RESEARCH REPORT

Proximity to gambling venues, gambling behaviours and related harms

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Conflict of interest declaration

The authors declare no conflict of interest in relation to this report or project.

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Proximity to gambling venues, gambling behaviours and related harms

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Executive summary

Background and aims

Easy access to gambling venues is a concern in many countries, including Australia, Canada, the United Kingdom and the United States (Vasiliadis et al. 2013). Greater accessibility may increase the likelihood that some individuals gamble on impulse, rather than making a planned decision to gamble (Productivity Commission 1999; Victorian Department of Justice 2008). A further concern is that gambling venues in Australia are more densely located in socioeconomically disadvantaged neighbourhoods, and therefore the availability of gambling venues can have disproportionate consequences on the poorest communities (Welte et al. 2004; Young et al. 2012; Rintoul et al. 2013).

Evidence from previous studies suggest that greater physical accessibility to gambling venues is associated with higher rates of gambling involvement and problem gambling (e.g. Welte et al. 2004; McMillen and Doran 2006; Ministry of Health 2008; Pearce et al. 2008; Storer et al. 2009; Vasiliadis et al. 2013; Welte et al. 2016b; Kato and Goto 2018). However, there is currently limited quantitative evidence on the impact of residing close to gambling venues on broader harms related to gambling. This study aimed to:

1. investigate whether the close proximity of a gambling venue to a person's home or their local shopping zone influences gambling behaviour and harms associated with problem gambling, including mental health problems and financial hardship
2. identify the characteristics of individuals who are most influenced by residential proximity to gambling venues
3. provide robust empirical evidence that can be used to inform policy regarding the accessibility of gambling venues.

Research approach

We constructed a unique panel dataset that combines the precise geographical location of all electronic gaming machine (EGMs) venues in Sydney, Melbourne, Brisbane and Adelaide, with detailed individual survey data on gambling behaviours, health and finances. Specifically, we combined four sources of data:

1. geolocations of all non-casino gambling venues which operate electronic gaming machines in years 2015 and 2018 in New South Wales, Victoria, Queensland and South Australia, sourced from each state's administrative gaming licence databases
2. the Household, Income and Labour Dynamics in Australia (HILDA) survey: respondents aged 18 years and over (legal gambling age), who reside in urban areas of Sydney, Melbourne, Brisbane and Adelaide, and who provided information on gambling behaviours (wave 15 or wave 18). This provides a sample of 14,860 observations from 9,071 people
3. data on the geolocation of non-gaming pubs, hotels and clubs (alcohol-serving venues that do not have a gaming license) in years 2015 and 2018 in New South Wales, Victoria, Queensland and South Australia, sourced from each state's administrative liquor licence databases
4. data on the geolocation of post-offices in New South Wales, Victoria, Queensland and South Australia, sourced from the Australian Postal Corporation.

Our analysis has three main parts:

First, we estimated the relationships between proximity of gambling venues and the likelihood of undertaking gambling of different types.

- Using multivariate regression analyses, we estimated differences in the gambling behaviours of people residing in the same neighbourhood, but with different distances to their nearest gambling venue.
- We controlled for people's age, sex, marital status, number of children, and educational attainment, and the month and year of the survey. We include the residential distance to non-gambling venues that serve alcohol to control for alcohol accessibility. We also include other small-area level controls (SA1 level), including an income and wealth index; education and occupation index; mean house prices, mean residential rents, and mean perceptions on seven aspects of neighbourhood quality.
- Additionally, we included controls (fixed effects) for each neighbourhood, defined as a Statistical Area 2 (SA2). By including neighbourhood fixed-effects, we control for all time-invariant characteristics of neighbourhoods (such as socioeconomic status, demographic factors and local government policies), which may confound the relationship between local access to gambling venues and the health and economic status of residents.

Second, we estimated the relationships between proximity of gambling venues and financial, mental and overall wellbeing.

- We used a dynamic regression model to estimate the impact of proximity to gambling venues on each of the three outcomes. The model included all of the same control variables that were included in the analysis on gambling behaviours. In addition, each regression included all three of the lagged outcomes (i.e. lagged mental health, financial hardship, overall wellbeing). These terms enabled the models to account for the possibility that current location of residence is impacted by past mental and financial wellbeing.

Finally, we explored the population subgroups who are most strongly affected.

- We investigated heterogeneity in the estimated relationships by re-estimating the effects of distance on financial hardship and mental health using subsamples defined by gender, age, employment status, income, subjective financial risk preference, subjective financial time preference, and cognitive ability.

Results

Within a local area, people residing further from gambling venues were less likely to gamble: doubling the distance from a venue (e.g. 1km to 2km) reduced the likelihood of gambling by 1.5 percentage points (relative to a mean gambling rate of 13 per cent). This proximity effect is especially large for short distances. People residing within 250m of a gambling venue were 6 percentage points more likely to gamble than were people residing >2km from a venue.

This increase in gambling appears to translate to harmful outcomes. Residing in close proximity to gambling venues is associated with a large increase in the likelihood of financial hardship: people residing within 250m of a gambling venue were 5 percentage points more likely to experience a financial hardship than were people residing >2km from a venue. The relationship with mental health was smaller, but still meaningful. There was no relationship between proximity and overall wellbeing or the probability of self-reporting problem gambling behaviours.

Importantly, the effects of living close to a gambling venue were largest for more vulnerable population subgroups, such as those with low income.

Conclusions

Our findings suggest that the close proximity of gambling venues to people's homes increases financial hardship and mental health problems, particularly for socioeconomically vulnerable populations. This evidence may be useful for state and local governments with their decisions to approve future gaming licence applications.

Introduction

Gambling has long been a topic of great interest to economists, with important contributions in understanding decision making in betting markets, efficient design of lotteries, taxation of gambling winnings and the link between gambling and the economy, just to name a few (Suits 1979; Even and Noble 1992; Farrell and Walker 1999; Walker and Young 2001; Kumar et al. 2011). However, the health and economic consequences of gambling addiction has gained relatively little attention by economists. This is surprising given the enormity of gambling losses experienced in many countries each year (The Economist 2017) and the strong link between gambling addiction and harmful health and economic outcomes, such as psychological distress, suicidal ideation, relationship breakdown, bankruptcy and criminal activity (American Psychiatric Association 2013; Langham et al. 2016). Robust evidence on the magnitude of any harms related to gambling is important for at least two reasons. First, to inform governments on the costs associated with policies that allow gambling. Second, to support the development of policies that aim to reduce harmful consequences of gambling addiction.

In this study we contribute new information on how the geographical proximity of gambling venues to a person's home and local shopping district influences gambling behaviour and potentially harmful outcomes. We additionally identify the population groups who are most influenced.

We construct a unique panel dataset that combines the precise geographical location of gambling venues (that operate electronic gaming machines) in Australia's largest gambling states to detailed survey data on individual's gambling behaviours, and their health and economic situation. We focus on mental health problems, financial hardship and overall wellbeing to capture harms relating to gambling. This is consistent with the public health approach, which acknowledges that gambling behaviour can increase the risk of, or contribute to, a diverse range of negative health and wellbeing outcomes (Langham et al. 2016). We compare individuals living very close to such gambling venues to those living further away, within the same neighbourhood. By including neighbourhood fixed-effects, we implicitly control for all fixed characteristics of the neighbourhood (such as socioeconomic status, demographic factors and local government policies), which may confound the relationship between local access to gambling venues and the health and economic status of residents.

Previous studies have demonstrated the interconnectedness between psychiatric disorders and gambling behaviour (Lorains et al. 2011; Clark et al. 2014; Hartmann and Blaszczynski 2018). We utilise the longitudinal data on health and economic outcomes to estimate dynamic models, which include lagged measures of mental health, financial hardship and wellbeing outcomes. This enables us to control for pre-existing mental health and financial problems, in addition to unobserved individual traits that determined these outcomes. We further test the exogeneity of our 'distance to venue' measure by testing whether people who like to gamble (or have unobserved characteristics that make them more likely to gamble) tend to move closer to gambling venues. We find that gambling behaviour in 2015 is not a significant predictor of how close a person lives to a gambling venue in 2018, which supports the validity of our identification assumption.

Our study builds on previous findings, largely from cross-sectional study designs, which suggest that greater physical accessibility to gambling venues is associated with higher rates of gambling involvement and problem gambling (e.g. Welte et al. 2004; McMillen and Doran 2006; Ministry of Health 2008; Pearce et al. 2008; Storer et al. 2009; Vasiliadis et al. 2013; Welte et al. 2016b; Kato and Goto 2018). Our methodological approach accounts for confounders to a greater extent than previous studies. We are also able to examine financial and mental health harms that respondents were not asked about in direct relation to gambling. This is novel. Studies typically rely on questions used to screen for 'problem gambling' in order to measure the harmful extent of gambling. However, it has been shown that such indicators are often inadequate in measuring gambling-related harm (Browne et al. 2016). In particular, they tend to measure behaviours more than consequences, and do not capture the breadth

and complexity of harms experienced from gambling. For example, the harms suffered by family members of gamblers are not captured.

Access to gambling venues in local communities is an ongoing concern in many countries, including Australia, Canada, the United Kingdom and the United States (Vasiliadis et al. 2013). When gambling venues are located in close proximity to homes, travel time and costs are reduced, making it cheaper to visit a gambling venue. This increased level of convenience can also make it easier for individuals to gamble on impulse, rather than making a planned decision to gamble (Productivity Commission 1999; Victorian Department of Justice 2008). This can be particularly harmful for vulnerable individuals, including those with impulse-control or addictive disorders (Blaszczynski and Nower 2002). Evidence from our study is highly policy relevant because governments have the capacity to define the terms of access to gambling venues. For example, in Australia and Canada, some state/provincial governments are responsible for the conduct and management of all EGMs, and most local governments have the power to reject applications from gambling venue operators who wish to open a new venue or expand an existing one. Gambling venue operators in most Australian states must demonstrate that the community benefits of any new or expanded gambling venue offset any harms to the community.

Australia is an important setting to explore the harms relating to gambling. In 2017-18, total gambling losses amounted to almost AUD $25 billion (about US$19 billion) or about 1.4 per cent of annual GDP, making Australia the world leader in gambling losses per capita (Queensland Government 2019).[1] Electronic Gaming Machines (EGMs), also known as poker machines, “pokies” or slot machines, are by far and away the largest contributor to gambling losses in Australia, with about half of all gambling expenditure spent on them. What makes Australia’s EGMs particularly accessible is their abundance outside of casinos. There exists over 5000 hotels, pubs and clubs with EGMs in Australia, containing about 200,000 EGMs (Productivity Commission 2010). On a per capita basis this is about five times as many EGMs as in the United States. A further concern is that gambling venues in Australia are more densely located in socioeconomically disadvantaged neighbourhoods, and therefore the availability of gambling venues can have disproportionate consequences on the poorest communities (Welte et al. 2004; Young et al. 2012; Rintoul et al. 2013).

Our results generate three main findings. First, we show that within a local area, individuals living further away from EGM gambling venues are significantly less likely to gamble: doubling the distance from a venue reduces the likelihood of gambling by 1.5 percentage points (relative to a mean gambling rate of 13 per cent). We show that this distance effect is driven by distances less than 1km. We find no significant effect for other types of gambling (casinos, lotteries, or scratch cards). Second, we show that this increase in gambling appears to translate to harmful outcomes; residential proximity to gambling venues significantly increases financial hardship and mental health difficulties, especially for very close distances (less than 250m). However, we do not see a significant effect on overall wellbeing or the probability of having a self-reported gambling problem. Third, we show that the effects of living close to a gambling venue are most acutely felt by the more vulnerable members of our population, such as those with low income.

In related economic literatures, several studies have carefully explored the behavioural impacts of being in close proximity to potentially unhealthy outlets. For example, there is evidence to suggest that the proximity to fast food outlets increases body mass index (Currie et al. 2010; Chen et al. 2013) and that distance to the nearest cannabis shop (in the Netherlands) affects the age of onset of cannabis use (Palali and van Ours 2015). We apply similar approaches to the context of gambling venues. Our study is the first to our knowledge to rigorously examine how the proximity of gambling venues influences gambling and contributes to mental health problems and financial difficulties. Our findings show that gambling venues located in close proximity to people’s homes significantly increases gambling and related harms.

1 In a distant second place is Singapore, followed by Ireland. The United States leads in terms of total amount of gambling losses, at almost $117 billion in 2016 (The Economist 2017).

Data description

Our data are drawn from the Household, Income and Labour Dynamics in Australia (HILDA) survey. HILDA is an annual nationally-representative longitudinal study of Australian households that began in 2001. It collects detailed information on all household members aged 15 years and over on a variety of economic and social outcomes, including employment, income, health, wellbeing and major life events (Wilkins and Lass 2015). Our primary sample includes HILDA respondents aged 18 years and over (legal gambling age), who reside in urban areas of Sydney, Melbourne, Brisbane and Adelaide, and who provided information on gambling behaviours (wave 15 or wave 18). This provides a sample of 14,860 observations from 9,071 people.

Gambling expenditure and problem gambling

HILDA collected information on gambling expenditures and problem gambling symptoms in the wave 15 and wave 18 self-completion questionnaires. Respondents are first asked about their expenditure on 10 different types of gambling in a typical month. From the expenditure information we construct two types of gambling variables. Our main gambling variable is a binary indicator representing any positive gambling expenditure in EGM gambling venues.[2] For comparative purposes, we also use similar binary indicators for other types of gambling (e.g. lotteries, scratch cards). Our secondary gambling variables are expenditure on different types of gambling in $000s (these results are shown in the Appendix). In our data, 13 per cent of respondents report positive expenditure in EGM gambling venues. Among this 13 per cent (N = 1875), mean expenditure equals $161, and mean expenditure as a percentage of weekly household income equals 13 per cent. Around 6 per cent of these gamblers report expenditure in a typical month that exceeds 50 per cent of their total weekly household income.

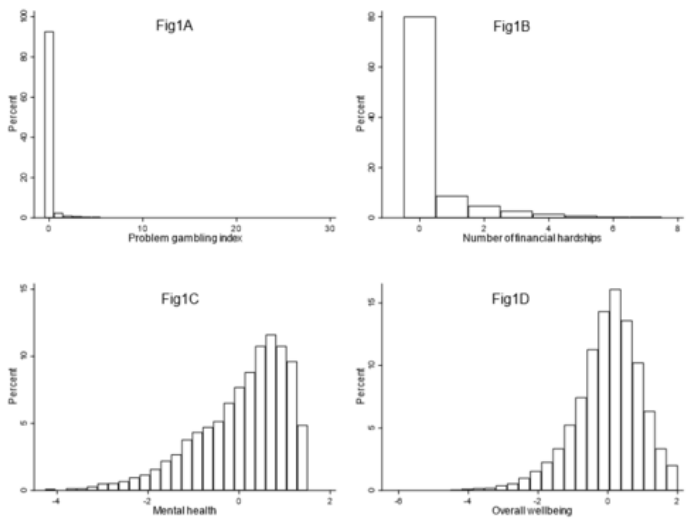
HILDA respondents are additionally asked questions that are used to construct the Problem Gambling Severity Index (PGSI) (Ferris and Wynne 2001). The nine questions measure problem gambling behaviours (e.g. “have you borrowed money or sold anything to get money to gamble?”) and adverse consequences of gambling (e.g. “has your gambling caused any financial problems for you or your household?”). See Appendix Table A1 for the full list of questions. The PGSI is shown in Figure 1A and is constructed by summing up the responses: 0 “never”; 1 “sometimes”; 2 “most of the time”; and 3 “almost always”. The figure demonstrates that most people score zero, indicating the person has no ‘problem gambling’ (PG) behaviours or adverse consequences from gambling. Given the rarity of positive values, and the extreme positive skewness of the distribution (skewness = 8.07), in all analyses we use a binary variable signifying at least one PG symptom (7per cent of people).

Table 1 presents descriptive statistics of the gambling expenditure and PG variables separately by individual socioeconomic characteristics. Gambling expenditures and incidence of PG symptoms are higher for males, older people (aged ≥ 45), and people with lower incomes (< median household income). These figures are in-line with previous studies that document higher gambling expenditure and disorder rates for more disadvantaged individuals and communities (Welte et al. 2004; Rintoul et al. 2013). Table 1 also demonstrates that gambling expenditures and PG are higher for people who: are willing to take financial risks (less risk averse), have a short time horizon for financial planning (high time discounting); and have lower cognitive ability.[3]

2 The types of gambling that are generally available in EGM gambling venues are: poker/slot machines, Keno, sports betting, and betting on horse/dog racing. Our EGM gambling venue measures therefore represent gambling expenditure on any of these four types.

3 Cognitive ability is measured using the predicted factor from a factor analysis of scores on the National Adult Reading Test, Backwards Digit Span test, and Symbol Digits Modalities test. See Gong and Zhu (2019) for a detailed investigation of the association between gambling behaviours and cognitive ability.

Figure 1: Histograms of potential harms from excessive gambling



Financial and mental wellbeing

We estimate potential negative consequences of gambling using measures of financial hardship, mental health, and overall wellbeing. Financial hardship is measured through self-completion survey questions asking people whether due to a shortage of money they: could not pay electricity, gas or telephone bills on time; could not pay the mortgage or rent on time; pawned or sold something; went without meals; was unable to heat home; asked for financial help from friends or family; and asked for help from welfare or community organisations. Figure 1B displays the number of financial hardships experienced by our sample: 80 per cent did not experience any of the financial hardships, and only 6 per cent experienced three or more hardships. In our main analyses we use a binary variable signifying at least one financial hardship. We also present supplementary estimates for each hardship separately, and for number of hardships.

Table 1: Sample means of gambling variables for subgroups

	Gamble (0/1)	Positive expend ($000s)	Positive expend as % of income	Gambling problem (0 / 1)
Socioeconomic characteristics				
Men	0.18	0.19	14.4	0.10
Women	0.09	0.12	11.0	0.05
Younger (Age < 45)	0.11	0.15	10.9	0.07
Older (Age ≥45)	0.16	0.17	14.7	0.08
Employed full-time	0.14	0.18	10.7	0.08
Not employed full-time	0.12	0.14	15.6	0.07
Low household income (< median)	0.15	0.16	18.6	0.09
High household income (> median)	0.12	0.16	6.40	0.06
Preferences and ability				
Unwilling to take financial risks	0.12	0.12	12.0	0.06
Willing to take financial risks	0.15	0.19	14.0	0.09
Short planning horizon	0.15	0.17	16.4	0.10
Long planning horizon	0.11	0.15	8.70	0.05
Poor cognitive ability (< median)	0.16	0.18	16.0	0.09
Good cognitive ability (> median)	0.11	0.15	10.5	0.06

Note: Sample sizes: men 6,947, women 7,913, younger 7,535, older 7,325, employed 6,855, not employed 8,005, low income 7,389, high income 7,471, risk averse 7,352, risk taker 7,319, short horizon 7,648, long horizon 7,212, poor cognition 5,929, and good cognition 8,931. 'short planning horizon' indicates the person reported that the important period for planning saving and spending is weeks or months, compared with years. Cognitive ability measured using Backwards Digit Span Test, Symbol-Digits Modalities Test and National American Reading Test.

Mental health is measured using answers to five questions from the 36-Item Short Form Survey (SF-36) health instrument in the self-completion questionnaire. People are asked how much of the time during the past four weeks they have: been a nervous person; felt so down in the dumps that nothing could cheer you up; felt calm and peaceful; felt down; and been a happy person. There were six possible responses, ranging from 1 (all of the time) to 6 (none of the time). We construct a mental health index by summing responses (some reversed), and standardising the sum to have a mean of zero and a standard deviation of one. A histogram of the index is shown in Fig 1C.

The final outcome measure is a person's overall wellbeing. This variable is displayed in Fig 1D and is generated using a principal components factor analysis on responses to eight satisfaction questions. The questions ask about the respondent's satisfaction with their home, financial situation, safety, community, health, neighbourhood, amount of free time, and life overall. Only one factor has an eigenvalue greater than 1 (eigenvalue = 3.42), and it loads similarly on the eight items (see Appendix table A2). The overall Kaiser-Meyer-Olkin (KMO) statistic equals 0.85, with each item having a KMO statistic greater than 0.8. These KMO statistics indicates that the predicted latent factor explains a relatively high proportion of the variance in the satisfaction measures.

Proximity of gambling venues

Data on the location of EGM gambling venues in years 2015 and 2018 were constructed by combining separate administrative databases from New South Wales (Sydney), Victoria (Melbourne), Queensland (Brisbane) and South Australia (Adelaide). In these data, an EGM gambling venue is defined as any non-casino business with at least one licenced EGM in operation.[4] For Queensland, we obtained latitude and longitude of all existing venues. Other states provided venue addresses, which were subsequently geocoded using the ArcGIS World Geocoding Service. A similar approach was used to construct data on the location of all alcohol serving venues.

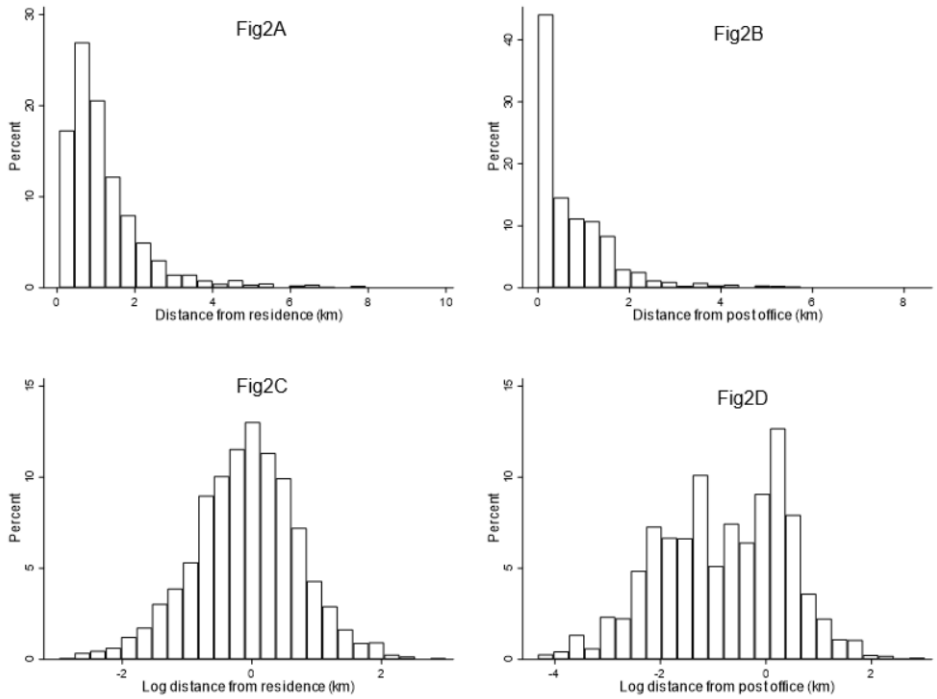
The exact latitude and longitude of HILDA respondents' residential addresses are unknown. However, the HILDA dataset does contain relatively precise information on residential locations through two non-overlapping geographical classifications systems: Statistical Area 1 (SA1) and census Collection District (CD). There are 57,523 SA1s covering the whole of Australia, with an average of about 400 people in each (Australian Bureau of Statistics 2016). For the 2006 census, there were 38,200 CDs throughout Australia, with an average of about 225 dwellings in each. To calculate the approximate distance from the respondent's home to the closest EGM gambling venue, we used the midpoint of the intersection between the respondent's SA1 and CD areas, and calculate the Euclidean distance to the nearest EGM gambling venue. The median size of the intersected areas is 0.4 kilometres squared (equivalent to a circle with radius 200m), and so the measurement error in this distance measure will not be large.

Undoubtedly, people travel to EGM gambling venues from locations other than their residence. In particular, they may visit venues after work or after shopping. Doran et al. (2007) highlighted the appeal of gambling venues located in shopping strips and other places of social congregation. HILDA does not contain precise information on workplace locations, and roughly one-third of our 18 –90 year-old sample is not employed (21 per cent work part-time 46 per cent work full-time). However, we have calculated the distance between HILDA respondents' closest post office and its closest EGM gambling venue. Most shopping areas in Australia include a post office, and so these calculated distances provide an approximation of the proximity of gambling venues to HILDA respondents' closest shopping area. Data on the location of post offices were obtained from the Australian Postal Corporation and consists of the exact addresses of every post office.

The mean distances between EGM gambling venues and people's residence and nearest post office equal 1.28km and 0.86km, respectively. As shown in the top panel of Figure, 2, these distance measures display substantial positive skewness. Therefore, in all primary analyses we use the natural logarithm of the distances to EGM gambling venues; the histograms are shown in the bottom panel of Figure 2. Our secondary approach for measuring proximity to people's residence is to aggregate distance to nearest venue into four categories: < 250m (6 per cent); 250m –1km (47 per cent); 1km –2km (32 per cent); and > 2km (16 per cent).

4 The seven casinos were excluded from the data because they are distinct from local EGM gambling venues. Casinos are generally large, destination- or resort-style gambling complexes located in central business or commercial districts, which offer different types of gambling (e.g. poker, blackjack and roulette) and other forms of entertainment (e.g. cinemas). We additionally explored the sensitivity of our results to omitting neighbourhoods with unusually large venues, containing >300 EGMs. These large venues may also be viewed as destination gambling complexes. All estimated coefficients using this reduced sample were very similar to those presented below.

Figure 2: Distance to closest EGM gambling venue from people's residence and nearest shopping district



Methodology

This study includes three main sets of analysis. First, we estimate whether the proximity of gambling venues impacts upon a person's likelihood of undertaking gambling of different types. Second, we estimate reduced form regression models to determine whether the observed increases in gambling leads to reductions in financial, mental and overall wellbeing. Finally, we explore the population subgroups who are most strongly affected. A specific focus will be on disadvantaged subpopulations (e.g. low income and non-employed), and individuals with economic preferences and cognitive ability levels that make them vulnerable to gambling harms.

Our main empirical approach is represented by the following dynamic regression model of wellbeing outcomes:

$$y_{iat}^{k} = \alpha_a + \delta distance_{at} + \sum_{j=1}^{3} \rho_j y_{iat-1}^{j} + X_{it}'\beta + Z_{at}'\beta + \varepsilon_{iat}, \qquad k = \{1,2,3\}$$

where y_{iat}^{k} is wellbeing outcome *k* of individual *i*, living in neighbourhood *a*, in year *t*. The individual level covariates include X_{it}', which is a set of variables representing the month and year of the survey, and basic demographic characteristics: a cubic function of age, sex, marital status, number of children, and educational attainment. Each regression also includes all three of the lagged outcomes (i.e. lagged mental health, financial hardship, overall wellbeing). These terms are included to control for state dependence, and also for the possibility that current residential location is impacted by past mental and financial wellbeing.

The key parameter of interest is δ; the effect of venue proximity ($distance_{at}$) on wellbeing. Given the inclusion of neighbourhood fixed-effects α_a, this parameter is identified by differences in the distance to a gambling venue, between people living in the same neighbourhood. Importantly, neighbourhoods are defined by the Australian Bureau of Statistics, Statistical Area Level 2 (SA2) geographical system. A SA2 is defined to "represent a community that interacts together socially and economically", and often aligns with suburb borders (Australian Bureau of Statistics 2016). There are 2,310 SA2 regions covering the whole of Australia, but our sample includes 254, 265, 210 and 96 SA2s dividing the metropolitan areas of Sydney, Melbourne, Brisbane, and Adelaide, respectively. The median area of an SA2 in our sample equals 8.2 square kilometres (3.2 square miles), which is equivalent to a circular area with radius of 1.6 km (1 mile). Appendix Figure A1 includes a map of Sydney that further illustrate the size of SA2s.

Each neighbourhood (SA2) contains a relatively homogenous population; however, small demographic and socioeconomic differences exist. To control for these differences, we include a detailed set of area-level control variables (Z_{at}'). A key variable is distance from non-gambling venues that serve alcohol. This variable does not represent distance from restaurants or cafés that may have a liquor licence. Rather it includes venues that are more similar in size and style to gambling venues, such as pubs, clubs and hotels. Distance from gambling venues and distance from other alcohol serving venues are positively correlated, and given the known harms from excessive consumption of alcohol, it's important to control for alcohol accessibility. Other area-level controls, measured at the (smallest) SA1 geographical level, are: income and wealth index; education and occupation index5; mean house prices, mean residential rents, and mean level perceptions on seven aspects of neighbourhood quality (traffic noise; noise from industry, trains and airplanes; condition of homes and gardens; extent of rubbish and litter; incidence of hostility and aggressiveness; incidence of vandalism and damage to property; and incidence of burglary and theft). In Table 2 we demonstrate that these area-level control variables,

5 The two indices are Australian Bureau of Statistics Socio-Economic Indexes for Areas (SEIFA) called the Index of Economic Resources, which summarises people's income and wealth levels, and the Index of Education and Occupation (IEO), which summaries people's educational and occupational levels, using data from the 2016 Census.

together with the neighbourhood fixed-effects, sufficiently reduce within-neighbourhood heterogeneity that may be associated with gambling.

Table 2: Estimated effects of log distance to venue on potentially confounding factors

Outcomes	Without controls		With area controls	
Socioeconomic status				
Employed full-time	-0.007	(0.005)	0.011	(0.009)
Log household income	0.043***	(0.008)	-0.007	(0.012)
Preferences and ability				
Financial risk aversion	0.020**	(0.008)	0.003	(0.014)
Financial planning horizon	-0.011	(0.014)	-0.015	(0.022)
Cognitive ability	-0.055***	(0.013)	0.020	(0.020)
Risky health behaviours				
Number of standard drinks per week	-0.355***	(0.133)	0.055	(0.233)
Number of cigarettes per week	-0.122	(0.418)	-0.379	(0.836)
Physical health				
Physical functioning	-0.002	(0.011)	0.002	(0.019)
Bodily pain	-0.029**	(0.011)	-0.003	(0.019)
Role physical	-0.009	(0.011)	0.016	(0.019)

Note: Figures are coefficient estimates and clustered standard errors from 10 linear regressions without covariates and 10 linear regressions with area-level covariates. The Sample sizes for the 10 different outcomes (in vertical order) are: 17,757, 17,684, 14,660, 16,796, 14,943, 12,001, 14,817, 14,760, 14,802, and 14,734. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

Column (1) of Table 2 presents estimated associations between distance from residence to the nearest EGM gambling venue and individual socioeconomic status, preferences and ability, risky health behaviours, and physical health (i.e. estimates from a regression without any covariates apart from log distance). The statistically significant estimates from this column suggest that people who live closer to venues have lower household income, are less risk averse, have greater cognitive ability, drink more alcohol, and are physically healthier. Column (2) presents estimated associations from regressions that include area-level covariates and neighbourhood fixed-effects. These estimates suggest that the area-level covariates adequately control for differences between people living near and far from venues. The estimates for income, risk aversion, cognitive ability, drinking and pain are much smaller in magnitude, and are no longer statistically significant.

As an additional robustness test, we explore the possibility of endogenous residential sorting based on the propensity to gamble. Or, in other words, we test whether people who like to gamble (or have unobserved characteristics that make them more likely to gamble) tend to move closer to gambling venues. Specifically, we regress distance to gambling venues in 2018 on gambling behaviours from 2015, and our set of control variables from 2015. This regression is estimated using the sample of respondents (N = 2,082) who changed residential location between 2015 and 2018. The results indicate that 2015 gambling behaviour is not a significant predictor of how close a person lives to a gambling venue in 2018: estimated effects of gamble (0/1), gambling expenditure ($000s) and problem gambling (0/1) equal -0.05 (p=0.46), -0.09 (p=0.30) and -0.04 (p=0.67), respectively. Moreover, distance from venue in 2015 isn't a significant predictor of distance from venue in 2018 (coefficient=-0.02, p=0.61). Overall, these test results support the validity of our identification assumption.

Results

Impacts on gambling behaviours

Table 3 presents estimated effects of proximity to venues on gambling behaviour. In Panel A, proximity is measured using log distance from residence. The estimate of -0.015 in column 1 indicates that doubling the distance from an EGM gambling venue (an increase of 100 per cent), reduces the likelihood of gambling on games offered in such venues by 1.5 percentage points (relative to a mean gambling rate of 13 per cent). Such effects do not hold for other gambling types: people who live further from EGM gambling venues are no less likely to gamble on games offered at casinos (roulette, blackjack, poker), play the lottery, or purchase scratch cards.[6] This suggests that there are no spillover effects from gambling in EGM gambling venues to other types of gambling. The results also suggest that the significant finding for EGM venue gambling (-0.015) is not driven by unobserved confounding factors, such as preferences (e.g. risk aversion), behavioural traits (e.g. impulsivity), or socioeconomic status (e.g. liquid wealth), because we would expect these factors to have similar effects on other gambling types.

Table 3: Estimated associations between venue proximity and gambling behaviour

	EGM venues (1)	Alternative gambling types			Problematic gambling symptom (5)
		Casino (2)	Lotteries (3)	Scratch cards (4)	
A. Distance from residence					
Log distance	-0.015**	0.000	-0.007	0.000	0.000
	(0.007)	(0.003)	(0.009)	(0.005)	(0.005)
B. Distance from residence					
Distance < 250m	0.058***	-0.006	-0.018	-0.000	0.004
	(0.022)	(0.009)	(0.028)	(0.016)	(0.017)
Distance 250m-1km	0.036**	-0.001	-0.015	-0.010	0.002
	(0.015)	(0.006)	(0.020)	(0.011)	(0.012)
Distance 1-2km	0.018	-0.004	-0.032*	-0.011	0.010
	(0.014)	(0.006)	(0.019)	(0.010)	(0.010)
C. Distance from shops					
Log distance	0.002	0.002	-0.002	-0.003	0.007*
	(0.005)	(0.002)	(0.006)	(0.004)	(0.004)

Note: Figures are coefficient estimates and clustered standard errors from linear regressions with neighbourhood fixed-effects, area-level covariates, and individual-level covariates. All outcomes are binary variables. Columns 1-4 outcomes are indicators of positive gambling expenditure for different gambling types. Column 5 outcome is an indicator of a gambling problem. Sample size equals 14,767. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

6 In Appendix Table A3, we demonstrate that log distance from venues is not a significant predictor of the amount of gambling expenditure, among gamblers (the intensive margin of gambling).

Panel B of Table 3 shows that the significant distance effect in Column 1 is driven by distances less than 1km; essentially comfortable walking distances. People living within 250m of a venue are 5.8 percentage points more likely to gamble on games offered in such venues, and people living within 250m-1km are 3.6 percentage points more likely to gamble, relative to people living >2km from a venue. These effect sizes are comparable with estimated coefficients for other statistically significant coefficients (see Appendix Table A4). The estimated effects for male, having no children (relative to having three), and being a high school dropout (relative to university educated) equal 9.0, 5.6 and 8.1 percentage points, respectively. Importantly, the distance effects are not driven by the strong documented association between mental illness and gambling (Hartmann and Blaszczynski, 2018). If we omit people from the estimation sample who report having depression, anxiety or another mental illness, the estimated effects are similar to those reported in Table 3: people living within 250m and 250m-1km of a venue are 5.7 percentage points and 4.1 percentage points more likely to gamble, respectively.

As discussed in Section 3, having a gambling venue located near to or within a shopping district may also induce people to gamble. In Panel C we test this proposition by replacing distance from residence with distance from nearest post office in the regressions. The estimates indicate that this distance measure is not a predictor of gambling.[7] This could imply that people rarely gamble near where they shop. It could also mean that a significant proportion of people do not regularly shop at their closest shopping district; introducing measurement error in our distance measure and attenuating our estimates.

Finally, in Column 5 we explore whether venue proximity is associated with increased rates of PG symptoms, such as betting more that you can afford, borrowing money to gamble, and gambling with larger amounts to get the same feeling of excitement. We find that living or shopping near an EGM gambling venue does not increase the likelihood of self-reported problematic gambling behaviours, with all the point estimates small in magnitude. We return to this finding in the discussion section, and argue that this lack of impact may be due to measurement error.

Impacts on financial hardship, mental health and overall wellbeing

To explore whether increased gambling in EGM venues worsens household finances and mental health, we take a reduced form approach, and regress our three wellbeing outcomes on venue distance, lagged outcomes, and the same set of area- and individual-level controls used previously. The estimated effects of distance from these regressions could be driven by direct effects on gamblers (i.e. the gambler has worse health) and/or indirect effects on gamblers' families (i.e. the gambler's spouse has worse health). In other words, a person does not need to be induced to gamble themselves in order to experience a negative effect from residing close to a venue.

Column (1) of Table 4 presents the effects of proximity on the experience of financial hardship. The estimate in Panel A indicates that a 100 per cent increase in distance reduces the likelihood of financial hardship by 1.5 percentage points (relative to a mean likelihood of 20 percent, $p<0.05$). As shown for the gambling outcomes in Table 3, the distance effect is especially large for people living very close to venues. People living within 250m of a venue are 5.4 percentage points more likely to experience financial hardship ($p<0.05$), and people living within 250m-1km are 3.4 percentage points more likely ($p<0.05$), relative to people living >2km from a venue. Appendix Table A5 shows that the financial hardship effects shown in Table 4 are driven in particular by the effect of distance on the need "for financial help from friends or family". The estimated effects are large. As a comparison, estimates for other covariates in our model, such as being divorced (relative to married), having three children (relative to having none), and being a high school dropout (relative to university educated) equal 3.8, 6.0 and 6.3 percentage points, respectively (see Appendix Table A4).

7 The coefficients on 'log distance from post office' in regressions that also include 'log distance from residence' are also small and statistically insignificant.

Table 4: Estimated associations between venue proximity and financial and mental wellbeing

	Financial hardship (0 / 1)	Mental health (SD 1)	Overall wellbeing (SD 1)
A. Proximity			
Log distance in km to venue	-0.015**	0.028*	-0.000
	(0.007)	(0.015)	(0.013)
B. Proximity			
Distance to venue < 250m	0.054**	-0.118**	-0.034
	(0.022)	(0.051)	(0.043)
Distance to venue 250m-1km	0.034**	-0.025	-0.032
	(0.016)	(0.036)	(0.030)
Distance to venue 1-2km	0.032**	-0.048	-0.052*
	(0.014)	(0.033)	(0.028)
C. Distance from shops			
Log distance	0.003	-0.004	0.002
	(0.005)	(0.010)	(0.009)
Number of observations	14812	14981	16773

Note: Figures are coefficient estimates and clustered standard errors from linear regressions with neighbourhood fixed-effects, area-level covariates, and individual-level covariates. Sample sizes equals 14,812, 14,981 and 16,773 for the financial hardship, mental health and wellbeing outcomes, respectively. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

The estimated effects on mental health are weaker on average, with a 100 per cent increase in distance estimated to improve mental health by 2.8 per cent of a standard deviation (only significant at the 10 per cent level). However, living very close, within 250m of a venue, is estimated to significantly worsen mental health by 11.8 per cent of a standard deviation ($p<0.05$). This is similar in magnitude to the mental health difference between married and single people, and between university graduates and high school dropouts. In Appendix Table A6, we show that most of the items that make up the mental health index are similarly affected. The one exception is the item “been a nervous person”.

In recognition of the possible correlation between the proximity to the closest venue and the density of venues in your neighbourhood, we additionally control for the number of EGM gambling venues within 1km of a person’s residence (a measure of venue density). This inclusion has only a small effect on the distance estimates, and density is itself an unimportant predictor of harms, suggesting that it is proximity and not density which is relevant.[8]

The final column in Table 4 shows that overall wellbeing is relatively unaffected. The estimated coefficients on distance from residence are negative in sign – suggesting living close to venues reduces wellbeing – but they are small in magnitude and statistically insignificant. As an example, it is estimated that a 100 per cent increase in distance is estimated to improve wellbeing by only 0.002 per cent. This finding of small wellbeing effects holds for most wellbeing domains: distance is a weak predictor of people’s satisfaction with their home, safety, community, health, neighbourhood, and amount of free time (see Appendix Table A7). Though, there is a significant negative effect of living within 250m of an EGM gambling venue on satisfaction with “your financial situation”, which is in-line with the financial hardship results.

8 For example, the financial hardship and mental health log distance estimates in Panel A of Table 4 change from -0.015 to -0.017, and 0.028 to 0.036 (i.e. the estimated harms from living close to a venue become slightly larger).

Which population subgroups are most strongly affected?

Undoubtedly, most people are unaffected by proximity to EGM gambling venues. Only certain types of people will be induced to gamble, and to subsequently experience financial hardship. We investigate who is most vulnerable by re-estimating the effects of distance on financial hardship and mental health using subsamples defined by gender, age, employment status, income, subjective financial risk preference, subjective financial time preference, and cognitive ability.

Table 5: Estimated effects of 'log distance from residence' from separate subsample regressions

	Sample size	Financial hardship		Mental health	
Male	6971	-0.016	(0.011)	0.058**	(0.030)
Female	7923	-0.012	(0.011)	0.010	(0.027)
Younger (age < 45)	7552	-0.024**	(0.011)	0.081***	(0.028)
Older (age ≥ 45)	7342	0.005	(0.011)	-0.023	(0.032)
Employed full-time	6860	-0.014	(0.012)	0.028	(0.027)
Not employed full-time	8034	-0.012	(0.011)	0.042	(0.031)
Low income	7453	-0.024*	(0.012)	0.024	(0.031)
High income	7441	0.004	(0.009)	0.032	(0.028)
Unwilling to take financial risks	7321	-0.005	(0.012)	0.051	(0.031)
Willing to take financial risks	7286	-0.029***	(0.010)	-0.015	(0.027)
Short planning horizon	7682	-0.014	(0.012)	0.050*	(0.030)
Long planning horizon	7212	-0.015	(0.009)	0.023	(0.029)
Poor cognitive ability	7459	-0.019	(0.012)	0.083***	(0.031)
Good cognitive ability	7435	-0.019*	(0.011)	-0.004	(0.026)

Note: Figures are coefficient estimates on the variable 'log distance from residence to venue'. Clustered standard errors shown in parentheses. Linear regressions include neighbourhood fixed-effects, area-level covariates, and individual-level covariates. Each regression is estimated using a subsample defined by the characteristic in column 1. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

The estimated coefficients on log distance from residence are presented in Table 5, and show that the populations most vulnerable to financial hardship appear to be younger people, with low incomes, who are more willing to take financial risks. An alternative approach for exploring heterogeneity is to estimate one financial hardship regression that includes interaction terms between log distance and each of the individual characteristics. In this regression,

log household income is clearly the most important moderating factor (p-value on interaction term = 0.004). People with low incomes are much more likely to experience financial hardship when residing close to a gambling venue.

The mental health effects appear to be largest for young men and people with low cognitive ability. The alternative approach using interaction terms supports the observed difference by sex, with the relationship between distance and mental health being significantly more positive for men.

Discussion and conclusions

Like in many industrialised countries, the gambling industry in Australia is a significant player in the economy (Christiansen 1998; Productivity Commission 1999). In 2017-18 the industry generated over AUD $25 billion in revenue across the country (Queensland Government 2019) and employed over 100,000 people.[9] Gambling losses bring in considerable state revenue. For example in the state of Victoria, over 9 per cent of government revenue came from gambling taxes and levies (Queensland Government 2019). For the majority of gamblers, the entertainment value gained from gambling either equals or exceeds the losses they incur. However, for a small proportion of the population, the losses incurred from gambling can lead to a myriad of harmful outcomes, including unmanageable amounts of debt, financial hardship, mental health problems and suicidal thoughts (Langham et al. 2016). This means that there is inevitably some level of trade-off between government revenue and individual harms.

To determine whether the benefits of gambling venues outweigh the costs, we need reliable evidence of the harms. Several studies have previously investigated the relationship between gambling venue proximity to homes and gambling involvement; however methodological limitations, including a lack of longitudinal data and limited adjustments for socioeconomic confounders, limit the policy implications from these studies (for a systematic review, see Vasiliadis et al. 2013).[10]

Our study extends the existing literature by combining the geolocation of all non-casino gambling venues in four states of Australia (NSW, VIC., QLD and SA), with rich longitudinal survey data from HILDA, to rigorously examine the links between proximity to gambling venues and gambling involvement and harms. Our main results indicate that proximity matters: doubling the distance from one's residence to an EGM gambling venue reduces the likelihood of gambling on games offered in such venues by 1.5 percentage points (relative to a mean gambling rate of 13 per cent). We find no significant effect for other types of gambling (casinos, lotteries or scratch cards), suggesting that spillover effects are limited.

We also find that this increase in gambling likely translates into harmful outcomes. We find residential proximity to gambling venues significantly increases financial hardship and mental health difficulties, especially for very close distances. Given the aetiology of gambling disorder (American Psychiatric Association 2013), it is possible that these mental health effects are driven by the increased financial hardship. This would imply a simplified causal pathway such as: residing close to a venue causes increased gambling (for a minority of people), which causes financial problems for those who gamble excessively, which in-turn causes lower mental health for the gamblers and/or their families.

Our results for problem gambling (PG) symptoms show that distance to venue has near zero effects on a binary outcome, a continuous Problem Gambling Severity Index (PGSI), and each individual item of the PGSI. These results may appear to contradict the significant financial hardship and mental health effects, especially given the PGSI includes a financial hardship item ("has your gambling caused any financial problems for you or your household?") and a mental health item ("has gambling caused you any health problems, including stress or

9 Reliable figures for employment in the gambling industry are dated, but estimates from 2005 suggested 125,000 people were employed in just hotels and clubs with gambling (Productivity Commission 2010).

10 Most studies examining this relationship have found a significant relationship between distance to their nearest or regular gambling venue and gambling involvement (measured by participation in gambling at venues or expenditure at gambling venues (e.g. Marshall et al. 2004; Pearce et al. 2008; Young et al. 2012; Welte et al. 2016a). However, of those that have examined problem gambling (e.g. using the PGSI), results have been mixed. For example, Young et al (2012) found no association in the Northern Territory, Australia, whereas Pearce et al. (2008) found a significant association. Other studies have examined the density of gambling venues and gambling involvement or problem gambling and have found mixed results. For example Storer et al. (2009) found the prevalence of problem gambling to be significantly associated with per capita density of EGMs in a meta-analysis of surveys from Australia and New Zealand. However, McMillen and Doran (2006) found that between 2001 and 2005, expenditure was not significantly higher in parts of a Victorian local government area that had a high density of gambling venues. Kato and Goto (2018) found that the number of Pachinko parlours with a 1.5km radius from home in Japan was not significantly associated with pathological gambling in general, but that the effects of accessibility varied by subpopulation.

anxiety?). An explanation for this inconsistency is that the framing of the questions, which requires people to acknowledge their problematic gambling behaviour, leads to an under-reporting of gambling problems (Tourangeau and Yan 2007) and subsequently an underestimate of the estimated association. Moreover, an emphasis on using indicators of problem gambling or indexes used to screen for gambling disorder can overlook the broader outcomes associated with gambling.

Consistent with a public health approach to viewing harms (Langham et al. 2016), we examined welfare outcomes directly using measures of mental health and financial hardship. While several studies have, like us, examined problem gambling using the PGSI (or other similar indices) to measure the harms of living in close proximity to gambling venues, we are aware of very few studies that have investigated the harms from living in close proximity to gambling venues using other broader measures of harm. Perhaps the closest studies are those that investigate the impact of changing the physical accessibility of gambling venues on severe financial harm in Australia (Badji et al. 2020) and in Canada (Mikhed et al. 2017). Both of these studies find that reducing the physical accessibility of gambling venues (by closing venues or removing EGM machines) reduces the number of personal bankruptcies.

Importantly, we show that the harmful effects of living in close proximity to gambling venues is not equal across populations. We found that the effects for financial hardship were greater for people who are younger, with low incomes, and who are more willing to take financial risks. The effects for mental health difficulties were greater for young men and people with low cognitive ability. This suggests that the location of gambling venues in close proximity to people's homes affects the populations that are more vulnerable, and as such likely result in a widening of socioeconomic and health inequalities.

Our methodological design involves comparing proximity to a gambling venue between individuals living within the same neighbourhood. This allows us to control for all area-level confounders including socioeconomic and demographic characteristics. We are not aware of any other study that has done this in this context. We also control for the residential distance to all non-gaming liquor venues which have not been accounted for in previous studies. Furthermore, we take advantage of our longitudinal data and control for lagged outcomes; this addresses concerns of reverse causality (i.e., that financial hardship or mental health problems influence how close you live to gambling venues) and that unobserved characteristics may jointly determine how close one lives to gambling venues and their financial and mental health problems. Our robustness regression results additionally suggest that our 'distance to gambling venues' measure is exogenous.

While the interconnectedness of gambling behaviour and other psychiatric disorders has been previously acknowledged (Lorains et al. 2011; Hartmann and Blaszczynski 2018), few studies have attempted to tease out the impacts of gambling on mental health. An exception is Churchill and Farrell (2018) who use a Lewbel instrumental variable estimator to support their ordinary least squares estimates on the impact of gambling behaviour on depression in Great Britain. Their findings suggest that gambling addiction has a positive impact on depression.

Our study is not without limitations. We focus on one key aspect of accessibility to gambling – the distance of gambling venues from homes and shops. In additional models, we controlled for the density of venues (number of venues within 1km) and found it made no meaningful difference. However, due to data limitations, we have not accounted for social accessibility (e.g. attractive and non-threatening environment), temporal accessibility (e.g. opening hours) and cognitive accessibility (e.g. familiarity with how gaming machines work). These accessibility domains can all facilitate gambling involvement (Hing and Haw 2009; Hing and Nisbet 2010; Thomas et al. 2011). Another limitation is that we don't have access to people's exact residential address, meaning that that the distance to nearest gambling venue will contain some measurement error. Fortunately, the measurement error is likely to be small and random, implying that the estimates we present may be slightly smaller in magnitude (attenuated) than their true values. Finally, while we have longitudinal data on the location of gambling venues, we were unable to examine within-individual changes in outcomes as there was insufficient across-time variation in the number of venues within neighbourhoods (lack of openings and closings).

In most countries, gambling markets are regulated and fine-tuning of regulatory models is an ongoing process. There have historically been particular concerns about the 'safety' of EGMs, which has led to rules about machine design (e.g. minimum rate of return, maximum bet) and restrictions on their accessibility (e.g. licensing of venue operators and maximum number of EGMs in a jurisdiction) (Productivity Commission 2010). If the location of gambling venues in close proximity to people's homes induces gambling at unsafe levels, then there is a public health and economic argument for governments to reduce accessibility. Our findings suggest that the close proximity of gambling venues to homes increases financial hardship and mental health problems, particularly for socioeconomically vulnerable populations. The current process in Australia already requires applicants to demonstrate that the community benefits of the new or expanded gambling venue offsets any harms to the community. The evidence from our study can therefore be used to help state and local governments with their decisions to approve future gaming licence applications.

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Appendix

Appendix Table A1: Problem gambling questions in the HILDA survey

1	Have you bet more than you could really afford to lose?
2	Have you needed to gamble with larger amounts of money to get the same feeling of excitement?
3	When you gambled, did you go back another day to try to win back the money you lost?
4	Have you borrowed money or sold anything to get money to gamble?
5	Have you felt that you might have a problem with gambling?
6	Has gambling caused you any health problems, including stress or anxiety?
7	Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?
8	Has your gambling caused any financial problems for you or your household?
9	Have you felt guilty about the way you gamble or what happens when you gamble?

Appendix Table A2: Sample means and scoring coefficients for items in the overall wellbeing index

	Sample mean	Scoring coefficient
The home in which you live	7.98	0.19
Your financial situation	6.47	0.18
How safe you feel	8.20	0.20
Feeling part of your local community	6.74	0.19
Your health	7.26	0.18
The neighbourhood in which you live	7.87	0.21
The amount of free time you have	6.71	0.14
Overall	7.92	0.23

Note: Variables provide answers to question 'How satisfied or dissatisfied are you with…'. All variables range from 0-10. Scoring coefficients are from principal component factor analysis of all HILDA observations with non-missing satisfaction information. Sample size equals 268,874.

Appendix Table A3: Estimated associations between venue proximity and expenditure on different gambling types ($000s)

	EGM	Alternative gambling types		
	venues (1)	Casino (2)	Lotteries (3)	Scratch cards (4)
A. Distance from residence	0.000	-0.000	0.001	-0.000
Log distance	(0.003)	(0.000)	(0.002)	(0.000)
B. Distance from residence				
Distance < 250m	-0.002	0.000	-0.009*	0.000
	(0.007)	(0.001)	(0.005)	(0.000)
Distance 250m-1km	0.000	0.001	-0.007	-0.000
	(0.006)	(0.001)	(0.005)	(0.000)
Distance 1-2km	-0.003	0.000	-0.005	-0.000
	(0.005)	(0.001)	(0.003)	(0.000)
C. Distance from shops				
Log distance	-0.000	-0.000	-0.000	-0.000
	(0.002)	(0.000)	(0.002)	(0.000)

Note: Figures are coefficient estimates and clustered standard errors from linear regressions with neighbourhood fixed-effects, area-level covariates, and individual-level covariates. All outcomes are expenditure in $1000 units for different gambling types (zeros included). Sample size equals 14,646. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

Appendix Table A4: Estimated coefficients on all covariates from main regressions

	EGM venue gambling (1)	Financial hardship (2)	Mental health (3)	Overall wellbeing (4)
Log distance from residence to EGM venue	-0.014**	-0.015**	0.028*	0.000
	(0.007)	(0.007)	(0.015)	(0.013)
Age	0.004	0.009*	-0.018*	-0.023***
	(0.005)	(0.005)	(0.011)	(0.009)
Age squared	-0.005	-0.020**	0.054**	0.039**
	(0.010)	(0.009)	(0.022)	(0.018)
Age cubed	0.002	0.012**	-0.041***	-0.018
	(0.006)	(0.006)	(0.014)	(0.011)
Male	0.090***	-0.014**	0.058***	-0.008
	(0.007)	(0.006)	(0.013)	(0.011)
Married or cohabitating	-0.002	-0.036***	0.100***	0.085***

	EGM venue gambling (1)	Financial hardship (2)	Mental health (3)	Overall wellbeing (4)
	(0.009)	(0.009)	(0.021)	(0.018)
Divorced or separated	0.017	0.038**	0.028	-0.063**
	(0.015)	(0.015)	(0.032)	(0.029)
Number of children	-0.019***	0.020***	-0.003	-0.025***
	(0.004)	(0.004)	(0.009)	(0.008)
Number of adults	-0.003	-0.007**	0.009	0.002
	(0.003)	(0.004)	(0.008)	(0.007)
Education: University degree	-0.081***	-0.063***	0.105***	0.055***
	(0.012)	(0.010)	(0.024)	(0.020)
Education: Diploma / certificate	-0.023*	-0.006	0.077***	0.035*
	(0.012)	(0.010)	(0.023)	(0.019)
Education: High school graduate	-0.035***	-0.010	0.066**	0.026
	(0.013)	(0.012)	(0.027)	(0.022)
Log distance from residence to alcohol	-0.005	0.008	-0.006	-0.004
serving venue	(0.006)	(0.007)	(0.015)	(0.013)
Index of economic resources	0.000	-0.000	-0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Index of Education and Occupation	0.000	-0.000	0.001**	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Traffic noise	0.003	0.013**	0.032**	-0.026**
	(0.006)	(0.007)	(0.015)	(0.013)
Noise from airplanes, trains or industry	0.004	-0.017***	-0.001	-0.010
	(0.006)	(0.007)	(0.015)	(0.013)
Homes and gardens in bad condition	0.003	-0.010	0.005	-0.063***
	(0.011)	(0.012)	(0.027)	(0.023)
Rubbish and litter lying around	-0.011	0.005	-0.046*	-0.023
	(0.010)	(0.012)	(0.026)	(0.023)
People being hostile and aggressive	0.015	0.054***	-0.116***	-0.122***
	(0.011)	(0.012)	(0.027)	(0.024)
Vandalism and deliberate damage to property	-0.007	-0.023*	0.011	0.007
	(0.012)	(0.013)	(0.029)	(0.026)
Burglary and theft	-0.004	0.020*	-0.003	-0.017
	(0.009)	(0.011)	(0.024)	(0.021)
Log values of homes	-0.005	-0.007	0.017	0.040**
	(0.011)	(0.010)	(0.023)	(0.020)

	EGM venue gambling (1)	Financial hardship (2)	Mental health (3)	Overall wellbeing (4)
Log home rental prices	0.010	-0.010	0.018	0.040**
	(0.010)	(0.009)	(0.020)	(0.017)
Lagged financial hardship		0.302***	-0.050**	-0.045**
		(0.012)	(0.022)	(0.020)
Lagged mental health		-0.018***	0.495***	0.090***
		(0.004)	(0.011)	(0.008)
Lagged overall wellbeing		-0.032***	0.151***	0.529***
		(0.004)	(0.010)	(0.010)
Number of observations	14767	14725	14894	16677

Note: Figures are coefficient estimates and clustered standard errors from linear regressions with neighbourhood fixed-effects, area-level covariates, and individual-level covariates. EGM venue gambling and financial hardship are binary outcomes. Mental health and wellbeing are continuous outcome with standard deviation equal to 1. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

Appendix Table A5: Estimated effects of proximity to venue on financial hardship items

	Sample mean	Log distance	Reside within 250m
Could not pay electricity, gas or telephone bills on time	0.116	-0.003	0.027
		(0.006)	(0.018)
Could not pay the mortgage or rent on time	0.054	-0.002	0.026*
		(0.005)	(0.015)
Pawned or sold something	0.054	0.004	-0.013
		(0.004)	(0.014)
Went without meals	0.040	-0.010**	0.029**
		(0.004)	(0.014)
Was unable to heat home	0.031	-0.003	0.010
		(0.004)	(0.011)
Asked for financial help from friends or family	0.117	-0.013**	0.059***
		(0.006)	(0.019)
Asked for help from welfare/community organisations	0.038	0.004	-0.005
		(0.004)	(0.012)

Note: Figures are coefficient estimates on the variable 'log distance from residence to venue' from 7 regressions, and coefficient estimates on the variable 'reside within 250m from a venue' from another 7 regressions. In the latter set of regressions, also included but not shown are the variables reside 250m-1km and 1km-2km from a venue. Clustered standard errors shown in parentheses. Linear regressions include neighbourhood fixed-effects, area-level covariates, and individual-level covariates. All outcome variables are binary. Sample size equals 14,669. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

Appendix Table A6: Estimated effects of venue proximity on mental health items

	Sample mean	Log distance	Reside within 250m
Been a nervous person	2.17	-0.023	0.026
		(0.020)	(0.062)
Felt down in the dumps	1.68	-0.032*	0.155***
		(0.018)	(0.059)
Felt calm and peaceful	3.93	0.030	-0.135**
		(0.020)	(0.065)
Felt down	2.20	-0.016	0.098*
		(0.018)	(0.059)
Been a happy person	4.35	0.021	-0.111*
		(0.018)	(0.059)

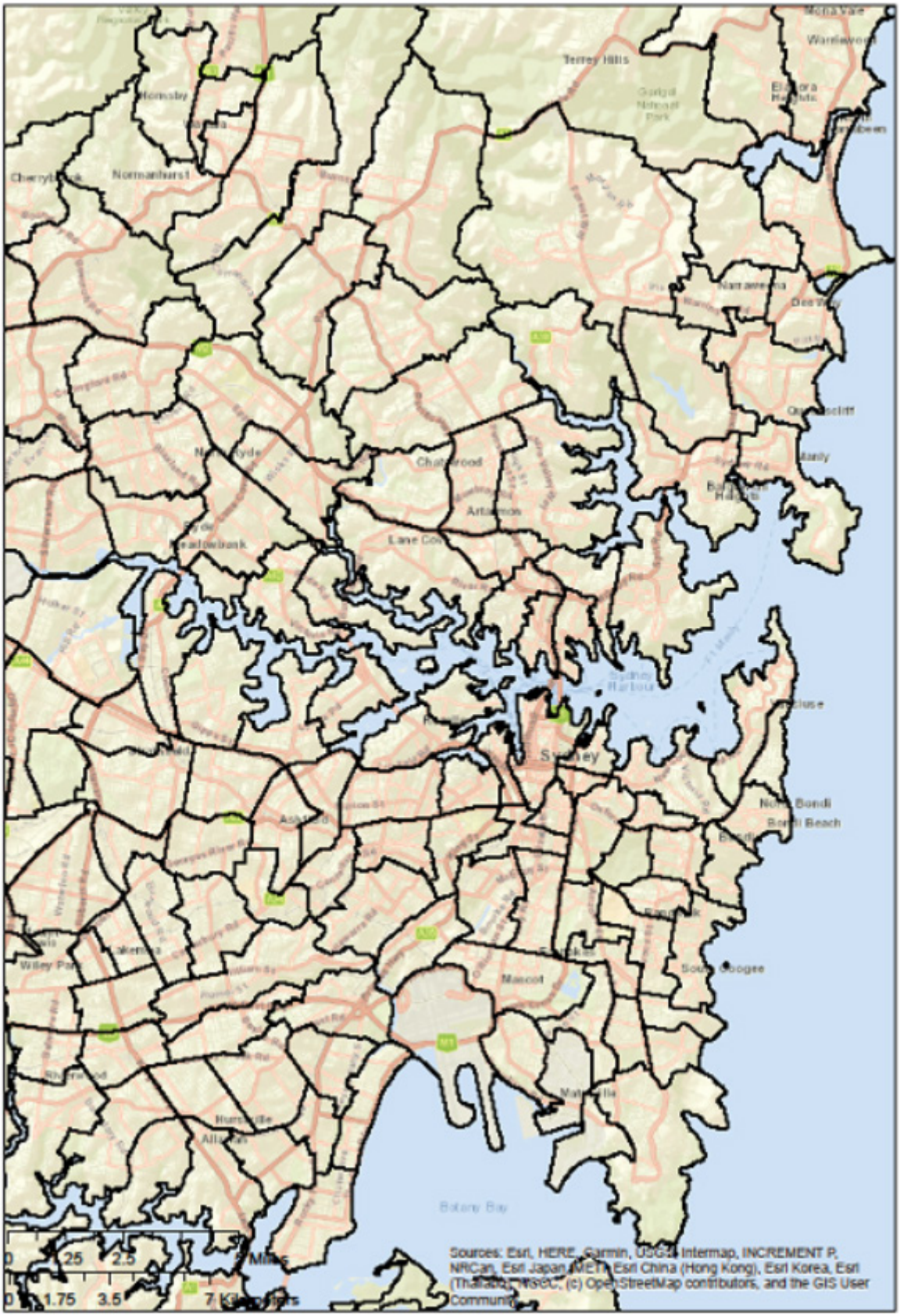
Note: Figures are coefficient estimates on the variable 'log distance from residence to venue' from 5 regressions, and coefficient estimates on the variable 'reside within 250m from a venue' from another 5 regressions. In the latter set of regressions, also included but not shown are the variables reside 250m-1km and 1km-2km from a venue. Clustered standard errors shown in parentheses. Linear regressions include neighbourhood fixed-effects, area-level covariates, and individual-level covariates. All outcome variables range from 1 (none of the time) to 6 (all of the time). Sample size equals 14,669. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

Appendix Table A7: Estimated effects of venue proximity on wellbeing domains

	Sample mean	Log distance	Reside within 250m
The home in which you live	7.98	0.003	-0.135
		(0.028)	(0.094)
Your financial situation	6.47	-0.009	-0.202*
		(0.033)	(0.108)
How safe you feel	8.20	0.023	-0.046
		(0.023)	(0.080)
Feeling part of your local community	6.74	-0.044	0.145
		(0.035)	(0.113)
Your health	7.26	-0.005	0.102
		(0.029)	(0.099)
The neighbourhood in which you live	7.87	-0.004	0.023
		(0.026)	(0.082)
The amount of free time you have	6.71	-0.011	-0.039
		(0.038)	(0.122)
Overall	7.92	0.026	-0.182**
		(0.022)	(0.073)

Note: Figures are coefficient estimates on the variable 'log distance from residence to venue' from 8 regressions, and coefficient estimates on the variable 'reside within 250m from a venue' from another 8 regressions. In the latter set of regressions, also included but not shown are the variables reside 250m-1km and 1km-2km from a venue. Clustered standard errors shown in parentheses. Linear regressions include neighbourhood fixed-effects, area-level covariates, and individual-level covariates. All outcome variables range from 0 (totally dissatisfied) to 10 (totally satisfied). Sample size equals 14,669. *, ** and *** denote statistical significance at the 0.10, 0.05 and 0.01 levels.

Appendix Figure A1 – Map of Sydney with neighbourhood (SA2) areas highlighted



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