Electronic gambling machines in New Zealand: A local government policy analysis

Christopher Erwin, Gail Pacheco, Alexandra Turcu[1]

Abstract

In many countries, problem gambling is a significant public health concern. Gambling addiction has been linked to poor health, psychological distress, financial difficulties, and strained interpersonal relationships. In New Zealand, problem gambling is estimated to affect over ten percent of the population. To minimize harm, the Gambling Act of 2003 was introduced to limit the number of electronic gaming machines in non-casino establishments. Beyond national-level restrictions, local governments were required to adopt gambling policies of their own and review them every three years. One specific policy that emerged at the local level, found exclusively in New Zealand, is the sinking lid. Sinking lids are designed to gradually reduce machine caps by prohibiting the transfer of gaming licenses. This study leverages variation in the geography and timing of local policy interventions to estimate the effect of sinking lids on gambling expenditure. Results suggest that sinking lids reduce problem gambling expenditure by 13 percent relative to regions not adopting policies beyond national-level restrictions. We also find some evidence that sinking lids reduce the uptake of gambling intervention services.

JEL Classification: C23, D04, Z31
Key Words: sinking lid, problem gambling, electronic gaming machines

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[1] New Zealand Work Research Institute, Faculty of Business, Economics, and Law, Auckland University of Technology; Private Bag 92006, Auckland 1142, New Zealand. Corresponding author – Christopher Erwin, Email: christopher.erwin@aut.ac.nz.

1. Introduction

Problem gambling is a significant public health concern in New Zealand (NZ), affecting approximately eleven percent of New Zealanders each year (Department of Internal Affairs, 2008). Problem gambling has been shown to strain professional and interpersonal relationships, cause financial problems, and lead to feelings of shame, guilt, and depression (National Center for Responsible Gaming, 2012). Several studies associate pathological gambling with health and psychiatric problems (Cunningham-Williams, *et al.*, 1998; National Research Council, 1999; Petry, 2005). Pathological gambling is also linked to an increased risk of poor physical and mental health (Petry, Stintson & Grant, 2005). The American Psychiatric Association (2013) lists jeopardizing or losing a significant relationship, job, or career opportunity as one of the major risks of problem gambling. In order to minimize harm from problem gambling, NZ overhauled its regulatory oversight of gaming in the early 2000s.

The Gambling Act of 2003 (hereafter, the "Act") made sweeping changes to how NZ regulates non-casino gaming. The Act characterizes problem gambling as any gambling-related activity that creates negative consequences for the individual, their family, or the community. This definition includes those who suffer from pathological gambling, but also individuals whose gambling behavior is not considered severe enough to register as a psychological condition but is severe enough to cause harm. The Act defined electronic, non-casino slot machines as Class 4 gambling (for our purposes, referred to as electronic gaming machines, or EGMs). Several studies have found that Class 4 gambling is the most common form of gambling associated with pathological or problem gambling behavior (Dowling, Smith & Thomas, 2005; Abbott, 2006; Storer, Abbott & Stubbs, 2009). EGMs are generally located in enclosed, isolated spaces, are age-restricted, and are typically removed from areas patrons at a bar or club might commonly occupy.[2] The Act mandated a baseline set of restrictions regarding the number of EGMs per Class 4 venue, which was 18 machines per venue if allocated before October 17, 2001, and nine machines per venue thereafter.

[2]We refer to a business that hosts Class 4 gaming as a "Class 4 venue."

Recognizing geographic heterogeneity in gaming intensity and preferences, the legislation also asked territorial authorities (TAs) to adopt policies of their own. TA-level policies produced various responses: some TAs took no action beyond enforcing the Act; others adopted absolute caps based on the number of machines, venues, or both; others instituted per capita caps based on the number of machines, venues, or both; while others adopted "sinking lid" policies, restricting the transfer of Class 4 licenses in order to gradually reduce the availability of gambling outlets.

Although Class 4 gaming is common internationally, policy evaluations in this space are rare. This is likely due to a lack of data and the private nature of Class 4 gaming. The authors could only identify one quasi-experimental study focusing on the causal effect of EGM availability on EGM expenditure. According to a 2005 study by the South Australian Centre for Economic Studies, placing an absolute cap on EGMs in five "vulnerable communities" in Victoria, Australia did not appear to increase or decrease overall EGM expenditure. It is important to note, however, the study relies on propensity score matching to estimate average treatment effects and is thus susceptible to bias from unobserved community-level characteristics. 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 neighborhoods, which may be due to the small magnitude of reductions relative to their existing numbers (Rook *et al*., 2018). The authors plot changes in EGMs versus the change in EGM 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. We argue that the use of micro-level Class 4 gambling expenditure data may be helpful in understanding the efficacy of local policies meant to curb problem gambling. Table 1 presents a summary of the literature, although we caution all studies (with the exception of the South Australian Centre for Economic Studies, 2005) identified are correlational, rather than causal, in nature. Some studies suggest a positive link between EGM availability and EGM expenditure (Australian Institute for Gambling Research, 1995; Nova Scotia Gaming

Corporation, 2005). Other studies find no clear impact of EGM availability on gambling expenditure (McMillen & Doran, 2006; Bondolfi *et al*., 2008; South Australian Centre for Economic Studies, 2005; Rook *et al*., 2018). Several studies find that decreased availability of EGMs decreases the demand for problem gambling intervention services (Carr *et al.*, 1996; Campbell & Lester, 1999; Bridwell & Quinn, 2002; Williams, West, & Simpson, 2012). Lund (2009) found that decreases in EGM availability did not have any meaningful effect on participation in other forms of gambling.

TABLE 1

Summary of literature on EGMs, gambling expenditure, and problem gambling intervention services

Source	Availability change	Key findings
Australian Institute for Gambling Research (1995)	EGMs allowed in hotels	Increase in EGM availability increased problem gambling (as measured by expenditure as a percentage of total income).
Carr *et al*. (1996)	Blanket ban	Decrease in EGM availability decreased the demand for problem gambling intervention services, although the ban only lasted three months.
Campbell & Lester (1999)	Allowed EGMs in parishes	Increase in EGM availability increased participation in gamblers anonymous groups.
Bridwell & Quinn (2002); Williams, West & Simpson (2012)	Blanket ban	Decrease in EGM availability decreased participation in gambling anonymous groups and resulted in a reduction in demand for problem gambling intervention services.
Nova Scotia Gaming Corporation (2005)	Reduction in EGM venue opening hours	Decrease in EGM availability reduced gambling revenue by 5% - 9% and reduced spending by problem gamblers by 18%
McMillen & Doran (2006)	Per capita cap of 11.7 EGMs per 1,000 adults	Decreased EGM availability did not affect EGM expenditure, with little effect on the spatial distribution of expenditure.
South Australian Centre for Economic Studies (2005)	Absolute cap of 27,500 EGMs	Decrease in EGM availability did not impact EGM expenditure.
Bondolfi *et al*. (2008)	Ban on non-casino EGMs	Decrease in EGM availability did not affect overall problem gambling but reduced the prevalence of problem gamblers with probable alcohol dependency.
Lund (2009)	Blanket ban	Decrease in EGM availability did not affect participation in other forms of gambling.
Rook *et al*. (2018)	Sinking lid	A reduction in EGMs was not strongly correlated with a reduction in gambling expenditure in high deprivation neighborhoods.

We use administrative data from the NZ Department of Internal Affairs (DIA) and the NZ Ministry of Health (MOH) to study the effectiveness of local government policy interventions on problem gambling expenditure. We leverage variation in the type and timing of policy interventions to assess efficacy. Noting limitations, we utilize quasi-experimental methods to estimate how local government policy affected problem gambling behavior. We first focus on the direct impact of policy changes by examining the impact on Class 4 gaming availability—the number of EGMs and Class 4 venues in the community. Next, we turn to a measure of spending intensity—the amount of Class 4 gambling expenditures within the year, on a per capita basis. We find that any policy superseding the Act is effective in reducing venues and EGMs, relative to the reference group of TAs following baseline restrictions. Reducing access to Class 4 gambling via sinking lid policies is estimated to decrease problem gambling expenditure by between 10 and 14 percent within the first two years of implementation, relative to the baseline. We also examine the effect of TA policies on gambling intervention services. Overall, results suggest that any policy to mitigate Class 4 gambling is better than none—people respond to supply restrictions and this may mitigate community harm from problem gambling, as measured by Class 4 gambling expenditure. Sinking lid policies appear to be particularly effective in this effort.

Our study makes two contributions to the literature on problem gambling. First, we are the only study identified to use quasi-experimental panel data methods to estimate the causal impact of EGM availability on Class 4 gambling expenditure. We leverage the timing of policies and their geographic heterogeneity to identify how different local policies affect the availability of, and expenditure on, Class 4 gaming. Panel data methods allow us to control for time-invariant heterogeneity at the TA-level, as well as trends in gambling expenditure over time. Second, rather than appealing to a survey of self-reported gamblers (as in Australian Institute for Gambling Research, 1995 and Bondolfi *et al.*, 2008, for example), we utilize expenditure data from all EGMs within NZ over nine years, which avoids non-reporting bias.

The remainder of this report is organized as follows: Section 2 details the legislative background in NZ; Section 3 discusses the theoretical perspectives regarding problem gambling; Section 4 describes our administrative data; Section 5 presents the difference-in-differences empirical strategy; Section 6

reports main findings; Sections 7 analyzes the impact of sinking lid policies on the use of gambling intervention services; and Section 8 concludes with a discussion of limitations and directions for future research.

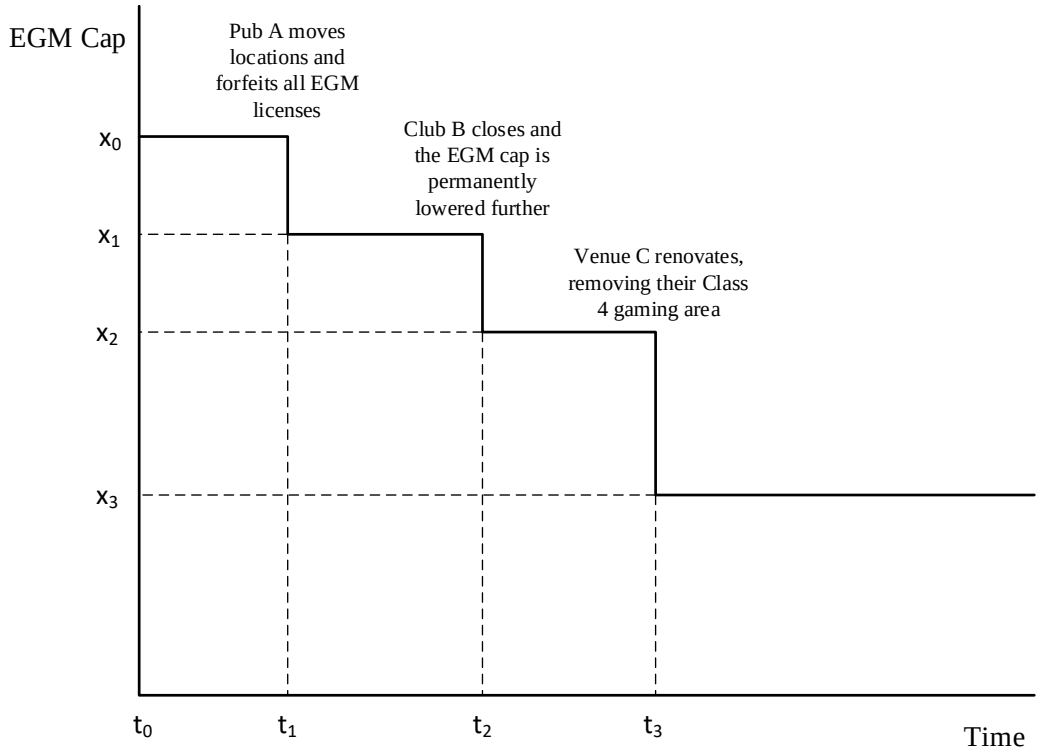
2. Legislative background

Problem gambling has been recognized as a significant issue in NZ since the early 2000s, when the Act made sweeping changes to the industry's regulatory environment and declared gambling to be a public health concern (Adams, Raeburn & De Silva, 2009). The Act had several explicit purposes, including controlling growth in gambling; minimizing community harm; clarifying legal versus prohibited gambling; and ensuring gambling proceeds benefit the community. The Act also clarified regulatory roles. The DIA was responsible for all forms of gambling law enforcement, while the MOH was tasked with organizing and funding NZ's approach to addressing problem gambling. As part of their role, the MOH was required to regularly develop strategic plans focused on preventing and minimizing gambling harm in NZ.

Although we focus on sinking lid policies, several TAs put in place other types of restrictions on Class 4 gambling. We group policies into three categories. First, some TAs have enforced absolute caps on the number of EGMs, the number of Class 4 venues, or both, within their jurisdiction. Second, some TAs have implemented per capita caps on the number of EGMs, the number of Class 4 venues, or both. Third, several TAs have adopted sinking lid policies. Sinking lid policies entail a cap on EGMs which is fluid, and only decreases when the transfer of a Class 4 gaming license is prohibited. For example, under a sinking lid policy, Bar X may currently have 20 EGMs under license. If Bar X were to move their location, or shut down altogether, then those 20 licenses are forfeited. Likewise, Bar X cannot sell or transfer their Class 4 EGM licenses to Bar Y by law. And if Bar X were to expand their operations, new Class 4 licenses would not be granted. In effect, sinking lids are a monotonically decreasing step function of EGM licenses over time. Sinking lid policies are considered relatively strict compared to absolute and per capita caps, which are static in nature. See Figure 1 for a hypothetical illustration of how a sinking lid affects EGM caps over time.

FIGURE 1

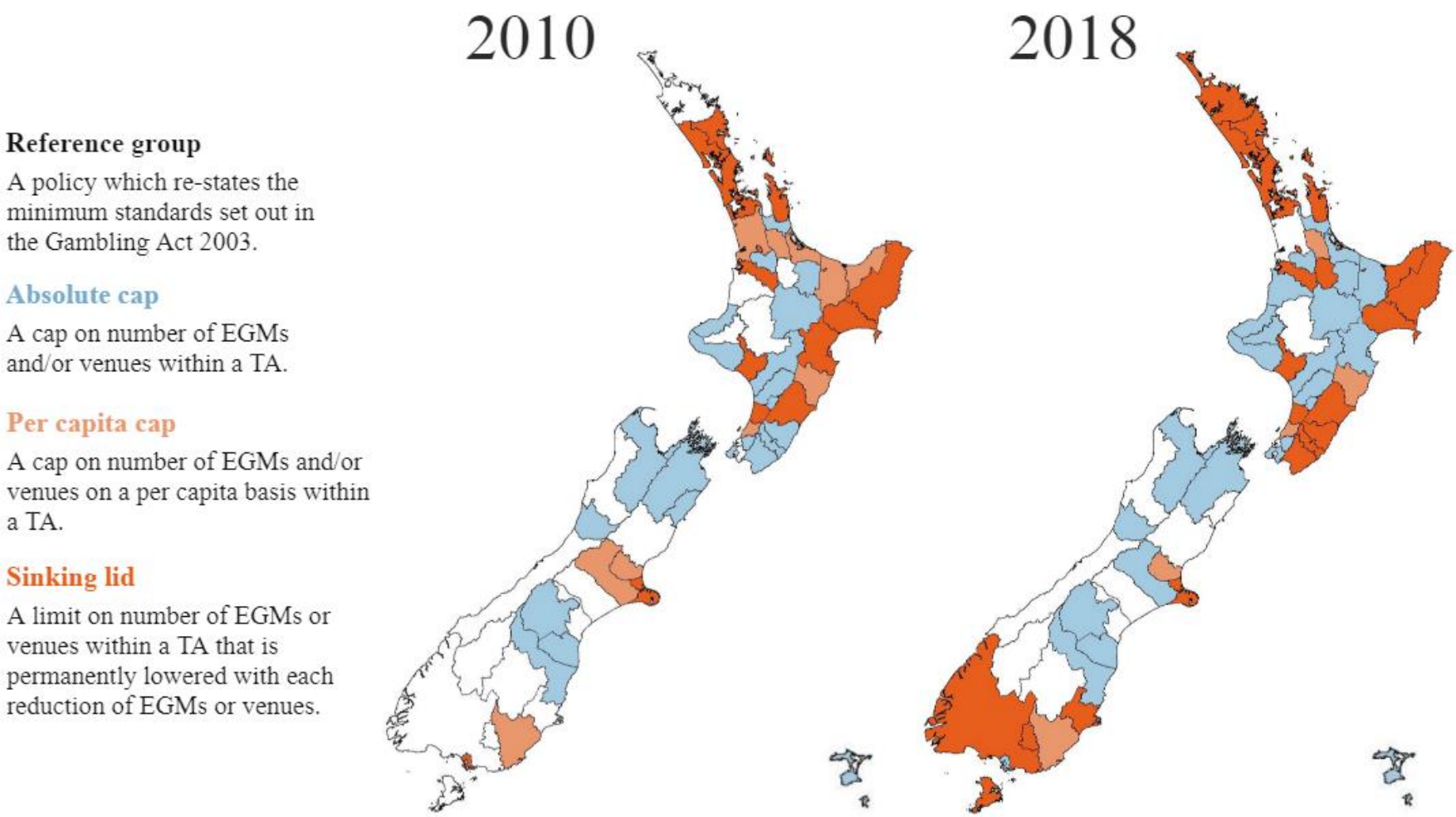
Hypothetical sinking lid policy over time



There is substantial geographic variation in Class 4 gambling policies over time. As illustrated by Figure 2, over the sample period the proportion of TAs in the reference group (i.e., TAs not adopting any restrictions beyond the Act) or adopting a per capita cap decreases, while the proportion of TAs enacting absolute caps and sinking lid policies increases. Notably, no TAs set absolute caps below the number of existing EGMs or venues. This supports the idea that some authorities use the sinking lid policy to initially reduce the number of EGMs or venues by a desired amount, before switching to an absolute cap once numbers have reduced. Over the sample period, no TAs ever moved into the reference group from a more stringent local policy. The most common change in Class 4 gambling policy was for a TA to adopt a sinking lid policy from having an absolute cap, a per capita cap, or no policies beyond baseline restrictions set forth in the Act.

FIGURE 2

Class 4 gambling policy types, by TA, 2010 and 2018



2.1 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). Table 2 presents a brief overview of the most common policy categories internationally.

TABLE 2

Common policies limiting access to EGMs

Policy	Definition
Bans	
Blanket ban	No EGMs allowed to operate anywhere in the jurisdiction.
Venue ban	EGMs permitted in specific venues types only.
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.
Individual Restrictions	
Age	Gambling prohibited below a certain age.
Intoxication	Individuals banned from using machines while intoxicated.

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

Around the world, several legal strategies have been enacted to limit access to EGMs. These include blanket bans, venue bans, and restriction related to the legal gambling age and access to alcohol. Although rare, blanket bans have been implemented in several jurisdictions, including NZ where EGMs were banned until their legalization in 1988 (Abbott, 2017). In 2007, in response to rising concern regarding the harm caused by problem gambling, Norway 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 where EGMs were available in a wide range of locations, including shopping centers and train stations (Norsk Tipping, 2010). While new EGMs were reintroduced into Norway in 2009, modern machines are under control of the government and have features designed to make them less harmful, such as mandatory play breaks, lower prizes, limits on gambling amount, and the inability to insert cash (Engebø, 2010). Blanket bans were also issued the U.S. states of Alaska, Hawaii, and Utah (Friedl, 2020), as well as being issued in Hungary and Western Australia (except machines located 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 centers, and co-located racetrack casinos (Gaming Policy and Enforcement Branch, 2019).

A less intensive way of restricting access to EGMs, compared to bans, involves capping EGMs and/or venues in some form. Australia provides a good example. 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 Act, 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. Also, in similar fashion to NZ, Australian states can undertake additional, stricter 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). The cap was specifically targeted at disadvantaged communities and was 11.7 EGMs per 1,000 adults (McMillen & Doran, 2006). Municipalities within Victoria that initially failed to meet this threshold were given three years to comply.

Often, venue caps differ according to the type of venue in which EGMS are located. For example, 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 Alberta, Canada are permitted up to 14 EGMs, while gaming entertainment centers 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, while other venue types are assessed on an individual basis (Nevada Gaming Commission & Nevada Gaming Control Board, 2020).

To the best of our knowledge, NZ is the only jurisdiction that uses sinking lid policies to limit problem gambling. As indicated earlier, a sinking lid policy prohibits transferring EGM licenses, so venue closures and relocations result in permanent forfeiture of EGMs within the relevant TA.

2.2 Individual-level policies that limit EGM access

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). In many jurisdictions, the minimum gambling age is set with reference to the minimum drinking age, especially since most gambling venues are liquor licensed. 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. In another example from Canada, individuals in Alberta who "appear to be intoxicated" are not allowed to engage with EGMs (AGLC, 2020).

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 several states for casino gambling (American Gambling Association, 2020). In NZ, the gambling age is 20 for casinos, and 18 for EGMs outside of casinos.

3. Theoretical perspectives

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 minimizing harm associated with problem gambling.

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 legalization 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 legalized 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, coinciding with a decrease in problem gambling. This finding is consistent with the "adaptation theory" or "adaptation hypothesis." This theory argues that gambling behavior is influenced by several psychosocial and economic factors beyond availability, and that problem gambling behavior may be influenced by public health interventions (Abbott, 2006).

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 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 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 recognized "pathological gambling as a disorder of impulse control" (Lesieur & Rosenthal, 1991; American Psychiatric Association, 2013). Since then, this theory has become widely recognized 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), recognizes the importance of the mental health model, but seeks to offer a more holistic approach, including harm minimization. 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).

4. Data

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—the number of Class 4 venues, the number of EGMs, and gaming machine proceeds (GMP) from the DIA. GMP measures net gaming machine spending by patrons (i.e., total revenue minus wins payed out), or player losses (Department of Internal Affairs, 2020). 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 adjust the venue and EGM indicators for population by dividing the annual mean values per 100,000 usual resident population within the TA. Annual GMP figures are adjusted for inflation using Q2 2019 NZ dollars as the base. Over our sample period, average annual EGMs and venues per 100,000 population decrease by 28.7 percent and 26.5 percent respectively, while player losses (measured in terms of real GMP per capita) decreases by 13.1 percent. The trend in EGM spending is displayed in Figure 3. The strong seasonal nature of Class 4 gambling in NZ is clear—Class 4 gambling is most popular in last quarter of each year and then abruptly drops in the first quarter of the next year. Figure 4 presents the average number of EGMs, per 100,000 population, over time. As expected, there is little evidence of a seasonal component to the stock of EGMs, and declines are gradual over the sample period.

FIGURE 3

Real gross machine spending per capita, 2010 to 2018

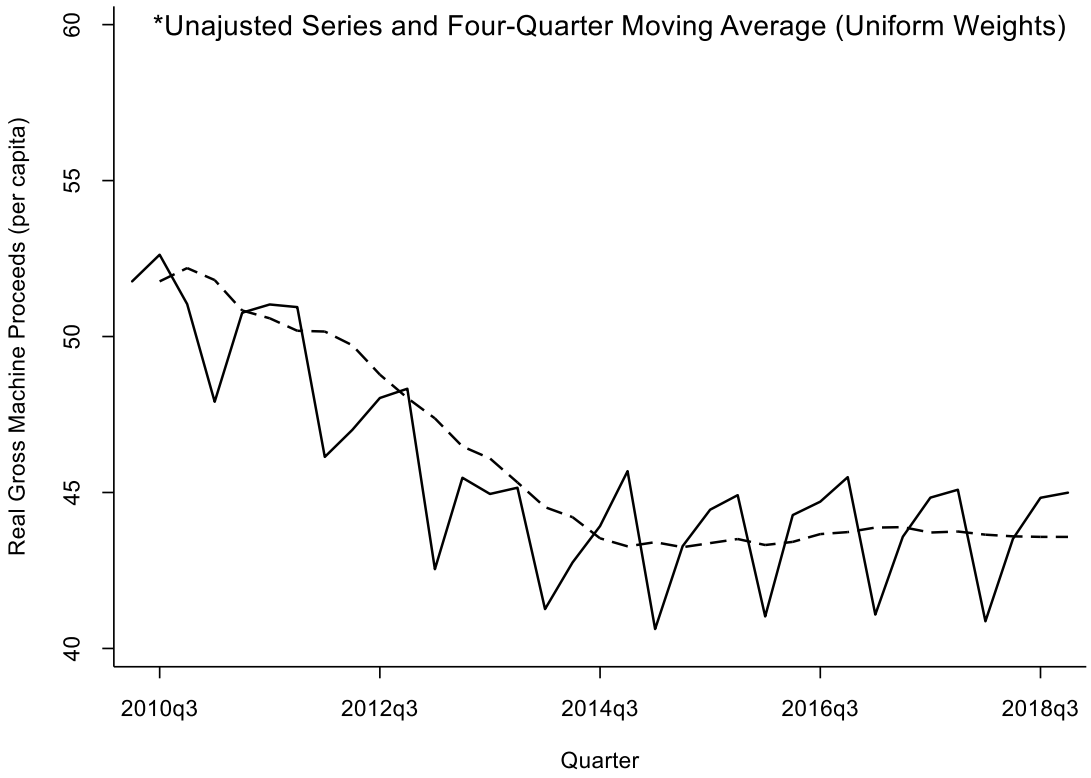
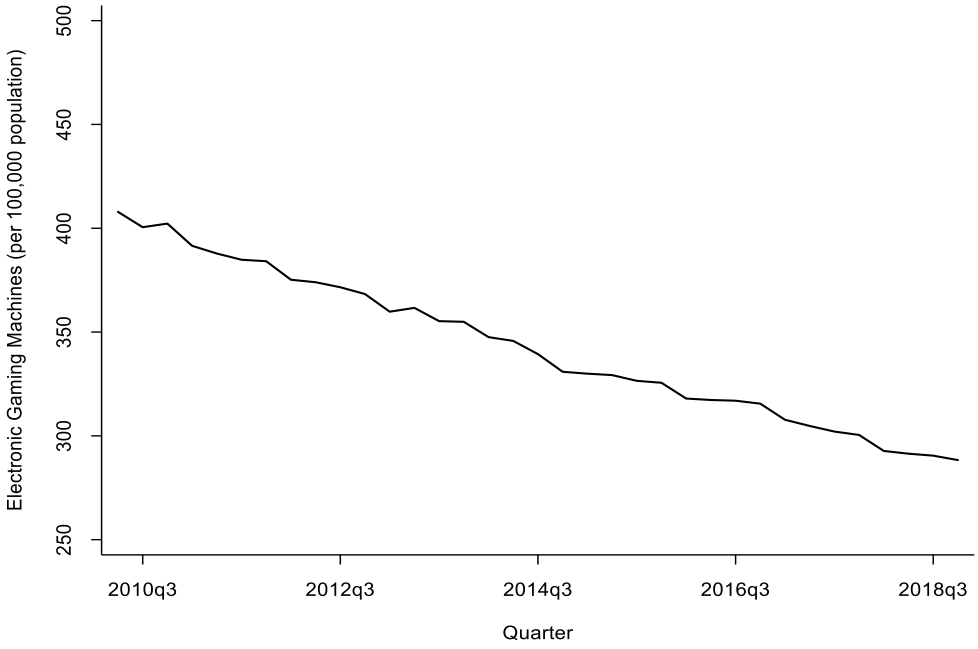


FIGURE 4

Electronic gaming machines per 100,000 TA population, 2010 to 2018



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. Ethnicity by age cohort is not 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 in non-census years. 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 TAs. We also include annual information on the socioeconomic deprivation level of each TA. The NZ Deprivation index is constructed by the University of Otago, and is based on several items, including the rate of persons within a geographic region buying cheap food, enduring low temperatures to avoid heating costs, being unemployed, receiving government benefits, and going without fresh fruits or vegetables, among others. TAs are categorized into deciles, with the most deprived placed in the top decile (Ward, Trowland & Bracewell, 2019). Deprivation scores are interpolated between census years using spline functions in similar fashion to demographic indicators.[3] We also include estimated annual GDP growth rate for each TA, based on TA-level GDP estimates produced by the Ministry of Business, Innovation and Employment (MBIE). This allows us to control for broad economic conditions at the local level, which we suspect are correlated with EGM spending.

Our resulting sample is annual in nature, covers all 67 TAs in NZ, and spans the period 2010 to 2018. Table 2 provides definitions for our outcome variables, key policy indicators, and control variables. All descriptive statistics in Table 3 are unweighted TA-year means. Sinking lid policies were in place for approximately one out of three TA-year observations in our data. The share of observations in the reference group was approximately 20 percent. Average real GMP expenditure per capita over the sample was $186 NZD.

It should be noted that our main outcome of interest, real player losses from Class 4 gambling, is a strong indication of overall problem gambling in New Zealand. According to the literature, the vast majority of Class 4 gambling expenditure *is* problem gambling expenditure. For example, according to the New Zealand National Gambling Study, the proportion of self-reported problem gamblers that chose Class 4 gambling as their preferred gambling mode increased from 12 percent 1991 to 78 percent in 2002 (Abbott

[3]More information on the NZ Deprivation Index can be found at the University of Otago website, https://www.otago.ac.nz/wellington/departments/publichealth/research/hirp/otago020194.html (accessed 7 October 2020).

and Volberg, 1991; Paton-Simpson *et al*., 2003).[4] Further, problem gambling intervention service use data from the MOH show that over the period 2010 to 2018, 55 percent of individuals that received problem gambling services chose Class 4 gambling as their primary mode, while 64 percent listed Class 4 gambling as one of their top five modes of gaming.

Over half of all Class 4 gambling expenditure comes from individuals considered to be high risk or problem gamblers (Abbott *et al.*, 2016). As such, problem gamblers are disproportionately represented by player losses. Additionally, New Zealand survey data has consistently indicated that Class 4 gambling is the mode associated with the most harm (Rossen, 2015; Tu & Puthipiroj, 2015; Holland *et al.*, 2017; Thimasarn-Anwar *et al.* 2017).

[4]For comparison, in 2002 the percentage of problem gamblers that chose casino slot machines as their primary mode of gambling was ten percent.

TABLE 3

Descriptive statistics for gambling policy evaluation

Variables	Definitions	Mean
Gambling policy		
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 EGMs, 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

TABLE 3 Continued

Variables	Definitions	Mean
NZ European (%)	The percentage of the population whose prioritized ethnicity is NZ European.	74.56
Māori (%)	The percentage of the population whose prioritized ethnicity is Māori.	17.67
Pasifika (%)	The percentage of the population whose prioritized ethnicity is Pasifika.	3.04
Asian (%)	The percentage of the population whose prioritized ethnicity is Asian.	4.19
MELAA (%)	The percentage of the population whose prioritized 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. 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.	4.31 (6.67)
Observations		536

Notes: Data cover all 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. Annual GDP growth rates at the TA-level are estimates from MBIE. Standard deviations are shown in parentheses.

5. Empirical model

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:

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

where $\boldsymbol{y_{it}}$ 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 decile 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, $\boldsymbol{\varepsilon_{it}}$, 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 cluster bootstrapping (see Cameron and Miller, 2015, and MacKinnon, 2019 for details).

The identifying assumption in any difference-in-differences approach is that pre-treatment trends are similar across treatment and control groups. This is typically verified by visual inspection, or empirically using methods akin to event study models which check for placebo treatment effects before policy changes occur. In our case, due to having multiple treatment types enacted in different time periods, it is not clear how to visually inspect the parallel trends assumption. Instead, we empirically inspect this assumption by predicting our outcomes while including two leading policy indicators for each treatment type—one and two years prior to the actual policy change-alongside treatment dummy variables in levels and two lagged policy indicators. We refrain from adding additional leads/lags as it would leave us for too few observations for meaningful hypothesis testing. We examine the coefficients on leading indicators for each of our three main outcomes. Any coefficient statistically different from zero on leading indicators suggests that the parallel trends assumption does not hold. Table 4 presents the results of these tests. We find little evidence that there are any significant differences in pre-treatment trends in outcomes. Out of the 18 *t*-tests we conduct, in only one case do we find a coefficient on a pre-treatment policy indicator that is statistically different from zero. Specifically, we estimate a ten percent decrease in player losses in the year prior to

implementing a per capita cap. Although this effect is statistically significant, it is not unusual to detect a statistically significant coefficient when testing so many hypotheses (in our case the likelihood of detecting at least one false negative at the five percent significance level is $1 - 0.95^{18} = .603$).

TABLE 4

Tests of the parallel trends assumption

Variables	(1) EGMs	(2) Venues	(3) Machine spending
Absolute cap(*t-2*)	-1.22	.578	-.008
	(19.90)	(2.22)	(.046)
Absolute cap(*t-1*)	-25.95	-1.62	-.053
	(27.95)	(2.20)	(0.33)
F-statistic (*p*-value)	.286	.751	.123
Per capita cap(*t-2*)	-6.82	.876	-0.100
	(34.25)	(3.81)	(.086)
Per capita cap(*t-1*)	-33.98	-1.96	-0.100***
	(29.69)	(2.79)	(.036)
F-statistic (*p*-value)	.478	.718	.010
Sinking lid(*t-2*)	11.20	.783	-.001
	(25.27)	(3.44)	(.064)
Sinking lid(*t-1*)	-27.05	-1.20	-.051
	(29.91)	(2.63)	(.040)
F-statistic (*p*-value)	.646	.696	.446
Overall *F*-statistic (*p*-value)	.509	.992	.087
Observations	335	335	335

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. All regressions include two leading indicators of policy changes, two lagging indicators of policy changes, and policy change variables in levels. Coefficients on covariates are not reported for brevity. Indented *p*-values of *F*-statistics test the null hypothesis that the two leading policy indicators are jointly equal to zero. The overall p-value of the F-statistics test the null hypothesis that all leading policy indicators are jointly equal to zero.

6. Results

Table 5 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 5, 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 eight venues respectively), and lower for the sinking lid policy (36 machines and four venues respectively). As shown in Table 5, the direct impact on the number of venues and EGMs are contemporaneous in nature, with no significant impacts in the following year.

TABLE 5

Impact of gambling policies on EGMs, Venues and Machine spending

Variables	(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)

TABLE 5 Continued

Variables	(1) EGMs	(2) Venues	(3) Machine spending
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^2	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.

The impact on gambling expenditure is of key importance and is shown in column (3) of Table 5. 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. Sinking lid policies appear 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.

Lastly, we appeal to decomposition methods proposed by Goodman-Bacon (2018) to better understand what is driving our results. Goodman-Bacon showed that two-way fixed effects difference-in-difference models are a weighted average of results using three different groups as the control: timing groups, or groups that are treated at different times which can serve as other's control groups in different time periods (e.g., groups treated later in the sample period can serve as controls for groups that are treated earlier on); always treated, the group that was treated before the sample period; and the never treated group. We present these results in Table 6. Decomposition indicates that over 80 percent of results are driven by TAs that adopted regulations beyond the Act before the sample period began in 2010. Reassuringly, all estimates using the three control groups are negative for each outcome. Notably, Goodman-Bacon decomposition requires a single binary treatment indicator and does not allow for controls. Thus, the decomposition is also an exercise in whether results are similar when assuming homogeneous treatment (i.e., absolute caps are identical to per capita caps and sinking lids) and no lagged treatment effects. Although point estimates for models of EGMs and Class 4 venues are now not statistically different from

zero, the simplified model estimates an 11.7 percent decline in player losses upon enacting any Class 4 gambling policy beyond the Act.

TABLE 6

Goodman-Bacon decomposition

	(1) EGMs	(2) Venues	(3) Machine spending	Weight
Timing Groups	-41.18	-5.93	-.048	3.48%
Always Treated	-25.55	-4.58	-.122	82.04%
Never Treated	-34.13	-1.04	-.106	14.78%
Weighted Average	-27.34 (25.16)	-4.11 (3.05)	-.117*** (.028)	
Observations	603	603	603	

7. Impact on problem gambling intervention services

We next focus on one area we may expect to see changes in if there is a drop in the number of problem gamblers—the 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 endeavor. 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 several 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 5 illustrates, there are two types of services available—full and brief. Each of these service types may be attended by an individual, a group, a family, or a couple. These services may be directed at family members, individual gamblers, or other affected parties. 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 7.

FIGURE 5

Information available in the CLIC database

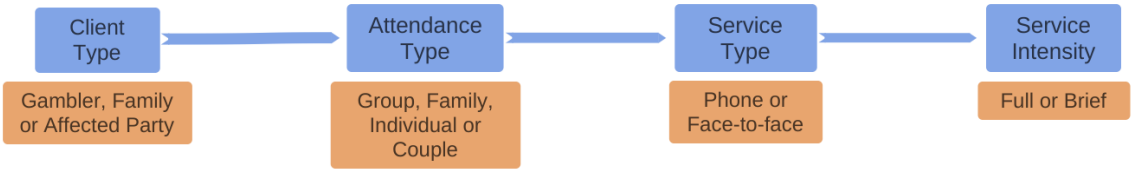


TABLE 7

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

Notes: 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 7, 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 8 presents the model estimates. Table 8 suggests mixed findings regarding problem gambling service utilization. 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. 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 8

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^2	0.09	0.07	0.12	0.09	0.05	0.09	0.10	0.08	0.07

Notes: 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 are included. Bootstrapped clustered standard errors are shown in parentheses. ***, **, and * denotes statistical significance at the one, five, and ten percent-levels, respectively.

Table 8 also shows that sinking lid policies seem to have a consistently negative and statistically significant effect on service use, relative to the reference group. Focusing 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 face-to-face or full interventions, or the narrower subgroup of existing clients.

Not shown in Table 8, 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 8 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.

8. Conclusions

This research aim of this paper is to understand the impact of local public health interventions on problem 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 spans from 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 (14.7 percent) and the number of venues by 7 (16.6 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 problem gambling 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. Sinking lids are the only policy estimated to reduce gambling expenditure in both contemporaneous and lagged years.

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 utilized 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, results should be interpreted cautiously.

Another limitation is that we do not 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. 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.

A last limitation that deserves discussion is how policy changes are likely endogenous in our econometric model of Class 4 gaming outcomes—that is, certain events at the TA-level may simultaneously cause TAs to enact certain Class 4 gambling policies, and also directly affect EGM densities and gambling expenditure. For example, if several new Class 4 venues opened up within a particular year, by availability theory this would be expected to increase machine spending, and that several new venues opened within a short period of time could cause the local government to enact tougher gaming restrictions. In this case it is problematic to attribute any changes in subsequent spending to the policy itself. As another example, there may be cultural heterogeneity at the TA-level, where some regions have a less favorable view of Class 4 gaming in general. One might reasonably expect less Class 4 gambling and tougher gambling restrictions in such a TA. For these reasons, it is difficult to precisely identify a causal link between local gambling policy and machine spending. We note, however, that the inclusion of TA and time fixed effects should control for many forms of policy endogeneity. Any unobservable characteristics that does not change over time, such as a local culture of gambling disapproval, is captured by TA-level fixed effects. Any trends that occur over time, such as increasing spending due to new venues opening, is captured by time fixed effects.

Our results support the availability hypothesis. Recall that the availability hypothesis simply asserts that the more exposure individuals have to gaming outlets, the more gambling activity occurs. Over our sample period, we observe significant declines in Class 4 venues and EGMs on a per 100,000 basis at the TA-level. We also observe substantial declines in real per capita EGM spending at the TA-year-level. Further, we find evidence that stringent Class 4 gaming policies, including absolute caps, per capita caps, and sinking lids—designed to reduce the availability of problem gambling outlets, significantly decrease problem gambling spending.

In terms of future research, there are a number of potential areas. To further explore patterns in the use of gambling intervention services, future research could undertake hazard modelling with the CLIC data to better understand which factors are associated with the duration and completion of gambling

intervention service use. This research would also benefit from a 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.

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