased exposure to EGMs is associated with an increase in gambling activity.

3 Data

3.1 Data source and descriptives

Data are sourced from the DIA, Stats NZ and each local government body.

We first sourced TA-level statistics on the outcome variables of interest - number of Class 4 venues, number of EGMs, and gaming machine proceeds (GMP) from the DIA. The data are quarterly and span the period Q2 2010 to Q4 2018. We collapse this information to produce annual figures at the TA-level for our outcome variables, specifically the annual mean values for number of Class 4 venues and number of EGMs, and the annual sum of GMP. We also adjust the venue and EGM indicators for population by dividing the annual mean values per 100,000 population. Furthermore, we adjust the annual GMP figures for population and inflation to derive the real GMP per capita at the TA level, in 2019 dollars.

Over our sample period of 2010 to 2018, we find the average annual EGMs and venues per 100,000 population decrease by 28.7% and 26.5% respectively; while machine spending (measured in terms of real GMP per capita) decreases by 13.1%.[18]

We next sourced data on the type of Class 4 gambling policies adopted by TAs over time by contacting each of NZ's 67 TAs under the umbrella of the Official Information Act (OIA). Responses were used to construct a novel panel of TA-level Class 4 gambling policy types over the period 2004 to 2019. This unique dataset also includes information on the specific number of EGMs and venues allowed within the TA over time, on a quarterly basis. We collapsed this information to produce annual policy indicators based on the first quarter of available information for each year. Therefore, gambling policies were sourced from Q1 for the years 2011 to 2018, and Q2 for the year 2010.

We control for the age, gender and ethnicity distributions in each TA using data from Stats NZ.[19] Ethnicity by age cohort is not generally available at the TA-level outside of census years. Therefore, to estimate ethnicity by age cohort for each TA, for each age cohort, we first construct the proportion of five ethnic groups– Asian, European, Maori, MELAA (Middle Eastern/Latin American/African) and Pacific Peoples – for each census year 2006, 2013 and 2018. With these rates, we use spline functions to interpolate ethnicity rates. [20] We then apply these rates to available population levels available for each TA by year, to obtain annual estimates of population by ethnicity, for each age cohort across every TA.

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[18] It is necessary to note the importance of ensuring our outcomes of interest account for population size and inflation changes over time. For example, the change in GMP over our sample timeframe would be an increase of 13.2% if not adjusted for population and inflation; and if only adjusted for inflation (in 2019 dollars), the change would be an increase of 0.97%.

[19] Dataset: Subnational population estimates (TA), by age and sex (using 2019 boundaries).

[20] Using the method described in Forsythe, Malcolm and Moler (1977).

We also include annual information on the deprivation level of each TA, which has been interpolated between census years using spline functions, in a similar fashion to what was conducted with demographic indicators. Our final covariate included is estimated annual GDP growth rate for each TA, based on TA-level GDP estimates produced by the Ministry of Business, Innovation and Employment (MBIE).

Our resulting sample, which merges information from the above sources, is annual in nature, cover the 67 TAs in NZ and spans the period 2010 to 2018.[21] Table 2 provides definitions for our outcome variables, key policy indicators, and control variables. All descriptives in Table 3 are unweighted TA-year means.

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[21] The annual nature of the dataset is due to our available demographic information from Stats NZ being annual. Nonetheless, when we estimate the empirical models using quarterly data and omitting demographic covariates, our findings are qualitatively similar.

Table 3. Descriptive statistics for gambling policy evaluation

Variables	Definitions	Mean
Gambling policy[22]		
Reference group	A policy which re-states the minimum standards in the Gambling Act 2003, i.e. a limit on the number of EGMs to 18 per venue if a gambling license was granted before 17 October 2001, and nine per venue if granted later.	0.18
Absolute cap	A cap on number of machines and/or venues within a TA.	0.35
Per capita cap	A cap on number of machines and / or venues on a per capita basis within a TA.	0.13
Sinking lid	A limit on number of EGMs and venues within a TA that is permanently lowered with each reduction of EGM or venue.	0.34
Outcome variables		
Machine spending	Gross money spent on EGM gambling, less wins paid out (real 2019 $), per capita of each TA.	185.91 (56.82)
EGMs	Number of EGMs per 100,000 population of TA.	449.27 (167.48)
Venues	Number of Class 4 venues per 100,000 population of TA.	40.77 (21.49)
Control variables		
Female (%)	The percentage of the population that is female.	50.80
Aged 15 - 39 (%)	The percentage of the population aged between 15 and 39.	27.85
Aged 40 - 64 (%)	The percentage of the population aged between 40 and 64.	39.09
Aged 65+ (%)	The percentage of the population aged 65 or more.	18.60
NZ European (%)	The percentage of the population whose prioritised ethnicity is NZ European.	74.56
Māori (%)	The percentage of the population whose prioritised ethnicity is Māori.	17.67
Pasifika (%)	The percentage of the population whose prioritised ethnicity is Pasifika.	3.04
Asian (%)	The percentage of the population whose prioritised ethnicity is Asian.	4.19
MELAA (%)	The percentage of the population whose prioritised ethnicity is Middle Eastern, Latin American, or African.	0.54
Deprivation	The weighted average of meshblock deprivation deciles using the usual resident population within each meshblock[23]. Deprivation is an ordinal scale ranging from 1 (least deprived) to 10 (most deprived).	5.88 (1.44)
GDP growth rate	Annual GDP growth rate.[24]	4.31 (6.67)
Observations		536

Notes: Data cover the 67 TAs in NZ from 2010 to 2018. The machine spending variable used in the regression is the natural log of the variable defined in this table. All descriptives are unweighted TA-year means. Standard deviations are shown in parentheses.

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[22] The means for the four gambling policy groups represent the proportion of each group in the sample.

[23] We follow the aggregation process recommended by Atkinson et al (2019).

[24] Derived from modelled TA-level GDP estimates at https://www.mbie.govt.nz/business-and-employment/economic-development/regional-economic-development/modelled-territorial-authority-gross-domestic-product/

3.2 Class 4 gambling policies

Since 2004, all TAs have been required to adopt a Class 4 gambling policy.[25] At a minimum, they could restate the venue and EGM thresholds provided in the Act. These are 9 gaming machines per Class 4 venue, and 18 if the EGM license was issued before October 2001.

As indicated earlier, many TAs have adopted policy interventions that have stricter regulations in addition to those provisioned by the Act. The first policy intervention is a simple absolute cap on the number of either EGMs or Class 4 venues the TA will allow in the district. It is understood that, in practice, TAs have not set caps below the number of EGMs or venues that were in the district at the time the policy was passed. Therefore, a cap is an instrument used to keep the number of machines or venues relatively constant.

The second policy intervention is a per capita cap on the number of either EGMs or Class 4 venues. This type of cap aims to keep EGM or venue numbers proportional to the resident population in the TA.

Finally, the third and strictest policy intervention, is the sinking lid policy. This is a cap on the number of EGMs or Class 4 venues allowed in the TA, which sinks as venues lose their licenses. This means that no new licenses are granted in the TA and any licences lost cannot be reallocated to a new venue or used to expand an existing venue's EGM capacity. Potentially, some TAs may use a sinking lid policy to reduce the number of EGMs, before adopting an absolute or per capita cap.
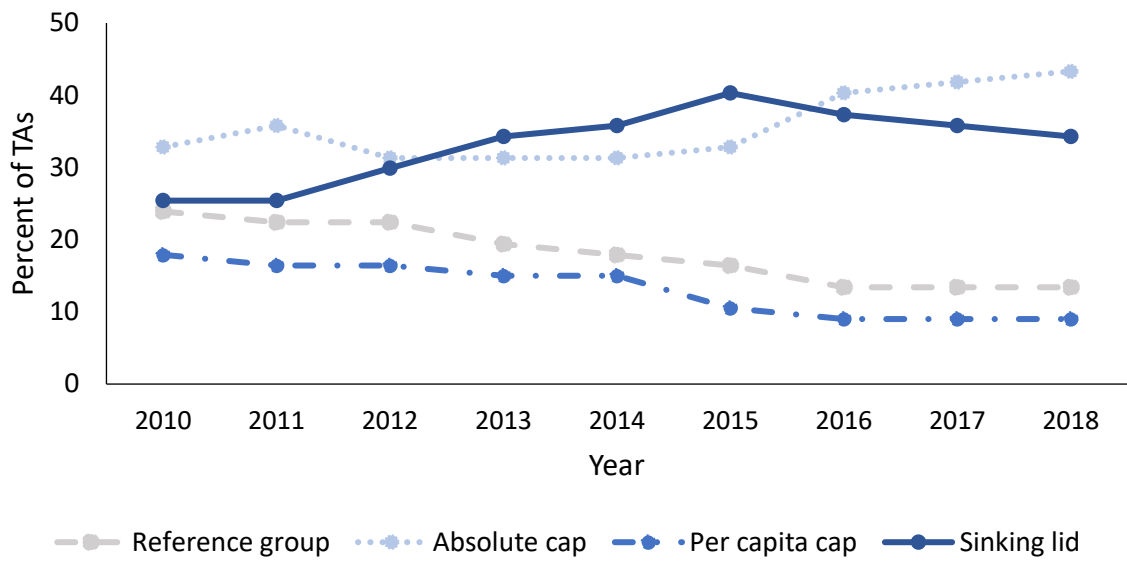
TAs which have none of the three policy interventions form the reference group in the following analysis.

There is substantial geographic variation in Class 4 gambling policies over time. As illustrated by Figure 1, the number of TAs in our reference group is just over 25% in 2010; decreasing steadily over time to 14% in 2016. TAs adopting absolute caps vary considerably over time. The numbers are lowest in 2012 and 2013 at just over 31%, and peak in 2018 just over 43%. The number of TAs adopting per capita caps drops considerably between 2010 (just under 18%) and 2016 (just under 9%). Finally, the number of TAs adopting a sinking lid policy grows from 2011 to 2015 (25% to 40%) and then dips to 34% by 2018.

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[25] According to section 101 of the Act, TAs needed to adopt a Class 4 venue policy within 6 months of the section's commencement (3 September 2003).

Figure 1. Class 4 gambling policy types, by year

Notes: Data sourced from TAs through individual OIA requests. Percentages represent the TAs policy as of the second quarter in each calendar year.

4 Method

We evaluate the effectiveness of TA-level interventions using variation in geography and policy timing. We focus on Class 4 gambling, of which there are three distinct policy interventions: absolute venue and/or EGM caps (AC); per capita venue and/or EGM caps (PC); and sinking lid policies (SL). Policy interventions are captured by dummy variables equal to one if the policy was in place in the TA in a particular year, and zero otherwise. The reference group are TAs that did not impose any additional restrictions on Class 4 gambling beyond baseline restrictions set forth in the Act.

The econometric model may be expressed as:

$$y_{it} = \beta_0 + \beta_1 AC_{i,t} + \beta_2 AC_{i,t-1} + \beta_3 PC_{i,t} + \beta_4 PC_{i,t-1} + \beta_5 SL_{i,t} + \beta_6 SL_{i,t-1} + \boldsymbol{X\theta} + \delta_t \\ + \delta_i + \varepsilon_{it} \tag{1}$$

where y_{it} is an outcome for TA i in year t. Three direct outcomes of interest are examined—the number of Class 4 venues; the number of EGMs; and machine spending.

To capture the impact of varying policy interventions at the TA-level, we use a difference-in-differences approach. $\boldsymbol{X}$ is a vector of demographic controls which includes ethnicity, age, and gender composition. $\boldsymbol{X}$ also includes the deprivation level over the sample period to help capture socio-economic status at the TA-level, as well as annual GDP growth rates at the TA-level. One-year lags are included to estimate the delayed effect of policies on outcomes. Summing the contemporaneous and lagged impacts of each policy intervention provides an estimate of the cumulative impact in the first two years. TA and year fixed effects remove time-invariant factors which affect gambling behaviour within each TA. An idiosyncratic error term, ε_{it}, captures all other factors which are not taken account of in the model.

Because data are naturally clustered into TAs, ignoring this feature will result in standard errors that are misleadingly small and confidence intervals that are too narrow. As a result, estimates would appear more precise than they are. To obtain the correct standard errors we conduct inference using bootstrapped clustering (see Cameron and Miller, 2015, and MacKinnon, 2019 for details).

5 Results

Table 4 presents model estimates for our three outcomes of interest. There is evidence of effectiveness across all three forms of policy intervention (absolute cap, per capita cap, and sinking lid) of reducing venues and EGMs relative to the reference group. For example, as shown in column (1) of Table 4, the impact of an absolute cap policy (relative to the reference group) is a drop of 67 EGMs and approximately 7 venues (per 100,000 population) over one year. This equates to a 15 percent drop in EGMs and a 16.9 percent drop in venues, per 100,000 population. In terms of magnitude, numbers are marginally larger for the per capita cap policy (85 machines and 8 venues respectively), and lower for the sinking lid policy (36 machines and 4 venues respectively). As shown in Table 4, the direct impact on the number of venues and EGMs are contemporaneous in nature, with no significant impacts in the following year.

The impact on gambling expenditure is of key importance and is shown in column (3) of Table 4. This variable is measured as the natural logarithm of machine spending in real 2019 dollars. Regression coefficients are therefore interpreted as a percentage change. For example, a coefficient of -0.10 for an absolute cap indicates that compared to the reference group, this policy intervention resulted in a 10 percent decline in gambling expenditure.

When assessing the cumulative impact of policy interventions (sum of both contemporaneous and lagged effects), it appears that per capita caps and sinking lids are the most effective in reducing gambling expenditure. Compared to the reference group, either of these policy interventions has the cumulative impact of reducing gambling expenditure by an estimated 13 - 14 percent. We find that absolute caps reduce overall gambling expenditure by 10 percent.[26]

Of further note, the sinking lid appears to be the only policy intervention with evidence of both contemporaneous and lagged negative impacts on gambling expenditure.

We tested the sensitivity of our findings by replicating the regression model with weights based on the TA-level population statistics. Our results remain qualitatively similar, thus providing a reassuring signal of robustness of findings.

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[26] Note that a Wald test of the sum of the contemporaneous and lagged coefficients is statistically significant at the 1 percent level, regardless of whether focussing on the impact of absolute cap, per capita cap or sinking lid; on machine spending.

Table 4. Impact of gambling policies on EGMs, Venues and Machine spending

Variable	(1) EGMs	(2) Venues	(3) Machine spending
Outcome variables			
Absolute cap	-67.18**	-6.88**	-0.10**
	(26.84)	(3.43)	(0.04)
Lagged absolute cap	6.14	-0.07	-0.03
	(21.93)	(2.08)	(0.02)
Per capita cap	-84.64**	-8.01**	-0.14***
	(33.29)	(3.94)	(0.05)
Lagged per capita cap	8.28	-1.08	-0.03
	(24.74)	(2.53)	(0.03)
Sinking lid	-36.21*	-4.47*	-0.08***
	(19.65)	(2.61)	(0.03)
Lagged sinking lid	-11.53	-0.36	-0.05***
	(19.78)	(1.83)	(0.02)
Control variables			
Female (%)	117.71	2.95	-0.02
	(72.29)	(2.64)	(0.03)
Aged 15 - 39 (%)	50.59***	3.49**	0.05*
	(17.93)	(1.52)	(0.02)
Aged 40 - 64 (%)	69.09***	6.09***	0.09***
	(25.20)	(1.93)	(0.03)
Aged 65+ (%)	42.35***	4.17**	0.05*
	(14.53)	(1.63)	(0.03)
Maori (%)	11.08	2.27*	0.03*
	(9.74)	(1.26)	(0.02)
Pasifika (%)	65.50*	3.90*	0.01
	(35.40)	(2.31)	(0.03)
Asian (%)	16.84**	2.78***	0.01
	(8.05)	(0.82)	(0.01)
MELAA (%)	11.33	0.23	0.004
	(45.05)	(5.19)	(0.06)
Deprivation	-32.39**	0.72	0.0001
	(15.89)	(1.80)	(0.03)
GDP growth rate (%)	0.063	0.00003	0.0007
	(0.28)	(0.03)	(0.0005)
Observations	536	536	536
R-squared	0.69	0.68	0.58

Notes: Machine spending is the natural logarithm of real GMP per capita, reported in 2019 dollars. TA and year fixed effects included. Bootstrapped clustered standard errors are shown in parentheses. ***, **, and * denote statistical significance at the one, five, and ten percent-levels, respectively.
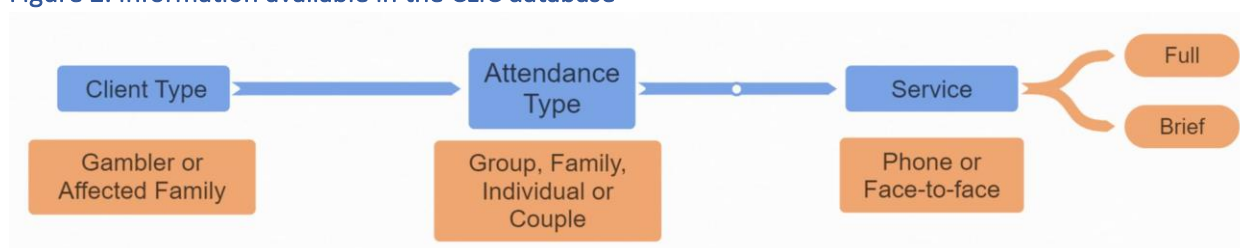
6   Impact on problem gambling service use

We next focus on one area we may expect to see changes in if there is a drop in the number of problem gamblers – use of gambling intervention services. The evidence provided in Section 2 illustrated several studies where there was a positive empirical association between EGM availability and demand for gambling help services (Campbell & Lester, 1999; Carr et al, 1996; Bridwell & Quinn, 2002; Williams, West & Simpson, 2012). However, theoretical expectations are in fact ambiguous.

For instance, a policy intervention that reduces access to gambling machines and venues and thus raises the indirect cost of gambling, in addition to the usual expected direct cost, may lead to a drop in the number of problem gamblers that need to access intervention services. On the other hand, there may be an increase in those accessing services if those on the margin of quitting and seeking help are pushed in that direction because of the additional barrier to access. Whether these two forces cancel each other out is an empirical question.

Further, there is a dynamic element to this research question. For example, if a rise in access cost pushes some problem gamblers to quit, then in the short run they may seek intervention services to aid in this endeavour. However, in the long run, we would then expect to see a drop in service use as the number of problem gamblers declines. Suffice to say there are a number of potentially opposing forces in play at both the contemporaneous and lagged stages, making it difficult to have clear hypotheses about expected outcomes.

The data used for this analysis is from the Client Information Collection (CLIC) database provided by the MoH. As Figure 2 illustrates, there are two types of services available, full and brief.[27] Each of these service types may be attended by an individual, a group, family or a couple. These services may be directed at family members, individual gamblers, or other affected parties.

Figure 2. Information available in the CLIC database

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[27] There is also a follow-up service offered to clients after they have completed a full service and have been identified as suffering problem gambling related harm.

When a client receives treatment, they are asked to identify the gambling activities that are causing then significant harm. Up to five gambling types can be recorded, and we limit our sample to clients that identify Class 4 gambling as at least one of their problem gambling activities.

All outcome variables of interest sourced from the CLIC database have been derived at the TA-level and are on an annual basis per 100,000 population over the period 2010 to 2018. Specific definitions and means of all variables across TAs are provided in Table 5.

Table 5. Descriptive statistics of intervention service use variables

Variables		Mean
All services	Total number of service contacts	442.31 (532.26)
New clients	Number of service contacts for clients identified as new within the respective year.	236.94 (329.32)
Existing clients	Number of service contacts for existing clients i.e. clients which received intervention services in a prior year	152.20 (192.48)
Gamblers	Number of service contacts where the client identifies as a problem gambler.	283.37 (317.17)
Family/other	Number of service contacts where the client identifies as being a family member or other person concerned about the main gambler.	105.77 (186.20)
Face-to-face	Number of service contacts delivered in person.	303.56 (376.06)
Phone calls	Number of service contacts delivered over the phone.	85.58 (105.35)
Brief interventions	Number of brief service contacts. Typically, part of a caseload of three or less contacts less than or equal to 30 minutes each.	73.48 (121.09)
Full interventions	Number of service contacts that are more intensive in terms of frequency and duration. These services are typically community-based assessment and intervention services.	246.08 (282.43)
Observations		536

Note: Data cover individuals who indicated that Class 4 gambling was one of their problem gambling activities and excludes non-Class 4 gamblers. Sample period is 2010 to 2018. All descriptives are unweighted TA-year means. Standard deviations are shown in parentheses.

For all outcomes described in Table 5, we employ the same difference-in-difference framework portrayed in Section 4 to examine the impact of policy interventions on the use of gambling intervention services. Table 6 presents the model estimates.

The main finding from Table 6 is that results are mixed. First, with respect to the absolute cap policy, there are no significant impacts on intervention service use of implementing this policy relative to the reference group. When viewing the impacts of a per capita cap, there are no contemporaneous effects on intervention service use, but there are signs of an increase in service use in the following year. In particular, we find a statistically significant increase in service use by new clients, and for face-to-face and full interventions, relative to the reference group.

Table 6 also shows that sinking lid policies seem to have a consistently negative and statistically significant effect on service use, relative to the reference group. Focussing on aggregate service use, as shown in column (1), we find insignificant impacts of the absolute cap and per capita cap policies (whether contemporaneous or lagged) and only one statistically significant coefficient indicating the negative impact of sinking lid with respect to use of gambling intervention services. Specifically, compared to the reference group, the sinking lid policy results in a decline of 159 service contacts in a year. This finding is significant at the 10 percent level and equates to a 36 percent drop in service use in affected TAs, relative to the reference group.

The negative impact of the sinking lid policy on gambling intervention service use also holds for various outcome indicators – whether it be face-to-face or full interventions, or the narrower subgroup of existing clients.

Not shown in Table 6, we conducted a Wald test to investigate whether the sum of contemporaneous and lagged coefficients were statistically significant for each policy intervention. Results of these tests suggest cumulative effects, regardless of which column of Table 6 we focus on, are statistically insignificant.

Given the mixed results regarding the impact of gambling policies on intervention service use, and the unclear theoretical expectation, this is an area worthy of further investigation.

Table 6. Impact of gambling policies on intervention service use

Variables	(1) All services	(2) New clients	(3) Existing clients	(4) Gamblers	(5) Family/other	(6) Face-to-face	(7) Phone calls	(8) Brief	(9) Full
Absolute cap	121.95	34.19	60.23	83.64	10.79	69.13	25.29	11.01	60.70
	(103.54)	(58.89)	(50.04)	(62.70)	(34.83)	(71.34)	(27.47)	(17.36)	(58.24)
Lagged absolute cap	9.24	17.44	10.98	28.88	-0.46	45.00	-16.58	-10.47	41.16
	(69.54)	(46.66)	(36.72)	(47.37)	(30.13)	(43.91)	(32.46)	(12.43)	(43.02)
Per capita cap	18.07	-26.66	3.88	-53.45	30.67	-20.56	-2.22	25.42	-40.07
	(164.56)	(113.54)	(73.42)	(100.88)	(74.61)	(110.52)	(44.58)	(33.46)	(94.59)
Lagged per capita cap	177.56	186.30*	0.77	170.34*	16.73	190.33**	-3.25	17.51	160.83*
	(134.76)	(105.29)	(46.75)	(94.61)	(39.11)	(94.32)	(35.00)	(32.32)	(90.79)
Sinking lid	-159.37*	-50.33	-87.23*	-96.59*	-40.97	-104.77**	-32.79	-15.11	-90.19**
	(84.14)	(43.06)	(49.03)	(53.88)	(27.23)	(52.57)	(34.04)	(13.66)	(45.36)
Lagged sinking lid	21.08	9.47	19.78	8.72	20.53	30.49	-1.23	-3.30	30.55
	(77.61)	(57.61)	(25.48)	(51.54)	(30.78)	(53.08)	(29.10)	(14.06)	(48.57)
Observations	536	536	536	536	536	536	536	536	536
R-squared	0.09	0.07	0.12	0.09	0.05	0.09	0.10	0.08	0.07

Notes: The control variables described in Table 3 are included in these regressions, but not included here for the sake of brevity. TA and year fixed effects included. Bootstrapped clustered standard errors are shown in parentheses. ***, **, and * denotes statistical significance at the one, five, and ten percent-levels, respectively.

7 Impact on bankruptcies

7.1 Introduction

This section investigates the relationship between Class 4 gambling policies and bankruptcy rates.[28]

According to the existing literature, many households where problem gamblers reside become insolvent due to unhealthy gambling behaviour. Research suggests that problem gambling results in "increased levels of poverty and bankruptcy, more family breakups, domestic violence, increased stress and anxiety and a range of wider community and (local) economic impacts" (Adams et al., 2004, p. 24). The Australian Productivity Commission (1999) also lists bankruptcy as a potential form of problem gambling harm, alongside other outcomes including suicide, depression, low productivity, and job loss.[29]

The relationship between gambling and bankruptcy has been empirically documented in international literature as well. For example, Mikhed, Scholnick, and Hyungsuk (2017) find that a policy which reduced the number of EGMs in bars in Nevada resulted in reduced bankruptcy rates. Barron, Staten, and Wilshusen (2002) examine the effects of casino gambling on personal bankruptcy filings in the U.S. Results show that casino gambling exerts a significant, albeit small, local effect on personal financial crises at the county-level. The authors estimate that eliminating casino gambling altogether in the U.S. would reduce personal bankruptcy filings by five percent for counties surrounding a casino, but only decrease the national filing rate by one percent.
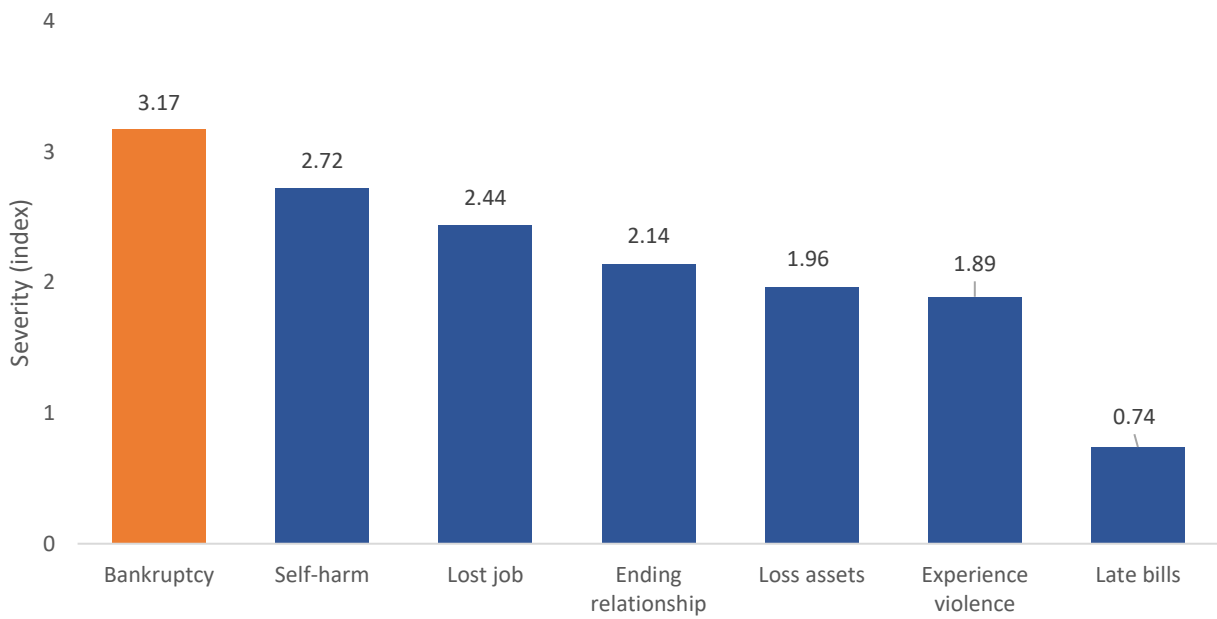
In NZ, Browne et al. (2017) document bankruptcy as a key factor in the burden of gambling harm. Applying confirmatory factor analysis and item-response theoretic methods to a survey of problem gamblers, the authors rank harms from problem gambling according to their severity. Bankruptcy sits towards the higher end of severity relative to other financial indicators of harm as well as broader indicators of harm (see Figure 3).

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[28] Other poor outcomes associated with access to gaming machines and gaming density include domestic violence (Markham, Doran and Young, 2016); binge drinking by adolescents (Zu et al. 2017); poor budgeting (Australian Productivity Commission, 1999) and poor mental health (Van der Mass, 2016).
[29] See Productivity Commission (1999).

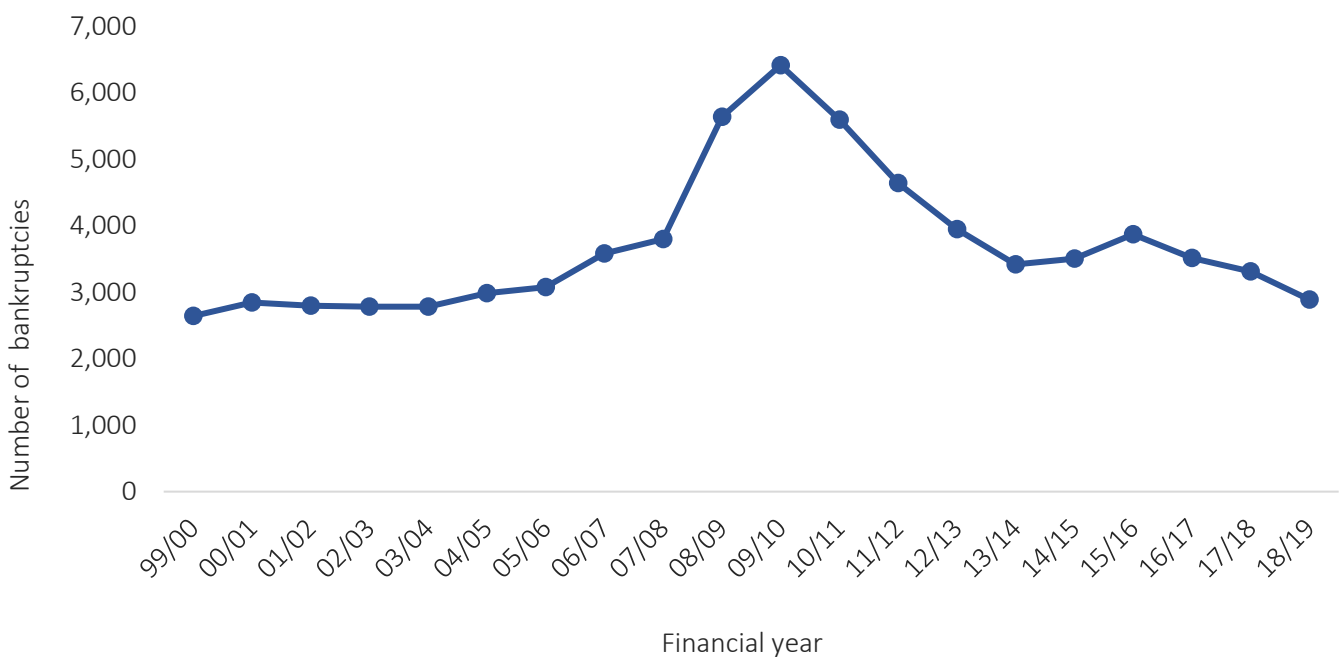## Figure 3. Severity of selected gambling harms

Note: Selected factors sourced from Browne et al. (2017), Tables 10-12.

7.2   Data

Bankruptcy data

The NZ Insolvency and Trustee Service provide statistics on the number of bankruptcies per financial year (June end). Figure 4 shows the total number over the last two decades in NZ.

Figure 4. Number of bankruptcies, by financial year

Note: Data sourced from the NZ Insolvency and Trustee Service.

As shown in Figure 4, the number of bankruptcies recorded in the 2018/19 financial year was 2,890. Thus, while bankruptcies may represent the severest extreme of harm for problem gamblers, bankruptcies are not common in NZ. The NZ Insolvency and Trustee Service also collected qualitative information[30] on the primary reason for declaring bankruptcy in 2017/18. Gambling did not feature prominently in this information, representing just 1% of the population surveyed, with the highest proportion (22%) attributing their circumstances to unemployment or lost job. Note though that there is a strong disincentive to self-report the impacts of gambling on debt since the court-appointed Official Assignee can press charges if debtors' gambling is found to have contributed to bankruptcy.[31] Further, this survey asked for the primary reason, and therefore we do not know what proportion of respondents would have listed gambling as one of the list of reasons.

One key takeaway from Figure 4 is that bankruptcies spiked immediately after the Global Financial Crisis, at the low point of the economic cycle. This suggests that in order to assess the impact of Class 4 gambling policies on bankruptcies we need to ensure our specification accounts for economic conditions.

Internationally, researchers have found a strong link between local unemployment shocks and bankruptcies. For example, Agarwal and Liu (2003) show that even after adjusting for health and relationship break-up (at least as measured by divorce), personal bankruptcy is driven by U.S. county unemployment rates.

Consequently, alongside the demographic and economic controls used in our main analysis in Table 4 we add further economic controls to our bankruptcy models to capture changes in house prices[32], as well as business and employment growth (all detailed in Table 7).

Bankruptcy and access to gambling

There is evidence that problem gambling occurs more frequently in areas with higher concentrations of EGMs (Storer, Abbot, and Stubbs, 2009). This highlights the importance of accounting for the spatial dimension of problem gambling and bankruptcy. To explore the role of spatial access on bankruptcy in NZ, we create three distance variables that approximate access for population for each TA over time.

We begin by geocoding every Class 4 venue in each year of our sample. We then define a binary variable equal to one if the centroid of the Statistical Area Unit 1 (SA1)[33] is within a certain distance to an EGM, and zero otherwise. We define these variables using three distances: 0.5km, 1km, and 2km. Thus, each SA1 has three binary variables which indicate proximity to Class 4 gaming. The measures are constructed for each

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[30] See New Zealand Insolvency and Trustee Service (2018).
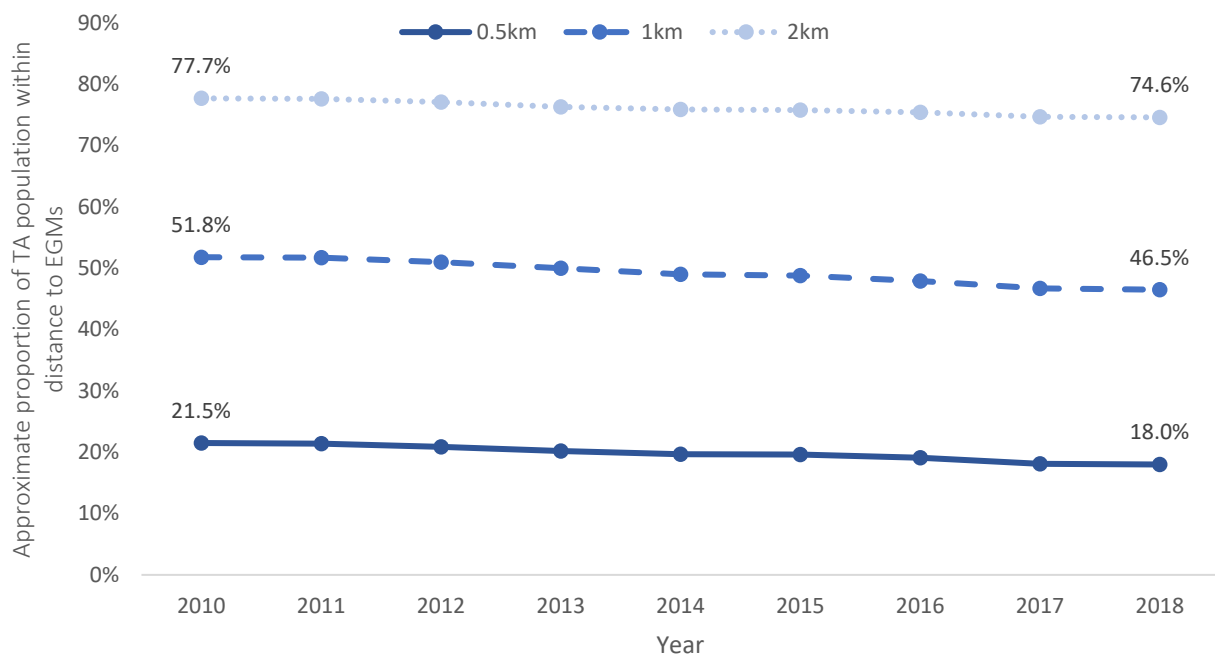[31] See Stuff (2018).
[32] To account for collateral effects, as in Fabling and Grimes (2005).
[33] There are approximately 30,000 SA1 units.

TA by summing the population of SA1s whose centroid lies within each distance measure, and then dividing by TA population.[34]

Figure 5 compares the three measures of access. Each measure declines slowly over time with the 0.5km access variable declining by 19.3 percent over the sample timeframe (2010 to 2018); while the 1km and 2km access variables show smaller declines (11.4 percent and 4.2 percent respectively). The general declining trend is in accord with the falling number of Class 4 venues and EGMs in NZ over time.

Figure 5. Access to EGMs

Notes: Distance measures are constructed using geographic boundaries and population estimates sourced from Stats NZ. Physical locations of EGMs provided by DIA.

Figure 5 masks variation in the accessibility to EGMs at the TA-level. In the appendix, Figure A1 presents the approximate proportion of the TA population that is within 1km of an EGM in 2018. As evident in Figure A1, there is substantial variation across TAs. For example, our distance measure estimates that approximately 68 percent of residents in the Napier TA live within 1km of an EGM in 2018, while the comparable number for the TA of Otorohanga is 12 percent.

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[34] We tested the robustness of this method relative to allocating population by the more computationally intensive alternative of attributing access by the fraction of each SA1 that lies within the relevant distance, on two TAs (Wellington and Christchurch). There are small differences in the mean of the ratio but the change over time is extremely similar to our preferred method.

Descriptive Statistics

Table 7 presents definitions and descriptives of our outcome of interest (bankruptcies), additional economic controls included in the upcoming empirical specification (beyond those already employed in Section 4), and the three distance measures constructed. As evident in the table, there are eight fewer observations relative to earlier analysis in this study. The reason for this is because the house price indicator is not available for the Chatham Islands TA.

Table 7. Descriptive statistics of bankruptcies, economic controls and distance variables

Variables	Description	Mean
Dependent variable		
Bankruptcies	Bankruptcies per 100,000 population of TA	20.23 (17.77)
Economic controls		
House price index	REINZ House Price Index (December month)	2193.54 (564.20)
Business unit growth	Two-year percent change in the number of businesses[35]	1.20 (2.86)
Employee growth	One-year percent change in employment	1.30 (3.67)
Distance variables		
Distance to EGM 0.5km	Approximate proportion of the TA population residing within 0.5km of an EGM	0.16 (0.07)
Distance to EGM 1km	Approximate proportion of the TA population residing within 1km of an EGM	0.40 (0.13)
Distance to EGM 2km	Approximate proportion of the TA population residing within 2km of an EGM	0.62 (0.16)
Observations		528

Notes: Data cover the 66 TAs in NZ from 2010 to 2018. All descriptives are unweighted TA-year means. Standard deviations are shown in parentheses. The house price variable used in the regression is the natural log of the variable defined in this table. Business unit growth and employee growth are sourced from Stats NZ's Business Demography Database. The base year of the REINZ House Price Index is 2013.

7.3   Method

Our modelling approach is driven by two key sets of characteristics: (i) Class 4 gambling policies complemented with a measure of accessibility; and (ii) a set of economic characteristics designed to capture the impact of the economic cycle on bankruptcies.

We repeat the difference-in-differences approach of section 4 (equation 1), in order to capture the impact of policy interventions at the TA level. We add to equation (1) our accessibility variable, $ACC_{i,t}$ that varies across time and each TA. We also include X_e which includes additional controls for the economic cycle, as described in Table 7.

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[35] Similar two-year rate utilised in Platt and Platt (1994) and Fabling and Grimes (2005)

Finally, it is worth noting that we omit variables that we only have available at the national level (such as inflation) since these impacts will be captured in the vector of impacts δ_i that are invariant at the TA level.

7.4   Results

Since we generate three access variables but are unsure as to which is most appropriate we estimate three models: (i) Model 1 includes distance to EGM 0.5km; (ii) Model 2 uses distance to EGM 1km; while (iii) Model 3 uses distance to EGM 2km. Table 8 presents the results of these specifications. In each case the dependant variable is the number of bankruptcies per 100,000 people.

Table 8. Impact of gambling policies on bankruptcies

Variable	Model 1	Model 2	Model 3
Outcome variables			
Absolute cap	-6.33	-6.24	-5.70
	(5.82)	(6.19)	(5.95)
Lagged absolute cap	1.21	1.16	1.29
	(6.99)	(7.10)	(6.77)
Per capita cap	-3.46	-3.33	-2.50
	(6.91)	(7.15)	(7.51)
Lagged per capita cap	5.08	5.19	5.76
	(8.05)	(7.88)	(7.59)
Sinking lid	-7.56*	-7.49	-6.82
	(4.54)	(4.79)	(4.97)
Lagged sinking lid	4.41	4.41	4.30
	(6.32)	(6.35)	(6.20)
Distance variables			
Distance to EGM 0.5km	17.87	-	-
	(99.01)		
Distance to EGM 1km	-	15.05	-
		(76.45)	
Distance to EGM 2km	-	-	44.47
			(94.73)
Economic controls			
Natural log of house price index	-12.10	-12.09	-11.92
	(9.73)	(9.46)	9.96)
Business unit growth	0.72*	0.72*	0.70
	(0.41)	(0.40)	(0.38)
Employee growth	0.01	0.02	0.03
	(0.12)	(0.11)	(0.12)
Observations	528	528	528
R-squared	0.58	0.58	0.58

Notes: The control variables described in Table 3 are included in these regressions, but not included here for the sake of brevity. TA and year fixed effects included. Bootstrapped clustered standard errors are shown in parentheses. ***, **, and * denote statistical significance at the one, five, and ten percent-levels, respectively.

In terms of the distance variables employed across the three models in Table 8, none are found to be statistically significant in explaining bankruptcies. It should be noted that these estimates appear to be quite noisy, given that the standard errors are much larger than the point estimates, regardless of which model is viewed. Consequently, these particular findings should be viewed with that caveat in mind.

With respect to the additional economic controls included in these bankruptcy models, business growth is significant in explaining bankruptcy variation. This relationship is relatively weak, as it is found in two of the three specifications, and is only significant at the 10 percent level.

In terms of the policy variables of interest, all contemporaneous policy indicators have the expected sign, i.e. decreasing the number of bankruptcies relative to the reference group. However, the majority of these indicators are statistically insignificant. There is weak evidence of the sinking lid reducing bankruptcies. This effect is only evident in Model 1 and is significant at the 10 percent level.

8 Conclusions

This research aim of this paper is to understand the impact of public policy interventions on gambling.

To conduct our empirical analysis, we gathered information on Class 4 gambling policies from all 67 TAs in NZ. This allowed us to construct a novel panel data set of TA-level Class 4 gambling policy types over time. In each year, a TA either had the baseline policy mandated by the Gambling Act 2003 or had more stringent regulation in the form of either an absolute cap on number of EGMs and / or venues; a per capita cap on number of EGMs and / or venues; or a sinking lid policy. We combined this policy information with data on machine spending from the DIA and demographic and economic indicators from Stats NZ and MBIE. A quasi-experimental difference-in-differences identification strategy relying on geographic and time variation in gambling policy is used to estimate the causal impact of Class 4 gambling policies on the number of venues, EGMs, and machine spending. Our analysis is at the TA-level and the sample period of interest is 2010 to 2018.

We found that all three forms of policy intervention prevalent in NZ are effective in reducing Class 4 venues and EGMs relative to the reference group (i.e. TAs with no restrictions beyond those in the Gambling Act 2003). For example, absolute caps are estimated to reduce the number of EGMs by 67 (15 percent) and the number of venues by 7 (16.9 percent) on a per 100,000 population basis over one year. Estimated reductions are marginally larger for the per capita cap policy and lower for the sinking lid policy.

In terms of reducing machine spending, sinking lids and per capita caps appear the most effective. Compared to the reference group, these policies are associated with a cumulative reduction (sum of contemporaneous and lagged effects) in machine spending of between $13 - 14$ percent. Absolute caps were shown to reduce cumulative expenditure by 10 percent, relative to the reference group. Furthermore, sinking lids are the only policy estimated to reduce gambling expenditure in both contemporaneous and lagged years (again, relative to the reference group).

One limitation worth pointing out is that we don't know the source of reduction in gambling expenditure. More specifically, we cannot ascertain what proportion of the drop in spending is from casual gamblers compared to problem gamblers. The closest insight we achieve on this front is by examining the impact of all three policies on gambling intervention service use. For this purpose we utilised data from the CLIC database provided by the MoH. Results on this front are mixed. For example, an increase in service use is found a year after implementation of per capita caps; whereas a decrease in service use is detected in the year of implementing a sinking lid policy, relative to the reference group. Given these mixed results, as well as an unclear theoretical expectation regarding impact of gambling policies on intervention service use, this presents as an area worthy of further investigation in future research.

Another limitation to note is that we don't have information on other forms of gambling activity. Therefore, we don't know if the drop in machine spending created spill-over effects, such as a rise in online gambling

activity.[36] We also don't have information on additional measures (perhaps more informal in nature) undertaken by TAs to try and curb problem gambling. Although, we can potentially assume that the policy intervention employed (whether absolute cap, per capita cap or sinking lid) is not only a signal of the level of commitment a TA has towards trying to reduce problem gambling, but also a proxy for the likely level of other informal activities aimed at this goal.

Our research also explored the impact of Class 4 gambling policies on the prevalence of personal bankruptcies. This empirical endeavour employed additional controls to proxy accessibility (via distance to EGM) and capture economic activity (known to be important in explaining bankruptcy patterns). We constructed three distance measures which approximated the proportion of TA population within 0.5km, 1km, and 2km of an EGM. None of these accessibility indicators were found to be statistically significant in explaining bankruptcy. Furthermore, there was limited evidence to link policy interventions to bankruptcies, with only one out of three models trialled signalling that the sinking lid policy reduces bankruptcy rates, relative to the reference group.

In terms of future research, there are a number of potential areas. For example, to further explore patterns in the use of gambling intervention services, future research could undertake hazard modelling with the CLIC data. Depending on the availability of information within the database, such modelling would entail a detailed investigation of the individual characteristics of service use clients (e.g. demographics); what intervention services they engage in and how long they engage for; and whether there are factors that predict length of service use, as well as success of service use.

Additional research could also explore links between spatial access to Class 4 venues and problem gambling using individual-level unit record data. Future research could also endeavour down the qualitative line of enquiry to complement our findings and provide additional context regarding the mechanisms at play. This would be particularly useful with respect to understanding the indirect impacts of policy interventions on use of gambling intervention services, and personal bankruptcies.

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[36] Note that TA fixed effects will capture one of the alternative gambling opportunities – casinos, as they don't vary with respect to location over time. Also note, that while we don't have information on other types of opportunities such as Lotto and TAB outlets for our sample period, if these numbers do not vary substantially over time, they will also be picked up by the TA fixed effects.

9 References

Abbott, M. (2006). Do EGMs and problem gambling go together like a horse and carriage? *Gambling Research: Journal of the National Association for Gambling Studies (Australia)*, 18(1), 7.

Abbott, M., Bellringer, M., Garrett, N., & Mundy-McPherson, S. (2016). New Zealand National Gambling Study: Wave 3 (2014). Report number 5. Auckland: Auckland University of Technology, Gambling and Addictions Research Centre.

Abbott, M. (2017). Gambling and gambling harm in New Zealand: a 28-year case study. *International Journal of Mental Health and Addiction*, 15(6), 1221-1241.

Abbott, M., Browne, M., Bellringer, M., Greer, N., Kolandai-Matchett, K., Rawat, V., Langham, E., Rockloff, M., Du Preez, K.P. (2017) *Measuring the Burden of Gambling Harm in New Zealand*.

Adams, P.J., Raeburn, J. & De Silva, K. (2009). A question of balance: prioritizing public health responses to harm from gambling. *Addiction*, 104, 688-691.

Adams, P., Rossen, F., Perese, L., Townsend, S., Brown, R., Brown, P. & Garland, J. (2004) Gambling Impact Assessment for Seven Auckland Territorial Authorities. Centre for Gambling Studies, University of Auckland.

Agarwal, S., and C. Liu, (2003), Determinants of credit card delinquency and bankruptcy: Macroeconomic factors, *Journal of Economics and Finance* 27, 75–84 https://doi.org/10.1007/BF02751591

AGLC, 2020. Liquor Licencee Handbook. Retrieved from: https://aglc.ca/documents/liquor-licensee-handbook

American Gambling Association. (2020). *State of the States 2020*. https://www.americangaming.org/wp-content/uploads/2020/06/AGA-2020-State_of_the_States_FINAL.pdf

American Psychiatric Association. (2013). Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). American Psychiatric Publishing.

Atkinson, J., Salmond, C. & Crampton, P. (2019) *NZDep2018 Index of Deprivation User's Manual.* Wellington: University of Otago.

Australian Productivity Commission. (1999). Australia's Gambling Industries. Report No. 10, AusInfo, Canberra.

Australian Productivity Commission. (2010). Gambling. Report No. 50, Canberra.Barron, John M., Michael E. Staten and Stephanie M. Wilshusen, (2002), "The Impact Of Casino Gambling On Personal Bankruptcy Filing Rates," *Contemporary Economic Policy*, Western Economic Association International, vol. 20(4), pages 440-455, October.

Bondolfi, G., Jermann, F., Ferrero, F., Zullino, D., & Osiek, C. H. (2008). Prevalence of Pathological Gambling in Switzerland After the Opening of Casinos and the Introduction of New Preventive Legislation. *Acta Psychiatrica Scandinavica*, 117(3), 236–239. doi: 10.1111/j.1600-0447.2007.01149.x

Bridwell, R. R. and Quinn F. L (2002). From Mad Joy to Misfortune: The Merger of Law and Politics in the World of Gambling. *Mississippi Law Journal*, 72(2), 565-729.

Browne, Matthew, Maria Bellringer, Nancy Greer, Komathi Kolandai-Matchett, Vijay Rawat, Erika Langham, Matthew Rockloff, Katie Palmer Du Preez and Max Abbott (2017), ""Measuring the Burden of Gambling Harm in New Zealand", Report for Ministry of Health, May 2017

Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources*, 50(2), 317-372.

Campbell, F., & Lester, D. (1999). The Impact of Gambling Opportunities on Compulsive Gambling. *Journal of Social Psychology*, 139(1), 126–127, doi: 10.1080/00224549909598366

Carr, R. D., Buchkoski, J. E., Kofoed, L., & Morgan, T. J. (1996). "Video lottery" and Treatment for Pathological Gambling: A Natural Experiment in South Dakota. *South Dakota Journal of Medicine*, 49(1), 30–32.

Cox, M., and K. Hurren. (2017). Research into Influences on Glass4 Gaming Machine Proceeds: Report to the Department of Internal Affairs.

Department of Internal Affairs, Gambling Fact Sheet #1: Gambling Regulation in New Zealand, retrieved from https://www.dia.govt.nz/diawebsite.nsf/Files/GamblingFactSheets-Feb2013/$file/FactSheet1-Feb2013.pdf (accessed 12 September 2019).

Department of Internal Affairs, Classes of Gambling, retrieved from https://www.dia.govt.nz/diawebsite.nsf/wpg_URL/Services-Casino-and-Non-Casino-Gaming-Classes-of-Gambling (accessed 18 July 2019).

Department of Internal Affairs (2008, October, 6). Problem gambling in New Zealand – a brief summary. DIA. Retrieved from https://www.dia.govt.nz/diawebsite.nsf/wpg_URL/Services-Casino-and-Non-Casino-Gaming-Problem-Gambling-in-New-Zealand-A-Brief-Summary?OpenDocument.

Department of Internal Affairs. (2017). Gambling Expenditure Statistics. Retrieved from https://www.dia.govt.nz/diawebsite.nsf/wpg_URL/Resource-material-Information-WeProvide-Gambling-Expenditure-Statistics (accessed 13 September 2019).

Dowling, N., Smith, D., & Thomas, T. (2005). Electronic gaming machines: are they the 'crack-cocaine' of gambling? *Addiction*, 100(1), 33-45.

Elhorst, J. P. (2003). Specification and estimation of spatial panel data models. *International Regional Science Review*, 26(3), 244-268.

Engebø J., (2010) From slot machines to gaming terminals—experiences with regulatory changes in Norway. Vienna, September 2010, viewed 10 November 2011. Retrieved from: http://www.easg.org/media/file/vienna2010/presentations/Thursday/1330/P2/4_Jonny_Engebo.pdf

Fabling, Richard and Arthur Grimes (2005), "Insolvency and economic development: Regional variation and adjustment," *Journal of Economics and Business*, Elsevier, vol. 57(4), pages 339-359.

Forsythe, G. E., Malcolm, M. A. and Moler, C. B. (1977). *Computer Methods for Mathematical Computations*. Wiley.

Friedl, J., (2020). Online Resource: A State-By-State Slot Machine Casino Gambling Series. *Professor Slots*. Retrieved From: https://professorslots.com/online-resource/

Gaming Policy and Enforcement Branch, (2019). Gaming Policy and Enforcement Branch Annual Report 2018/2019. Retrieved from: https://www2.gov.bc.ca/gov/content/sports-culture/gambling-fundraising/gambling-in-bc/reports-publications-statistics

Korn D. A., Shaffer H. J. (1999). Gambling and the health of the public: Adopting a public health perspective. *Journal of Gambling Studies* 15(4): 289-365.

Lesieur, H. R., & Rosenthal, R. J. (1991). Pathological gambling: A review of the literature (prepared for the American Psychiatric Association task force on DSM-IV committee on disorders of impulse control not elsewhere classified). *Journal of Gambling Studies*, 7(1), 5-39.

Livingstone, C., Rintoul, A., de Lacy-Vawdon, C., Borland, R., Dietze, P., Jenkinson, R., Livingston, M., Room, R., Smith, B., Stoove, M., Winter, R. & Hill, P. (2019). Identifying effective policy interventions to prevent gambling-related harm, Victorian Responsible Gambling Foundation, Melbourne.

Lund, I. (2009). Gambling Behaviour and the Prevalence of Gambling Problems in Adult EGM Gamblers when EGMs are Banned. A Natural Experiment. *J Gambl Stud* 25, 215–225. https://doi.org/10.1007/s10899-009-9127-y

MacKinnon, J. G. (2019). How cluster-robust inference is changing applied econometrics. *Canadian Journal of Economics/Revue canadienne d'économique*, 52(3), 851-881.

Markham, F., Doran, B., & Young, M. (2016). The relationship between electronic gaming machine accessibility and police-recorded domestic violence: A spatio-temporal analysis of 654 postcodes in Victoria, Australia, 2005–2014. *Social Science & Medicine*, 162, 106-114.

McMillen, J., & Doran, B. (2006). Problem gambling and gaming machine density: Socio-spatial analysis of three Victorian localities. *International Gambling Studies*, 6(1), 5-29.

Mikhed,V., Scholnick, B., & Byun, H. (2017). Spatial Commitment Devices and Addictive Goods: Evidence from the Removal of Slot Machines from Bars. Working Papers 17-34, Federal Reserve Bank of Philadelphia.

Ministry of Health. (2008). Raising the Odds? Gambling behaviour and neighbourhood access to gambling venues in New Zealand. Wellington: Ministry of Health.

Ministry of Health. (2019). Strategy to Prevent and Minimise Gambling Harm 2019/20 to 2021/22. Wellington: Ministry of Health.

New Zealand Insolvency and Trustee Service (2018). Insolvency Statistics and Debtor Profile Report. Retrieved from https://www.insolvency.govt.nz/support/about/statistics/statistical-data-reports/
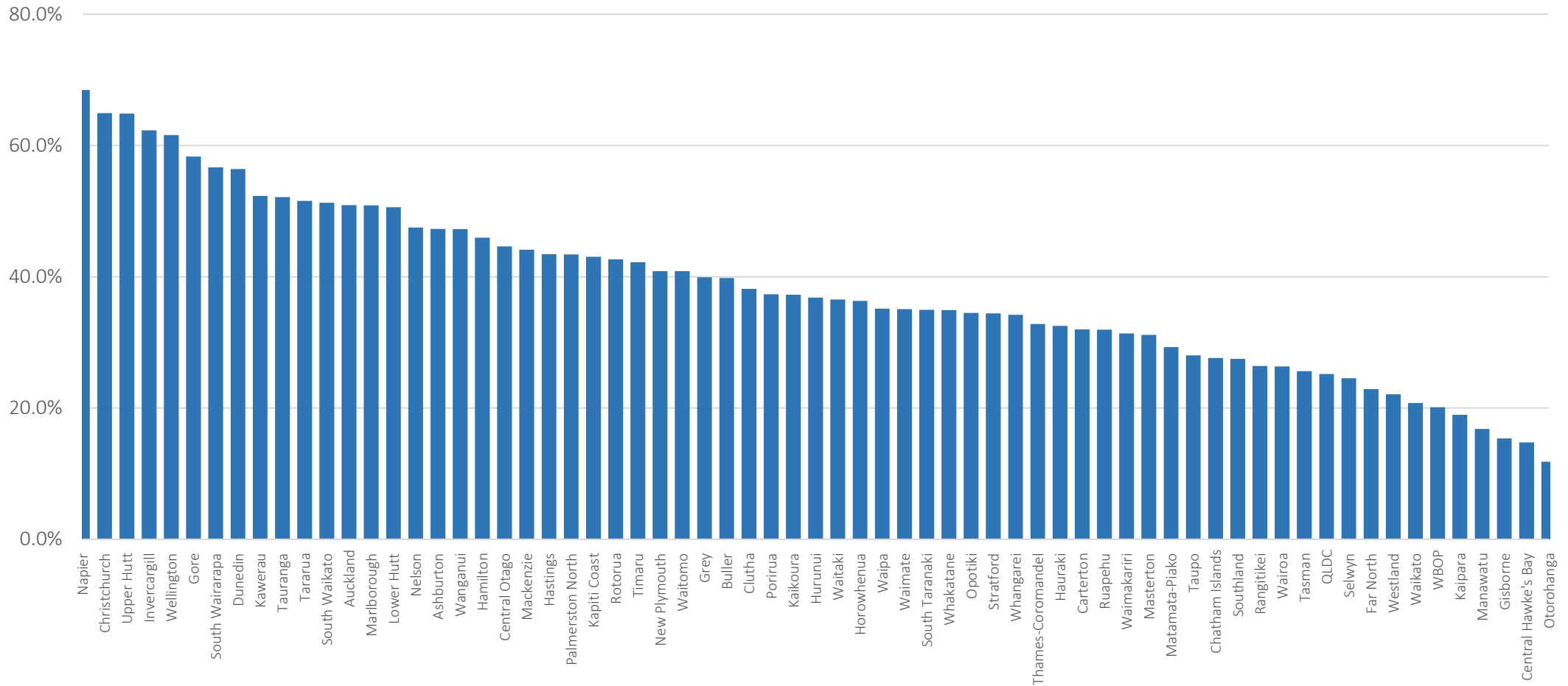
Nevada Gaming Commission & Nevada Gaming Control Board. (2020). State of Nevada Regulations. Retrieved from: gaming.nv.gov/modules/showdocument.aspx?documentid=16507

Norsk Tipping. (2010). Annual and social report 2010. Norsk Tipping. Viewed 10 November 2011. Retrieved from: https://www.norsk-tipping.no/selskapet/_binary?download=true&id=48334

Nova Scotia Gaming Corporation. (2005). VLT Time Change: Findings Report.

Platt, H. D. and M. B. Platt. (1994), "Business cycle effects on state corporate failure rates," *Journal of Economics and Business*, 46, pp. 113–127.

Rook, H., Rippon, R., Pauls, R., Doust, E., & Prince, J. (2018). Gambling Harm Reduction Needs Assessment. Sapere Research Group.

South Australian Centre for Economic Studies (2005). Study of the Impact of Caps on Electronic Gaming Machines. Retrieved from: https://www.adelaide.edu.au/saces/system/files/media/documents/2019-06/study-of-the-impact-of-caps-on-electronic-gaming-machines.pdf

Stevens, M., Livingstone, C. (2019). Evaluating changes in electronic gambling machine policy on user losses in an Australian jurisdiction. *BMC Public Health* 19, 517. doi: 10.1186/s12889-019-6814-1

Storer, J., Abbott, M., & Stubbs, J. (2009). Access or adaptation? A meta-analysis of surveys of problem gambling prevalence in Australia and New Zealand with respect to concentration of electronic gaming machines. *International Gambling Studies*, 9(3), 225-244.

Stuff (2018), "Bankrupt Auckland builder squanders $1.5 million at SkyCity casino", April 10 2018, accessed 31/08/2020, https://www.stuff.co.nz/business/102973747/bankrupt-auckland-builder-squanders-15-million-at-skycity-casino

Sulkunen, P., Babor, T. F., Ornberg, J. C., Egerer, M., Hellman, M., Livingstone, C., Marionneau, V., Nikkinen, J., Orford, J., Room, R. & Rossow, I. (2018) The effects of changing availability. In *Setting Limits: Gambling, Science and Public Policy* (pp. 87–106). Oxford Scholarship Online. DOI: 10.1093/oso/9780198817321.001.0001

Szczyrba, Z., Fiedor, D., & Smolová, I. (2016). Gamblerization of Post-Communist Society in Central Europe. 16th International Conference on Gambling & Risk Taking, June 8, 2016, Las Vegas. Audio recording available at: http://digitalscholarship.unlv.edu/gaming_institute/2016/June8/15/

Van der Maas, M. (2016). Problem gambling, anxiety and poverty: an examination of the relationship between poor mental health and gambling problems across socio-economic status. *International Gambling Studies*, 16(2), 281-295.

Volberg, R. A. (1994). The prevalence and demographics of pathological gamblers: implications for public health. *American Journal of Public Health*, 84(2), 237-241.

Williams, R. J., West, B. L., & Simpson, R. I. (2012). *Prevention of Problem Gambling: A Comprehensive Review of the Evidence and Identified Best Practices*. Ontario Problem Gambling Research Centre and the Ontario Ministry of Health and Long Term Care.

10 Appendix

Figure A 1. Approximate proportion of the TA population within 1 km of an EGM, 2018

Notes: The distance measure is constructed using geographic boundaries and population estimates sourced from Stats NZ. Physical locations of EGMs provided by DIA.