

DEPARTMENT OF ECONOMICS AND FINANCE
SCHOOL OF BUSINESS AND ECONOMICS
UNIVERSITY OF CANTERBURY
CHRISTCHURCH, NEW ZEALAND

**Alcohol Availability and Alcohol-Related Harm:
Exploring the Relationship between Local Alcohol Policies
and Crime in New Zealand**

**Lauren Tyler-Harwood
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**Department of Economics and Finance
School of Business
University of Canterbury
Private Bag 4800, Christchurch
New Zealand**

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Alcohol Availability and Alcohol-Related Harm: Exploring the Relationship Between Local Alcohol Policies and Crime in New Zealand

Lauren Tyler-Harwood¹
Andrea Kutinova Menclova^{1†}

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Abstract: We exploit spatial and temporal variation in the implementation of local alcohol policies in New Zealand to study their impact on crime. To do this, we construct a detailed dataset on local alcohol policies applicable across territorial authorities between July 2014 and January 2019. We then merge in monthly crime counts and estimate Poisson regressions of the relationship, controlling for unobservable local characteristics and time trends. Overall, local alcohol policies do not appear to have reduced crime. This result holds for specific policy dimensions and their stringency, and is reasonably robust across crime types, days/times of occurrence, and socio-economic subgroups.

Keywords: Local alcohol policies, Crime, Availability theory

JEL Classifications: I12, I18, H75

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¹ Department of Economics and Finance, University of Canterbury, NEW ZEALAND

[†]Corresponding author: Andrea Menclova, email: andrea.menclova@canterbury.ac.nz

I. Introduction

Alcohol consumption is an important part of the sporting, home and social lives of many New Zealanders. While it is widely accepted that moderate levels of consumption yield significant private benefits and generate only small negative externalities, excess alcohol consumption generates large costs (internal as well as external), including via aggression, violence and injury (Babor et al., 2010). For example, 18% of worldwide interpersonal violence-related deaths in 2016 were attributable to alcohol consumption (World Health Organization, 2018, p. 67). Domestically, the New Zealand Police (2010; 2018) report that one in three violent crimes, and one in two serious violent crimes, are committed by perpetrators who have been drinking prior to the offence, and the Ministry of Health (2019) find that roughly one in five New Zealanders engage in drinking that carries a risk of harming themselves or others.

Alcohol availability - that is, the ease at which alcohol can be obtained - is considered to be a key environmental factor of alcohol-related crime (Babor et al., 2010). In many countries, the post-World War II. era saw a liberalisation in access to alcohol (Stockwell & Chikritzhs, 2009). This trend has often been reversed in the last two decades following growing public discontent with increased alcohol availability and a perceived increase in alcohol related problems as a result (Wilkinson et al., 2016). These legislative changes have provided research opportunities to examine the so-called Availability Theory that increasing/decreasing the availability of alcohol in a society leads to increased/decreased consumption and societal problems such as crime (Stockwell & Gruenwald, 2003).

New Zealand's Sale and Supply of Alcohol Act 2012 set national default trading hours for alcohol outlets. The Act also gave territorial authorities (TAs) the option to develop their own local alcohol policies (LAPs) to regulate alcohol availability through licensing constraints such as local maximum trading hours. In this paper, we exploit the spatial and temporal variation in the implementation and stringency of LAPs to study the impact of such policies on crime.

Specifically, we construct a panel dataset on New Zealand's 66 mainland TAs over 55 months between July 2014 and January 2019. This dataset links local trading hour and licensing restrictions to TA-level crime rates for a range of crime types. We also include TA-level demographic information, which we use as covariates in our initial regression analyses to control for observable heterogeneity in local circumstances that may contribute to variation in crime rates across TAs. In our preferred model specification, we include TA fixed effects to control for unobservable heterogeneity among TAs, as well as TA-specific linear time trends and month-year fixed effects to control for unobservable time-varying factors that may be

correlated with LAP adoption.

Overall, we do not find any strong evidence of a reduction in crime following the implementation of LAPs. This null result holds across a range of model specifications and LAP dimensions. It also holds for a range of crime types and across various subsamples by the day of week (weekend vs. weekday) and time of day (nighttime vs. daytime). Our failure to identify significant reductions in crime following LAP imposition may reflect LAPs being non-binding: in some cases, licensed premises appear to have already operated within the restricted trading hours specified by the LAP.

The remainder of this paper is structured as follows: section II. provides an overview of New Zealand's liquor regulations from the earliest licensing laws to the introduction of LAPs and section III. reviews previous literature on the effects of such laws and local policies on crime. Section IV. discusses our empirical strategy and section V. describes the panel datasets we have compiled and documents the observed variation in LAP characteristics across TAs. Section VI. presents our regression results and section VII. offers a discussion and general conclusions.

II. Background

II.A. Liquor Laws in New Zealand

New Zealand adopted its earliest liquor licensing laws from Britain in 1842 (Newman, 1975). Between 1836 and 1919, New Zealand, like Britain and elsewhere, had a strong temperance movement. While nationwide prohibition was narrowly avoided - it gained 55.8% of the vote in a 1911 referendum, just short of the three-fifths majority needed - New Zealand had relatively strong restrictions on the sale of liquor during these early years (Christoffel, 2008). In 1893, New Zealand put a freeze on the number of liquor outlets with an option to reduce them or ban the sale of alcohol altogether via local polls. By 1910, nearly 20% of the population lived in a district that had banned the sale of alcohol (Murray & Cocker, 1930). Finally, in 1917, New Zealand became the only country in the world to implement a nationwide ban on selling alcohol after 6pm (Christoffel, 2006).

New Zealand liquor laws started to slowly loosen after World War II. For example, in 1948, a law banning Māori from buying alcohol was abolished. In 1967, the nationwide ban on selling liquor after 6pm that had by then been in place for fifty years was lifted and replaced with a 10pm nationwide closing time (Gibson, 2008).¹

¹ There were some limited exceptions made in the early 1960s before the ban was lifted. For example, a small

The pace of reform increased following the passing of the Sale of Liquor Act 1989, which liberalised the alcohol-licensing regime. Licences became easier to obtain as the earlier “needs test,” which required applicants to demonstrate that a new outlet was “necessary or desirable” for the public, was removed (New Zealand Law Commission, 2009). In addition, licences were available to a wider range of premises, including supermarkets and grocery stores that were able to sell wine (Christoffel, 2006). This allowed for the rapid proliferation of alcohol outlets, which almost doubled in just five years, from around 6,200 licences in 1990 to 10,800 by 1995 (Hill & Stewart, 1996). Uniform hours of sale were also removed. Instead, hours were at the discretion of the Alcohol Licensing Authority, which often allowed liberal closing times (Christoffel, 2006).

The year 1999 brought further changes, including the removal of the nationwide ban on the sale of alcohol on Sundays, lowering the drinking age from 20 to 18, and allowing supermarkets to sell beer (New Zealand Law Commission, 2009). Per-capita alcohol consumption increased by 9% between 1998 and 2008 (New Zealand Law Commission, 2010).

II.B. The Sale and Supply of Alcohol Act 2012

Various reports in the 2000s drew associations between the apparent increases in alcohol availability and an increase in alcohol-related harm (Huckle et al., 2006; Kypri et al., 2017). Eventually, mounting public concern led the Government to commission a comprehensive review of the current regulatory settings for alcohol in New Zealand (MacLennan et al., 2016). The Law Commission’s review was completed in 2010 and called for the 1989 Sale of Liquor Act to be repealed and replaced, noting in particular that they believed it had the effect of increasing rather than reducing alcohol-related harm (New Zealand Law Commission, 2010, p.8).

In response to the Commission’s findings, the Government introduced the Sale and Supply of Alcohol Act 2012 (“the Act”).² The Act legislates that “the sale, supply, and consumption of alcohol should be undertaken safely and responsibly; and the harm caused by the excessive or inappropriate consumption of alcohol should be minimised.” The Act lists crime as a key harm to be minimised.

The Act implemented two main measures that constrain alcohol availability. First, it set

number of restaurants were allowed to obtain licences to sell alcohol until 8pm (Christoffel, 2006).

² The Law Commission’s proposals went much further than the Government’s subsequent legislation. Notably, the recommendations to increase the excise tax on alcohol by 50%, bring alcohol marketing under greater regulation, and increase the purchasing age of alcohol to 20 were not included in the Act (Randerson et al., 2018).

national default trading hours to 8am - 4am for club and on-licences and 7am - 11pm for off-licences.³ These restrictions reportedly led to only modest reductions in alcohol availability in urban centres. For example, Randerson et al. (2018) find that just 6% of on-licence premises in New Zealand were impacted by the national maximum closing time. Second, and importantly for our purposes, the Act gave TAs the option to develop LAPs, which were seen as key instruments for achieving the Act's wider goal of enabling greater community input into local licensing decisions (Maclennan et al., 2016).

II.C. Local Alcohol Policies

Through developing an LAP, TAs can restrict the maximum trading hours beyond the national default provided in the Act.⁴ An LAP can also include policies on the following matters relating to alcohol licensing: i) one-way door policies, which allow patrons to leave premises but not enter or re-enter after a certain time; ii) whether further licences, or licences of particular kinds, should be issued for premises in the district concerned, or any stated part of the district; and iii) restrictions on the locations of licensed premises, by reference to the proximity to certain facilities (such as sensitive sites), premises of particular kinds, or broad areas.

Section 133 of the Act specifically precludes taking into account any inconsistency between a relevant LAP and the renewal of a licence, or the consequences of its renewal, when deciding whether to renew a licence. Therefore, provisions relating to density and location of alcohol outlets apply only to new licences. This may limit the impacts of LAPs in districts that already have a large number of outlets (Jackson & Robertson, 2017).

Developing an LAP is an involved process that can take TAs many months. To adopt an LAP, a TA must: produce a draft LAP in consultation with Police, licensing inspectors and Medical Officers of Health; hold official public consultations; develop a provisional policy taking into account the feedback received; and provide public notice of the intent to adopt the provisional LAP with a 30 day period for appeals. If there are no appeals then the provisional policy becomes final 30 days after it is notified, after which public notice of the adoption advising the date of entry into force should be issued. Where appeals are made, these must be

³ On-licence and club licence premises can sell alcohol for consumption at the premise, while an off-licence premise can sell alcohol for consumption somewhere else. A club licence has an extra condition that it may only supply alcohol to authorised customers of the club (Sale and Supply of Alcohol Act 2012).

⁴ While the option to extend trading hours past the national default also exists in theory, no TA has successfully adopted such a provision in practice. Wellington included a 5am closing time in its provisional LAP. During the appeal process however, the Alcohol Regulatory and Licensing Authority ruled that Wellington's proposed 5am closing time was unreasonable in light of the object of the Act (NZARLA 21-8, January 2015). Auckland also included a 5am closing time in their draft LAP but decided to remove it in their provisional policy.

heard in a public hearing. The Alcohol Regulatory and Licensing Authority (ARLA) may require the TA to reconsider particular elements in the provisional LAP if they are deemed unreasonable in light of the objectives of the Act. Once all appeals have been resolved, the revised provisional LAP can be adopted and becomes effective three months after public notice of the adoption is given.⁵ Once in force, District Licensing Committees must take LAPs into account in their licensing decisions.⁶

III. Literature Review

The dominant theory on how policy interventions that restrict access to alcohol might affect alcohol-related harm is the Availability Theory, which posits that when alcohol is more widely available in society, alcohol consumption increases, in turn increasing alcohol-related harm (Single, 1988). Government controls on alcohol availability can either regulate its physical availability (i.e., how easy it is to obtain alcohol in one's physical environment) or its economic availability via the price of alcoholic drinks relative to disposable income (Stockwell & Gruenwald, 2003).

Physical availability can be further divided into temporal availability (i.e., outlet trading hours) and spatial availability (i.e., outlet location and density) (Sherk et al., 2018). According to proponents of the Availability Theory, policies that regulate the physical availability of alcohol, such as those in scope of LAPs, are some of the most cost-effective strategies to minimise alcohol-related harm (Babor et al., 2010). Previous studies cover a broad range of alcohol-related harms, including motor vehicle crashes, injuries/hospital attendances, crimes and specific types of crime such as assault or violence. Given our study uses crime data, including on assaults, we focus our literature review primarily on the latter two categories.

III.A. On-licence Trading Hours

While more empirical studies examining the effect of restricting or liberalising on-licence trading hours offer support to the Availability Theory than not, the overall picture lacks consistency.⁷ Many of the studies suggesting that restricted trading hours reduce alcohol-

⁵ Aspects other than the maximum trading hours and one-way door policies can enter into effect immediately upon adoption.

⁶ District Licensing Committees must also consider factors other than those included in an LAP when deciding whether to issue a licence, such as the impact of issuing a licence on the amenity and good order of a locality. The District Licensing Committee also has the discretion to implement conditions on individual licences that go beyond those included in an LAP or the national default level; for example, closing times that are earlier than the maximum on-licence hours in the LAP (or the national default where there is no LAP).

⁷ The quality of studies examining changes to on-licence trading hours is also varied. In their systematic review

related harm are based in Australia. In particular, studies focused on Newcastle and Sydney, following reforms in 2008 and 2014, find that restricted trading hours were associated with a substantial reduction in assaults, without displacement into earlier parts of the evening or into a neighbouring “control area” where regulations were not applied (Kypri et al., 2011, 2014; Menéndez et al., 2015, 2017). These studies demonstrate the importance of including month-year fixed effects in crime analyses by documenting crime rates’ strong seasonal components. However, in both Newcastle and Sydney, restrictions on trading hours were part of a wide-reaching package of reforms designed to reduce alcohol-related violence. Since other changes were implemented at the same time, it is difficult to isolate the effect caused by reduced trading hours. The restrictions also applied to relatively small geographic areas; for example, the Newcastle restrictions only affected 14 pubs (Kypri et al., 2011).

A number of other international studies also provide support for the Availability Theory. For example, de Goeij et al. (2015) find that a one hour extension of alcohol outlet closing times in two of the five nightlife areas in Amsterdam, the Netherlands, was associated with an increase in alcohol-related injuries of 34%. However, since suburbs are in walking distance of one another, the authors cannot rule out the possibility that patrons simply switched from control to intervention areas soon after hours were extended. Indeed, the authors document a fall in injuries in control areas. Rossow and Norstrom (2012) analyse assault data from eighteen Norwegian cities that have either extended or restricted closing times and find that extending the closing time of on-licence premises by one hour is associated with a 16% increase in assaults. They also show that this effect appears to be symmetric in that a one hour restriction in closing times is associated with a decrease in assaults by a similar magnitude. However, when Tesch and Hohendorf (2018) replicate the study and include a time trend, they find that extending trading hours no longer has a statistically significant effect on assaults.

A smaller number of studies fail to find evidence for the Availability Theory. Tesch and Hohendorf (2018) conduct a panel study of thirteen Bavarian towns in Germany. In their baseline model, they find that a change of Bavarian towns back to restrictive opening hours reduced violence by 21%. However, the effect only holds where daytime violence is low. Where daytime violence is high, crime actually increases in response to restrictions even after controlling for population, and time and area fixed effects.

Studies examining the 2003 Licensing Act in England and Wales produce particularly

of the literature between 1965 and 2008, Stockwell and Chikritzhs (2009) note that of forty-nine studies only fourteen include baseline and control measures. This problem remains in the most recent systematic review covering studies from 2005 to 2015 (Wilkinson et al., 2016).

mixed results.⁸ Contrary to the traditional advice provided by the Availability Theory, the 2003 Licensing Act proposed to reduce violence by removing restrictions on closing times. The rationale for such removals was that uniform closing times were thought to increase the opportunities for crime by leading to crowding of the streets and other infrastructure during peak closing times (Humphreys & Eisner, 2014). Removing the fixed closing time staggered departures of patrons from the city, leading to less potential for interaction and conflict between intoxicated people, and therefore less opportunity for violence and crime. This rationale is based broadly on Situational Crime Prevention (SCP) theories, which emphasise the role of situational factors in explaining why crimes occur in space and time and in developing interventions that reduce opportunities for crime (Clarke, 1983).

Humphreys and Eisner (2014) use firm-level data in Manchester City to create detailed indicators to specifically test both the Availability and the SCP theories following the introduction of the 2003 Licensing Act. They find no evidence to support either theory. An earlier study by Humphreys et al. (2013), while deviating from the Availability Theory in finding no evidence for an increase in overall violence in Manchester, did observe some of weekend violence shifting into later times of the night. Other studies in the UK have also found similar displacements, suggesting that it may be important to examine temporal changes in crimes throughout the day/night (Durnford et al., 2008).

III.B. Off-licence Trading Hours

The majority of studies examining the effect of trading hours on alcohol-related harm look at on-licence premises. However, the small numbers of studies that focus on off- licences tend to find a positive relationship between longer hours and alcohol-related harm.

Heaton (2012) and Han et al. (2016) find some evidence for an increase in crimes following the lifting of the Sunday off-licence alcohol sales ban in the U.S. states of Virginia and Pennsylvania, respectively. The Sunday bans were only lifted for certain jurisdictions in Virginia and for certain premises in Pennsylvania. Both studies exploit this variation in a triple difference design that compares the change in crime before and after the intervention, relative to other days of the week, and relative to stores that remain closed. In Virginia, Heaton (2012) finds that permitted Sunday liquor sales increased lower-level property and public order crime by 5% and alcohol-related serious crime by 10%. In Pennsylvania, Han et al. (2016) find that the repeal was associated with an increase in total crimes and property crimes in low socio-

⁸ See Humphreys et al. (2013) for an overview of studies covering the 2003 Licensing Act.

economic neighbourhoods. However, neither study finds a statistically significant effect of the bans on other crime types, such as violent crimes.

Baumann et al. (2019) analyse a reduction in off-licence trading hours to 5am - 10pm in the German state of Baden-Württemberg. They conduct a difference-in-difference analysis to compare daytime crime (5am - 10pm) and night-time crime (10pm - 5am) before and after the restriction on selling alcohol during the night is put in place. They find that night-time simple assault and aggravated assault decreased by around 8% and 11%, respectively, relative to their daytime values. However, they do not find a statistically significant impact on late-night robbery or rape. Marcus & Siedler (2015) also analyse the Baden-Württemberg off-licence trading hour restrictions, with alcohol-related hospitalisations as the outcome variable. Using difference-in-difference analysis, they find that alcohol-related hospitalisations among adolescents and young adults fell by around 7% relative to other German states. They also provide evidence of a decrease in violent assault-related hospitalisations as a result of the restrictions.

A study by Wicki & Gmel (2011) in the canton of Geneva, Switzerland, finds similar patterns to the German experience. The restriction of off-licence trading hours to 7am - 9pm was associated with a 25-40% fall in alcohol-related hospitalisations for adolescents and young adults. However, the restriction in trading hours occurred alongside the prohibition of alcohol sales from petrol stations and video stores, making it difficult to isolate the causal effect of trading hours.

III.C. One-Way Door Policies

A one-way door restriction (also known as a “lock-out”) is the practice of not allowing new patrons to enter or re-enter a licensed premise after a specified time (Taylor et al., 2018). It is usually implemented around one hour before closing time to encourage a spread in patrons’ departure times from entertainment precincts (Nepal et al., 2018). Such restrictions are typically informed by SCP theories.⁹ They are designed to reduce the opportunities for crime to occur by minimising the crowding of patrons on the streets at closing time (and in the early hours of the morning as patrons cannot move between bars). The idea is that this will limit the interaction between intoxicated persons (Miller et al., 2016). However, one-way door restrictions may actually increase violence, in particular by patrons who are trying to enter a premise before the one-way door restriction commences (Cameron et al., 2018).

⁹ Some authors also appeal to the Availability Theory as lockouts restrict new patrons from accessing alcohol after a certain time, although those inside can keep drinking until closing time (Taylor et al., 2018).

One-way door restrictions have been popular policy instruments, particularly in Australian jurisdictions (Hughes & Weedon-Newstead, 2018). However, a recent systematic review of studies that evaluated one-way door restrictions independently of other regulatory interventions failed to find any evidence that one-way door policies were effective in reducing alcohol-related harm (Nepal et al., 2018). Using New Zealand data, Kirkwood and Parsonage (2008) study a one-way door restriction implemented from 4am onwards in Christchurch from October 2006 to March 2007 and find that offences actually increased by 75% in the period following the one-way door policy, compared with the same period a year earlier. However, most of this increase was driven by an increase in liquor ban breaches, which were thought to be a result of increased police presence. When liquor ban breaches and other disorder offences were excluded, the increase in crime dropped to 8% after the intervention. In addition, there were also decreases in some subsets of crime, such as serious violence offences.

A recent New Zealand study by Cameron et al. (2018) uses a mixed methods approach to examine a one-way door restriction in Whangarei. Whangarei is unique in having a one-way door policy (since 7 April 2015), despite not having adopted an LAP. Although the authors find "...strong suggestive evidence that the overall impacts (of the one-way door) have been positive" (p.39) they also concede that their quantitative evidence produces conflicting results.

III.D. Outlet Density

Many studies explore the link between outlet density and crime (Taylor et al., 2018).¹⁰ In general, such studies find a positive association between outlet density and crime (Popova et al., 2009; Gmel et al., 2016). However, relationships vary by the type of premise, the type of crime, and the specific context (Cameron et al., 2016; Gmel et al., 2016). Studies in the United States find particularly varied results. For example, some studies find a strong positive relationship between assault and off-licences, but not for on-licences (Pridemore & Grubestic, 2013) while others find the opposite (Toomey et al., 2012; Lipton et al., 2013; Snowden & Pridemore, 2013).

Moreover, some studies, including a few conducted in New Zealand, find a mediating effect of socioeconomic status and population size (Mair et al., 2013; Gmel et al., 2016). For example, Cameron et al. (2016) find that an increase in certain licence types is positively associated with crime in high deprivation and/or low population areas but not in low deprivation/high population areas.

¹⁰ Outlet density refers to the concentration of outlets in an area. It is measured a variety of ways, including the number of alcohol premises per capita, per unit of area or per roadway mile (Gmel et al., 2016).

III.E. Local Alcohol Policies in New Zealand

Research to date on the implementation of LAPs has primarily consisted of qualitative case studies and descriptive statistics. The LAP appeals process has been a key focus of research to date. For example, a mixed methods study by Randerson et al. (2018) conducted between 2013 and 2015 finds that appeals, particularly by the alcohol industry, are the most frequently reported barrier to developing an LAP, with some TAs deferring or halting development until appeal outcomes in other TAs are confirmed. Jackson and Robertson (2017) find some descriptive evidence of delays: of the thirty-three provisional policies notified as of August 2017, thirty-two were appealed, just twenty-one were adopted, and there was an average of 790 days between provisional notification and adoption of the LAP. They also report that one or both of the supermarket retailers (Progressive Enterprises and Foodstuffs) registered as appellants in thirty of the thirty-two appealed LAPs, compared to non-industry groups who registered for just 28% of all appealed policies.

UMR (2018) emphasise that although there was optimism that LAPs would be an important vehicle for addressing alcohol-related harm, there was also concern that the long, costly and resource intensive appeals process may result in some TAs being tempted to “water down” their LAPs (or abandon them altogether) to avoid appeals. Jackson and Robertson (2017) document the change in the stringency of policies in LAPs as they move through each stage towards adoption and observe that less restrictive policies tend to be included in LAPs as they progress. In particular, they note that all LAP revisions made following the appeals process have been less, rather than more, restrictive. The authors conclude that appeals by the alcohol industry have resulted in most TAs adopting LAPs that lack strong provisions, putting a significant onus on District Licensing Committees and local communities within each TA to be engaged in individual licensing decisions.

NZIER (2019) measure changes in spending patterns at licenced venues after the implementation of LAPs in three TAs (Tauranga, Western Bay of Plenty, and Waimakariri). They find no evidence of a reduction in total spending at on-licence premises. However, they observe that some patrons substitute spending from on-licence to off-licence premises in the weekends and that spending during the weekends has declined following reductions in maximum trading hours. They also find some evidence that spending at on-licences is brought forward, with an increase in purchases directly before the closing time.

IV. Method

We test whether reducing alcohol availability leads to a reduction in crime by comparing crime rates across TAs that do and do not implement LAPs. We consider TAs that implement LAPs as members of the treatment group, receiving doses that vary in intensity and/or type, and TAs that do not implement LAPs as members of the control group.

Specifically, we estimate empirical models of the form:

$$\text{crime rate}_{it} = \alpha + \beta X_{it} + \gamma_i + t + Y_i + \varepsilon_{it},$$

where i indexes TAs, t indexes monthly time periods, X_{it} is a vector of local licensing restrictions, γ_i is a vector of fixed effects capturing time-invariant TA-level characteristics, t are month-year fixed effects capturing a national time trend, Y_i is a vector of TA-specific linear time trends, and ε_{it} is an error term. We estimate heteroskedasticity-robust standard errors clustered at the TA level. X_{it} includes the following local licensing restrictions:

Maximum on-licence closing time: a set of dummy variables that indicate the extent to which any restriction on the maximum on-licence closing times is more stringent than the national default of 4am. We also include a dummy variable for whether the TA allows on-licence premises in the Central Business District (CBD) to extend their closing time.

One-way door policy: a dummy variable for whether the TA has a mandatory one-way door restriction in place for on-licence premises.

Club licence maximum closing time is earlier than on-licence: a dummy variable for whether the TA has a more restrictive maximum club closing time than the on-licence closing time. This variable controls for possible substitution between on-licence and club licence venues based on their relative closing hours.¹¹

Restriction on issuing new licences: a dummy variable for whether the TA has at least one restriction on issuing new licences. Restrictions include a cap on the total number of licences to be issued in an area, a restriction on the location by proximity to other licensed premises, or a restriction on the location by proximity to sensitive sites such as schools.

Difference between on and off-licence closing times: a set of dummy variables that measure the difference between the on-licence and the off-licence maximum closing times. When included in the model together with on-licence closing times, this variable captures the effect of only having one alcohol purchase option (on-licence) available. In theory, a larger

¹¹ NZIER (2019) find some evidence of substitutions between different types of premises.

distance between on- and off-licence closing times should be negatively associated with crime because only one type of drinking – and a more “monitored” one - is available. However, we acknowledge that this is a crude measure given that the time alcohol is purchased in an off-licence venue does not constrain the time at which it is consumed.

In preliminary analysis, we include TA-level control variables that the literature suggests may be positively associated with crime. These include the proportion of young men (Cameron et al., 2016) and the New Zealand Socioeconomic Deprivation index score in 2013 (Krivo & Peterson, 1996; Cameron et al., 2016).¹² However, we replace these covariates with TA fixed effects in our preferred model.

We derive crime rates from crime counts, which take on a limited number of non-negative integer values. Therefore, we estimate our regression coefficients using a Poisson estimator. We include population as an exposure variable to control for the number of people who could have committed a crime. To ease interpretation, we report coefficient estimates as incidence rate ratios (IRRs) that describe percentage changes in the crime rate from a baseline of 1.00, holding all else constant. For example, an IRR of 0.90 denotes a 10% reduction of the crime rate while an IRR of 1.10 is a 10% increase.

V. Data

We construct a unique panel dataset on the licensing restrictions within each mainland TA in New Zealand.¹³ We match these data with monthly TA-level crime rates from July 2014 to January 2019.

V.A. Local Alcohol Policies

We have obtained information on LAPs from each TA’s LAP document, as published online as at 1 January 2019. We have then manually recorded all key LAP provisions and categorised them into the LAP dimensions discussed above.¹⁴

Just under half of the TAs (32 out of 66; Table 1) had adopted LAPs by January 2019, covering a quarter of New Zealand’s population. The first LAP was adopted in Ruapehu in August 2014 and the majority of TAs adopted their LAPs in 2016 and 2017. Two TAs, Ruapehu

¹² The NZ Socioeconomic Deprivation index (Atkinson et al., 2014) uses Census data from 2013 to measure the deprivation levels of meshblocks. We calculate the TA deprivation score by taking a population-weighted mean score among the meshblocks within the TA. A higher value indicates a more socially deprived area.

¹³ The Chatham Islands are excluded from this study due to unavailability of crime data, as well as their remoteness and distinctness.

¹⁴ Our raw data is available on request.

and Hutt City, have amended their LAPs since adoption.¹⁵

TAs with LAPs tend to be smaller: the median population among all TAs in 2018 was 34,850 people, while the median population among TAs with LAPs was 32,950. New Zealand's four most populous TAs - Auckland, Christchurch, Wellington, and Hamilton - do not have LAPs in force.

Half of the TAs with LAPs are part of a joint LAP, which two or three TAs have developed together. Overall, there are 22 individual LAPs (Table 1). Our analysis is conducted at the TA level, as in many instances there are different provisions applying to each TA even within a joint LAP.

On-licence closing times

The maximum on-licence closing times adopted in LAPs range from 11pm to 3am (Table 2). The most common choice is 1am. Most TAs have the same maximum closing times for on-licences and club licences. However, ten TAs have earlier closing times for club licences.¹⁶ Four TAs (Invercargill, Hutt City, New Plymouth and Tauranga) provide extended maximum on-licence closing times of 3am for on-licence premises in the CBD. Some TAs have different maximum closing times for different types of on-licences, such as restaurants or wineries. Where this is the case, we follow previous studies and focus on the closing time for the key on-licence category which is taverns/bars.

One-way door policy

Six TAs have implemented one-way door policies as part of their LAPs. In addition, Whangarei did not have an LAP, but implemented a one-way door policy during the period of study. One-way doors were implemented one to two hours ahead of closing. Of the seven TAs to implement a one-way door policy, three implemented it only for the CBD (Ashburton, Tauranga, Whangarei), and three only implemented a one-way restriction on Thursday, Friday, and Saturday nights (Mackenzie, Timaru, and Waimate). Gisborne is the only TA to implement

¹⁵ Our panel dataset reflects these changes when enforced. The amendment to the Ruapehu LAP entered into force on 28 March 2018, and reduced the off-licence closing time from 11pm to 10pm. The Hutt City introduced a cap on off-licences from 19 October 2018. We are also aware of new LAP adoptions after the end of our study period. More recent LAP adopters include: Dunedin and Central Hawke's Bay (1 February 2019), Rotorua (9 June 2019), Napier and Hastings (21 November 2019), and Whanganui (2 December 2019).

¹⁶ Four TAs (Ashburton, Carterton, Masterton, and South Wairarapa) provide recommended maximum closing hours for club licences that are earlier than their on-licence maximum trading hours. However, as these are to be determined on a case-by-case basis, we do not flag them as necessarily more restrictive than on-licences. Invercargill is the only TA with an explicitly less stringent maximum club licence closing time (although the CBD maximum on-licence closing time is the same as the club licence closing time). Lower Hutt does not provide any reference to maximum closing hours for club licences.

a one-way door policy throughout the district and on all days of the week.

Off-licence closing times

The maximum off-licence closing times in LAPs range from 9pm to 11pm (Table 3). Just over half of TAs with LAPs specified 10pm as the maximum off-licence closing time. Five TAs opted to keep the national default maximum closing time of 11pm in their LAPs.¹⁷

Restrictions on issuing new licences

LAPs adopted to date include three key types of restrictions on the issuing of new licences: a cap on the total number of off-licences allowed in an area, a restriction on the location of a new licensed premise with respect to its proximity to other licensed premises, and a restriction on the location of a new licensed premise with respect to its proximity to sensitive sites.¹⁸ We group these three restrictions in our analysis due to the limited number of TAs adopting them, as well as the significant overlap of TAs (e.g., Waikato is one of only two TAs to adopt a cap on further off-licences¹⁹ and also one of only two to adopt the proximity restriction²⁰). These restrictions are also similar in that they all aim to restrict new licensed premises from opening in a specified area.

Four TAs - Stratford, New Plymouth, Waitomo, and Hauraki - include restrictions on the location of licensed premises by reference to proximity to facilities of particular kinds. In their joint LAP, Stratford and New Plymouth restrict new on- and off-licence premises outside the CBD from being within 100 metres of a “sensitive site.” A sensitive site is defined as a school (from an early childhood centre through to high school), a recreational facility or an open space designed to attract young people (e.g. a playground or a skate park), a community

¹⁷ Ruapehu changed their off-licence maximum closing time from 11pm to 10pm in their revised LAP.

¹⁸ For each of the three types of licensing restrictions, we only count a TA as having a restriction where the restriction applies unconditionally. For example, many TAs include the provision that generally licences should not be issued within a given distance to a sensitive site, unless it can be demonstrated that the operation of a premise will not have a significant alcohol-related impact on that site. Non-binding provisions such as this are not considered to be restrictions in our analysis. Our decision is based on the fact that all District Licensing Committees are already required to consider the impact of issuing a licence on the amenity and good order of a locality and have the ability to implement discretionary conditions on licences.

¹⁹ Hutt City also introduced a cap on off-licences (in their second LAP from October 2018). In the case of both Waikato and Hutt City, the caps were fixed at the current number of off-licences for certain sub-regions. Waikato’s cap only applies to standalone bottle stores, and only to three sub-regions - Ngaruawahia, Huntly, and Raglan - while the Hutt City cap applies to all off-licences (i.e., supermarkets and bottle stores attached to hotels are not exempt) and to six regions within Hutt City.

²⁰ Waikato and Hauraki implemented location restrictions on new bottle stores by reference to proximity to off-licence premises. The Waikato LAP stipulates that no new bottle store can open within one kilometre of the boundary of any existing off-licence premise. (Business zones in the urban areas of Te Kauwhata, Tuakau, and Pokeno are exempt.) Hauraki applies the same condition within a fifty-metre distance.

centre, a hospital, or an addiction treatment centre. Waitomo’s policy only relates to on-licences that directly border or are within 40 metres of a school, early childcare facility, or place of worship, while the Hauraki policy only applies to new off-licences for bottle stores within 50 meters of a school, early childhood education centre, or a Council-administered playground.

V.B. Crime and Control Variables

We have obtained TA-level crime data from the New Zealand Police website²¹ for the period from July 2014 to January 2019. Data before July 2014 were not available due to a major change in crime recording which made older records incomparable.

The New Zealand Police record each instance of a person, organisation or premise being victimised. They also record the TA where the crime occurred, the crime type, as well as the month, weekday and time (to the nearest hour) that the crime occurred. Crimes committed in the home (except for burglary) and homicides were not available to us due to the sensitive nature of such data.

Crime type categories are based on the Australia New Zealand Standard Offence Classifications (ANZSOC) subdivisions. They include: abduction and kidnapping; assault; blackmail and extortion; illegal use of property; robbery; sexual assault; theft; and burglary.²²

Our population data, which we use as an exposure variable in the Poisson regressions to convert crime counts to crime rates, are Statistics New Zealand’s annual population estimates for each TA.²³ These estimates are reported for June each year. We interpolate monthly population estimates for each TA by assuming constant monthly growth rates between successive annual estimates. We also use Statistics New Zealand’s population estimates to obtain the percentage of young men aged between sixteen and twenty-four. Finally, we measure deprivation using the New Zealand Social Deprivation Index for 2013 (Atkinson et al., 2014).

VI. Results

VI.A. Summary Statistics

We have calculated the number of crimes per 100,000 persons (hereafter “crime rates”) for the 66 TAs over the 55 months of our study (Table 4). The mean monthly crime rate is 269.

²¹ <https://www.police.govt.nz/about-us/publications-statistics/data-and-statistics/policedatanz/victimisation-time-and-place> (Accessed on 1 June 2019)

²² Motor vehicle theft is another subdivision but is excluded as its reporting changed during the study period.

²³ <http://nzdotstat.stats.govt.nz/> (Accessed on 12 June 2019)

The most common crime types are burglary and theft, with monthly rates of 117 and 103, respectively. Robbery, abduction and kidnapping, and blackmail and extortion are relatively uncommon, with zero crimes occurring in at least half of the sample.

Our summary statistics also highlight the variation in the population sizes of TAs (Table 4). The least populated TA, Kaikoura, has less than 4,000 persons, while the most populated, Auckland, has nearly 1.7 million.

VI.B. Regressions

We begin by regressing the overall crime rate on a dummy variable for whether an LAP is in force and the negative relationship does not reach statistical significance (Table 5, column 1). The results remain similar when we control for variables that reportedly increase crime, namely the percentage of young males and social deprivation (Table 5, column 2). Social deprivation has a positive and significant relationship with crime: on average, and holding all else constant, a one-point increase in a TA's social deprivation score is associated with a 0.5% increase in crimes per month.

However, the above estimates may be biased due to unobservable TA factors that are correlated with crime rates and LAP adoption. Our preferred specification therefore includes the full sets of TA and month-year fixed effects, as well as TA-specific linear time trends (Table 5, column 3). There continues to be no statistically significant relationship between adopting an LAP and crime. In fact, introducing appropriate controls drives the estimated effect of LAP policies to zero.

Using a crude dummy variable to capture when an LAP is in force may disguise effects driven by different levels of LAP stringency. In our subsequent analysis, we therefore introduce LAP dimensions in decreasing order of the effect we would expect them to have on crime (Table 6). Overall, we find little evidence that crime rates fall more in TAs with more stringent LAPs. The only LAP dimension that is consistently negative and statistically significant at the 1% level is the 11pm maximum on-licence closing time. On average, and holding all else constant, adopting a maximum on-licence closing time that is five hours earlier than the national default is associated with a 6% decrease in monthly crimes. However, given that only one TA, Waimakariri, has adopted this closing time (and only for weekdays), and that there is not a consistent pattern of increasingly strict on-licence closing hours being increasingly negatively associated with crime, we interpret this result with great caution.

As we build up our model, there is a trade-off between potentially identifying important dimensions of LAPs and introducing strong multicollinearity as TAs tend to implement similar LAP packages. For example, multicollinearity may be driving the positive coefficient for the

2am maximum on-licence closing time observed after controlling for club licence closing times (Table 6, columns 4 and 5). Moreover, the 11pm maximum on-licensing closing time is perfectly correlated with a one-hour difference between on-licence and off-licence closing times, preventing us from obtaining separate estimates (Table 6, column 6). Noting these issues, we proceed with robustness checks on two of our models: a simple model of the presence of an LAP (based on Table 5, column 3) and the most detailed model of LAP stringency that does not suffer from perfect multicollinearity (based on Table 6, column 5).

VI.C. Robustness Checks

Crime type

An analysis of total crimes may mask heterogeneous effects of LAPs across individual crime types. Indeed, the literature primarily focuses on the link between alcohol and assault (or a slightly broader group of violent crimes).

When we analyse different crime types separately, we observe that the introduction of an LAP is associated with a 5% decrease in assaults (Table 7). However, this result is only significant at the 10% level. We fail to find significant relationships between LAP policies and other types of crime. Similarly, we find only weak effects of individual LAP dimensions on most crime types – now also including assaults – and some of the point estimates have unexpected signs (Table 8). Burglary appears to drive the statistically significant negative association between the 11pm maximum on-licence closing time (in Waimakariri) observed earlier.

While the models with detailed LAP dimensions produce some highly significant effects on burglary and sexual assault (Table 8), we believe they are likely spurious. Specifically, 2am maximum on-licence closing time and club restrictions are significantly associated with increased and reduced levels of burglary, respectively. However, we suspect that this result is driven by multicollinearity because the effects almost exactly offset each other (19% vs. 21% changes, respectively) and neither variable continues to be statistically significant when the other is not included in the model. Similarly, 3am maximum on-licence closing time is negatively associated with sexual assault: on average and holding all else constant, reducing the maximum on-licence closing time by one hour beyond the national default is associated with a 40% reduction in sexual assaults. However, this dramatic decrease seems unlikely given that more stringent maximum on-licensing closing times are not negatively associated with sexual assault beyond the 10% significance level. In addition, when we re-estimate the model with CBD on-licence closing hours instead of non-CBD on-licence

closing hours (for the four TAs that have extended the CBD closing time) there is no longer a significant relationship. In the same way, when we remove the dummy variable for whether the maximum closing time is earlier for club licences than on-licences, the significant relationship between sexual assault and 3am maximum on-licence closing time disappears. The low frequency of reported sexual assault crimes across TAs provides another reason to interpret this result with caution.

Weekend crime

To take into account well-known public drinking patterns and to focus on times when LAP provisions such as on-licence maximum closing hours are most likely to be binding, we re-estimate our models for weekend crimes. We define weekends here in two different ways: “weekend 1” consists of Friday, Saturday and Sunday, and “weekend 2” is between 9pm on Friday and 6am on Saturday, and between 9pm on Saturday and 6am on Sunday.

Given the low prevalence of some types of crimes and the emphasis in the previous literature, we restrict our weekend analysis to assaults and thefts. We also note that while assault and theft records sometime miss week day and hour information, these records are more complete than for other types of crime.²⁴ Following previous studies, some of our weekend analyses control for the number of crimes that occurred during non-weekend hours in order to compare weekend behaviour with a baseline crime rate not expected to be affected by LAPs (Tesch & Hohendorf, 2018).

Similar to our other estimates, our weekend analyses do not reveal any strong relationships between LAP presence/dimensions and assaults (Table 9) or theft (Table 10). Moreover, the results are very similar to the full sample specification in terms of estimated magnitudes and, in general, the two different definitions of weekend yield similar results.

Time of day

It is possible that varying restrictions on trading hours affect the temporal distribution of crimes even if they do not change the overall number of crimes. Consistent with previous studies, we investigate weekend assaults over the following intervals: 9-11:59pm, 12-2:59am,

²⁴ Specifically, 5% and 13% of assaults observed over the study period are missing information on the week day and hour of the crime, respectively; and the corresponding frequencies are 10% and 17% for thefts. Other crime records are much less complete. For example, 53% of burglaries (the most frequent crime type overall) recorded over the study period are missing week days and 73% are missing the hour the burglary occurred. Police officials report that time/day information is typically recorded as missing where victims have forgotten or do not know when the crime took place. For example, with burglary offences, a victim may have been away from their residence for a long period of time.

and 3-5:59am. If an LAP has an effect on crime, we might expect this to decrease assaults over the 3-5:59am period (as maximum on-licence closing times in LAPs are 3am or earlier) and possibly shift these assaults to earlier time periods.

Even though there is a suggestive pattern in the magnitude of IRR estimates, with the largest negative association between an LAP being in force and assaults occurring at 3-5:59am, none of the estimates are statistically significant (Table 11, columns 1-3). When investigating LAP dimensions (Table 11, columns 4-9), the IRRs for a 1am on-licence closing time are of the expected direction, with an increase in crime directly before closing, and decreases in subsequent periods. However, the results are only statistically significant for the 3-5:59am period and are not statistically significant beyond the 5% level when the extended CBD on-licence times are used.²⁵ The IRRs for on-licence maximum closing times of 3am and 2am are not statistically significant.

Socio-demographic characteristics

Finally, we test whether the effect of adopting an LAP on crime varies across TA socio-demographic characteristics that the literature suggests are important. These include the social deprivation index, population size, the percentage of young men and, for weekend crimes, the baseline crime rate. For each subsample analysis, we divide TAs into two equal-sized groups (i.e., those below or above the median). We estimate two models, one with all crimes (Table 12) and one with weekend assaults (Table 13), and focus on the binary indicator of LAP existence. Our results are qualitatively similar across subgroups, indicating that LAPs do not appear to have a heterogeneous effect based on TA socio-demographic attributes.

VII. Conclusions

Overall, we find little evidence that LAPs introduced by TAs between July 2014 and January 2019 have had a significant impact on crime. As all LAPs restrict, rather than liberalise, the temporal and/or physical availability of alcohol in society, we find little empirical evidence to support the Availability Theory. Our findings are robust to many different specifications, including: controlling for specific LAP dimensions and the stringency at which they are applied; subsampling by different types of crimes; subsampling by crimes occurring at different times of the day/week. In addition, we do not find any strong evidence of temporal shifts in

²⁵ The results also appear to suffer from multicollinearity between the 1am on-licence closing time and the dummy variable for whether a TA has an extended maximum closing time for CBD on-licences.

assaults into earlier parts of the evening as a result of closing hours being brought forward.

Our results alone do not conclusively prove that LAPs, and the specific policies contained in them, are ineffective in combating crime. One reason for the absence of a change in crime rates may be that LAPs that TAs have implemented to date have not been very binding. Some TAs, including Gore, Invercargill, Southland and Porirua, explicitly acknowledge in their LAP policy document that the prescribed on-licence hours reflect the actual hours observed at the time of implementation. Using Ministry of Justice data²⁶ on all active licences in New Zealand between 2015 and 2018, we are able to estimate the percentage of existing licences that are likely to have been impacted by maximum on-licence closing hours in the LAP.²⁷ Based on active licences before LAPs were introduced in each region, none of the on-licence premises would have been impacted by the LAP on-licence maximum closing times in two of the five TAs (South Wairarapa and Porirua) that introduced LAPs in 2018. Just one, five, and fourteen existing licence(s), representing 7%, 20% and 18% of total on-licences, would have been affected by the maximum closing times in Carterton, Masterton and Gisborne, respectively.

NZIER's (2019) analysis of spending at licensed venues in Tauranga, Western Bay of Plenty and Waimakariri provides additional evidence that at least some LAPs have imposed maximum closing hours that do not affect actual hours of operation for the majority of premises. Spending data for licences in these TAs reveal that new trading hour restrictions for both on-licences and off-licences are estimated to have affected less than 0.1% of sales.²⁸ TAs may be seeking to lock in existing settings as a means of future-proofing against the possibility of more liberal District Licensing Committees. Our inability to find a significant impact on crime, coupled with suggestive evidence that core LAP provisions were not binding for at least some TAs, is consistent with other studies and commentary on LAPs to date, which emphasise the "watering down" of LAPs following legal appeal or negotiation with industry.

Another reason for a null result could be data quality. Information about the day of the week and the time of the crime was missing from our raw data for a significant portion of the crime observations. This limits our ability to detect an impact of an LAP during the key periods where the LAP may be expected to have an impact, such as night-time drinking on the

²⁶ <https://www.justice.govt.nz/tribunals/arla/register-of-licences-and-certificates/> (Accessed 11 August 2019)

²⁷ Specifically, we look at on-licences that were active directly before the LAP entered into force, to see whether any/what percentage of these licences allowed staying open beyond the LAP maximum closing times that were subsequently introduced.

²⁸ A precise estimate of on-licence sales in Tauranga was not possible due to the differing CBD and non-CBD closing times. However, using the non-CBD closing times, which likely overestimate the effect, the new hours would affect at most 2.5% of sales.

weekends. It also makes it difficult to detect shifts in crime to different parts of the day/night.

Like in many other studies, a further limitation of our data is that we cannot observe crimes directly caused by alcohol and must instead use all crimes as a proxy. Our results may also be influenced by the omission of crimes occurring in dwellings, which are not available to researchers for privacy reasons. However, if anything, we would expect this to bias our results away from a null finding. For example, if reduced hours shift people's drinking from the city to home (where they are not constrained by closing hours) and crimes are subsequently redirected to dwellings, this would appear in our analysis as a reduction in crime due to crimes committed at home not being included.

Finally, it is difficult to assess the contribution of individual policies contained in the package of an LAP because TAs generally implement a range of policies at the same time and the core provisions in LAPs are similar across TAs. Including many variables in the model creates multicollinearity problems, which may disguise effects of particular policies. We address this concern by including a range of model specifications for comparison. Across all of our models, we consistently fail to find a strongly significant effect of LAPs on crime.

There are a number of valuable potential extensions. First, it would be useful to repeat this analysis using a different harm outcome variable such as hospitalisations or motor vehicle accidents. Second, it would be useful to repeat this study with updated data on LAPs which keep being introduced in additional TAs. Third, obtaining data for each TA on the actual numbers of licences, and their permitted or actual trading hours, would also be a worthwhile extension because it would provide a more accurate picture of experienced changes to alcohol availability following the introduction of an LAP. Obtaining individual licence level sales data, as in NZIER (2019), but with an expanded scope to include all TAs, would be a further step. This would be useful in enabling a more direct observation of the impact on LAPs on alcohol consumption, which is the key mechanism through which alcohol availability is believed to influence crime.

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Table 1: LAPs adopted over time

Year	Number of TAs to adopt a new LAP	Number of new LAPs adopted (i.e. counting joint LAPs once)
2014	1	1
2015	4	3
2016	15	9
2017	7	6
2018	5	3
Total	32	22

Table 2: Maximum on-licence and club licence closing times among TAs with LAPs

	On-licence	Club licence
3am	Gore, Mackenzie, Ruapehu [†] , Southland, Timaru, Waimate	Gore, Invercargill, Southland
2am	Ashburton, Gisborne, Hurunui, New Plymouth ^{††} , Otorohanga, Porirua, Selwyn, Stratford, Tasman, Waipa, Waitomo, Whakatane	New Plymouth ^{††} , Porirua, Stratford, Tasman, Whakatane
1am	Carterton, Hauraki, Invercargill ^{††} , Kawerau, Hutt City ^{††} , Masterton, Matamata-Piako, Opotiki, South Wairarapa, Tauranga ^{††} , Thames- Coromandel, Waikato, Western Bay of Plenty	Hauraki, Kawerau, Mackenzie , Matamata-Piako, Opotiki, Otorohanga , Ruapehu , Tauranga ^{††} , Thames- Coromandel, Timaru , Waikato, Waimate , Waipa , Waitomo , Western Bay of Plenty
Midnight	n/a	n/a
11pm ^{†††}	Waimakariri	Waimakariri, Gisborne
10pm ^{†††}	n/a	Hurunui , Selwyn

[†] Ruapehu's Waimarino-Waiouru and National Park Wards have a maximum closing time of 3am, while the Taumarunui and Ohura Wards have a maximum closing time of 1am

^{††} CBD closing time of 3am

^{†††} Weekend closing time of midnight (1am for Waimakariri)

Note: TAs in **bold** impose stricter closing times on the club licence than on-licence.

Table 3: Maximum off-licence closing times among TAs with LAPs

Off-licence	
11pm	Gore, Southland, Invercargill, Whakatane, Ruapehu (2014)
10pm	Carterton, Hurunui, Kawerau, Hutt City, Masterton, Opotiki, Otorohanga, Porirua, Ruapehu (2018), South Wairarapa, Stratford, Tasman, Tauranga, Waikato, Waimakariri, Waipa, Waitomo, Western Bay of Plenty
9:30pm	Ashburton, New Plymouth
9pm	Gisborne, Hauraki, Mackenzie, Matamata-Piako, Selwyn, Thames-Coromandel, Timaru, Waimate

Table 4: Summary statistics for crime rates and TA characteristics, July 2014–January 2019

Variable	Mean	Median	Std. dev.	Min.	Max.
<i>Dependent variable: Monthly, TA-level crime rates (per 100,000)</i>					
All crime events	268.88	252.75	111.37	22.12	795.80
Burglary	116.86	109.72	56.32	0	510.51
Theft	102.73	94.29	54.76	0	437.16
Assault	38.51	35.43	22.53	0	169.49
Illegal use of property	3.66	1.73	5.35	0	57.64
Sexual assault	3.65	2.62	4.85	0	54.64
Robbery	2.92	0	4.82	0	47.24
Abduction and kidnapping	0.34	0	1.38	0	24.00
Blackmail and extortion	0.21	0	1.13	0	24.51
<i>Control variables</i>					
Population (00,000)	0.71	0.34	1.99	0.04	16.96
Percentage of young males	6.35	6.22	1.05	4.30	10.43
Social deprivation (2013)	1,005.34	996.754	48.81	909.04	1,184.84

Note: Our sample includes 3,630 monthly, TA-level observations.

Table 5: Preliminary analysis of LAPs (0/1) and overall crime rates

Dependent variable: number of crimes			
	(1)	(2)	(3)
LAP in force (0/1)	0.864 (0.075)	0.920 (0.069)	1.007 (0.026)
% young males	-	1.041 (0.041)	-
Social deprivation	-	1.005*** (0.001)	-
TA FEs	No	No	Yes
Month-year FEs	No	No	Yes
TA-specific time trend	No	No	Yes
Observations	3,630	3,630	3,630

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include population as an exposure variable.

Table 6: LAP dimensions and overall crime rates

Dependent variable: number of crimes						
	(1)	(2)	(3)	(4)	(5)	(6)
3am max. on-licence closing time	0.892 (0.062)	0.892 (0.062)	0.909 (0.072)	0.976 (0.092)	0.973 (0.091)	0.984 (0.221)
2am max. on-licence closing time	1.053 (0.040)	1.055 (0.043)	1.063 (0.035)	1.115*** (0.029)	1.109*** (0.029)	1.168 (0.158)
1am max. on-licence closing time	0.989 (0.036)	0.997 (0.036)	1.001 (0.036)	1.008 (0.036)	1.006 (0.033)	1.024 (0.148)
11pm max. on-licence closing time	0.941*** (0.013)	0.941*** (0.013)	0.940*** (0.013)	0.941*** (0.013)	0.941*** (0.013)	
Extended max. closing time for CBD on-licences		0.986 (0.049)	0.993 (0.055)	0.970 (0.051)	0.969 (0.049)	0.999 (0.061)
One-way door policy			0.969 (0.045)	0.993 (0.038)	0.994 (0.037)	1.004 (0.038)
Club max. closing time < on-licence				0.881* (0.050)	0.884* (0.050)	0.836* (0.070)
Restrict. on issuing new licences					1.028 (0.025)	1.046 (0.032)
2hr diff between on and off-licence closing time						1.051 (0.162)
3hr diff between on and off-licence closing time						0.947 (0.135)
4hr diff between on and off-licence closing time						0.998 (0.134)
4.5hr diff between on and off-licence closing time						0.867 (0.126)
7hr diff between on and off-licence closing time						1.040 (0.192)
Observations	3,630	3,630	3,630	3,630	3,630	3,575

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable. The omitted category for the difference between on-licence and off-licence closing times is 5 hours (the national default). We exclude Waimakariri in model 6 due to perfect multicollinearity. The omitted category for on-licence maximum closing times is 4am (the national default).

Table 7: LAP (0/1) and crime type

Dependent variable: number of crimes

	Assault	Illegal use of property	Sexual assault	Theft (excl. motor v.)	Burglary
LAP in force (0/1)	0.951* (0.019)	1.037 (0.146)	1.015 (0.066)	1.011 (0.041)	1.033 (0.036)
Observations	3,630	3,630	3,630	3,630	3,630

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable.

Table 8: LAP dimensions and crime types

Dependent variable: number of crimes

	Assault	Illegal use of property	Sexual assault	Theft (excl. motor v.)	Burglary
3am max. on-licence closing time	1.018 (0.161)	3.214* (1.515)	0.598*** (0.079)	1.021 (0.118)	0.910 (0.089)
2am max. on-licence closing time	0.993 (0.036)	1.157 (0.393)	0.986 (0.144)	1.059 (0.063)	1.194*** (0.051)
1am max. on-licence closing time	0.957 (0.027)	1.073 (0.248)	0.810* (0.084)	1.031 (0.058)	1.023 (0.049)
11pm max. on-licence closing time	1.026 (0.032)	0.809* (0.067)	0.864* (0.052)	1.012 (0.024)	0.854*** (0.020)
Extended max. closing time for CBD on-licences	0.949 (0.030)	1.335 (0.363)	1.071 (0.119)	0.928 (0.083)	1.034 (0.064)
One-way door policy	0.947 (0.039)	0.682* (0.108)	1.228* (0.120)	1.004 (0.069)	1.016 (0.042)
Club licence max. closing time < on-licence	1.000 (0.071)	0.495* (0.177)	1.267 (0.203)	0.978 (0.104)	0.787*** (0.054)
Restriction on issuing new licences	1.078 (0.066)	0.942 (0.253)	1.346* (0.164)	1.054 (0.036)	0.984 (0.051)
Observations	3,630	3,630	3,630	3,630	3,630

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable. The omitted category for the maximum on-licence closing time is 4am (the national default).

Table 9: Effect of LAPs on weekend assaults

Dependent variable: number of assaults						
	(1)	(2)	(3)	(4)	(5)	(6)
	Weekend	Weekend	Weekend	Weekend	Weekend	Weekend
	1	2	1	2	1	2
LAP in force (0/1)	0.952 (0.033)	0.929 (0.067)				
3am max. on-licence closing time			1.004 (0.187)	0.999 (0.310)	0.933 (0.075)	0.833 (0.119)
2am max. on-licence closing time			1.040 (0.080)	1.047 (0.169)	0.966 (0.049)	0.883 (0.105)
1am max. on-licence closing time			0.945 (0.059)	0.870 (0.100)	1.003 (0.066)	1.008 (0.115)
Extended max. closing time for CBD on-licences			0.961 (0.086)	0.905 (0.141)		
One-way door policy			0.991 (0.056)	1.136 (0.085)	0.987 (0.056)	1.134 (0.106)
Club licence max. closing time < on-licence			0.897 (0.099)	0.832 (0.164)	0.968 (0.079)	0.990 (0.141)
Restriction on issuing new licences			1.032 (0.079)	1.105 (0.155)	1.046 (0.066)	1.145 (0.096)
Non-weekend crimes			0.999* (0.000)	1.000 (0.000)	0.999* (0.000)	1.000 (0.000)
Observations	3,630	3,630	3,630	3,630	3,630	3,630

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable. Column 1, 3 and 5 include all crimes occurring on Friday, Saturday or Sunday, while columns 2, 4, and 6 include crimes occurring between 9pm on Friday and 6am on Saturday, and between 9pm on Saturday and 6am on Sunday. The omitted category for on-licence maximum closing times is 4am (the national default).

Table 10: Effect of LAPs on weekend theft

Dependent variable: number of thefts

	(1) Weekend 1	(2) Weekend 2	(3) Weekend 1	(4) Weekend 2	(5) Weekend 1	(6) Weekend 2
LAP in force (0/1)	1.014 (0.058)	0.933 (0.081)				
3am max. on-licence closing time			1.189 (0.218)	1.009 (0.323)	0.921 (0.091)	0.997 (0.140)
2am max. on-licence closing time			1.140 (0.100)	0.692** (0.088)	1.157 (0.108)	0.676** (0.089)
1am max. on-licence closing time			1.099 (0.077)	0.849 (0.103)	1.048 (0.080)	0.876 (0.124)
Extended max. closing time for CBD on-licences			0.809* (0.086)	1.229 (0.193)		
One-way door policy			1.032 (0.076)	1.044 (0.136)	1.020 (0.075)	1.072 (0.138)
Club licence max. closing time < on-licence			0.890 (0.143)	1.271 (0.334)	0.930 (0.141)	1.280 (0.292)
Restriction on issuing new licences			0.931 (0.037)	0.964 (0.260)	0.939* (0.030)	0.913 (0.219)
Non-weekend crimes			1.000 (0.000)	1.000 (0.000)	1.000 (0.000)	1.000 (0.000)
Observations	3,630	3,630	3,630	3,630	3,630	3,630

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable. Column 1, 3 and 5 include all crimes occurring on Friday, Saturday or Sunday, while columns 2, 4, and 6 include crimes occurring between 9pm on Friday and 6am on Saturday, and between 9pm on Saturday and 6am on Sunday. The omitted category for on-licence maximum closing times is 4am (the national default).

Table 11: LAP dimensions and temporal distribution of weekend assaults

Dependent variable: number of assaults									
	9-11:59pm	12-2:59am	3-5:59am	9-11:59pm	12-2:59am	3-5:59am	9-11:59pm	12-2:59am	3-5:59am
LAP in force (0/1)	0.925 (0.077)	0.985 (0.094)	0.743 (0.155)						
3am max. on-licence closing time				1.419 (0.611)	0.946 (0.304)	0.465 (0.212)	0.917 (0.107)	0.797 (0.120)	0.784 (0.232)
2am max. on-licence closing time				0.917 (0.167)	1.222 (0.225)	0.556 (0.211)	0.746 (0.130)	1.065 (0.164)	0.547 (0.232)
1am max. on-licence closing time				1.222 (0.230)	0.870 (0.174)	0.264*** (0.090)	1.368 (0.297)	0.990 (0.227)	0.329* (0.155)
Extended max. closing time for CBD on-licences				0.763 (0.154)	0.832 (0.171)	2.600** (0.885)			
One-way door policy				1.148 (0.160)	1.105 (0.092)	1.320 (0.286)	1.189 (0.161)	1.083 (0.117)	1.214 (0.304)
Club licence max. closing time earlier than on-licence				0.602 (0.194)	0.938 (0.186)	1.306 (0.542)	0.780 (0.156)	1.102 (0.169)	1.191 (0.463)
Restriction on issuing new licences				0.908 (0.228)	1.192 (0.256)	1.258 (0.270)	0.818 (0.202)	1.317* (0.180)	1.606 (0.411)
Observations	3,630	3,630	3,520	3,630	3,630	3,520	3,630	3,630	3,520

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable. The omitted category for on-licence maximum closing times is 4am (the national default). Columns 4, 5 and 6 apply the on-licence maximum closing hours with a dummy variable for whether a TA has an extended maximum closing time for CBD on-licences, while columns 7, 8, and 9 apply the CBD on-licence maximum closing hours. Two TAs drop out of the 3am-5.59am due to having zero observations across this time period.

Table 12: LAPs and overall crime, subsampled by TA socio-demographic characteristics

Dependent variable: number of crimes

	Low depriv.	High depriv.	Low popul.	High popul.	Low % young males	High % young males
LAP in force (0/1)	1.038 (0.020)	0.980 (0.048)	0.966 (0.050)	1.012 (0.029)	1.033 (0.028)	0.992 (0.038)
Observations	1,815	1,815	1,806	1,824	1,806	1,824

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable.

Table 13: LAPs and weekend assaults, subsampled by TA socio-demographic characteristics

Dependent variable: number of assaults

	Low weekday crime	High weekday crime	Low depriv.	High depriv.	Low popul.	High popul.	Low % young males	High % young males
LAP in force (0/1)	0.911 (0.091)	0.906 (0.086)	0.911 (0.094)	0.977 (0.098)	0.968 (0.159)	0.914 (0.074)	0.901 (0.087)	0.914 (0.091)
Observations	1,811	1,812	1,815	1,815	1,806	1,824	1,806	1,824

Notes: Estimates are IRRs. Heteroskedasticity-robust standard errors, clustered at the TA level, in parentheses (** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). All models include month-year fixed effects, TA fixed effects and a TA-specific linear time trend, and population as an exposure variable.

Weekend is here defined as being between 9pm on Friday and 6am on Saturday, and between 9pm on Saturday and 6am on Sunday.