Restrictions on Market-based Solutions to Gambling: The Effect of a Gaming Machine Act Amendment on Domestic Households

Executive Summary

This paper examines the casual effect of a decrease of electronic gaming machines as a result of the Gaming Machines Amendment (Leasing and Assessment) Act 2018 (NSW) on non-business-related insolvencies and domestic violence reports. It utilises a difference-in-difference framework to evaluate longitudinal data which geographically separates local government areas. The model generates a control group of local government areas that have not had the quantity of their electronic gaming machines affected by the policy change and a treatment group that experience tighter legislative restrictions. Empirical analysis of the policy change enables this paper to conclude that there is no causal relationship between the subsequent decrease in electronic gaming machines and the number of domestic violence reports or personal insolvencies. The paper also considers various model specifications to examine the effect on males and females. The analysis aims to contribute to the existing literature and demonstrate the subsequent effects of gambling related policy changes.

Introduction

It is well understood that gambling creates undesirable and perverse effects. Our paper will examine the causal effect of gambling on domestic abuse and financial stability. More specifically, we look at the causal effect of an amendment of the *Gaming Machine Act 2001* (NSW) on domestic assault and non-business personal insolvencies. Australia is an international gambling capital that holds the global record for gambling losses per capita. According to the Queensland department of justice and Attorney-general, Gambling alone caused $2.2 billion in relationship and breakdown costs and $1.6 billion in emotional and psychological issues as a result of the staggering $242 billion bet in 2017. The current consensus of both Australian and international literature indicates that electronic gaming machines have an adverse effect on relationships and thus on domestic violence. Further, the consumption of income is known to decrease available income and thus increase risks of insolvency and bankruptcy. Our use of a difference-indifference framework enabled us to effectively evaluate the 2018 policy change using longitudinal data, opposed to the current existing literature that has been limited to cross-sectional data in multivariate OLS models. The paper found a zero-causal relationship between the policy change and our specified outcomes, despite a decrease in electronic gaming machines. The paper is set out as follows. Section one explores the background to our research and the hypothesised effect of legislative amendments. Section two will summarise the literature and draw upon the novelty of our model. Section three explains the data we use. Section four explains our econometric methods for causal analysis and provides support for underlying assumptions. Section five provides our results and discussion. We then probe the robustness of our results by regressing multiple specifications to explore the impact on our estimates. Section six concludes the paper.

1. Background

i) Theoretical Rationale

Gambling creates many social concerns which often stem from a loss of money. Finances and the domestic household are intertwined; financial stress may cause relationship stress and unfortunately, result in violent outcomes. A 2010 Productivity Commission Report stated that

gaming can have adverse effects on suicide, depression, relationship breakdown, lowered work productivity, job loss, bankruptcy and Crime. A 2006 Victorian study surveyed a group of family violence victims and concluded that 34.2% of family violence experiences were perpetrated by or against problem gamblers and that gambling was a significant factor in 70% of all cases (Grant Kalischuk, Ruth, Nadine Nowatzki, Kelly Cardwell, Kurt Klein and Jason Solowoniuk. 2006). The Queensland Treasury has established that between 2016-17 alone, gaming caused $2.2 billion in relationship breakdown costs which emphasises the manner to which financial stress acts as a mechanism to manifest relationship breakdowns and domestic violence from regular gambling behaviour.

This financial loss may affect individuals to the extent that they are no longer able to manage their financial liabilities, becoming insolvent. Non-business insolvency is attributed to the excessive use of credit, unemployment or income loss, gambling or speculative behaviour, domestic discord or relationship breakdown, ill health or adverse legal action according to the Australian Financial Security Authority (AFSA). The presence of gambling as a notable contributor according to the AFSA indicates it's severity. However, the aforementioned 2010 Productivity commission report attributed family breakdown, income loss, unemployment and crime as other by-products of gaming, indicating that a decrease in EGMs will not only lead to a decrease in non-business induced insolvencies directly from decreased gambling, but decrease the amount of family breakdowns, unemployment and income loss, and adverse legal action which will also decrease non-business insolvencies. Therefore, the rationale is that a decrease in EGMs as a result of the 2018 policy change will also lead to a decrease in non-business-related insolvencies.

ii) Legislative Amendment

Gaming machines are defined as devices designed for the playing of a game of chance and the pay out of money.[1] They are regulated by the *Gaming Machine Act 2001 (NSW)* ('GMA').[2] The GMA provides a threshold of gaming machine 'entitlements' that a venue must not exceed and sets a cap of 99,000 gaming machine entitlements that cannot be exceeded by the whole state.[3] Each gaming machine entitlements allows one Electronic

[1] *Gaming Machine Act 2001 (NSW)* s 4
[2] *Gaming Machine Act 2001 (NSW)*
[3] GMA s 10

Gaming Machine (EGM) to be authorised and operate. If a venue wishes to increase their maximum number of gaming machines they hold (their gaming machine 'threshold'), they must get existing entitlements from someone else.[4] The Act stipulates the rules and requirements for a transfer of gaming machine entitlements from one venue to another – it is here where our treatment policy is focused upon.

An application to increase a venue's threshold may need an accompanying Local Impact Assessment (LIA) which is to be approved by the Liquor and Gaming Authority ('the Authority'). The LIA will only be approved by the Authority if it satisfies various positive benefit on the community tests.[5] It effectively makes it harder for venues to accumulate more machines. Before the policy change, venues could acquire entitlements from any venue in their LGA without an LIA.

The Gaming Machines Amendment (Leasing and Assessment) Act 2018 (NSW) introduced provisions that prohibits the movement of gaming machines to higher risk areas. This is done through four steps. Firstly, instead of considering whether or not an LIA is needed inter-LGA, the amendment reduces the size of government boundaries from LGAs to Statistical Area level 2 (SA2) as defined by the ABS to reflect how communities interact. This limits options for venues to trade without submitting a LIA. Secondly, the Authority must rank each SA2 into one of three bands based off the area's risk of gambling related harm. This is then used to determine what increase to its gaming machine threshold a venue can apply for and what it is required to do as part of its LIA – the higher the band the more burdensome the restrictions and requirements are, making it harder for higher risk areas to obtain more machines. Figure A1 provides a map of the boundaries and their respective band. Thirdly, venues are restricted to acquiring entitlements without an LIA only from venues within their LGA *and* where the entitlements move from a SA2 that is of the same banding or a lower banding. This does not allow gaming machines to move from lower to higher risk areas without consulting the community and assessing the impact of additional machines in the area. Fourthly, if a venue is within a band 3 SA2, they are prohibited from acquiring any additional machines whatsoever, effectively creating 'no go' areas.

[4] GMA s 19.
[5] GMA s 36.

The amendment was part of a suite of reforms described as "the most significant set of reforms to New South Wales gaming regulation in more than 10 years". We focus on this specific amendment as it is the most substantial change to gaming machine regulation. Other enacted legislation focuses on tougher penalties for breaching gambling advertising restrictions and regulatory environments for casinos, both of which we expect no impact on the operation of gaming machines in venues.

TABLE 1

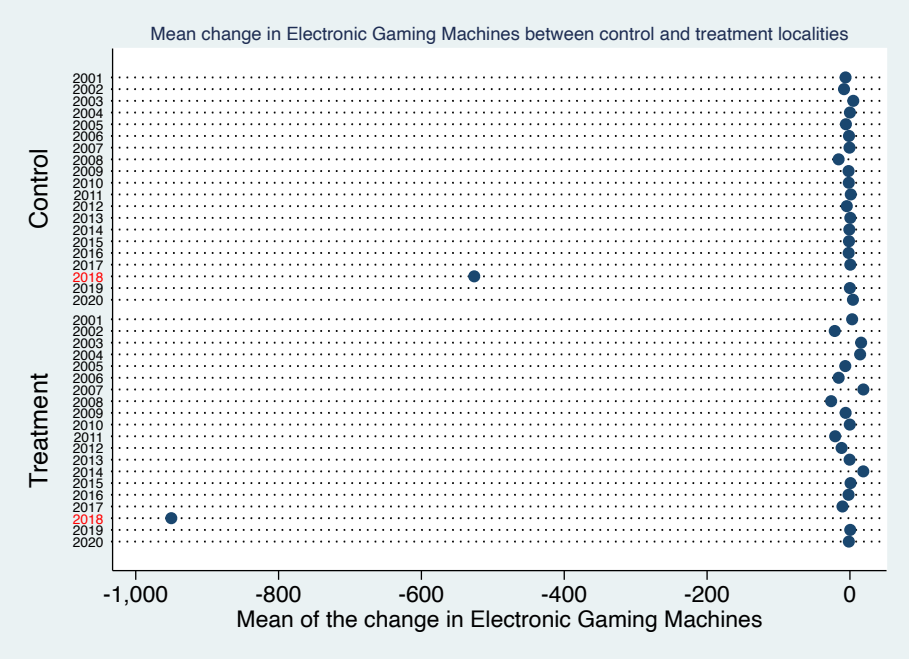
Local Government Areas affected by band 3 restrictions on entitlements trading

	Count	**Percent of total**
Treatment groups	32	31%
Control groups	72	69%
Total	104	100%

Table 1 summarises the effect of the policy on the localities. The treatment affects 31% of LGAs in NSW. Treatment groups are not concentrated in one area of the state; they are spaced seen in Figure A1. Treatment groups are more likely to represent a true population as a result.

FIGURE 1

Control includes areas classed below band 3 and Treatment includes areas classed as band 3



The amendment had an immediate effect on the number of gaming machines venues held as graphed in Figure 1. In 2018, the amendment reduced on average more than 900 EGMs per venue in localities classed as band 3 and reduced around 500 in localities classed as less than band 3. The lesser, but substantial, effect of the policy on the number of EGMs in the control group may complicate any link between a decrease in gaming machines and the outcomes of interest. Nevertheless, our paper seeks to primarily assess the causal relationship between the policy treatment as a whole on various outcomes. This is because the objective of the amendment is not to simply reduce the number of EGMs, but rather to improve decision making processes and *restrict the movement* of EGMs between localities. Ultimately, the policy inhibits the operation of supply and demand you expect from a market-based solution to a negative externality such as gambling. In order for our causal inference to maintain its legitimacy in light of the EGM change on our control group, our results are to be interpreted as the effect of a restriction in the gaming machine trading scheme on domestic violence assaults and non-business personal insolvencies.

2. Literature

i) Domestic Violence

The United States has released multiple reports into the effects of Casinos on crime but due to uniform data collection approaches, they fail to differentiate domestic violence from aggravated assaults. William S. Reece's 2010 study, '*Casinos, Hotels, and Crime*,' showed the effects of these limitations as it contradicted the common trend found by most econometric papers in stating that the opening of a Casino will reduce the rate of aggravated assaults within Indiana. The report used a multivariate linear regression which resulted in the study claiming that the overall opportunity cost of employment opportunities over the cost of crime is worthwhile. Our study will be able to differentiate overall assaults from domestic violence which will result in a more specific analysis of the relationship between EGMs and domestic violence.

Within an Australian context, a 2016 study utilised a Bayesian spatio-temporal Poisson regression to examine the relationship between EGM accessibility and police recorded

domestic violence. The report concluded that postcodes with no EGMs had 30% fewer domestic violence reports than postcodes with over 75 EGMs per 10,000 people. Further, the incorporation of female income variables, ratio of women to children and indigenous population allowed the study to develop a more succinct approach that effectively manages omitted variable bias. This literature acknowledged the possibility of downward bias due to the unreported nature of domestic violence. Notably, the study demonstrated that there is a relationship between domestic violence reports and the number of EGM machines within a local area, supporting our rationale. Our study will be able to determine whether the 2018 amendment which caused a decrease in EGMs had a causal effect on domestic violence rates through a difference-in-difference analysis.

ii) Insolvencies

The Australian Financial Security Authorities (AFSA) 2016-17 annual report of non-business-related insolvencies found that 2.7% of personal insolvencies for men and 1.36% for women were a result of 'gambling and speculation.' However, as acknowledged by the Melbourne University Law Review, gambling can lead to,' *employment problems, criminal behaviour, psychological illnesses, interpersonal problems and, of present interest, insolvency*' which indicates that other causes of non-business insolvencies, such as, 'domestic discord and relationship breakdown,' 'adverse legal action,' and even, 'unemployment or loss of income,' to an extent. The 2016-17 AFSA report included domestic discord, adverse legal action, and unemployment or loss of income to reflect 12.78%, 1.5% and 31.83% of non-business induced insolvencies respectively.

The multivariate simple regression of, '*The Impact of Casino Gambling on Personal Bankruptcy Filing Rates*,' highlights the causal effect of the presence of venues that manifest gambling behaviour and the adverse effects they have on an individual's ability to maintain a healthy financial position. Although there is a legal difference between bankruptcy and insolvency, the underlying classification of the two categories stem from the circumstance of individuals no longer being able to afford their contractual liabilities. The report found that if revenue growth of Casinos were to remain fixed at 1994 levels, there would be a 3.9% decrease in bankruptcy filing rates in counties that hosted or were adjacent to Casinos by 1998. The report continued to determine that an eradication of all casino gabling would lead

to an 8% decrease in bankruptcy filing of these same communities within the same period. Gambling venue availability and bankruptcy filings are thus evidentially linked.

An Australian examination of this link between Gambling venue availability and bankruptcy filings/insolvency can be seen within a 2020 study undertaken by associate professor Nicole Black *et al* of the Centre of Health Economics at Monash University. The longitudinal study using a multivariate linear regression concluded that a decrease of one venue with EGMs in a given local area will lead to a decrease in 1.8 personal insolvencies for that particular local area. Importantly, the local areas that the study evaluated were similar to the Band 3 statistical areas that were codified through the *Gaming Machines Amendment (Leasing and Assessment) Act 2018* (NSW). Unlike our difference-in-difference approach, this multivariate simple regression did not account for or examine other effects of EGMs, such as domestic violence. Further, the study failed to effectively examine policy amendments that may have impacted these changes in EGMs, such as the aforementioned amendment to the *Gaming Machines Act 2001*(NSW).

3. Data

i) Geo-Spatial Treatment Data

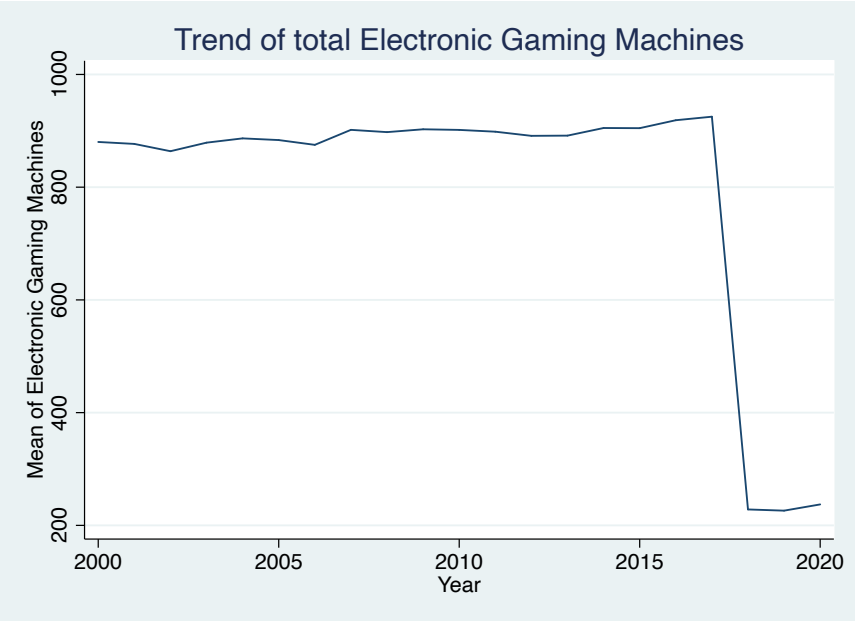
Our difference-in-difference utilises annual data that is geographically located within New South Wales and is categorised by local government areas (LGAs). A local government area is a spatial unit that describes the legislated boundaries that a particular local government operates within and is responsible for. NSW is divided up into 128 LGAs which often have different socio-economic and cultural qualities. The 2018 legislative amendments that we analyse were separated by statistical area level 3 (SA3) which is a smaller geographical unit that subdivided these LGAs. Our model regresses the data by LGA instead of SA3 despite the classification change due to data limitations and the nature to which gaming behaviour can spill over into separate SA3s which are commonly clustered within the same LGA. This spill over can be observed particularly in rural LGAs, the SA3s targeted by EGM restrictions under the amendment commonly reflect the more densely populated areas of that LGA - inferring that regulating EGM venues within a rural SA3 will commonly regulate the popular venues for the entire LGA. This can be observed at Figure A2, where we have selected two

LGAs at random to demonstrate the relationship between the LGA population and targeted SA3's. The left column is population density by LGA, and the right column highlights these special areas that were targeted by the 2018 amendment in red. Due to this, we classify any LGA with a band 3 SA3 as a band 3 LGA. Table 1 reflects this.

ii) Electronic Gaming Machine Data

The EGM data was provided by Liquor and Gaming NSW in a longitudinal format. It provides EGM count, premises count, net profit and tax data by LGA, year and venue. The effectiveness of the policy in decreasing EGMs can be seen in Figure 2, whereby year on year growth of EGMs by LGA dramatically decreased for 2018 which was the year that the amendment was implemented. It is evident there are no other intervening policies that caused shocks to EGMs.

FIGURE 2



iii) Domestic Violence

The domestic violence (DV) dataset is sourced from the NSW Bureau of Crime Statistics and Research which is the delegated criminal research authority according to the Department of Communities and Justice. The longitudinal data separates domestic violence counts by LGA

and year. Further, the dataset is capable of sub-categorizing these counts by gender, age, alcohol exposure and the type of premises for both the offenders and the victims. We choose DV as our outcome variable as we believe it is most responsive to changes in gambling regulation. This is supported by our theoretical rationale – the effects of gambling are closely related with domestic relationships.

A notable limitation within domestic violence crime data is the lack of people who are able to escape or report such crime. BOCSAR data may be plagued by omissions in reporting – women with less income are often more dependent on their abuser, and therefore less likely to report domestic violence to the police. Our policy effect may be understated as LGAs with the specified restrictions are more likely to be disadvantaged and thus more likely to have unreported domestic violence. Our estimated coefficient may suffer a downward bias as the observed decrease in domestic violence may not be as large according to police reports when compared to the unreported and reported cohort.

It is worth noting the sharp incline of DV in 2020 was in response to lockdown measures. This has no bearing on our estimates if both control and treatment groups are affected proportionately. This is proved in Figure A3 and is discussed later.

iv) Non-Business Insolvencies

Non-business insolvencies dataset was obtained from the Australian Financial Security Authority which incorporates the total of non-business insolvencies by LGA and the amount of non-business insolvencies that arise due to income loss and unemployment. The data specifies the total number of personal insolvencies within each LGA between 2014-2019 and further subcategorises the number of personal insolvencies that were explicitly a result of unemployment or loss of income. Non-business insolvencies arise when individuals are not able to meet their financial obligations which often leads to an increase in arrears status on loans and defaults on financial liabilities or bills. According to the Australian Financial Security Authority (AFSA), these non-business insolvencies are primarily due to excessive credit usage but are also a result of gambling, legal actions, loss of income, illness, unemployment and family breakdown. As mentioned, the effect of a decrease in EGMs can lead to a decrease in gambling, as well as a breakdown in family relationships, income loss and unemployment, widening the scope of our hypothesis. The mere categorisation of non-

business personal insolvencies by ‘gambling and speculation’ by the AFSA suggests that the relationship between the two is known, observable and prominent.

v) Control data

Total mean income data by LGA was obtained from the ABS Personal Income in Australia release and covers the years 2012-2018. We then used a linear forecast to obtain values for 2019. This is done after checking for any unusual acceleration or shock in income by generating a change in income variable and scanning for any large increase or decreases. This data was publicly available and was opted over any measure of socio-economic disadvantage measure due to ease and grouping by LGA availability. Population data by LGA was obtained from the ABS Estimated Resident Population release and covers the years 2014-2019. It is further sorted by male and female population.

vi) Data cleaning and pre-processing work

With insolvency and controls only providing data for the period 2014-2019, all observations where year is less than 2014 were dropped, deleting 1864 observations and leaving 941. BOCSAR provided domestic violence assault rates per 100,000 population allowing for comparable estimates by LGA. BOCSAR had not computed a rate for any LGAs with less than 3000 population as marginal changes in offence numbers or population may have a large effect on the rate. For this reason, we drop observations with missing values in DV rate, deleting 246 observations and leaving 695. We are left with 104 LGAs in our dataset, as produced in Table 1.

4) Method

We estimate the effect of a band 3 imposed upon a LGA on our outcome variables, namely the domestic violence assault rate and non-business personal insolvencies. We seek to examine the impact of gaming machine entitlement trading restrictions using a difference-in-difference (DID) model. The policy we exploit creates explicit boundaries between each band and its effect is immediate, creating a suitable environment for DID analysis. We first

estimate a simple OLS with the treatment dummy and years after the policy introduction as dependant variables to compare our DID model against:

$$\log(Y_{it}) = \beta_1 + \beta_2 level3LIA_{it} + \sum_{t=2019}^{2020} \eta_t Year_t + \varphi Controls_{it} + u_{it} \qquad (1)$$

The following specification is then estimated to remedy problems of omitted variable bias:

$$\log(Y_{it}) = \beta_1 + \beta_2 level3LIA_{it} + \sum_{t=2014}^{2019} \eta_t Year_t + \sum_{i=1}^{I} \tau_i Locality_i + \varphi Controls_{it} + u_{it} \qquad (2)$$

Y_{it} denotes our outcome variables for LGA *i* and year *t*. Logarithmic form is used as initial scatterplots showed skewed results. Estimates will be interpreted as elasticities – the percentage change in *Y*. The treatment dummy $level3LIA_{it}$ takes the value of one where an LGA is assigned a band 3 ranking and year is more than or equal to 2018. β_2 is our coefficient of interest; we expect it to take a negative value. *Year* is a full set of time dummies to remove the effects of unobserved time dependent variables across all localities. This captures the effect of the general downward trend in the number of EGMs in the state, or any changes in federal law affecting any outcome variable. It also captures state-wide fluctuations in economic activity, unemployment and wages which may encourage domestic violence and prompt insolvencies. *Locality* is a full set of area dummies to remove the effects of unobserved time invariant systemic effects. For domestic violence, these dummies capture LGA level variables such as gender inequality, rurality and crime trends. For insolvency, these dummies capture credit use and divorce trends, both of which contribute predominately to personal insolvencies (AFSA 2018). *Controls* are a set of time dependent, and area specific dummies included to capture the effect of time-varying heterogeneity, including income, as a proxy for socio-economic status, and population. We use mean employee income as a proxy for the income control due to data constraints. u_{it} represents any idiosyncratic errors.

A DID model is convenient for area level data with more than two time periods as it does not require the inclusion of all group or time variant confounders that may bias estimates. Conducting an OLS regression would necessitate the inclusion of all these variables, although

even then, we are still at large to unobservable heterogeneity that cannot be measured due to data constraints or simply the factual impossibility of obtaining such data. For example, equation (1) will fail to account for financial stability, social networks or cultural perceptions on gambling that vary widely from suburb to suburb. It is obvious that one LGA is not directly comparable to another – OLS fails to distinguish state and time varying characteristics and is liable to omitted variable bias.

i. Common trends assumption

Despite the suitability of a DID model, it demands a strong assumption to make causal inferences – treatment and control groups must evolve in line with one another to demonstrate no omitted variable bias. This assumption is defended below.

An issue arises if the policy was enacted to combat a rise in our outcome variables. Endogenous adoption of the policy would cause simultaneity bias. In reading the text of the legislation and supplemental resources such as the second reading speech which explicitly states the purposes of the amendment, there is no mention of enacting the amendment to reduce domestic violence nor any intention to curb debtors from entering insolvency.

Critical to understand, the assignment of a band 3 to localities is not randomised. The Authority ranks the areas by assessment of the following:

- Socio-Economic Indexes for Area (SEIFA) weighted at 70%;
- gaming machine expenditure per capita weighted at 15%; and
- the number of gaming machines per capita weighted at 15%.

It is important to discern whether socio-economic status may be a confounder, otherwise put, a variable that is correlated with the treatment variable and the change in our outcome variable over time. If this is true, our model will not satisfy the zero conditional mean assumption; the error term is likely to be correlated with the treatment dummy as an important variable is omitted from the model.

We first graphically test to see whether these confounding factors are present in the treatment groups but not the control groups. Figure A3 plots the mean of domestic violence assault rates over time for the treatment group and control group to observe for any deviations from

the parallel trends assumption. Figure A4 does the same for personal insolvencies. For domestic violence, we find that both groups have generally run in-tandem to one another. This gap is likely due to socio-economic differences. This is generally LGA invariant and will be captured in the model by our area fixed effects. The reference line in the figure represents the time the treatment was introduced. At first blush, the policy has a marginal effect on the treatment groups. DV increases against expectations. Turning to summary statistics, Table A1 shows that the DV rate increases more in treatment groups in response to the policy (+55.5) than it does in control groups (+14.2). This is generally desirable for a DID model, although the opposite force of the policy is of concern. This is to be explored in the results.

For personal insolvencies, the treatment and control groups visibly seem indistinguishable. Summary statistics in Table 2 show that treatment groups faced an average decline in personal insolvency rates by 8.6 whereas control groups declined by 9.4. It is unfortunate that we see no effect of the policy on our outcome variable. Consequently, the paper will focus predominately on DV. We continue to regress personal insolvency on our model despite its inelasticity to explore the consequences of the treatment on different spheres of one's life, domestic and financial.

Figure A1 providing a geospatial graphic of which areas are considered band 3 evidence some level of randomness in geography. Socio-economic differences are most prevalent between the treatment and control groups as areas further away from the CBD are more often classified as a band 3 area.

We further conduct post regression diagnostics to test for confounders by plotting residuals against each group to determine whether the residuals of the model skew in any way towards the treatment group. Figure A4 shows that the predictor variable satisfies the zero conditional mean assumption when regressing DV assaults. The mean of residuals is near equal to 0 for both treatment and control groups, presenting no evidence of an omitted variable that might bias our estimates. Conversely, Figure A5 presents a slight bias in the treatment variable's residuals as the mean deviates away from 0, indicating there may be some confounder not accounted for and now captured by the error term.

TABLE 2

Summary Statistics by Treatment and Control before and after commencement of policy

	Treatment localities		Control localities	
	Before Policy	After Policy	Before Policy	After Policy
Crime Rate per 100,000 population				
Total Domestic Violence Assault mean	555.4	611.0	404.6	418.8
Standard deviation	(236.5)	(403.5)	(270.5)	(261.5)
Number of observations	129.0	93.0	279.0	194.0
Male Domestic Violence Assault mean	659.4	680.3	484.4	493.0
Standard deviation	(246.3)	(287.6)	(329.8)	(329.7)
Number of observations	124.0	90.0	244.0	175.0
Female Domestic Violence Assault mean	144.1	177.8	114.2	150.6
Standard deviation	(66.4)	(89.0)	(90.5)	(123.7)
Number of observations	120.0	87.0	247.0	175.0
Non-business Personal Insolvency per 100,000 population				
Total debtors entering non business personal insolvencies mean	121.5	112.9	96.1	86.7
Standard deviation	(37.9)	(34.9)	(43.8)	(35.8)
Number of observations	128.0	63.0	266.0	126.0
Demographics				
Population mean	98955.6	99700.6	58763.3	64906.6
Standard deviation	(103737.7)	(105289.1)	(65948.8)	(71290.0)
Number of observations	129.0	63.0	271.0	128.0
Male population mean	48996.3	49464.1	29117.9	32175.8
Standard deviation	(51375.7)	(52356.6)	(32868.7)	(35596.9)
Number of observations	129.0	63.0	271.0	128.0
Female population mean	49959.3	50236.5	29645.4	32730.8
Standard deviation	(52386.3)	(52964.4)	(33101.7)	(35714.1)
Number of observations	129.0	63.0	271.0	128.0
Income				
Mean Total Income mean	50787.5	54544.4	60162.1	65043.1
Standard deviation	(6310.1)	(6137.9)	(20996.6)	(23446.3)
Number of observations	129.0	63.0	275.0	130.0

Note : Rounded to the nearest one decimal point.

Policy commenced in 2018.

Finally, we show using summary statistics that demographics and income remain steady throughout treatment and control groups to satisfy common trends. Table 2 shows minimal changes in population across groups before and after the policy. There is roughly a $10,000 between total incomes for treatment and control groups, although this gap seems to remain consistent pre and post policy introduction.

We test for socio-economic status as a confounder by including a proxy in our model, namely total mean income, to see whether it affects our estimates.

Overall, these tests legitimatise the use of a DID framework. We include an income variable to control for any socio-economic differences between the groups – we will compare estimates with and without this control to determine its degree of influence. More weight is to be given to the DV estimates, and more caution should be read with the insolvency estimates. That said, the effect of the policy on our outcome variables seems marginal.

5) Results and discussion

i) Main estimates

Produced in Table 3 are the main estimates of the model. Column one is a simplified OLS regression of the treatment dummy and years after the policy introduction on the dependant variables. Its estimates are statistically significant and present a strong positive effect. The sign is opposite to what we expect. The added controls in column two reduce the strength of the coefficients without increasing standard errors and maintaining statistical significance. Column three includes state and time fixed effects. The estimates lose their statistical significance. The treatment is estimated to reduce domestic violence assaults by 0.62% and increase personal insolvencies by 39.96%, although these estimates are statistically indistinguishable from zero. Column four includes time-varying controls. The treatment dummy estimates are weakened to a 0.14% decrease of DV and a 4.51% increase of personal insolvencies in response to the treatment. Population data is statistically insignificant whereas our socio-economic status proxy, mean income, is significant to the 5% level for DV, and is significant to the 1% level when regressing on insolvencies. The significant deflation of the treatment dummy coefficient in column three after the inclusion of mean income suggests the

existence of income as a confounder, possibly biasing our estimates. Mean income is not the strongest measure of socio-economic disadvantage, nor does it capture prevailing time varying factors that might confound our estimates. For DV, the impact of mean income led to an increase of 0.0048 in the coefficient of interest. This is a marginal increase and should not signal concern for omitted variable bias.

TABLE 3

Primary Regression Estimates

Dependant Variable: Log of Domestic Violence Assaults per 100,000 population				
	(1)	(2)	(3)	(4)
level3LIA	0.3804	0.3084	-0.0062	-0.0014
Standard error	0.0675	0.0725	-0.0271	-0.2996
P-value	0.0000	0.0000	0.8190	0.9630
Total Population		0.0000		0.0000
Standard error		0.0000		0.0000
P-value		0.0010		0.9660
Mean total income		0.0000		0.0000
Stardard error		0.0000		0.0000
P-value		0.0000		0.0510

Dependant Variable: Log of Non-business Personal Insolvencies per 100,000 population				
	(1)	(2)	(3)	(4)
level3LIA	0.2570	0.2044	0.3996	0.0451
Standard error	0.0598	0.0582	0.0488	0.0486
P-value	0.0000	0.0000	0.413	0.354
Total Population		0.0000		0.0000
Standard error		0.0000		0.0000
P-value		0.6170		0.4180
Mean total income		0.0000		0.0000
Stardard error		0.0000		0.0000
P-value		0.0000		0.0130

(1) Simple OLS without controls
(2) Simple OLS with controls
(3) Includes fixed effects
(4) Includes fixed effects and population and income controls
Note: All results rounded to 4 decimal places

The effect of the policy change was statistically insignificant on the change domestic violence reports within New South Wales. A plausible explanation for this is the unreported nature of domestic violence, particularly for women who are more dependent upon their abuser's income and thus less likely to approach the authorities. According to the Australian Gambling Research Centre, low-income households spend 27% on gambling which is four times the mean cost of utility bills for that group. This indicates that the group that would have been the most affected by the policy also had the highest level of unreported domestic violence. Therefore, the available data was not an accurate reflection of changes in domestic violence for the group that was impacted by the policy the most.

Personal Insolvencies are a financial circumstance that is usually the result of sustained shocks on disposable income with respect to contractual liabilities. The Australian Financial Security Authority characterised 67% of personal insolvencies between 2016-17 to be a result of excessive use of credit, unemployment and income loss which are circumstances where liabilities increase beyond a sustainable point or income is cut off entirely – causing individuals to drain their savings until there is no more disposable income to pay off their liabilities. Excessive credit is a long process that usually is delayed by a bank's sustainable repayment collections program, financial hardship plan or even a gradual build up on an existing line of credit that decreases a person's net-servicing ratio below one. Both of these scenarios take time and are accompanied by a lag, which our data did not have the capacity to incorporate as the policy change was in 2018 and our insolvency data was drawn from individual tax returns between 2018-19.

Changes in gambling will follow a similar pattern, the decrease in gaming machines won't necessarily boost disposable income instantaneously to a sustainable point. Given the timeframe discussed, the decrease in gaming machines would not necessarily bring people out of a near-insolvent situation in the matter of months. A decrease in gaming machines would allow more disposable income to build up savings or equity in minor assets which would allow for a healthier financial situation within a couple of years, not months. The impact of the decrease in gaming machines over this period of time would not be enough to bring people out of insolvency but only increase their disposable income slightly, the real effects on personal insolvency will be accompanied by a larger lag.

ii) Robustness checks

We test the sensitivity of the results through various robustness checks. Although DID results are largely insignificant, it is still of value to examine the effect of various model specifications on our estimates. First, we redefine the treatment variable, testing the effect of assigning a locality as a band 3 *or* band 2 against the effect of assigning a locality as only a band 3. Second, we show that results are not sensitive to certain LGAs. We chose specific control and treatment LGAs that exhibit similar characteristics in socio-economic status and demographics to regress.

TABLE 4

LGAs affected by redefined treatment	**Count**	**Percent of total**
Treatment groups	46	44%
Control groups	58	56%
Total	104	100%

To recall, the 3 bands that the Authority assigns an SA3 determines the level of burden a gaming premises must go through in applying for more gaming machine entitlements. We probe the robustness of our primary *level3LIA* estimate by including band 2 localities to find whether estimates differ in magnitude or significance. As band 2 restrictions are not as severe as band 3 restrictions, we expect the magnitude of the treatment dummy estimate to depress. The effect of the newly defined treatment on the number of treatment groups and control groups is summarised in Table 4, increasing the count treatment groups by 14. A regression of equation (2) on DV with the newly defined treatment taking the value of one where a LGA is classified as band 2 *or* band 3 produces a coefficient of 0.0220 (p=0.437). This is in line with expectations as the coefficient and p-value moves towards our significant estimate in our simple OLS with controls. The coefficient is now positive, showing that there is only a decrease in DV when restrictions are harshly imposed. The same regression on personal insolvency also moves the coefficient towards the stripped down OLS model (0.0511) and increases significance of the estimate (p=0.268). Regardless of expected movements, the results remain indistinguishable from a 0 effect.

TABLE 5

Regression Estimates for Selected Treatment and Control Groups

	Dependant Variable: Log of Domestic Violence Assaults per 100,000 population		*Dependant Variable: Log of Non-business Personal Insolvencies per 100,000 population*	
	(1)	(2)	(3)	(4)
level3LIA	-0.1070	0.1217	0.3070	0.2318
Standard error	0.0885	0.1475	0.0657	0.0647
P-value	0.2430	0.4260	0.0000	0.0000
Parramatta Dummy	-0.2464	-2.5482	-0.1500	-0.1663
Standard error	0.0657	0.8814	0.1744	0.1715
P-value	0.0020	0.0140	0.3900	0.3320
Liverpool Dummy	0.1417	-1.1906	0.2044	0.1619
Standard error	0.0657	0.5730	0.1744	0.1706
P-value	0.0460	0.0600	0.2420	0.3430
Camden Dummy	-0.1370	-2.5666	0.2514	0.2795
Standard error	0.0657	2.0957	0.1744	0.1674
P-value	0.0530	0.2440	0.1500	0.0960
Total Population		0.0000		0.0000
Standard error		0.0000		0.0000
P-value		0.6390		0.6420
Mean total income		0.0002		0.0000
Stardard error		0.0001		0.0000
P-value		0.0420		0.0000

(1) & (3) Includes fixed effects without controls
(2) & (4) Includes fixed effects with controls
Note: All results rounded to 4 decimal places. Base LGA = Fairfield; Base Year = 2014

Further robustness checks are taken by selecting LGAs with similar characteristics to each other but differ in treatment and control classification. We take Fairfield LGA for the treatment group as it is specifically legislated for under the amendment for the whole LGA to be classified as a band 3 rather than particular SA3s within the LGA, removing the need for aggregating exercises. We chose LGAs that are nearby to Fairfield (within a 30-minute drive) and not of band 3 classification in order to compare similar LGAs. This left us with Liverpool, Parramatta and Camden as our selected control LGAs. Due to geographical proximity, they share similar demographics in age and race. Table 5 produces the results.

Columns one and three are estimates with no controls and columns two and four include controls. The coefficients for DV radically improve in significance and standard errors – DV estimates have their p-values significantly reduced and personal insolvency estimates are significant to the 99% level. The inclusion of controls pull up rather than drag down the coefficients for both outcome variables from their expected sign, indicating the significance income has on these results. The estimates are stronger in magnitude; the treatment has a 12.17% positive effect on DV, and a 23.18% positive effect on personal insolvencies. These results go against the robustness of our estimates as the selection of controls and treatments should not inherently change our estimates. Despite this, such variation in estimates is to be accepted as cherry picking groups from 104 LGAs will lead to substantial differences. What is of interest in Table 5 is the much-improved significance of treatment dummies for both outcome variables. Selecting similar LGAs is expected to result in stronger and more convincing estimates, although these results are upheld by stronger assumptions.

iii) Subsample analysis with sex

It is well recognised that males represent the overwhelming majority of domestic violence offenders. On average, male DV rates are at 549 assaults per 100,000 whereas female DV rates are only at 139. Our study begs the question of what the composition of gaming machine users are like. The most susceptible age group to gambling is the 30–49-year-old bracket who make up 34% of regular gamblers but also make up 34.9% of the population (Australian Research Gambling Centre, 2017). However, the most overrepresented age group is the 50–64-year-old age bracket who make up 30.4% of gamblers but only 24.1% of the population. Regular gamblers are 54.2% male and are more likely to their highest level of education to be a TAFE certificate or diploma, indicating that the prime group is male tradesman. With respect to employment, 47.4% of regular gamblers are employed full-time with 70.3% earning wages or on a salary and 25% of gamblers are retired with 20.7% relying on government benefits. Therefore, the typical gambler can be characterised as a male aged over 30 who works full-time and has gained their qualifications through a trade or certification.

TABLE 6

Sub sample analysis by sex

Dependant Variable: Log of Domestic Violence Assaults per 100,000 population				
	Male		Female	
	(1)	(2)	(3)	(4)
level3LIA	-0.0146	0.0081	-0.0313	-0.0349
Standard error	0.0370	0.0398	0.0674	0.0772
P-value	0.6940	0.8400	0.6420	0.6520
Population		0.0000		0.0000
Standard error		0.0000		0.0000
P-value		0.0230		0.9850
Mean total income		0.0000		0.0000
Stardard error		0.0000		0.0000
P-value		0.0710		0.7960
Observations	633	547	625	540

Note: All estimates include fixed effects and controls
(1) Fixed effects without controls for males
(2) Fixed effects with controls for males
(3) Fixed effects without controls for females
(4) Fixed effects with controls for females
Note: All estimates are rounded to 4 decimal places

The composition of gamblers is important to understand as our coefficient of interest may weaken if women, whom which do not engage as much in gambling, are included. Unfortunately, we are unable to examine the difference between estimates of different ages due to data constraints. We could not find any data on sex-grouped personal insolvencies – we focus on DV in this section. To examine the causal effect of the policy on males and females, we run separate regressions restricted one sex. Table 6 produces the results. Columns one and two produce estimates for regressions restricted to males without controls and with controls respectively. Columns three and four do the same for regressions restricted to females. Population is also restricted to male or female populations. Similar to previous results, our treatment dummy remains statistically insignificant. If we were to interpret the coefficient in isolation, the policy has a 0.81% positive effect on male DV, although more interestingly observed is a larger effect on females with a 3.49% negative effect on DV. The female estimate is also more significant than the male result. The magnitude of estimates

suggests that females are more responsive to the policy introduction than males. This may be due to the majority of DV offenders being male – a small change in female domestic violence assaults may lead to a larger estimate. The authors cannot speculate on why this is so, as it raises systemic issues between males and females that cannot be addressed by reference to mere gaming machines. Regardless, the effect on males is in line with previous regressions. The policy does not have any significant effect on male DV.

6. Conclusion

Our study uses a DID framework to examine the causal effect of the Gaming Machines Amendment (Leasing and Assessment) Act 2018 (NSW) on domestic violence assaults and non-business personal insolvencies. We find that despite the number of gaming machines radically declined during the introduction of the policy, there is zero causal relationship between the amendment and our outcomes of choice. This finding is supported by extensive support for the common trends assumption which upholds the legitimacy of our results. Our results contribute to the current literature by employing a DID model rather than a cross sectional multivariate regression. Robustness tests conducted explore different specifications and their effect on estimates, producing interpretable results. Finally, the paper explores the separate effect of the policy on males and females, producing results that are of great importance when legislating against certain sexes.

Appendix

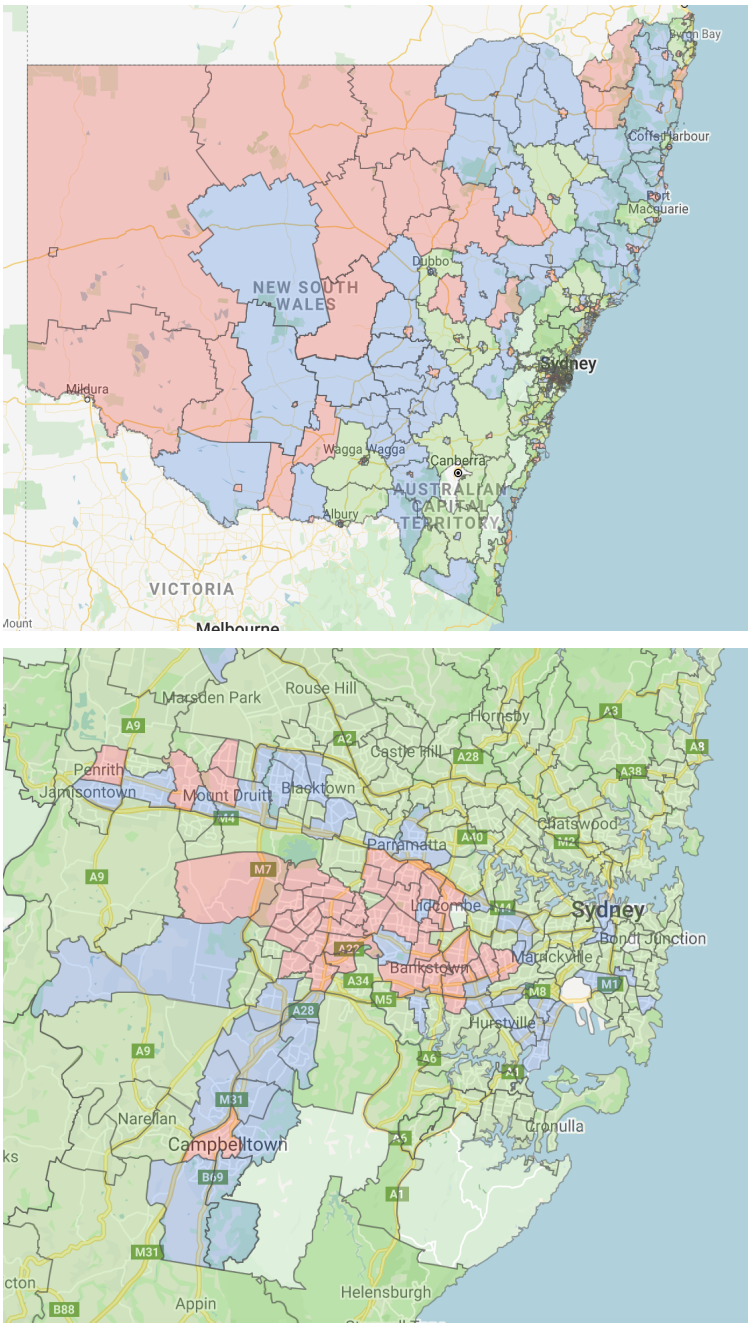


FIGURE A1 – Map of SA2 boundaries in NSW. Red areas are band 3 (highest risk), blue areas are band 2 (medium risk) and green areas are band 1 (low risk). Source: Liquor and Gaming NSW.

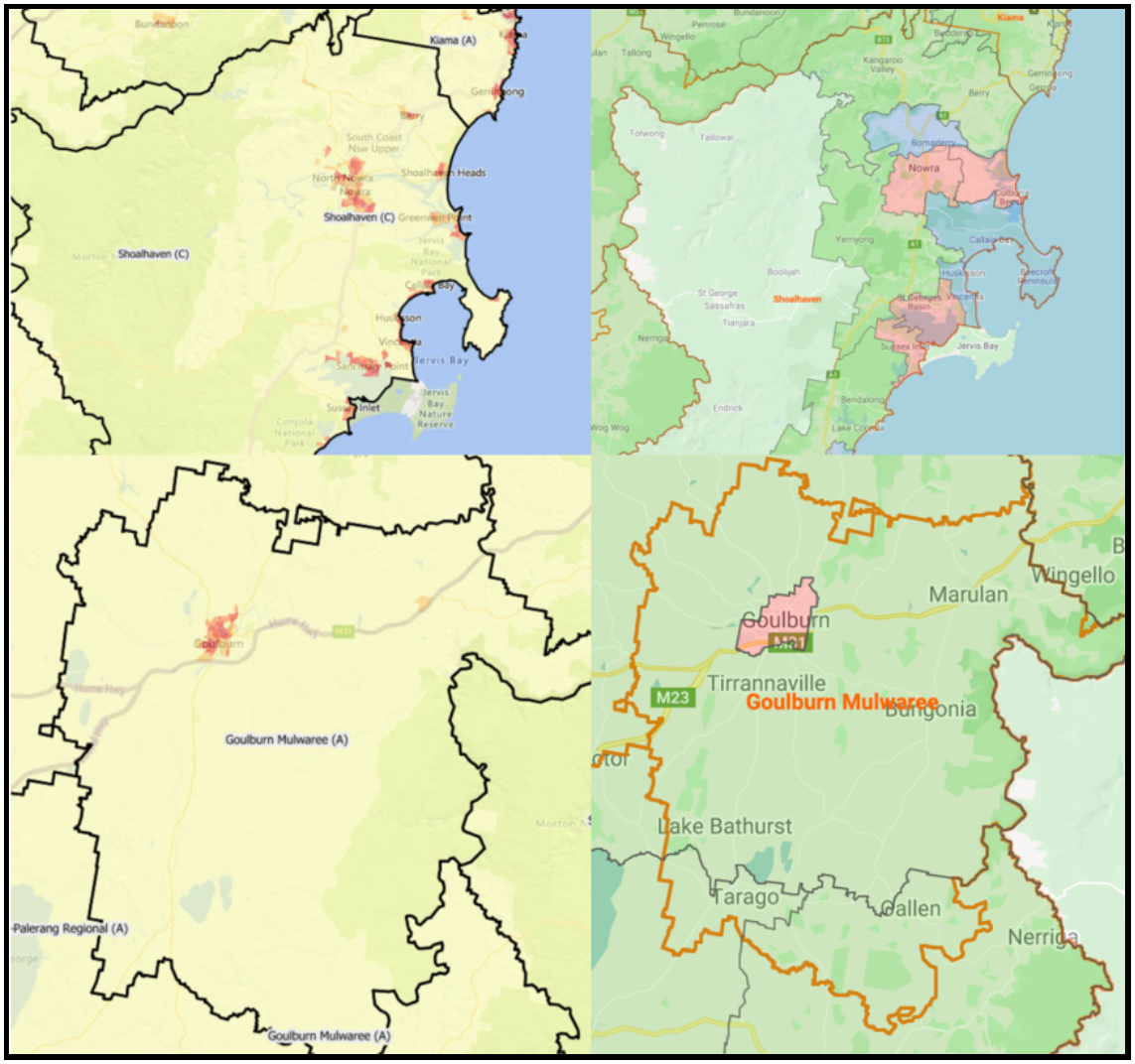


FIGURE A2 – LGA by population (left) compared to Statistical Areas with EGM restrictions (right). Source: Australian Bureau of Statistics (2016)

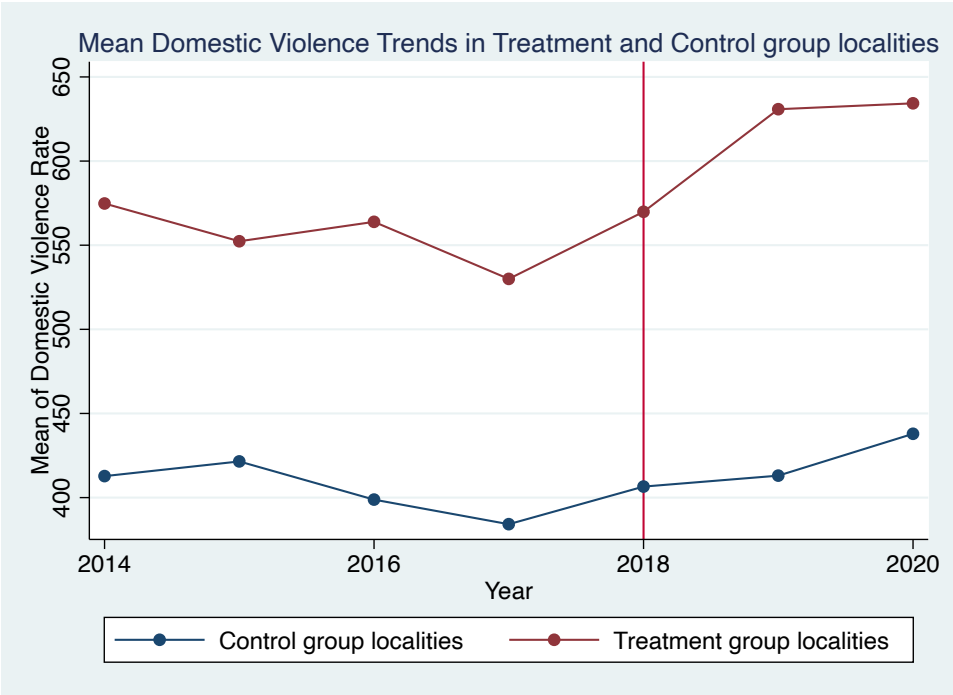


FIGURE A3 – Mean domestic violence rates over time by treatment and control groups

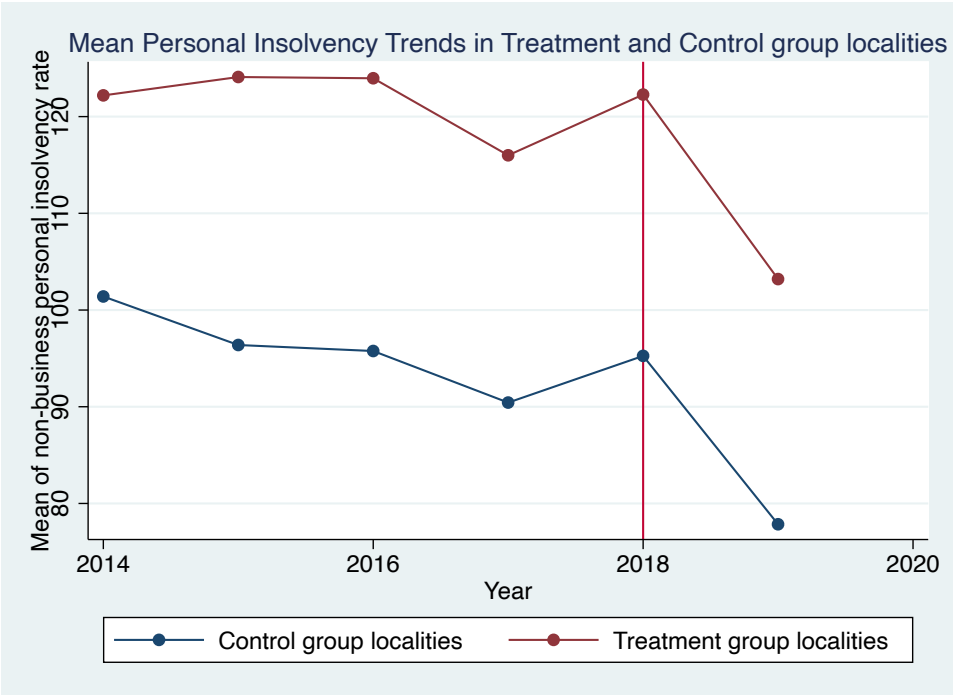


FIGURE A4 – Mean non-business personal insolvency rates over time by treatment and control groups

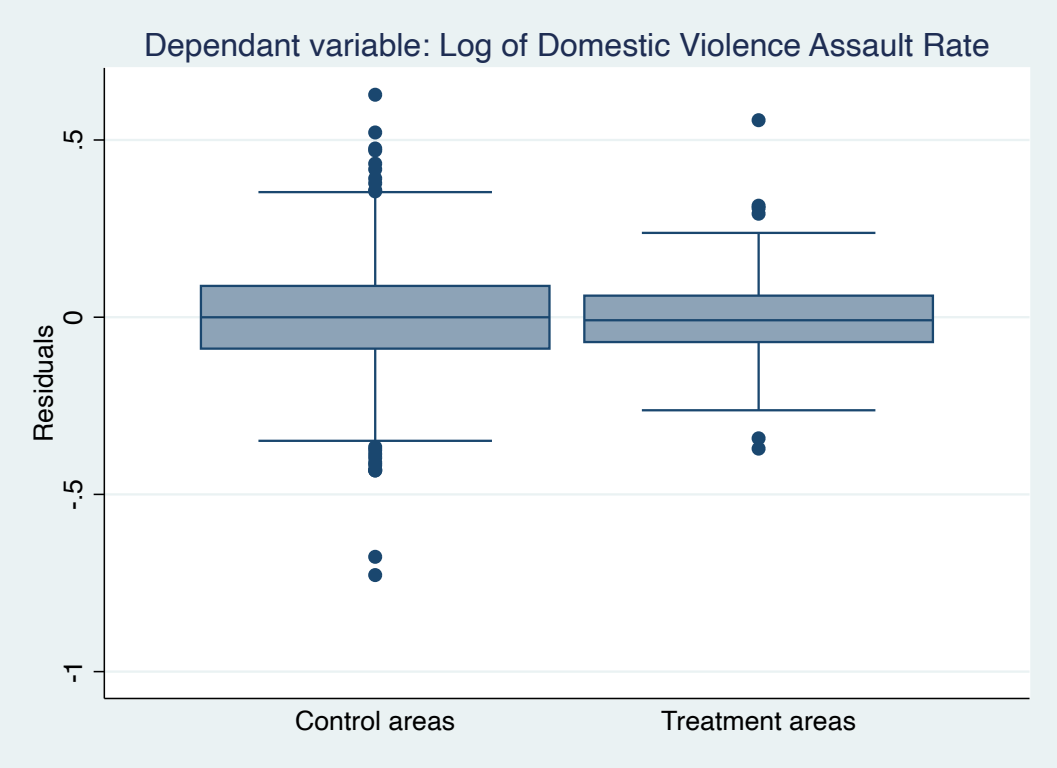


FIGURE A5 – Residuals of the log of domestic violence assault rate by treatment and control groups

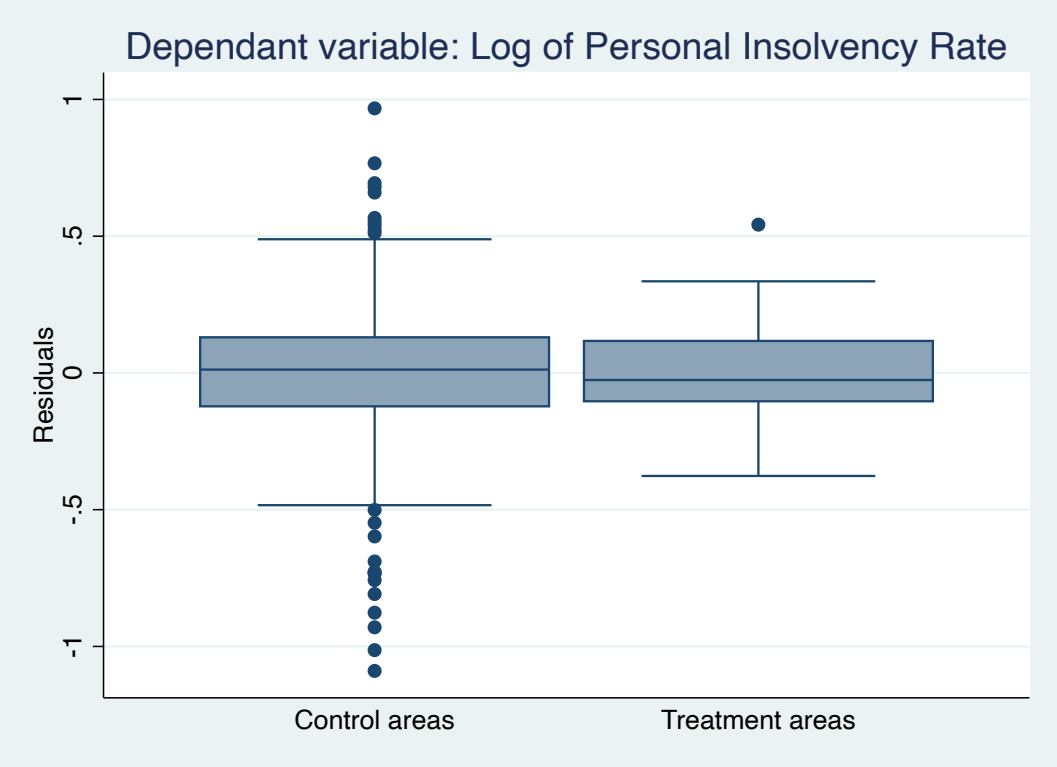


FIGURE A6 – Residuals of the log of non-business personal insolvency rate by treatment and control groups

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