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Discussion Paper no. 2021-06

**Samia Badji, Nicole Black and David W. Johnston**

**Keywords:** gambling, harms, mental health, financial hardship

**JEL Classification:** D10, H70, I10, I30

Samia Badji: Monash University (email: [Samia.Badji@monash.edu.au](mailto:Samia.Badji@monash.edu.au)); Nicole Black: Monash University (email: [Nicole.Black@monash.edu.au](mailto:Nicole.Black@monash.edu.au)); David W. Johnston: Monash University (email: [David.Johnston@monash.edu.au](mailto:David.Johnston@monash.edu.au)).

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# **Consequences of Greater Gambling Accessibility**

Samia Badji, Nicole Black\* and David W. Johnston\*

Centre for Health Economics, Monash business School, Monash University, 900 Dandenong Road, Caulfield East VIC 3145, Australia

July 2021

## **Abstract**

Greater accessibility to gambling venues may increase gambling rates, and therefore enhance welfare through the additional enjoyment from gambling and the related socialising. However, it may also lead to problematic gambling, financial hardship and psychological distress. We provide new evidence on the potential benefits and harms of greater geographic accessibility to suburban gambling venues containing electronic gaming (slot) machines. Our setting is Australia, the world leader in per capita gambling expenditure. Our approach combines geolocations of gambling venues with longitudinal survey data on gambling behaviours and economic, health and social outcomes. We find that people residing in close proximity to gambling venues are more likely to gamble, less likely to be happy, and are more likely to suffer from financial hardship and mental health problems. We find no significant impacts on socialising, general health, relationship dissatisfaction, or crime victimisation. These findings have implications for the regulation of gambling venues.

Keywords: gambling, harms, mental health, financial hardship,

JEL Codes: D1, H7, I1, I3

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\* Corresponding authors

Samia Badji: [Samia.Badji@monash.edu.au](mailto:Samia.Badji@monash.edu.au)

Nicole Black: [Nicole.Black@monash.edu.au](mailto:Nicole.Black@monash.edu.au)

David Johnston: [David.Johnston@monash.edu.au](mailto:David.Johnston@monash.edu.au)

## **Acknowledgements**

The authors are grateful for funding support from the Victorian Responsible Gambling Foundation (VRGF) Gambling Research Program (Round 9). Helpful comments were gratefully received from Lisa Farrell and participants at the Australian Health Economics Association Conference (2019) and the Monash Addiction Research Centre Symposium (2019). This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views expressed in this paper are those of the authors and should not be attributed to DSS, the Melbourne Institute, the VRGF or the ARC. NB is supported by an ARC research fellowship.

## 1. Introduction

Commercial gambling has grown rapidly throughout the world. Between 2001 and 2016, global annual takings doubled from US\$220b to US\$450b (Raspor et al., 2019). This rapid rise in revenues can be seen in nearly every country where legal gambling occurs. Economists have made important contributions in understanding these gambling markets and associated gambling behaviours.<sup>1</sup> However, there is a surprising paucity of convincing economic research on the consequences of gambling on gamblers themselves and those around them.<sup>2</sup> Most existing studies include important empirical limitations, and focus exclusively on harm minimisation, rather than welfare maximisation. In this paper, we present new evidence on the impacts of the availability of gambling venues on an individual's gambling involvement and their economic, health and social wellbeing.

Even though gambling has a negative expected monetary return, gamblers can be viewed as rational economic agents who are effectively purchasing entertainment, as well as the hope of acquiring wealth (Conlisk, 1993; Eadington, 1999). In other words, expected gambling losses are the price of excitement, and improvement in the accessibility of gambling opportunities is generally welfare improving. A juxtaposing perspective is that gambling produces a number of negative effects on society (Kearney, 2005). There are documented links between gambling, 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). The key policy question from a social welfare point of view is whether the increase in consumer utility from improved gambling accessibility, outweighs the reduction in welfare from the deleterious economic, health and

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<sup>1</sup> For example, research into the efficient design of lotteries, decision making in betting markets, regulatory constraints, pricing of gaming products, taxation of winnings, and the link between gambling and the economy (Suits 1979; Even and Noble 1992; Conlisk, 1993; Eadinton, 1999; Farrell and Walker 1999; Walker and Young 2001; Kearney, 2005; Guryan and Kearney, 2008; Kumar et al. 2011).

<sup>2</sup> This lack of research has been noted in several past studies, including in a review of the literature by Kearney (2005, p.287): “Additional data and research establishing the causal link between casino availability and the incidence of personal bankruptcies, suicide, divorce, and other costly behaviors is needed.” (p.287), and “More research on the intra-family externalities associated with lottery gambling is needed. More generally additional research is needed on associated costly behaviors, including for example, the incidence of financial distress and bankruptcy.” (p. 296). Regrettably, there has been little economics research on these issues since this review was published.

social outcomes experienced by problem gamblers and their families.<sup>3</sup> We help to answer this important policy question.

Our context is Australia. On a per-capita basis, Australians are the world's biggest gamblers with per capita gambling losses in 2017-18 equalling AU\$1,292 (NSW Parliament, 2019).<sup>4</sup> Electronic Gaming Machines (EGMs), also known as slot machines (US), fruit machines (UK) and poker machines (Australia), are 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).<sup>5</sup> Moreover, these gambling venues are typically located within suburban areas and usually offer other types of gambling, such as Keno, and sports and race betting.

Three methodological weaknesses in the existing empirical literature have caused the shortage of robust, replicable evidence on the positive and negative impacts of gambling. First, most multidisciplinary studies have relied upon small and non-representative samples, as there are few large individual-level datasets that include information on gambling behaviours. Second, many studies have been unable to control for unobserved factors that confound relationships between socioeconomic status, accessibility to gambling, and gambling behaviours. Third, studies have typically relied on 'problem gambling' survey questionnaires to measure the consequences of gambling. However, such data are likely to suffer from social desirability bias, and fail to capture the breadth and complexity of gambling experiences (Browne et al. 2016).<sup>6</sup>

Our empirical approach entails the matching of geographical locations of all EGM gambling venues in Australia's largest states to longitudinal, nationally representative survey data on gambling behaviours and expenditures, and economic, health and social outcomes. Using an area fixed-effects approach, we first estimate whether EGM venue accessibility increases

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<sup>3</sup> In addition to these impacts on individuals, there are potential economic benefits that arise from the revenue generated by governments from taxation of gambling revenues. We do not consider these potential benefits, and instead focus solely on the benefits and costs that accrue to gamblers and their families and neighbours.

<sup>4</sup> In comparison, 2017 per capita gambling losses in Hong Kong and Singapore, the next highest countries after Australia, equalled US\$768 and US\$725, respectively. The United States figure equalled US\$421.

<sup>5</sup> On a per capita basis this is about five times as many EGMs as in the United States.

<sup>6</sup> The problem gambling questionnaire includes questions such as "Have you felt that you might have a problem with gambling?", "Has gambling caused you any health problems, including stress and anxiety?", and "Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?"

gambling involvement and gambling expenditures.<sup>7</sup> Then, to identify the positive and negative impacts of gambling venues, we estimate the impacts of EGM venue accessibility on potential benefits (hedonic wellbeing, positive social interactions and local community participation), and potential harms (financial hardship, poor mental health, poor general health, relationship dissatisfaction and crime). We additionally explore the population sub-groups who are most strongly impacted by accessibility, including subgroups defined by income, financial risk and time preferences, and cognitive ability.

Our ultimate aim is to provide empirical evidence that can aid policy making with regard to the regulation of gambling industries. Gambling is subject to a wide variety of controls, including restrictions on where gaming is allowed, how it is advertised, the amount that can be wagered, hours of operation, and the types of games that can be offered (Eadington, 1999). The arguments for these restrictions are based partly on the social and economic costs and benefits from gambling. For example, Australian 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 states must demonstrate that the community benefits of any new or expanded gambling venue offset any harms to the community.

The analysis generates three main findings. First, we show that within a neighbourhood, people living closer to EGM gambling venues are significantly more likely to gamble. This effect is driven by distances less than 250m. Second, we show that this increase in gambling does not appear to give rise to positive wellbeing benefits; residential proximity to venues actually reduces hedonic wellbeing, and has no significant impact on either social interactions or community involvement. Third, we show that the close proximity of venues appears to have harmful consequences in terms of increased financial hardship and mental ill-health. We see no significant impact on general health, relationship dissatisfaction, or crime victimisation. Finally, we show that the effects of living close to a gambling venue are most acutely felt by vulnerable sub-populations, such as those with low income and low cognitive ability.

Our study provides a rigorous investigation of the individual consequences of greater gambling accessibility. It builds on previous findings that typically focus on participation in gambling or problematic gambling as the key outcomes of interest (e.g. Welte et al. 2004; McMillen and

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<sup>7</sup> The assumed causal pathway is that gambling venue accessibility reduces the (time and travel) costs of gambling, and so the quantity of gambling increases. Increases in the quantity of gambling by vulnerable members of the population (at the extensive and intensive margins) may then create problem gamblers.

Doran 2006; Ministry of Health 2008; Pearce et al. 2008; Storer et al. 2009; Young et al. 2012; Vasiliadis et al. 2013; Welte et al. 2016; Kato and Goto 2018). These studies generally suggest that greater accessibility is associated with higher rates of gambling involvement and problem gambling. Few studies in this multidisciplinary literature attempt to identify causal effects. An exception is Evans and Topoleski (2002) who use a difference-in-differences approach, comparing outcomes, before and after the opening of Native American owned casinos. They find that in counties where an Indian-owned casino opens, employment rates increased by about 5% of the median, and mortality fell by about 2% four years after a casino opened.<sup>8</sup> They also showed that the economic and health improvements came with some costs: four years after a casino opened, bankruptcy and crime rates were up 10 percent, in counties with a casino.

A number of other studies have also explored the impacts of gambling venues on area-level crime rates (Grinols and Mustard 2006; Hyckak 2011) and bankruptcy (Boardman and Perry 2007; Badji et al. 2020) and generally find positive effects.<sup>9</sup> However, causal evidence using individual-level data, in particular on mental health outcomes remains scarce. One relevant study is Churchill and Farrell (2018) who use a Lewbel instrumental variable estimator to explore the impact of an individual's self-reported gambling behaviour on self-assessed depression in Great Britain. Their findings suggest that gambling addiction has a positive impact on depression.

The remainder of the paper is structured as follows. Section 2 describes the HILDA data and administrative records of gambling venues, highlighting their unique features. Section 3 details our methodological approach. Section 4 presents the main results – we examine the impact of proximity of gambling venues on gambling involvement, potential benefits and potential harms. In Section 5, we explore who is more greatly affected by the proximity of gambling venues. Section 6 discusses the policy implications of our findings and concludes.

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<sup>8</sup> These economic improvements are a unique feature of the fiscal independence enabled by the opening of gaming operations on American Indian reservations (see Akee et al. (2015) for an overview), and do not necessarily generalise to other settings.

<sup>9</sup> In related economic literatures, several studies have carefully explored the behavioural impacts of being in close proximity to potentially unhealthy venues. 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.

## 2. Data

For our analysis, we combine two main data sources: the Household, Income and Labour Dynamics in Australia (HILDA) survey; and, administrative data on the geographical location of all electronic gaming machine (EGM) venues in the four largest capital cities with legalised EGM gambling venues (i.e., Sydney, Melbourne, Brisbane and Adelaide). We also supplement these main datasets with administrative data on the geographical location of all alcohol-serving venues and post offices in these cities. In this section, we describe these datasets and the key variables used in our analyses.

### 2.1 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). We use HILDA data to measure an individual's gambling behaviour and their potential positive and negative outcomes associated with residing in close proximity to an EGM venue. 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,<sup>10</sup> and who provided information on gambling behaviours (asked only in 2015 and 2018). This provides a sample of 14,860 observations from 9,071 people.

#### 2.1.1 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 in a typical month. The types of gambling that are generally available in an EGM gambling venue

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<sup>10</sup> We select these cities to match available data on EGM venues. We exclude rural areas because of the high mean distance between homes and EGM venues, as compared with urban areas, in which a high proportion of people live within one kilometre of a venue.

are: poker/slot machines, Keno, sports betting, and betting on horse/dog racing. Therefore, our main indicator for gambling at EGM gambling venues represents positive gambling expenditure on any of these gambling activities. 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. In our data, 13% of respondents report positive expenditure in EGM gambling venues. Among this 13% ( $N = 1875$ ), mean expenditure equals \$161, and mean expenditure as a percentage of weekly household income equals 13%. Around 6% of these gamblers report expenditure in a typical month that exceeds 50% 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 list of questions. The PGSI is constructed by summing up the responses: 0 “never”; 1 “sometimes”; 2 “most of the time”; and 3 “almost always”. Most people (97%) score zero on the PGSI, indicating the person has no ‘problem gambling’ 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 problem gambling symptom.

Table 1 presents descriptive statistics of the gambling expenditure at EGM gambling venues and problem gambling variables separately by individual socioeconomic characteristics. The likelihood of gambling, amount gambled (both in dollar terms and as a percentage of income) and incidence of any problem gambling symptoms are all higher for males, older people (aged  $\geq 45$ ), 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 problem gambling 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.<sup>11</sup>

### *2.1.2 Potential benefits from living near gambling venues*

Qualitative studies have shown that gambling venues can offer not only entertainment and enjoyment from gambling, but they can also provide social benefits (Productivity Commission 2010). Many gambling venues provide a range of amenities, such as restaurants, bars and entertainment facilities, which offer a comfortable place for people in the local community to socialise. To investigate whether living in close proximity to gambling venues is associated with greater enjoyment and social benefits, we examine three measures from waves 15 and 18 of HILDA.

The first is a binary indicator for whether or not the respondent reported feeling happy at least for ‘a good bit of the time’ during the past four weeks (78% of people). This aims to capture hedonic enjoyment, which could result from the excitement from gambling as well as engaging in enjoyable activities, including socialising. The second measure is a binary indicator for whether or not the respondent gets together socially with friends at least several times a week (23% of people). Our final ‘benefit’ variable is related to this measure, and quantifies the extent to which the respondent feels part of their local community. This variable ranges from 0 to 10, with higher values indicating that the respondent has a greater quantity and/or quality of connections with people in their neighbourhood.

### *2.1.3 Potential harms from gambling*

We estimate potential negative consequences of gambling using measures of financial hardship, relationship dissatisfaction, poor mental health, poor general health, and crime victimisation. These are based on the taxonomy of gambling related harms developed by Langham et al. (2016) and are described in more detail below. A consideration in selecting our measures of harm is that they should capture consequences experienced by anyone residing close to an EGM venue. This may be gamblers themselves, but it may also be their family members and neighbours.

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<sup>11</sup> 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.

Financial hardship is measured through self-completion survey questions, which ask 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; or, asked for help from welfare or community organisations. 80% of our sample did not experience any of the financial hardships, and 6% 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.

Mental health is measured using the mental health domain (index) from the 36-Item Short Form Survey (SF-36) health instrument. This index is derived from questions asking people how much of the time during the past four weeks they have experienced symptoms associated with mental illness (e.g. ‘felt so down in the dumps that nothing could cheer you up’). In our regressions, we use a binary variable of poor mental health, which indicates that the person has a score less than one standard deviation below the mean (19% of people). We additionally estimate effects on having fair or poor general health (17% of people).

Gambling venues could increase crime in the local area due to a number of reasons (Evans and Topoleski, 2002). For example, continued and problematic gambling can drive gamblers to theft and property crime as a means to address large debts and insufficient funds. Another reason why criminal activity could be higher is simply because more people congregate near the venue, and criminals are attracted to the higher opportunities to commit crime. To measure whether there are higher rates of crime in areas close to EGM venues, we use a binary indicator of whether or not the individual was a victim of a property crime (e.g. theft or housebreaking) or a violent crime (e.g. assault) in the past year.

Finally, we examine relationship disruption by using a question that asks respondents to rate their level of satisfaction with their relationship with their partner. We create a binary indicator of relationship dissatisfaction, which equals one if respondents scored 6 or lower on a 0-10 scale (14% of people).

## **2.2 Administrative records of gambling venues**

Data on the geographical location of EGM gambling venues in years 2015 and 2018 were constructed by combining separate administrative databases containing details of all licenced gambling venues from four states of Australia: New South Wales (Sydney), Victoria (Melbourne), Queensland (Brisbane) and South Australia (Adelaide). See Appendix B for more details on the sources of datasets from each jurisdiction. We define a gambling venue as any non-casino business with at least one licenced EGM in operation.<sup>12</sup> For Queensland, we obtained latitude and longitude coordinates 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 establishments with a licence to serve alcohol.

### *2.2.1 Proximity of gambling venues*

The exact residential addresses of HILDA respondents are not available. However, the HILDA dataset does contain relatively precise information on residential locations through two distinct 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). This indicates that the measurement error in the distance to gambling venues is small, but that the estimated effects of distance will suffer from (slight) attenuation bias.

The mean distance between EGM gambling venues and people's residence equals 1.28km. As shown in Panel A of Figure 1, the distance measure displays substantial positive skewness. Therefore, in all primary analyses we use the natural logarithm of the distance to EGM gambling venues; the histogram is shown in Panel B of Figure 1. Our secondary approach for

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<sup>12</sup> 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 in the paper.

measuring proximity to people's residence is to aggregate distance to nearest venue into four categories: < 250m (6%); 250m-1km (47%); 1km-2km (32%); and > 2km (16%).

Undoubtedly, people travel to 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% work part-time 46% work full-time). However, we 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 distance between EGM gambling venues and people's nearest post office equals 0.86km. As this distance measure is also positively skewed (see Appendix Figure A1), we use the natural logarithm of distance to post office.

### **3. Empirical Approach**

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 are associated with any positive wellbeing outcomes (hedonic enjoyment, social and community connectedness), and any harmful outcomes (financial, relationship, mental health, general health and crime).<sup>13</sup> 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 risk and time preferences and cognitive ability levels that make them vulnerable to gambling harms.

People who reside closer to gambling venues have higher socioeconomic status than people who reside farther away (this is demonstrated below), implying that distance from venues is

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<sup>13</sup> We focus on one key aspect of accessibility to gambling – the distance of gambling venues from homes and shops. However, we recognise that there are other aspects of the gambling venue that could influence accessibility (such as opening hours and attractiveness of the venue environment), and these may modify the estimated consequences of proximity. Unfortunately, venue level data on these other aspects are not available.

positively correlated with harmful outcomes, such as financial hardship. To control for this endogeneity bias, we estimate the following dynamic regression model:

$$y_{it} = \delta distance_{iat} + \rho y_{it-1} + Area'_{it}\gamma + X'_{it}\beta + \varepsilon_{it} \quad (1)$$

where  $y_{it}$  is the outcome of individual  $i$  from year  $t$ ,  $Area_{it}$  is the set of area-level covariates including neighbourhood fixed-effects, and  $X_{it}$  is the set of individual-level covariates: month and year of the survey, a cubic function of age, sex, marital status, number of children, and educational attainment. Each regression also includes the lagged outcome  $y_{iat-1}$  to control for state dependence, and also for the possibility that current residential location is impacted by past outcomes.<sup>14</sup>

The key parameter of interest is  $\delta$ , the effect of proximity of nearest gambling venue ( $distance_{iat}$ ) on wellbeing. Given the inclusion of neighbourhood fixed-effects, this parameter is identified by differences in the distance to a gambling venue, between people living in the same neighbourhood. 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. In our sample, we include the metropolitan areas of Sydney, Melbourne, Brisbane, and Adelaide, which are divided up into 254, 265, 210 and 96 SA2s 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 A2 includes a map of Sydney that further illustrates 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 also include in  $Area_{it}$  a detailed set of area-level control variables. One key area-level variable is accessibility to other drinking establishments such as pubs, clubs and hotels. We include the distance (in natural logs) from the individual’s residence to the closest (non-gambling) drinking establishment. Residential distance to gambling venues and distance to other drinking

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<sup>14</sup> Although we have panel data, we are 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).

establishments 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 index; mean house prices, mean residential rents, and mean score of perceptions of seven aspects of neighbourhood quality.<sup>15</sup>

In Table 2 we show that these observed area-level control variables, together with the neighbourhood fixed-effects, sufficiently reduce heterogeneity associated with venue proximity. Column (1) of Table 2 presents estimated associations between log distance from residence to the nearest EGM gambling venue and individual socioeconomic status, preferences and ability, and risky health behaviours (i.e. estimates from a regression without any covariates apart from log distance). The estimates from this column suggest that several individual characteristics are associated with log distance from nearest gambling venue. People who reside close to gambling venues tend to be higher paid, better educated, work in higher status occupations, are more risk averse, have greater cognitive ability, and drink more alcohol.

Column (2) presents estimated associations from regressions that include area-level covariates and neighbourhood fixed-effects ( $Area_{it}$ ). These estimates suggest that the area-level variables adequately control for the socioeconomic differences between people living near and far from venues. The estimates for income, education, occupational status, risk aversion, cognitive ability, and alcohol consumption are much smaller in magnitude, and are no longer statistically significant.

As an additional 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),

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<sup>15</sup> 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 summarises people's educational and occupational levels, using data from the 2016 Census. The neighbourhood quality measures are: 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.

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.

## 4. Results

### 4.1. Accessibility and gambling behaviour

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, reduces the likelihood of gambling on games offered in such venues by 1.4 percentage points (relative to a mean gambling rate of 13 percent). 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. 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.

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. To place these effect sizes in perspective, Appendix Table A2 presents the estimated coefficients on the demographic and socioeconomic covariates included in the regression. 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.<sup>16</sup>

In Appendix Table A3, we demonstrate that log distance from venues is not a significant predictor of the amount of gambling expenditure, among those who gamble (the intensive margin of gambling). All the estimated coefficients are very close to zero, including those on distance < 250m and distance 250m-1km, for which we found large effects on the likelihood of any gambling expenditure. These results are somewhat surprising. Our expectation was that gamblers spend more time in venues, and have higher gambling expenditure, when the costs of gambling are low. One explanation for these null effects is that people misreport their expenditure amounts. People may not know the precise dollar amount gambled, and big gamblers may feel uncomfortable disclosing how much they gamble (desirability bias).

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.<sup>17</sup> 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 problem gambling symptoms (from the PGSI). We find that living or shopping near a gambling venue does not increase the likelihood of reporting any problem gambling behaviours, with all the point estimates small in magnitude. These results may appear to contradict the significant financial hardship and mental health effects that we find in Section 4.3, 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 anxiety?”). An explanation for this inconsistency is that the framing of the questions, which requires people to acknowledge their problematic gambling

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<sup>16</sup> 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.

<sup>17</sup> The coefficients on ‘log distance from post office’ in regressions that also include ‘log distance from residence’ are also small and statistically insignificant.

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. We explore these broader outcomes in the following sections.

## **4.2 Potential benefits of greater accessibility**

We next investigate whether greater gambling accessibility leads to wellbeing benefits in the form of increased happiness, socialising and community participation. We 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 (e.g. the gambler has increased happiness/enjoyment) and/or indirect effects on family members of gamblers or other local residents (e.g. the gambler's spouse has increased happiness). In other words, a person does not need to be induced to gamble themselves in order to experience a positive impact from residing close to a venue.

Column (1) of Table 4 presents the effects of proximity to Gambling venues on being happy. Our results suggest that rather than providing opportunities for hedonic wellbeing and enjoyment (as is arguably a key benefit of such venues), living in close proximity to Gambling venues significantly reduces feelings of happiness. The estimate in Panel A indicates that increasing the distance between home and an EGM venue by 100% increases the likelihood of being happy by 1.4 percentage points (relative to a mean likelihood of 78 percent). This distance effect is strongest for people living within 250m of an EGM venue; such people are 7.2 percentage points less likely to be happy, relative to people living >2km from a venue. Columns (2) and (3) show that living in close proximity to an EGM venue does not have a significant effect on socialising or community belonging. Combined, the results from Table 4 suggest that there is no evidence of significant wellbeing benefits from living in close proximity to EGM venues. On the contrary, we find evidence of a modest reduction in feelings of happiness.

## **4.3 Potential harms of greater accessibility**

In this section we explore potential harmful impacts of living in close proximity to a gambling venue. Column (1) of Table 5 presents the effects of proximity on the experience of financial hardship. The estimate in Panel A indicates that a 100% 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. Living within 250m of a venue increases the likelihood of experiencing financial hardship by 6.4 percentage points, relative to people living  $>2\text{km}$  from a venue. Living 250m-1km or 1km-2km away increases the likelihood of financial hardship by 3.4 and 3.2 percentage points, respectively. The estimated effects are large. As a comparison, estimates for other covariates in our model, such as being divorced (relative to never married), having three children (relative to having none), and being a high school dropout (relative to university educated) equal 4.2, 5.4 and 6.3 percentage points, respectively (see Appendix Table A2).

Table 6 shows that the financial hardship effects shown in Table 5 are driven in particular by the effect of distance on the need for “financial help from friends or family”. Residing within 250m of a venue increases the likelihood of asking friends or family for financial help by 6.6 percentage points. This highlights that proximity of gambling venues not only affects gamblers, but also affects family members and friends. Several other financial hardship items are also positively affected by residing close to gambling venue: went without meals, couldn’t pay bills on time, and couldn’t pay the mortgage/rent.

We also find harmful effects of venue accessibility on mental health. A 100% increase in distance to a gambling venue is estimated to reduce the likelihood of poor mental health by 1.5 percentage points (relative to a mean likelihood of 19 percent). Again, this is driven by close proximity to venues. Living within 250m of a venue increases the likelihood of experiencing poor mental health by 5.6 percentage points, relative to people living  $>2\text{km}$  from a venue. In contrast to these mental health results, proximity is estimated to have small effects on general health. This null effect may be caused by the fact that general health reflects a person’s physical health more than mental health (Au and Johnston, 2014).

Relationship dis-satisfaction is similarly unaffected by proximity to gambling venues. This is not an entirely unexpected result. Though relationship distress is a commonly cited gambling harm in the public health literature – which is the motivation for including it here – the heterogeneity of causal effects within households are unknown. Even though spouses of

gamblers may be more dis-satisfied with their relationship (e.g. due to resenting their partner's gambling), it is unclear that gamblers themselves will be. The presented estimated effects of proximity are an amalgamation of the effects on gamblers and their spouses.

Finally, in contrast to Evans and Topoleski (2002), we find no evidence that gambling accessibility increases the likelihood of crime victimisation. This could be because crime is rarely reported in our sample (3.9% per year). The estimated effect of residing within 250m equals 1.3 percentage points, which is equivalent to a 33% increase, relative to the sample mean. Nevertheless, the imprecision of the estimates prevents us from drawing any conclusions.

## **5. 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 and poor mental health (Gong and Zhu 2019). We investigate who is most vulnerable by re-estimating the effects of living within 250m of a venue 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.

The estimated coefficients, presented in Table 7, show that the populations with more negative financial hardship effects are: men, younger people, people employed with low incomes, those who are risk averse and have a short planning horizon, and people with lower cognitive ability. 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; this controls for the correlation between the different individual characteristics (e.g. between income and cognitive ability). 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 males who are younger, employed and 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.

Overall, our results suggest that young males in low income jobs are most vulnerable to poorer mental health and financial difficulties when they have greater accessibility to gambling venues. Previous evidence has focussed on the wellbeing impacts of gambling among older people (>50 years) (Churchill and Farrell 2020). However, our findings suggest that despite older people representing the larger share of gamblers in Australia, the harmful effects are much greater for younger people. The higher mental health consequences among young males is particularly worrisome. This is a population group who are least likely to seek treatment for psychological problems (Mackenzie et al. 2006), and for whom suicide is the leading cause of death (AIHW 2021).

## **6. Conclusion**

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. This means that there is inevitably some level of trade-off between government revenue and individual harms. In most countries, gambling markets are regulated and fine-tuning of regulatory models is an ongoing process. There have been particular concerns about the ‘safety’ of electronic gaming machines (EGMs), which has led to rules about machine design (e.g. minimum rate of return, maximum bet) and restricted licensing of venue operators (Productivity Commission 2010).

However, better evidence on the impacts (both positive and negative) of the accessibility of gambling venues is needed in order to better understand whether the economic benefits of gambling venues outweigh the costs, under current regulations. In this paper, we combine the geolocation of all non-casino EGM gambling venues in four states of Australia (NSW, VIC, QLD and SA), with rich longitudinal survey data to present new evidence on the impacts of proximity to gambling venues on an individual’s gambling involvement, and on their economic, health and social wellbeing.

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 percent). 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 problems, especially for very close distances. Given the aetiology of gambling disorder (American Psychiatric Association 2013), it is possible that these mental health effects are (at least in part) driven by the increased financial hardship. Importantly, it is recognised that the costs of mental ill-health extend beyond the suffering felt by the individual and their family, for instance, it has flow-on consequences for health care expenditure, reduced economic participation and welfare support (Productivity Commission 2020). Such societal costs should be considered when governments weigh up decisions to approve gaming licence applications.

We additionally find that proximity reduces feelings of happiness, which may be related to the increased financial hardship and mental health problems. In our exploration of other possible wellbeing benefits, we find no evidence that living in close proximity to Gambling venues improves the likelihood of socialising with friends, or feeling part of your community.

Finally, we show that the harmful effects of living in close proximity to gambling venues is not equal across populations. The location of gambling venues in close proximity to people's homes have greater harmful impacts on populations that are traditionally more vulnerable (such the young, low income and low cognitive ability), and as such likely result in a widening of socioeconomic and health inequalities. This finding also implies that a reduction in welfare from greater gambling accessibility is most likely to occur in areas with low socioeconomic status.

## References

- Akee, R. K., Spilde, K. A., & Taylor, J. B. (2015). The Indian gaming regulatory act and its effects on American Indian economic development. *Journal of Economic Perspectives*, 29(3), 185-208.
- Au, N., & Johnston, D. W. (2014). Self-assessed health: what does it mean and what does it hide?. *Social science & medicine*, 121, 21-28.
- American Psychiatric Association (2013). Diagnostic and statistical manual of mental disorders, fifth edition. Washington, DC, American Psychiatric Association.
- Australian Bureau of Statistics (2016). 1270.0. 55.001 - Australian Statistical Geography Standard (ASGS): Volume 1—Main Structure and Greater Capital City Statistical Areas. Canberra, ABS.
- Australian Institute of Health and Welfare 2021. Deaths in Australia. Cat. no. PHE 229. Canberra: AIHW. Viewed 25 June 2021, <https://www.aihw.gov.au/reports/life-expectancy-death/deaths-in-australia>
- Badji, S., N. Black and D. Johnston (2020). "Association between density of gaming venues in a geographical area and prevalence of insolvency: Longitudinal evidence from Australia." *Addiction*.
- Blaszczynski, A. and L. Nower (2002). "A pathways model of problem and pathological gambling." *Addiction* 97(5): 487-499.
- Boardman, B., & Perry, J. J. (2007). Access to gambling and declaring personal bankruptcy. *The Journal of Socio-Economics*, 36(5), 789-801.
- Browne, M., E. Langham, V. Rawat, et al. (2016). Assessing gambling-related harm in Victoria: a public health perspective. Melbourne, Victorian Responsible Gambling Foundation.
- Chen, S. E., R. J. Florax and S. D. Snyder (2013). "Obesity and fast food in urban markets: a new approach using geo-referenced micro data." *Health economics* 22(7): 835-856.
- Christiansen, E. M. (1998). "Gambling and the American economy." *The Annals of the American Academy of Political and Social Science* 556(1): 36-52.
- Churchill, S. A. and L. Farrell (2018). "The impact of gambling on depression: New evidence from England and Scotland." *Economic Modelling* 68: 475-483.
- Churchill, S. A., & Farrell, L. (2020). *Gambling and Subjective Wellbeing of Older Australians*. In *Measuring, Understanding and Improving Wellbeing Among Older People* (pp. 97-116). Palgrave Macmillan, Singapore.
- Clark, L., B. Studer, J. Bruss, D. Tranel and A. Bechara (2014). "Damage to insula abolishes cognitive distortions during simulated gambling." *Proceedings of the National Academy of Sciences* 111(16): 6098-6103.
- Conlisk, J. (1993). The utility of gambling. *Journal of risk and uncertainty*, 6(3), 255-275.
- Currie, J., S. DellaVigna, E. Moretti and V. Pathania (2010). "The effect of fast food restaurants on obesity and weight gain." *American Economic Journal: Economic Policy* 2(3): 32-63.
- Doran, B. J., J. McMillen and D. C. Marshall (2007). "A GIS-based Investigation of Gaming Venue Catchments." *Transactions in GIS* 11(4): 575-595.
- Eadington, W. R. (1999). The economics of casino gambling. *Journal of economic perspectives*, 13(3), 173-192.
- Evans, W. N., & Topoleski, J. H. (2002). The social and economic impact of Native American casinos (No. w9198). *National Bureau of Economic Research*.
- Even, W. E. and N. R. Noble (1992). "Testing efficiency in gambling markets." *Applied Economics* 24(1): 85-88.
- Farrell, L. and I. Walker (1999). "The welfare effects of lotto: Evidence from the UK." *Journal of Public Economics* 72(1): 99-120.

- Ferris, J. A. and H. J. Wynne (2001). The Canadian problem gambling index, Canadian Centre on Substance Abuse Ottawa, ON.
- Gong, X., & Zhu, R. (2019). Cognitive abilities, non-cognitive skills, and gambling behaviors. *Journal of Economic Behavior & Organization*, 165, 51-69.
- Grinols, E. L., & Mustard, D. B. (2006). Casinos, crime, and community costs. *Review of Economics and Statistics*, 88(1), 28-45.
- Guryan, J., & Kearney, M. S. (2008). Gambling at lucky stores: Empirical evidence from state lottery sales. *American Economic Review*, 98(1), 458-73.
- Hartmann, M. and A. Blaszczynski (2018). "The longitudinal relationships between psychiatric disorders and gambling disorders." *International Journal of Mental Health and Addiction* 16(1): 16-44.
- Hing, N. and J. Haw (2009). "The development of a multi-dimensional gambling accessibility scale." *Journal of Gambling Studies* 25(4): 569-581.
- Hing, N. and S. Nisbet (2010). "A qualitative perspective on physical, social and cognitive accessibility to gambling." *Journal of Gambling Issues*(24): 101-120.
- Hyclak, T. (2011). Casinos and campus crime. *Economics Letters*, 112(1), 31-33.
- Kato, H. and R. Goto (2018). "Geographical accessibility to gambling venues and pathological gambling: an econometric analysis of pachinko parlours in Japan." *International Gambling Studies* 18(1): 111-123.
- Kearney, M. S. (2005). The Economic Winners and Losers of Legalized Gambling. *National Tax Journal*, 58(2), 281-302.
- Kumar, A., J. K. Page and O. G. Spalt (2011). "Religious beliefs, gambling attitudes, and financial market outcomes." *Journal of Financial Economics* 102(3): 671-708.
- Langham, E., H. Thorne, M. Browne, et al. (2016). "Understanding gambling related harm: a proposed definition, conceptual framework, and taxonomy of harms." *BMC Public Health* 16: 80.
- Lorains, F. K., S. Cowlishaw and S. A. Thomas (2011). "Prevalence of comorbid disorders in problem and pathological gambling: Systematic review and meta-analysis of population surveys." *Addiction* 106(3): 490-498.
- Mackenzie, C. S., Gekoski, W. L., & Knox, V. J. (2006). Age, gender, and the underutilization of mental health services: The influence of help-seeking attitudes. *Aging and mental health*, 10(6), 574-582.
- Marshall, D., J. McMillen, S. Niemeyer and B. Doran (2004). Gaming machine accessibility and use in suburban Canberra: A detailed analysis of the Tuggeranong Valley, ANU Centre for Gambling Research.
- McMillen, J. and B. Doran (2006). "Problem gambling and gaming machine density: Socio-spatial analysis of three Victorian localities." *International Gambling Studies* 6(1): 5-29.
- Mikhed, V., B. Scholnick and H. Byun (2017). Spatial Commitment Devices and Addictive Goods: Evidence from the Removal of Slot Machines from Bars, Research Department, Federal Reserve Bank of Philadelphia.
- Ministry of Health (2008). Raising the odds neighbourhood access to gambling venues in New Zealand. M. o. Health. Wellington.
- Palali, A. and J. C. van Ours (2015). "Distance to cannabis shops and age of onset of cannabis use." *Health economics* 24(11): 1483-1501.
- Pearce, J., K. Mason, R. Hiscock and P. Day (2008). "A national study of neighbourhood access to gambling opportunities and individual gambling behaviour." *Journal of Epidemiology and Community Health* 62(10): 862.
- Productivity Commission (1999). Australia's gambling industries. Report No.10. Canberra, AusInfo.

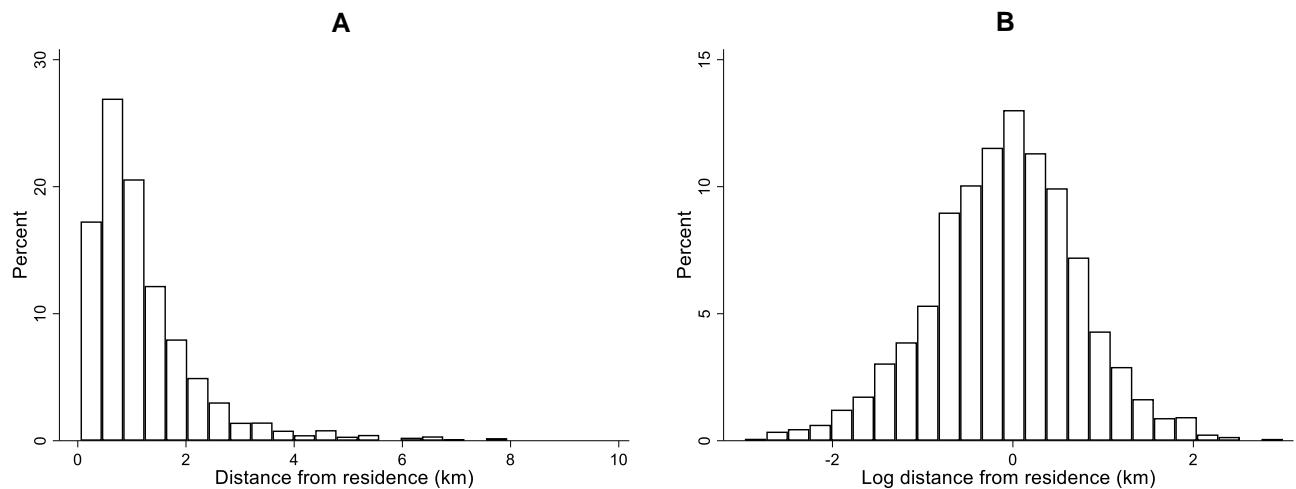
- Productivity Commission (2010). Gambling. Report no. 50. Canberra, Australian Government.
- Productivity Commission 2020, *Mental Health*, Report no. 95, Canberra
- Queensland Government (2019). Australian Gambling Statistics, 35th Edition.
- Raspor, A., Bulatović, I., Stranjančević, A., & Lacmanović, D. (2019). How Important is Gambling in National GDP: Case Study from Austria, Croatia, Italy and Slovenia. *Economics*, 7(1), 31-49.
- Rintoul, A. C., C. Livingstone, A. P. Mellor and D. Jolley (2013). "Modelling vulnerability to gambling related harm: How disadvantage predicts gambling losses." *Addiction Research & Theory* 21(4): 329-338.
- Storer, J., M. Abbott and J. Stubbs (2009). "Access or adaptation? A meta-analysis of surveys of problem gambling prevalence in Australia and New Zealand with respect to concentration of electronic gaming machines." *International Gambling Studies* 9(3): 225-244.
- Suits, D. B. (1979). "The elasticity of demand for gambling." *The Quarterly Journal of Economics*: 155-162.
- The Economist. (2017). "The world's biggest gamblers." Retrieved 2 April 2020, from <https://www.economist.com/graphic-detail/2017/02/09/the-worlds-biggest-gamblers>.
- Thomas, A. C., G. Bates, S. Moore, et al. (2011). "Gambling and the multidimensionality of accessibility: More than just proximity to venues." *International Journal of Mental Health and Addiction* 9(1): 88-101.
- Tourangeau, R. and T. Yan (2007). "Sensitive questions in surveys." *Psychological bulletin* 133(5): 859.
- Vasiliadis, S. D., A. C. Jackson, D. Christensen and K. Francis (2013). "Physical accessibility of gaming opportunity and its relationship to gaming involvement and problem gambling: A systematic review." *Journal of Gambling Issues*(28): 1-46.
- Victorian Department of Justice (2008). Destination gaming: Evaluating the benefits for Victoria, Victorian Department of Justice Melbourne, Australia.
- Walker, I. and J. Young (2001). "An economist's guide to lottery design." *The Economic Journal* 111(475): F700-F722.
- Welte, J. W., G. M. Barnes, M.-C. O. Tidwell, J. H. Hoffman and W. F. Wieczorek (2016). "The Relationship Between Distance from Gambling Venues and Gambling Participation and Problem Gambling Among U.S. Adults." *Journal of Gambling Studies* 32(4): 1055-1063.
- Welte, J. W., W. F. Wieczorek, G. M. Barnes, M.-C. Tidwell and J. H. Hoffman (2004). "The relationship of ecological and geographic factors to gambling behavior and pathology." *Journal of Gambling Studies* 20(4): 405-423.
- Wilkins, R. and I. Lass (2015). The household, income and labour dynamics in Australia survey: Selected findings from waves 1 to 12, Melbourne Institute of Applied Economic and Social Research, University of Melbourne.
- Young, M., F. Markham and B. Doran (2012). "Too close to home? The relationships between residential distance to venue and gambling outcomes." *International gambling studies* 12(2): 257-273.

**Table 1: Sample means of gambling variables for subgroups**

	Gamble (0/1)	Positive Expend (\$s)	Positive Expend as % of income	Gambling Problem (0 / 1)
Socioeconomic characteristics				
Men	0.18	185	14.4	0.10
Women	0.09	119	11.0	0.05
Younger (Age < 45)	0.11	152	10.9	0.07
Older (Age ≥ 45)	0.16	169	14.7	0.08
Employed full-time	0.14	182	10.7	0.08
Not employed full-time	0.12	141	15.6	0.07
Low household income (< median)	0.15	161	18.6	0.09
High household income (> median)	0.12	163	6.40	0.06
Preferences and ability				
Unwilling to take financial risks	0.12	124	12.0	0.06
Willing to take financial risks	0.15	191	14.0	0.09
Short planning horizon	0.15	169	16.4	0.10
Long planning horizon	0.11	151	8.70	0.05
Poor cognitive ability (< median)	0.16	177	16.0	0.09
Good cognitive ability (> median)	0.11	148	10.5	0.06

Note: Figures are sample means for the four outcomes in the top row. 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.

**Figure 1: Distance to closest EGM gambling venue from people's residence**



**Table 2: Associations between log distance to EGM venue and potential confounders**

Potential confounder	Correlation		Within-area estimates	
	(1)	(2)		
<b>Socioeconomic status</b>				
Employed full-time	-0.007	(0.005)	0.011	(0.009)
Log weekly wages	-0.035***	(0.010)	0.002	(0.017)
University degree attainment	-0.051***	(0.005)	-0.005	(0.008)
Occupational status index	-0.022***	(0.003)	0.000	(0.005)
<b>Preferences and ability</b>				
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)
<b>Risky health behaviours</b>				
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)

Note: Figures are coefficient estimates and clustered standard errors from 10 linear regressions without covariates and 10 linear regressions with area fixed-effects and area-level covariates. The sample sizes for the 9 different outcomes (in vertical order) are: 17,757; 11,153; 17,757; 11,386; 14,660; 16,796; 14,943; 12,001; and 14,817. \*, \*\* and \*\*\* denote statistical significance at the 0.10, 0.05 and 0.01 levels.

**Table 3: Effect of residential venue proximity on gambling behaviour**

	EGM Venues (1)	Alternative Gambling Types			Problematic Gambling Symptom (5)
		Casino (2)	Lotteries (3)	Scratchcards (4)	
<b>A. Distance from residence</b>					
Log distance	-0.014** (0.007)	0.000 (0.003)	-0.007 (0.009)	0.000 (0.005)	0.000 (0.005)
<b>B. Distance from residence</b>					
Distance < 250m	0.058*** (0.022)	-0.006 (0.009)	-0.018 (0.028)	-0.000 (0.016)	0.004 (0.017)
Distance 250m-1km	0.036** (0.015)	-0.001 (0.006)	-0.015 (0.020)	-0.010 (0.011)	0.002 (0.012)
Distance 1-2km	0.018 (0.014)	-0.004 (0.006)	-0.032* (0.019)	-0.011 (0.010)	0.010 (0.010)
<b>C. Distance from shops</b>					
Log distance	0.001 (0.004)	0.002 (0.002)	-0.004 (0.006)	-0.004 (0.003)	0.006* (0.003)
Outcome sample mean	0.133	0.020	0.255	0.066	0.073
Number of observations	14725	14725	14725	14725	14767

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. \*, \*\* and \*\*\* denote statistical significance at the 0.10, 0.05 and 0.01 levels.

**Table 4: Effect of residential venue proximity on potential wellbeing benefits**

	Been Feeling Happy (1)	Often See Friends (2)	Feel part of local community (3)
<b>A. Distance from residence</b>			
Log distance	0.014** (0.007)	0.007 (0.007)	-0.045 (0.032)
<b>B. Distance from residence</b>			
Distance < 250m	-0.072*** (0.023)	-0.024 (0.023)	0.160 (0.105)
Distance 250m-1km	-0.018 (0.017)	-0.001 (0.016)	0.132* (0.076)
Distance 1-2km	-0.017 (0.015)	-0.011 (0.014)	0.067 (0.071)
<b>C. Distance from shops</b>			
Log distance	-0.001 (0.005)	0.000 (0.005)	0.003 (0.022)
Outcome sample mean	0.776	0.234	6.664
Number of observations	14869	14708	16745

Note: Figures are coefficient estimates and clustered standard errors from linear regressions with neighbourhood fixed-effects, area-level covariates, and individual-level covariates. \*, \*\* and \*\*\* denote statistical significance at the 0.10, 0.05 and 0.01 levels. The outcome measures in columns (1) and (2) are binary indicators, and in column (3) it is on a scale of 0 to 10.

**Table 5: Effect of residential venue proximity on potential harms**

	Financial Hardship (1)	Poor Mental Health (2)	Poor General Health (3)	Relationship dissatisfaction (4)	Victim of crime (5)
A. Distance from residence					
Log distance	-0.015** (0.007)	-0.015** (0.007)	-0.001 (0.006)	0.000 (0.007)	-0.000 (0.004)
B. Distance from residence					
Distance < 250m	0.064*** (0.022)	0.056** (0.023)	0.017 (0.019)	0.004 (0.022)	0.013 (0.012)
Distance 250m-1km	0.034** (0.016)	0.013 (0.016)	-0.009 (0.014)	0.012 (0.016)	0.005 (0.008)
Distance 1-2km	0.032** (0.014)	0.019 (0.015)	0.002 (0.013)	0.011 (0.015)	0.007 (0.007)
C. Distance from shops					
Log distance	0.002 (0.005)	-0.004 (0.004)	0.003 (0.004)	-0.004 (0.005)	0.003 (0.002)
Outcome sample mean	0.200	0.194	0.166	0.138	0.039
Number of observations	14725	14894	14750	10931	14796

Note: Figures are coefficient estimates and clustered standard errors from linear regressions with neighbourhood fixed-effects, area-level covariates, and individual-level covariates. \*, \*\* and \*\*\* denote statistical significance at the 0.10, 0.05 and 0.01 levels. All outcomes are binary indicators.

**Table 6: 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	0.107	-0.003 (0.006)	0.033* (0.019)
Could not pay the mortgage or rent on time	0.055	-0.002 (0.005)	0.025* (0.015)
Pawned or sold something	0.052	0.004 (0.004)	-0.011 (0.015)
Went without meals	0.038	-0.010** (0.004)	0.032** (0.014)
Was unable to heat home	0.030	-0.003 (0.004)	0.012 (0.012)
Asked for financial help from friends or family	0.118	-0.013** (0.006)	0.066*** (0.019)
Asked for help from welfare/community organisations	0.037	0.004 (0.004)	-0.002 (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.

**Table 7: Subsample regression estimates of ‘residing within 250m of venue’**

	Sample size	Financial hardship	Poor mental health	
Male	6971	0.104*** (0.033)	0.058** (0.030)	
Female	7923	0.013 (0.031)	0.053 (0.033)	
Younger (age < 45)	7552	0.078** (0.033)	0.076** (0.034)	
Older (age $\geq$ 45)	7342	0.022 (0.032)	0.035 (0.035)	
Employed full-time	6860	0.079** (0.033)	0.071** (0.032)	
Not employed full-time	8034	0.034 (0.033)	0.056 (0.035)	
Low income	7453	0.095*** (0.035)	0.034 (0.037)	
High income	7441	0.008 (0.028)	0.060* (0.034)	
Unwilling to take financial risks	7321	0.083** (0.037)	0.033 (0.037)	
Willing to take financial risks	7286	0.044 (0.029)	0.039 (0.031)	
Short planning horizon	7682	0.079** (0.036)	0.042 (0.037)	
Long planning horizon	7212	0.045* (0.027)	0.058* (0.031)	
low cognitive ability	7459	0.075** (0.035)	0.072** (0.036)	
High cognitive ability	7435	0.067** (0.031)	0.061* (0.032)	

Note: Figures are coefficient estimates on the variable ‘residing within 250m of venue’. 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. 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.

## **Appendix A**

**Appendix Table A1: Problem Gambling Questions in the HILDA Survey**

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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: Estimated coefficients on all covariates from gambling and financial hardship regressions**

	EGM venue Gambling (1)	Financial Hardship (2)
Log distance from residence to EGM venue	-0.014 ** (0.007)	-0.015 ** (0.007)
Age	0.004 (0.005)	0.014 *** (0.005)
Age squared	-0.005 (0.010)	-0.029 *** (0.009)
Age cubed	0.002 (0.006)	0.017 *** (0.006)
Male	0.090 *** (0.007)	-0.016 *** (0.006)
Married or cohabitating	-0.002 (0.009)	-0.041 *** (0.009)
Divorced or separated	0.017 (0.015)	0.042 *** (0.015)
Number of children	-0.019 *** (0.004)	0.018 *** (0.004)
Number of adults	-0.003 (0.003)	-0.008 ** (0.004)
Education: University degree	-0.081 *** (0.012)	-0.063 *** (0.010)
Education: Diploma / certificate	-0.023 * (0.012)	-0.007 (0.010)
Education: High school graduate	-0.035 *** (0.013)	-0.011 (0.012)
Log distance to alcohol venue	-0.005 (0.006)	0.008 (0.007)
Index of economic resources	0.000 (0.000)	-0.000 (0.000)
Index of Education and Occupation	0.000 (0.000)	-0.000 (0.000)
Traffic noise	0.003 (0.006)	0.013 ** (0.007)
Noise from airplanes, trains or industry	0.004 (0.006)	-0.016 ** (0.007)
Homes and gardens in bad condition	0.003 (0.011)	-0.006 (0.012)
Rubbish and litter lying around	-0.011 (0.010)	0.006 (0.012)
People being hostile and aggressive	0.015 (0.011)	0.061 *** (0.012)
Vandalism and deliberate damage to property	-0.007 (0.012)	-0.022 (0.013)
Burglary and theft	-0.004 (0.009)	0.021 * (0.011)
Log values of homes	-0.005 (0.011)	-0.008 (0.010)
Log home rental prices	0.010 (0.010)	-0.011 (0.009)
Lagged financial hardship	-	0.326 ***

		(0.012)
Number of observations	14767	14725

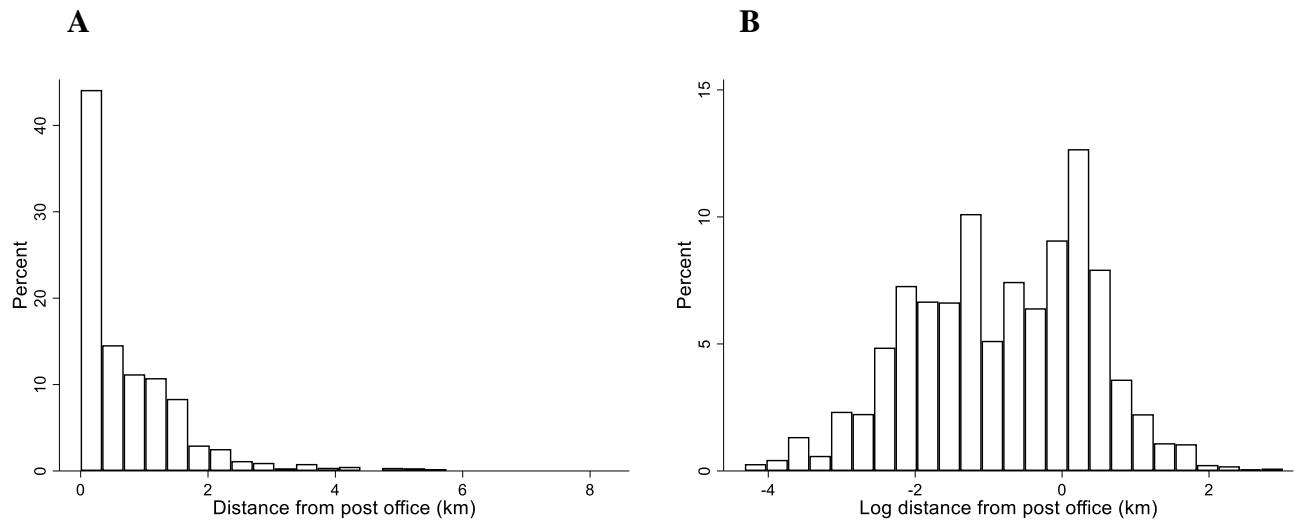
Note: Figures are coefficient estimates and clustered standard errors from linear regressions with neighbourhood fixed-effects, area-level covariates, and individual-level covariates. EGM venue gambling and financial hardship are binary outcomes. Mental health and wellbeing are continuous outcome with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

**Appendix Table A2: Estimated associations between venue proximity and expenditure on different gambling types (\$000s)**

	EGM Venues (1)	Alternative Gambling Types		
		Casino (2)	Lotteries (3)	Scratchcards (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 (0.007)	0.000 (0.001)	-0.009* (0.005)	0.000 (0.000)
Distance 250m-1km	0.000 (0.006)	0.001 (0.001)	-0.007 (0.005)	-0.000 (0.000)
Distance 1-2km	-0.003 (0.005)	0.000 (0.001)	-0.005 (0.003)	-0.000 (0.000)
C. Distance from shops				
Log distance	-0.000 (0.002)	-0.000 (0.000)	-0.000 (0.002)	-0.000 (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 Figure A1. Distance to closest EGM gambling venue from people's nearest post office**



**Appendix Figure A2 – Map of Sydney with neighbourhood (SA2) areas highlighted**



## Appendix B – Data sources

Data type	Spatial coverage	Source
Individual longitudinal data	Australia wide	Household, Income and Labour Dynamics in Australia (HILDA)  <a href="https://melbourneinstitute.unimelb.edu.au/hilda">https://melbourneinstitute.unimelb.edu.au/hilda</a>
Post offices	Australia wide (2018 only)	Australian Postal Corporation <a href="https://auspost.com.au/">https://auspost.com.au/</a>
EGM and liquor venue addresses	Victoria (Melbourne)	Victorian Commission for Gambling and Liquor Regulation site. <a href="https://www.vcclr.vic.gov.au/resources/data-and-research/">https://www.vcclr.vic.gov.au/resources/data-and-research/</a>
	New South Wales (Sydney)	New South Wales - Department of Trade and Investment, Regional Infrastructure and Services Office of Liquor, Gaming & Racing <a href="https://www.liquorandgaming.nsw.gov.au/resources">https://www.liquorandgaming.nsw.gov.au/resources</a>
	Queensland (Brisbane)	Queensland Department of Justice and Attorney-General Office of Liquor Gaming and Regulation <a href="https://secure.olgr.qld.gov.au/dcm/Gaming/Sites?">https://secure.olgr.qld.gov.au/dcm/Gaming/Sites?</a>
	South Australia (Adelaide)	Office of the Liquor and Gambling Commissioner <a href="https://data.sa.gov.au/data/dataset/liquor-gaming-licences">https://data.sa.gov.au/data/dataset/liquor-gaming-licences</a>