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Understanding gambling spending in Great Britain using payment card data

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Disclaimers / Notes

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Abstract

Historically the gambling market in Britain has been dominated by cash. However, in more recent times debit card payments have become the predominant form of payment in Britain, including in the gambling market. Within this context, we examine what transaction data for a sample of over 6 million cards over 4 years can tell us about gambling in Britain. We document a number of novel stylised facts of gambling in Britain. The geographic spread of our data reveals important variation in gambling intensity across Britain. We document important correlates of gambling behaviour at a local level including deprivation, ethnicity, and licensed premises locations. Areas tend to have more gambling spending as a share of total consumption if they are more deprived, have a higher share of ethnic minority residents, and have at least one licensed gambling premises. In addition to these cross-sectional comparisons we also detail how these characteristics relate to changes in gambling over time. Including that recent increases in gambling spend as a percentage of total spend are highest in the most deprived areas.

JEL codes: D12, L83, G50

Keywords: Gambling, Household finance, Household consumption

1. Introduction

Gambling is one of the oldest and most ubiquitous pastimes in human history. However, gambling markets continue to emerge and grow. Commercial gaming revenue in the US reached \$60 billion in 2022 (American Gaming Association, 2023), and sports betting is now legal in 38 States (American Gaming Association, 2024). In Great Britain in the 2022-2023 financial year more than £15 billion was gambled and lost (Gambling Commission, 2024a). Gambling is a source of enjoyment for the vast majority of participants. However, gambling is also a cause of harm¹.

Despite the age and size of the British gambling market, there is a lack of objective reliable data on gambling at the individual level and its relationship to socio-demographic factors. Many studies rely on self-report surveys and qualitative interviews rather than objective behavioural data. The newly launched Gambling Survey for Great Britain, (Gambling Commission, 2024b), is the source of official statistics on gambling participation and gambling harm. Previously these statistics have been gathered from a module as part of the Health Survey for England and the Scottish Health Survey since The British Gambling Prevalence Survey was last conducted in 2010.

Other researchers have used financial data to examine gambling in Britain (BIT, 2021a, 2021b; Muggleton et al., 2021), or card data to examine overall spending in Britain (Office for National Statistics, 2024a). There has also been research exploiting operator data, for example Forrest and McHale (2022). However, to the best of our knowledge no one has used card data to explore gambling spending². This paper aims to fill that gap by utilising novel data from more than 6 million debit and credit cards and 1.67 billion transactions over 4 years. Our data has other features which distinguish it from the data sources used in previous studies. Unlike the data for many previous studies, our data covers the universe of British gambling operators, the customers of multiple banks, spending on both debit and credit, and both online and offline gambling. It is also available at high frequency (at the week level), at a low-level of UK statistical geography. These features enable us to be the first to answer the following questions with objective data: How have gambling patterns in Britain changed in recent years? How is gambling spend distributed across Britain? How do gambling patterns vary by age, gender, ethnicity, and features of local geographic areas? To illustrate the potential of the data, Figure 1 displays the geographic distribution of gambling spending as a share of total consumption for every Middle Layer Super Output Area (MSOA)³ in Britain in 2021.

Our paper fits within a large and growing literature which aims to use large privately owned datasets to inform policy and policymakers, for example Chetty et al. (2024), who build a public database from anonymised transaction data from private companies to estimate near real-time effects of COVID-19 policy responses. It also aligns with work exploring the potential of card transaction data to generate real-time indicators (ONS, 2024b). In

¹ Gambling-related harms are defined by the Gambling Commission as the adverse impacts from gambling on the health and wellbeing of individuals, families, communities and society.

² We use the term spend interchangeably with sales. See section 3.1 for more discussion on this point.

³ MSOAs are a level of UK statistical geography which encompass between 2,000 and 6,000 households and between 5,000 and 15,000 persons.

considering the geography of gambling, our work is similar in spirit to Evans and Cross (2021), who examine the geography of gambling premises but do not have access to data on actual gambling behaviour.

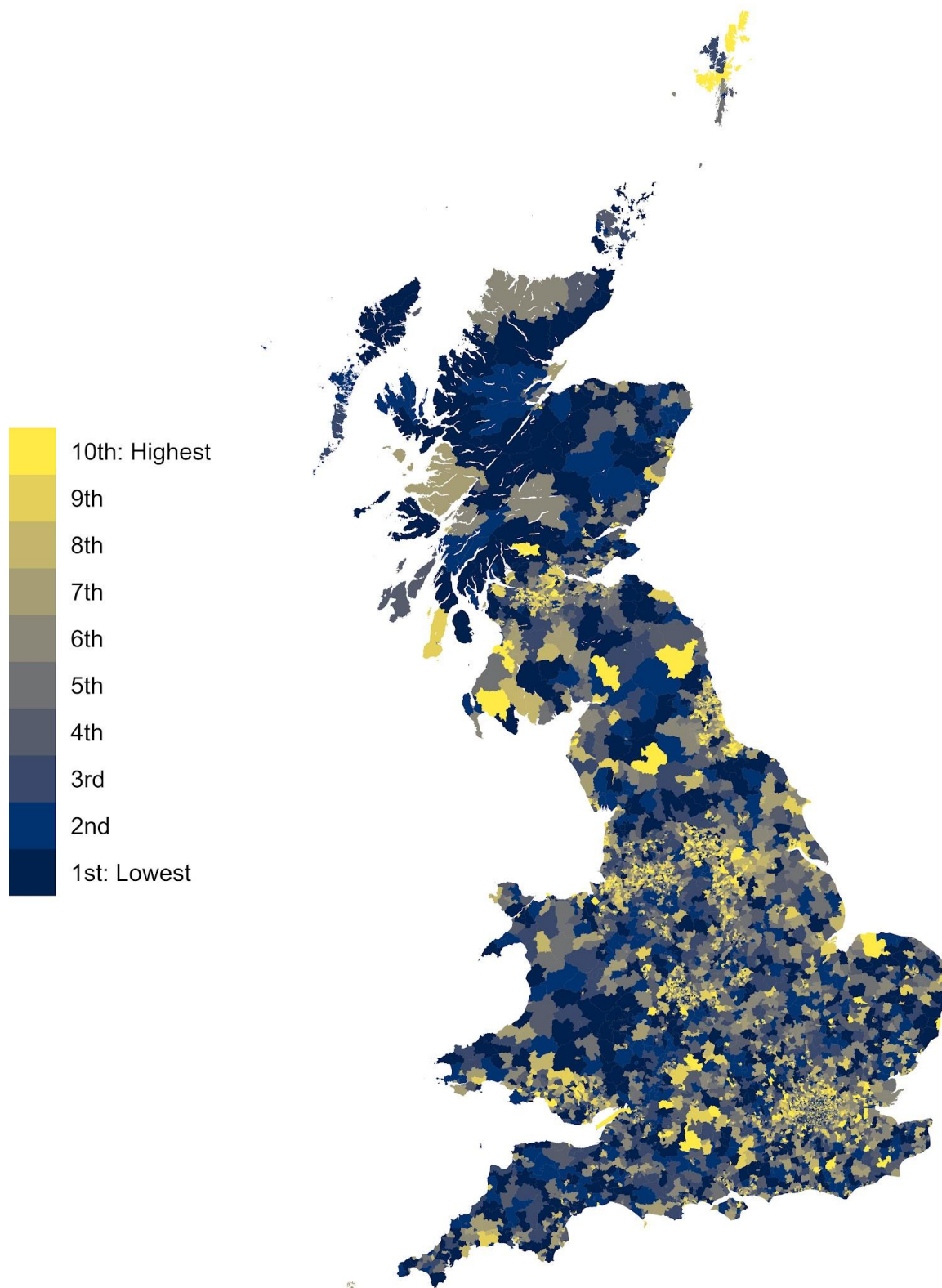


Figure 1: Britain's 2021 geographic distribution of non-cash gambling as a % of non-cash consumption at the Middle Layer Super Output Area (MSOA) level.

The context of our study is Britain from 2018 to 2021. This is a period of great change and disruption for the gambling market. The Covid-19 pandemic forced the closure of all gambling premises for some time, and restrictions on their use at other times. This in an environment where gambling premises were already closing (Evans & Cross, 2021). Historically cash has been the most common form of payment in the UK, there is some evidence that this is even more pronounced in the gambling sector⁴. However, debit card payments became the predominant form of payment in the UK in 2017, and now more than 50% of payments are made by debit card (UK Finance, 2023). In light of this trend, card payment data becomes more valuable for exploring changes in household spending, including that on leisure activities such as gambling. This is particularly true given the Department for Culture, Media & Sport's recent proposal to lift the prohibition on direct debit card payments on gaming machines (DCMS, 2024).

Our work documents a number of interesting features of the British gambling environment. We find a large increase in online gambling between 2018 and 2021, alongside a large increase in all online spending, consistent with previous work. We contribute new evidence by highlighting the geographic spread and variation in gambling intensity across Britain. We find that gambling spend as a percentage of total spend is 2-3 times higher in the most deprived areas compared to the least deprived, and this gap has widened in recent years. A cardholder in our data is also nearly twice as likely to gamble if they are in the most deprived areas compared to being in the least deprived areas. Additionally, areas with more of their population from ethnic minority backgrounds spend more on gambling as a percentage of their total spending. Our data also suggest that the North East of England is the area with the greatest propensity to gamble.

The rest of this paper is organised as follows: The next section describes the existing literature on gambling in Britain in more detail. In Section 3 we describe the data used in this paper. Section 4 contains details on our empirical strategy. Our results are in Section 5. Section 6 concludes.

2. Overview of the relevant literature

This section discusses some of the relevant work in this area. We focus on the evidence on which demographic or socioeconomic factors are related to gambling spend and previous uses of large datasets to explore gambling behaviour.

2.1 Influences of socio-economic factors on gambling spend

Gender

Among socio-demographic factors, gender demonstrates one of the most consistent relationships with gambling expenditure, with males associated with higher gambling

⁴ Partly this is due to restrictions on certain non-cash payments, discussed in more detail in section 3.3. However, there is some survey evidence that some prefer cash as a way to maintain control over their gambling spend (Gambling Commission, 2021b).

expenditure compared to females (Bastiani et al., 2013; Christensen et al., 2015; Grönroos et al., 2021; Guerra et al., 2022). For example, research conducted in Finland found that being male was significantly associated with higher weekly gambling expenditure, monthly gambling expenditure as a percentage of net income, and relative gambling expenditure (Castrén et al., 2018; Salonen et al., 2018).

Age

The relationship between age and gambling expenditure is more complex, with findings from different studies conflicting (although this may stem from methodological differences). Studies conducted in the UK, Germany, and Portugal (Forrest & McHale, 2022; Chagas et al., 2021; Giebeler & Rebeggiani, 2019) suggest an age-related increase in expenditure. However, not all research demonstrates this positive correlation. For example, a UK-based study by the Behavioural Insights Team (BIT, 2021b) utilising banking data found that the highest proportion of individuals in high-risk groups (defined using the ratio of monthly gambling deposits to disposable income) belonged to the 31-40 age range. Further discrepancies emerge from a Finnish study by Salonen et al. (2018), which found younger individuals associated with lower weekly gambling expenditure but higher relative expenditure (Gambling Commission, 2023).

Income

Some studies observe that individuals with higher incomes typically exhibit higher gambling expenditure levels, while other findings (not necessarily contradictory) suggest that individuals with lower incomes allocate a greater proportion of their income to gambling activities (Grönroos et al., 2021; Castrén et al., 2018; Tan et al., 2010). Additionally, those who dedicate a larger share of their net income to gambling each month are more likely to face social and economic challenges (Salonen et al., 2018).

Ethnicity

Research in this area, particularly within Britain, remains limited. Existing studies indicate diverse spending patterns across different ethnicities. For instance, a Malaysian study targeting non-Muslim families reveals higher expenditure among Chinese households compared to Indian and other ethnic groups (Tan et al., 2010). Similarly, a US study focusing on the student population highlights differences in gambling habits, with Asian participants gambling less frequently than Caucasian or Hispanic/Latino participants, yet spending more money on gambling than African-American/Black or Hispanic/Latino participants (Rinker et al., 2016). Within the UK (Conolly et al., 2018) find that although overall rates of gambling amongst ethnic minority populations tend to be lower than for White British, rates of problem gambling tend to be higher.

Deprivation and opportunities to gamble

Different types of gambling premises exhibit distinct geographical patterns in Britain.⁵ The literature documents a heightened prevalence of gambling opportunities within deprived communities (Evans & Cross, 2021). For instance, research conducted in both the UK and Finland (Wardle et al., 2014; Raisamo et al., 2014) indicates a positive correlation between higher levels of deprivation and increased density of electronic gambling machines (EGMs). EGM participation emerges as a significant predictor of harmful gambling behaviour (Williams et al., 2021).⁶ An exploration of the socio-economic characteristics of Welsh areas hosting Licensed Gambling Operators (LGOs) reveals concentrations of such establishments in Newport and Wrexham, predominantly situated within the most deprived areas in these locales (John et al., 2017). Similarly, across the whole of the UK, 21% of gambling premises were situated within the most deprived decile of areas in the nation, compared to just 2% in the least deprived decile. In contrast, location of supermarkets was a lot more balanced, with 10% of supermarkets being found in the most deprived decile, and 7% situated in the least deprived decile (Evans & Cross, 2021).

Wardle et al. (2016) examine the City of Manchester, which does not suffer from a high level of deprivation, however their analysis identified it as being at a higher risk of gambling harm. They attributed this to the array of services offered within the city, which may attract potentially vulnerable individuals to the city centre. Relatedly, Badji et al. (2023) found that individuals residing in close proximity to gambling venues are more likely to gamble. Although this does not establish a causal effect of physical gambling premises on gambling behaviour: operators will locate gambling premises where they expect them to be most popular, but the presence of a gambling store may increase locals' engagement with gambling.

The 2021 Health Survey England examined the relationship between gambling participation and IMD⁷ quintile among 3,773 people (NHS Digital, 2021a)⁸. In contrast to the gradient in the prevalence of opportunities to gamble, they found that gambling participation was similar across IMD quintiles. Excluding the National Lottery, 35% of those in the least deprived areas participated in gambling in the preceding 12 months, compared to 34% in the most deprived areas. They provide some evidence of differences in the types of gambling activities undertaken in different IMD quintiles. Those in less deprived areas were relatively more likely to participate in online gambling, and less likely to play gaming machines.

⁵ Betting shops are common across Britain but concentrated in some city centres like London, Glasgow, and Leeds. Casinos are less common but more prominent in larger cities. Adult gaming centres and bingo venues tend to be located outside major city centres. Family entertainment centres (FECs) are most commonly found in British seaside resorts. 72% of FECs are within 2km of the coastline (Evans & Cross, 2021).

⁶ Definitions of density vary across studies, they may use population or area metrics.

⁷ The Index of Multiple Deprivation (IMD) (Department for Education, 2019) is a ranking of neighbourhoods in Britain. Each nation in Britain defines the index slightly differently, but the core of the index is the same. The English IMD is based on 37 indicators across 7 domains of deprivation. The IMD is a measure of the overall deprivation experienced by people living in a neighbourhood, although not everyone who lives in a deprived neighbourhood will be deprived themselves.

⁸ See table 1 and table 5 in NHS Digital, 2021.

2.2 Using large datasets to investigate gambling behaviour

Researchers have capitalised on the availability of large datasets related to gambling to analyse them for consumer protection purposes.

Geolocation data

The Gambling Commission requires licensees to assess local risks (Gambling Commission, n.d.) and recommends licensing authorities complete their own local risk assessment (Gambling Commission, 2021a). Wardle et al (2016), using Manchester and Westminster City Councils as case studies, identified characteristics of people thought to be more vulnerable to gambling harm⁹ and for each characteristic reviewed the local level data (if any) to produce a gambling risk index for each, which the researchers displayed visually on maps. Similarly, GambleAware (2022a), has generated interactive maps depicting the prevalence of gambling harms across local authority areas in Great Britain, using data from the *November 2022 Annual Great Britain Treatment and Support Survey* (GambleAware, 2022b). The maps show the geographical distribution of gambling harm at the local level, the usage of treatment and support services for gambling harms and reported demand for treatment and support. This data suggests considerable geographical variation in harmful gambling. It is higher in Scotland (0.9%) and in Wales (0.8%) than in England (0.7%), but the most striking variations are between the English regions. The rate is highest in the North East and in the West Midlands (both 1.1%); in London it is 0.9%, but only 0.3% in the South East and 0.2% in the South West (Conolly et al., 2018).

Operator data

Online gambling operators collect individuals' activity data, including payment behaviour (e.g., deposits and withdrawals) and usage of gambling management tools like voluntary self-exclusion (VSE, where gamblers choose to bar themselves from further gambling participation). These data have huge potential for exploring how individuals gamble at high frequency, and they allow researchers to observe betting behaviour not just deposit behaviour. While there are a number of studies using operator data, in Great Britain the best known example is Forrest and McHale (2022), using 12 months of data for nearly 140,000 randomly sampled accounts from seven different gambling operators. They document patterns of play behaviour by time of day and across gambling activities, as well as the distribution of spending.

Banking data

Rather than solely focusing on an individual's gambling activity with a single operator, BIT (2021a, 2021b) showed the feasibility of utilising bank data to provide an overview of the financial habits and gambling tendencies of both gamblers and non-gamblers. They analysed

⁹ Wardle et al (2016, p4) "concluded that youths, those affected by substance abuse / misuse / excessive alcohol consumption, poorer mental health, those living in deprived areas, from certain ethnic groups, those with low IQs, personality/cognitive impairments, those seeking treatment for gambling problems and those who are unemployed are potentially more vulnerable to harm from gambling."

bank transaction data from 10,000 Monzo customers, a relatively new 'challenger' bank, and 1.5 million HSBC UK customers, a well-established high street bank. The Monzo analysis found that high-spending gamblers tend to gamble frequently, allocate a significant portion of their expenditure to gambling, save little, and exert less control over their gambling habits (BIT, 2021a). Meanwhile, the HSBC UK analysis explored the links between gambling, income, wealth, and credit usage. It found that while most individuals in the sample gambled less than 1% of their disposable account income on gambling, a minority of customers - approximately 1.5% of the sample (those classified as having "Very Concerning" gambling habits by HSBC UK) - spent an average of 58% of their disposable account income on gambling per month. Over time, this "Very Concerning" group also experienced the most significant declines in wealth (BIT, 2021b). This work also highlighted the key role of banking data in giving a more holistic view of individuals gambling behaviour as the "Very Concerning" group used an average of approximately 6 gambling operators.

Muggleton et al. (2021) investigated the relationship between gambling as a proportion of monthly income and 31 financial, social, and health outcomes using anonymised data from a UK retail bank, representing up to 6.5 million individuals over a period of up to 7 years. Their study revealed that gambling is associated with higher levels of financial distress, reduced financial inclusion and planning, and negative lifestyle, health, well-being, and leisure outcomes. Moreover, gambling is linked to elevated rates of future unemployment and physical disability and, at the highest levels, substantially increased mortality. Notably, gambling tends to persist over time, and its negative associations are more pronounced among those who gamble the heaviest.

Scholten et al. (2020) utilised the Ethereum cryptocurrency blockchain to acquire transaction data, providing insight on spending behaviours in this emerging domain. The "typical" player engaged in around six bets per day, with a total expenditure of approximately \$110. Conversely, the identified "heavier" user exhibited significantly higher expenditures, averaging \$110,000 across a median of 644 bets spread over 35 days.

3. Data

We combine data from multiple sources to perform the analysis in this paper: data from a sample of UK credit and debit cards, data publicly available from the Office of National Statistics (ONS), and data from the Gambling Commission (GC) on the location of licensed gambling venues. We focus on Great Britain throughout as the regulatory environment in Northern Ireland is different from the rest of the UK.

In the rest of this section, we describe our sample of cards, the other sources of data we use in this paper, the institutional context of gambling in Britain, and the representativeness of our spending data.

3.1 Card data

Our card data are the universe of transactions for a sample of 6,311,775 cardholders in Great Britain between 2018-2021, including card users from multiple high-street banks and credit card providers. Based on figures from UK Finance, we estimate our data captures 4-5% of UK debit cards, and around 2% of UK credit cards¹⁰. Our data is provided by a third-party provider, and is aggregated from transaction-level data. For each transaction, the provider has access to: the time and date of the transaction, the transaction amount¹¹, vendor, card type, and card identifier¹². Together with these transaction-level data points there is also information on the gender, age, and address of the cardholder.

We received data on sales, transactions and unique customers, aggregated by week for each of:

- 2 spending types: gambling¹³ or household
- 2 channels: online or offline transactions
- 2 card types: debit cards or credit cards
- 8 age bands: 18-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75+, unknown¹⁴
- 3 gender categories: male, female, unclassified¹⁵
- 41,724 lower super output areas (LSOA) and data zones in England, Scotland and Wales¹⁶.

Overall, this gives us 1.67 billion rows of data. To take an example row, an entry in the sales column of our data would give the sum of online, debit card gambling deposits for the week starting 2017-12-31 for men aged 35-44 who have a registered address within a given LSOA.

Due to its pervasiveness, varied methods of payment, and because National Lottery spending is typically associated with lower levels of risk of problem gambling than other forms of gambling (PHE, 2021), any spending on the National Lottery has been identified and removed from gambling spend in our data. Lottery spending offline is typically done in

¹⁰ According to [UK Finance](#) (2022, p.4), the value of debit card transactions in 2021 was £711.0bn. In our sample, the total is £30.2bn (i.e. 4.2% of this). For credit cards, the value of transactions was £183.1bn for the whole UK and £3.2bn (1.8% of this) for our sample. Similarly our data captures 5.6% of debit card transactions and 1.9% of credit card transactions reported by UK Finance in 2021.

¹¹ There are a small number of transactions with a zero transaction amount which appear in our data. These can represent active card checks or card balance requests, but represent less than 0.002% of transactions.

¹² Joint accounts with multiple cards are treated as multiple individuals - each customer has a unique customer identifier.

¹³ Gambling sales are identified by our data provider through a combination of brand and merchant category code

¹⁴ 0.002% of spending and transactions in our sample have unknown ages.

¹⁵ 0.013% of spending and 0.009% of transactions in our sample have unclassified gender

¹⁶ Lower-Layer Super Output Areas (LSOAs) are small areas designed to be of a similar population size, with an average of approximately 1,500 residents or 650 households. There are 32,844 LSOAs in England, and 1,909 LSOAs in Wales. Data Zones are the equivalent of LSOAs in Scotland. There are 6,976 Data zones in Scotland. We use LSOA to refer to LSOAs or Data Zones interchangeably in this paper. 5 LSOAs have been removed from the data due to suppression rules from the data provider relating to small numbers of customer records. Roughly 0.05% of customers were removed in this way.

non-gambling venues and therefore would not be captured in our data. Online lottery spend happens primarily through debit card and direct debit, only the first of which we would capture in our data. This difference for such a large volume of similar purchases by channel would unduly influence any online-offline comparisons.

The data we use are not typically used for research purposes, as such there are a few sample restrictions and variable definitions worth highlighting. We discuss the impact of these further in section 3.4. Firstly, the sampling criteria¹⁷ on our data are applied relative to the date on which the data was pulled from the raw transaction data, and include criteria both within and after the period of our spending data. The primary use of this data is on a rolling basis and the purpose of these criteria is to ensure that when drawn on a monthly basis the data produces comparable numbers which are not driven by new populations of card users entering the data. Secondly, the demographics associated with a card are held in the data only in their current form. This means the age of a customer is their age at the date the code is run to extract the data and not their age at the date of transactions in the data. As an example, those who were 35 in May 2023 will be classified as 35-44 despite at least three of their years of consumption falling into the 25-34 category. Similarly the registered address, and therefore the LSOA a card's consumption contributes to, is the value on record as of May 2023. Thirdly, for data protection reasons those who turn 18 during the data period are only included once they turn 18. This means the 18-24 age group grows in absolute number of cards over time, but are underrepresented in earlier years of data. However, this growth is small relative to the size of the overall dataset, there are 9,000 more cardholders aged 18-24 in 2021 compared to 2018. Fourthly, also for data protection reasons, a based on the Laplace distribution is applied to the underlying transaction data to avoid identification of individual transactions¹⁸. The transformation is symmetric so in expectation it will not bias our data at the LSOA level aggregations, though it will add uncertainty.

Throughout this paper we use the term spend interchangeably with sales. For household spending these are equivalent. However, the nature of gambling is that some people win money so they are not always the same. We do not observe gambling withdrawals or winnings paid in cash in our data so cannot calculate individuals net spend or net losses. Our estimates of the level of gambling spend should thus be interpreted as an upper bound of the amount of individual disposable income used on gambling with this in mind.

3.2 Other data sources

We supplement our main card data with three LSOA-level datasets (full details available in Appendix E):

¹⁷ Specifically, customers are included if they satisfy all the following criteria for our data pull (May 2023):

- Any card included has to have been used at least once in April or May 2023
- Any card included has to have been used 157 or more times during the period May 2019 to start of April 2022
- Any card included has to have been used at least once from May 2018 to April 2019

¹⁸ This is a common data privacy technique, see Dwork et al, 2016 for more detail.

1. Index of multiple deprivation for each nation (2019 for England and Wales, 2020 for Scotland). Each nation uses a slightly different methodology when ranking LSOAs and Data Zones.
2. % of non-white¹⁹ inhabitants (2021 for England and Wales, and estimated 2021 data for Scotland).²⁰
3. The presence of at least one licensed gambling premise open in the LSOA during a given year constructed from data from the GC.

3.3 Institutional Context

To better understand our data and results it is important to briefly discuss the gambling market of Great Britain, as regulated by the GC. The GC regulates arcades, betting, bingo, casinos, gaming machines, and lotteries delivered in either an offline or remote environment. This includes regulation of all gambling websites which trade or advertise to customers in Great Britain. There are a number of aspects to the regulatory environment which are relevant to our use of card data to examine gambling spending.

Firstly, no card, debit or credit, has been permitted to be used as payment on gaming machines since 2007. However, some of these machines accept tokens, so funds may be indirectly transferred onto the machine from a debit card. Across the time period covered by our data there was an average gross gambling yield of (GGY) approximately £2 billion per year²¹ on these gaming machines.

Secondly, on 1 April 2019, the maximum stake for the B2 class of gaming machines, also known as fixed odds betting terminals (Gambling Commission, n.d.) was reduced from £100 to £2. Since this change B2 gaming machines have been almost entirely withdrawn from the UK market (Gambling Commission, 2024a). Spending on other types of gaming machines has increased over this time period. The overall level of spending is lower in every year since this policy change, however this is also a period covered by the Covid-19 pandemic. There has been no formal evaluation of this policy change published, however Forrest & McHale (2022) find no evidence of substitution into online slots spending due to this policy, and overall the industry statistics show that overall gaming machine GGY fell 28% between the 2018-19 and 2019-20 financial years.

Thirdly, on 14 April 2020, the GC banned licensed gambling businesses from accepting credit card payments. This ban covers online and offline betting, casinos, bingo, arcades and online lottery payments. Credit cards can still be used to buy lottery tickets and scratchcards from non-gambling retailers as part of a wider purchase. The regulations also require licensed gambling businesses to verify that any payments made from online wallets do not originate

¹⁹ We use the terms non-white and ethnic minority interchangeably within this paper.

²⁰ At the time of writing, Scotland's most recent ethnicity data was from 2011. We inflated each data zone's 2011 non-white proportion by the national change in non-white proportion between 2011 and 2021. As a comparison, the correlation between England and Wales' LSOA level non-white proportion between 2011 and 2021 is 0.98.

²¹ GGY by gambling type is available for all financial years since 2008 from the Gambling Commission (2024a)

from credit cards. This ban falls within the time period of our data and we discuss it further in Section 5.1. We would not expect this change to remove all gambling spend on credit cards in our data, as it is still possible for individuals to gamble on credit cards either by conducting the gambling abroad or from Great Britain but on websites which are not licensed by the GC.

Whilst the GC sets licensing conditions for all operators, local authority districts have additional power to regulate the local provision of gambling. Specifically they can (i) grant, refuse and attach conditions to premises licences, (ii) issue a statement of licensing policy, setting expectations about how gambling will be regulated in a particular area and (iii) review premises licences and attach conditions or revoke them as a result (Gambling Commission, 2022). In practice this means local councils are able to refuse applications and stop new betting shops opening in their area (UK Government, 2024).

The wider UK context is one where in 2018 debit cards overtook cash as the most frequently used payment method (UK Finance, 2019), and in 2022 accounted for more than half of all payments in the UK (UK Finance, 2023). Card transaction data is capturing an increasing proportion of overall spending. However, in part due to the reasons described above, gambling has lagged behind in this transition to cashless payments. As a result, card sales data will not capture all forms of gambling within GB.

In common with all financial transactions data we won't identify as gambling those gambling payments which are bundled within other non-gambling transactions. For example, when an individual buys a lottery ticket or scratchcard at a supermarket as part of a grocery shop the transaction will appear in household spending within our data and not gambling.

Our ability to observe payments is also intrinsically linked with the type of gambling. Online gambling is much more likely than offline gambling to be paid for using a card to make a deposit (Gambling Commission, 2021b). That said, even online it is possible to use different non-cash payment methods which our data wouldn't capture. For example, many betting sites accept bank transfers²². Cash is much more common in offline gambling, both because of regulation (as detailed on gaming machines above) and other factors, e.g. individuals' preference for cash because it allows them to better control, monitor or set limits on spending (Gambling Commission, 2021b). In combination, this implies our data will underestimate the total volume of gambling sales, and (likely) overstate the share of gambling online relative to offline.

3.4 Representativeness

Our data are not a random sample of cards in Britain. However, overall, the data we use match the broad features of other data.

It is possible that people who predominantly use cash to gamble behave differently, or differ in profile, from those who predominantly use cards to gamble and as such we must accept

²² Gambling companies are also permitted to accept payment via e-wallet, as long as those funds do not directly or indirectly come from a credit card.

that our sample will not reflect every type of gambling and their participants. However, we are still capturing a large amount of gambling spending and types of gambling within our data.

The sample restrictions on our data mean that those appearing in our data have had cards for a number of years and have used them consistently (and were still using them more recently than the end of the period covered by our data). Due to these restrictions there might exist some survivorship bias. For example, those who gamble a lot may be more likely to use several cards or lose access to their cards (more likely credit, but maybe debit as well) and may therefore be less likely to be included. However, the restrictions also provide some benefits as they ensure any trends in the data are not the result of new people getting these cards (i.e. there are no composition effects), and that individuals in relatively short time windows on either side of any policy changes are very similar.

Furthermore, the sample restrictions mean the youngest adults are under-represented in our data, and those who remain may not be representative. For an individual to be included, their card must have been used at least once from May 2018 to April 2019. For example, someone who turned 20 in May 2023 would have to use their card at least once when they were aged 15 to be included in our sample. They must have also made 157 transactions between May 2019 - April 2022 (aged 16-19, meaning they both received a card young and made a large number of independent purchases. Thus, it may be that those young people who are more affluent might be overrepresented in our data, however we see no evidence for this when comparing across LSOAs²³.

The average card in our sample makes 174 transactions per year, the average UK card was used 136 times per year in these same 4 years²⁴, suggesting that our sample cards are more likely to be the card that account holders use on a regular basis (UK Finance, 2022; 2021; 2020; 2019). In the period 2018-2021 the average UK card had a total spend of £20,056, while the average total spend in our sample of cards is £18,649. Our data are less likely to sample cards from packaged bank accounts which charge monthly fees, and are therefore likely underrepresenting higher income individuals, so this lower average total spend is to be expected. This can also be seen in the average spend per transaction, which is £26.81 in our sample and £36.92 in the same period from UK finance data.

We can compare some of the features of the gambling spending in our data to other similar financial data. In our sample, the average card makes 5.28 gambling transactions per year, Muggleton et al. (2021) use a random sample of 100,000 Lloyds banking group customers who average 24.31 gambling transactions per year, while BIT (2021b) uses a sample of 1.5 million HSBC customers who have at least one gambling transaction in a year and find 31.2 gambling transactions per year. There are a few things which could explain this apparent disparity: firstly, unlike the sample for this paper, BIT (2021b) explicitly samples only customers who have engaged in gambling. Secondly, our unit of observation is a card while

²³ The average weekly correlation between the number of online debit gambling customers aged 18-24 and the index of multiple deprivation rank (higher is more affluent) is -0.03 in England and Scotland and -0.04 in Wales in 2021. This suggests younger people aren't concentrated geographically in the more affluent areas in our data.

²⁴ Authors calculations from UK Finance Card Spending Updates

in both Muggleton et al. (2021) and BIT (2021b) it is a bank account, as such because bank transfers are more common for gambling spend than credit cards we would expect to capture relatively fewer transactions on the average card than in the average bank account. Thirdly, we have explicitly excluded payments to the National Lottery which are likely to represent a large volume of lower valued transactions²⁵. Fourthly, there is evidence that the individuals in both the alternative samples (from Lloyds and HSBC) are richer than the national average²⁶.

Overall, despite the sample restrictions, our data cover approximately 4% of cards held in Britain during this period, 5.1% of the transactions, 4% of card consumption, and all but 5 LSOAs out of 41,729. We believe they provide important evidence on the non-cash, non-lottery gambling behaviour for a broadly representative sample of British adults between 2018-2021. Our results are important for understanding the gambling behaviour of a significant proportion of the GB adult population, including changes over time and geographical differences, but we will not speak to the overall prevalence of gambling in Britain.

4. Empirical Strategy

This section presents the empirical strategy we follow to examine four main outcome measures: gambling as a proportion of consumption, the proportion of cardholders who have any gambling spending, weekly gambling spend per gambling customer, and the proportion of gambling spend which is online.

For those outcomes related to the number of cardholders we focus on online debit-card spend only. The structure of our data means we cannot sum across different spending channels (i.e. online and offline), as cards might appear multiple times in a given week which would lead to double counting and bias in our outcome measures²⁷. We chose online debit card activity as it represents 31% of total sales and 93% of gambling sales in our data.

4.1 Descriptive Statistics

We present descriptive analysis at different geographic regions to answer two research questions:

1. How have gambling patterns in Britain changed over time?
2. How is gambling spend distributed across Britain?

²⁵ The average spend per gambling transaction in our data is £29.71, compared to £23.99 in Muggleton et al. (2021).

²⁶ Mean account annual income in the BIT (2021b) sample is £47,000. Muggleton et al. (2021) do not provide descriptive statistics on total spending, income or account turnover. However, based on calculations based on their Table 1 we estimate mean account annual spending in their sample is roughly £36,700. Although not directly comparable, mean equivalised UK household income for the 2020-21 financial year was approximately £37,600 (ONS, 2022b).

²⁷ For example, most of the gambling spend in the data is online and uses a debit card, but many individuals will make both online and offline purchases on other things in a given week. This means that we double-count customers who have any spending without double-counting gambling customers, which in turn leads to a downward bias in estimates of the proportion of cardholders with any spending who gamble in a given week. The (estimated) relationships between characteristics and these outcomes would likely be biased as well.

We sum across the gender and age dimensions of our data, and then aggregate each week for the following geographic units: Britain, England, Wales and Scotland, regions, and local authority districts. Details on the definitions used for each of these areas and the matching to LSOAs is in Appendix A.

4.2 Regression Analysis

We present regression analysis to answer our remaining research questions: how do gambling patterns vary by the deprivation of the local area, the presence of physical gambling premises, and by age, gender and ethnicity.

To explore the associations between gender, age, ethnicity, deprivation and number of gambling premises and our four outcome measures, we use LSOA-week-sex-age level regressions, for all weeks beginning in 2021. We focus on 2021 because, as we will see in section 5 overall spending and gambling patterns change a lot of the full period covered by our data.

Table 1 below shows the regression specification for each of our four outcome measures. Note that, for the outcomes related to average weekly gambling spend per gambling customer and proportion of gambling spend which is online, we can only analyse LSOA-week-sex-age combinations with at least some gambling spending²⁸.

Table 1: Outcomes for regression analysis

Outcome	Model	Weights
Gambling spend as a proportion of total spend - online and offline activity, debit and credit cards	Quasibinomial ²⁹	Total spend
Proportion of cardholders with any gambling spending - online debit-card activity only	Quasibinomial	Number of cards with any spending
Average weekly gambling spend per gambling customer - online debit-card activity only	Poisson	Number of gambling customers
Proportion of gambling spend which is online - online and offline activity, debit and credit cards	Quasibinomial	Gambling spend

²⁸ In 2021, this is 18.2% of all LSOA-week-sex-age combinations.

²⁹ This is equivalent to using a fractional logit model.

In each regression, we include age band dummies³⁰, a female gender dummy³¹, indicators for quintile of proportion of LSOA residents from a minority ethnic background, an indicator for the presence of at least one gambling premises in the LSOA during 2021, and an interaction between country and LSOA-level IMD quintile as covariates. Each of England, Scotland and Wales define the IMD slightly differently so the quintiles are country specific. We also include region and week fixed effects. For all regressions we cluster standard errors at the LSOA level.

In addition we run three robustness checks, reported in full in appendix C, using different categorisations for the following explanatory variables:

- Robustness check 1: using 3 broader age categories 18-34, 35-54 and 55+, instead of 4.
- Robustness check 2: use whether LSOA's IMD is above/below median rank by country in interaction with country, instead of quintiles.
- Robustness check 3: use whether LSOA's ethnic minority proportion is above/below median, instead of quintiles

5. Results

5.1 Gambling patterns in Britain over time

Summary:

1. The total share of gambling in card spending increased by 0.75 percentage points during the pandemic, reflecting a large increase in the volume of online gambling.
2. Among those who made an online debit card transaction, the percentage of those who also gambled went down during the pandemic.
3. Gambling spend has shifted online through this period, with a greater proportion of gambling sales having been made online since the pandemic.
4. The GC's ban of credit card gambling was largely effective, though we find an average of £3,350 gambling sales per week in the first 20 months after the ban.

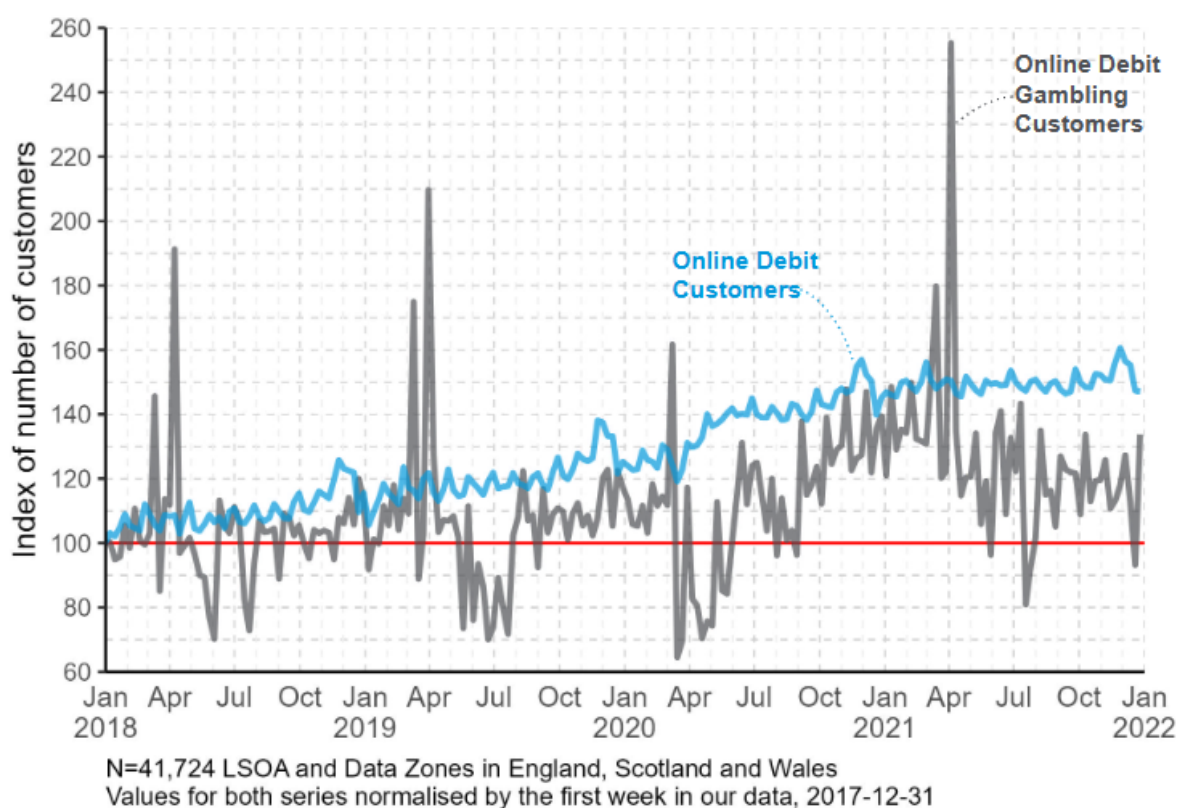
The period covered by our data is one of large changes in the nature of gambling in Britain. Some of these were legally enforced, either by restrictions on free movement in response to the COVID-19 pandemic or by a ban on the use of credit cards for gambling. Overall, yearly gambling spending in our data has increased 40% between 2018 and 2021 and gambling transactions have increased 50%. We would expect these increases to be larger than those captured by other data sources, as we capture changes in both the intensive and extensive margins of gambling spending, and also any substitution away from in-person cash gambling

³⁰ We include indicators for being 18-24, 45-64 and 65+ (reference category 25-44). We exclude those with an unknown age, who make up 0.002% of sales and transactions in our sample.

³¹ We exclude those with unknown gender, who make up 0.013% of sales and 0.009% of transactions in our sample.

into card-based gambling. Also obvious in our data is a more general increase in online spending. Figure 2 illustrates the large increase in the number of debit cardholders who spend any money online on their card over this period, indexed to the first week in our data. While the data are noisier and the trend appears to start later, this increase is also apparent in the number of debit cardholders who are using their card for any online gambling. Also visible in this Figure are the spikes in cardholders gambling around the Cheltenham festival and the Grand National.

Figure 2: Index of customers with any online debit-card spend who gambled online with the same card, by week

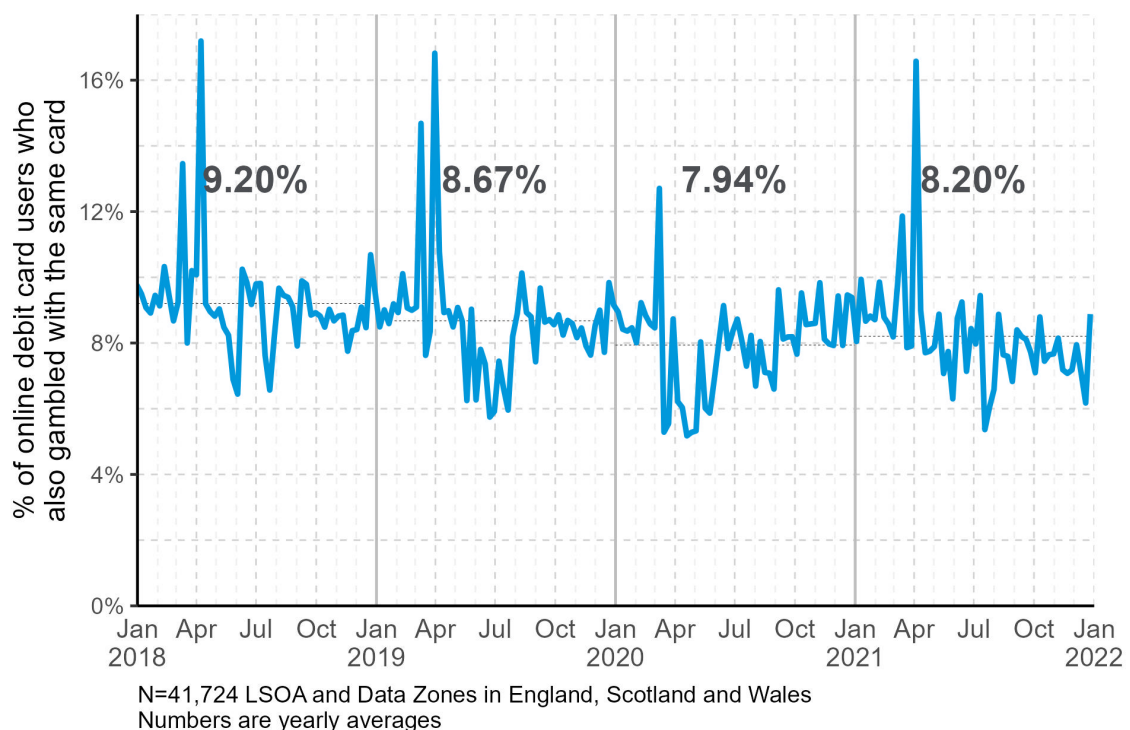


We can also examine the proportion of LSOA population who are using one of the cards in our sample to gamble for a given week in the data. While these will underestimate the level of participation in gambling because our cards do not cover the full population, the trends are indicative. Between the beginning of 2018 and the end of 2021, the average proportion of an LSOA population gambling online with a debit card in our sample increased 13.9%. As our data is aggregated at the week level rather than the previous four weeks (as used in most self-report surveys on participation), it is difficult to compare participation in our data to official participation statistics, however this increase is consistent with other measures. The gambling commission's quarterly telephone surveys asked about participation in the previous four weeks, and shows a 25% increase in online gambling participation excluding National Lottery products from 14.4% to 18% between 2018 to 2021 (Gambling Commission, 2021c). These prevalence estimates are in line with the latest official estimate from the first wave of the Gambling Survey for Great Britain 2023 of 16% (Gambling Commission, 2024b). Survey estimates of participation with longer recall periods show more muted increases. The 2021

Health Survey for England reported that 10% of adults had participated in any online gambling in the last 12 months (excluding National Lottery and other lotteries) (NHS Digital, 2021b), compared to 9% in the 2018 Health Survey for England (NHS Digital, 2019).

In a typical week, in our sample, 8.5% of those who used a debit card online made an online gambling transaction with a debit card. However, the large increase in online debit card users documented above were individuals who are less likely to gamble online. As a result, the proportion of online debit card users who gambled in a given week fell over time, see Figure 3. Consistent with this, we also observe that the share of online transactions by those aged 65 or older increased from 16.5% to 23.8%.

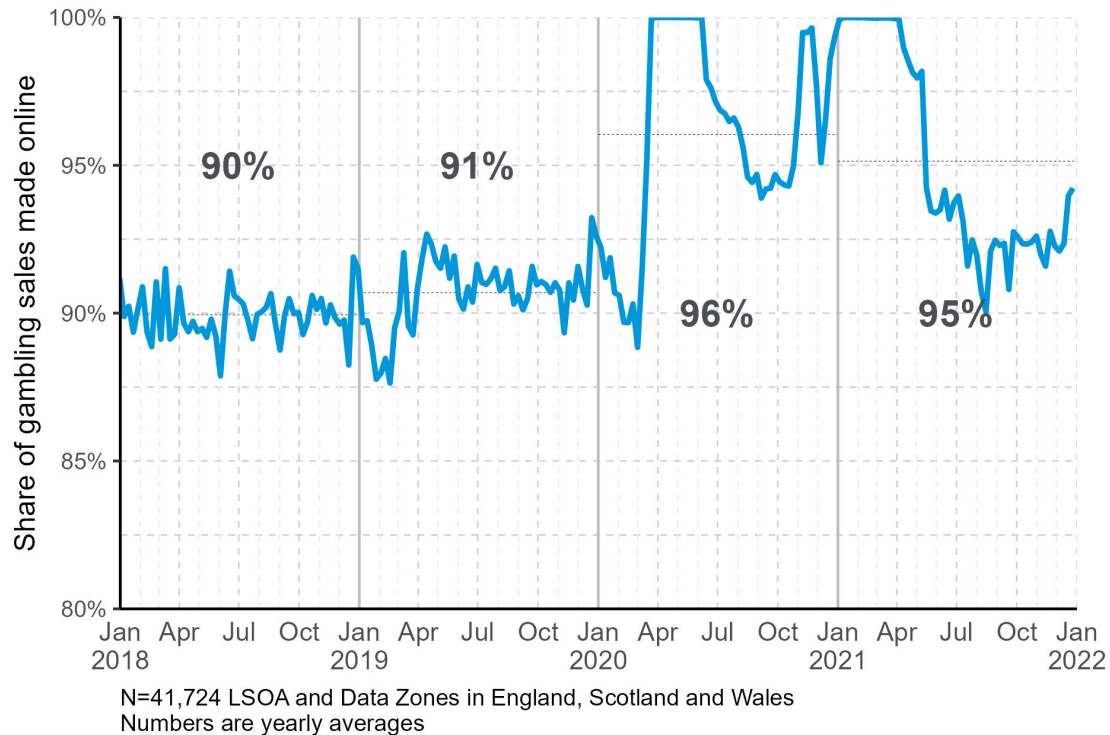
Figure 3: Percentage of customers with any online debit-card spend who gambled online, by week



Together with the increase in the number of online gambling transactions, we also observe that the share of overall gambling spend that is online has increased over the period. Figure 4 shows the weekly share of gambling sales that are online. Over the entire period covered by our data, 93% of observed gambling sales were online in the average week. The periods of national lockdown and forced closure of licensed premises are obvious, covering significant portions of 2020 and 2021 and increasing the average online shares for these years. However, also apparent in the graph is that the percentage of online sales is around 2.5 percentage points higher towards the end of our sample compared to 2018. This persistent increase in the share of gambling taking place online is consistent with industry statistics on GGY from the GC which shows the remote share of GGY was around 14

percentage points higher in the 2021 financial year than its 2018 value of 49%, but still down from a peak of 80% in the 2020 financial year (Gambling Commission, 2024a).

Figure 4: Percentage of gambling sales that are online, by week



This increase in the number of customers gambling online and the share of gambling sales online has been accompanied by an increase in gambling spending as a share of total spending. Over the 4 years of our data gambling sales made up 3.4% of overall spending but, as demonstrated by Figure 5, the share increased approximately 0.75 percentage points in 2020 and has remained at this level on a year-to-year basis. However, the persistence in 2021 is driven mainly by the first three months of the year, due to large reduction in general consumption during the third set of national lockdowns from 6 January 2021. It is not clear whether this change in average gambling share is likely to be permanent. Figure 6 clearly illustrates these relative falls in overall consumption around lockdowns. While in early 2020 this was accompanied by a similar fall in gambling spending, when many sporting events were cancelled, in early 2021 gambling spending remained high. A report by the ONS finds that online retail sales in general are still higher in January 2022 than pre-pandemic levels, ONS (2022).

BIT (2021b), using data on 1.5 million customers with at least one gambling transaction between March 1st 2019 and 29th February 2020, found that gambling sales as a percentage of account income was 2.4%. Over roughly the same period our data shows the ratio of gambling sales to all card spending was 2.9%. These numbers are not directly comparable since we use consumption as the denominator while they use income. We would expect our share to be higher given we will not capture large sources of essential spending

like rent or mortgage payments which would be relatively more likely to be paid for via bank transfer or direct debit.

Figure 5: Gambling sales as a share of total spending, by week

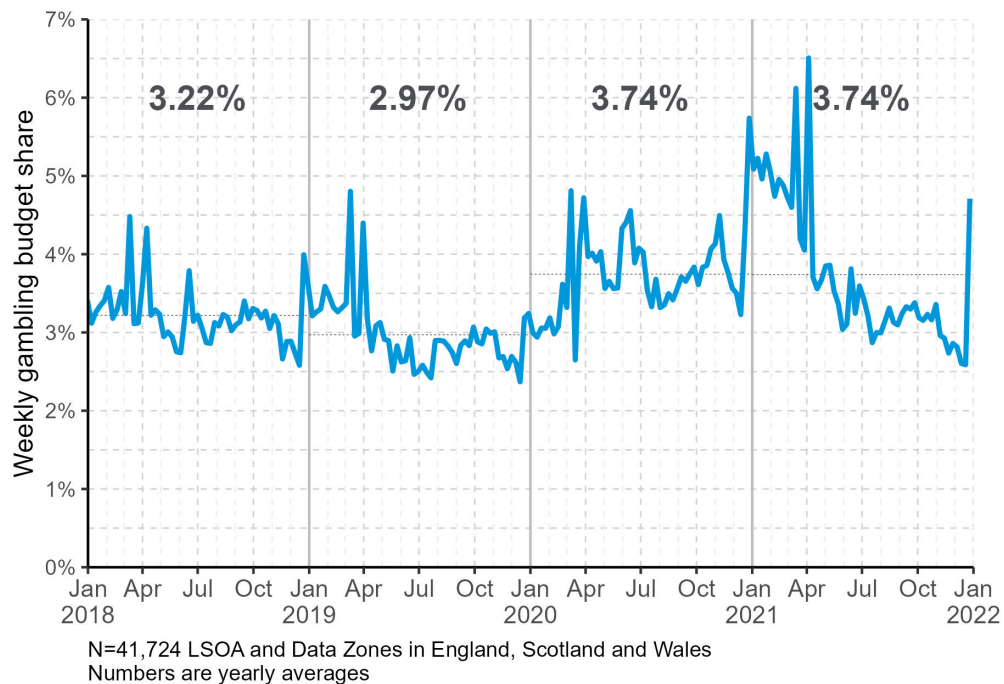
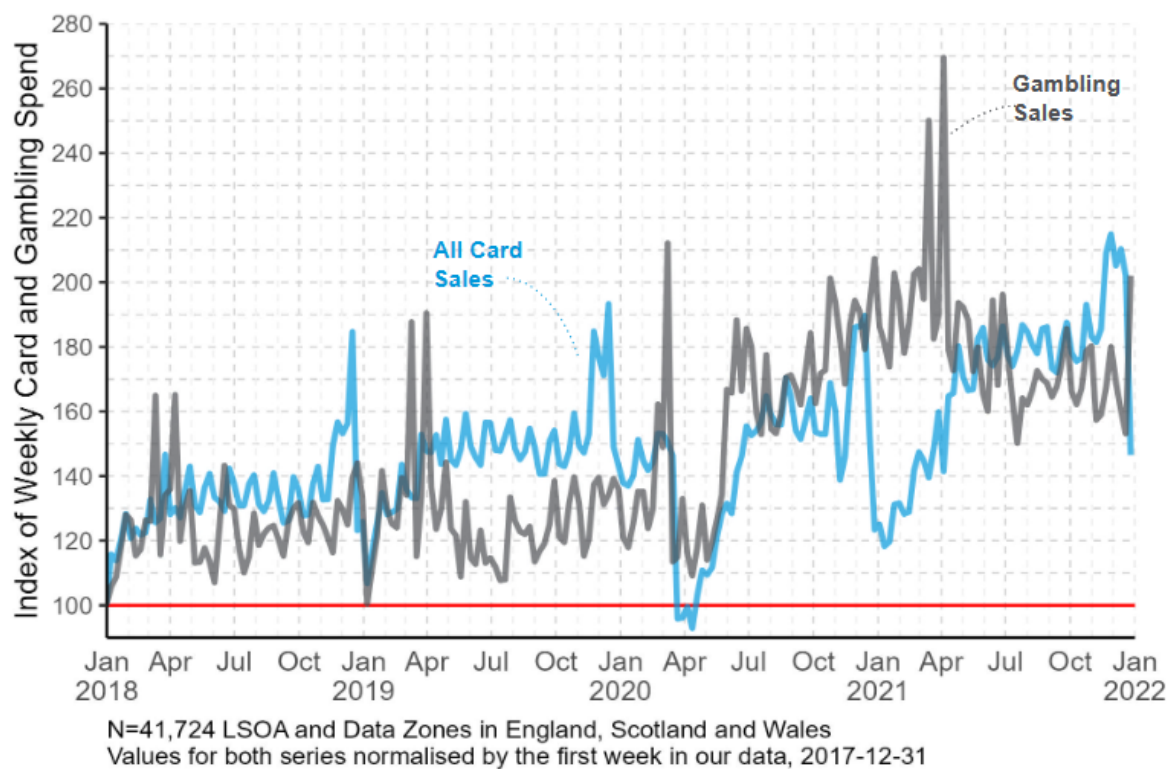


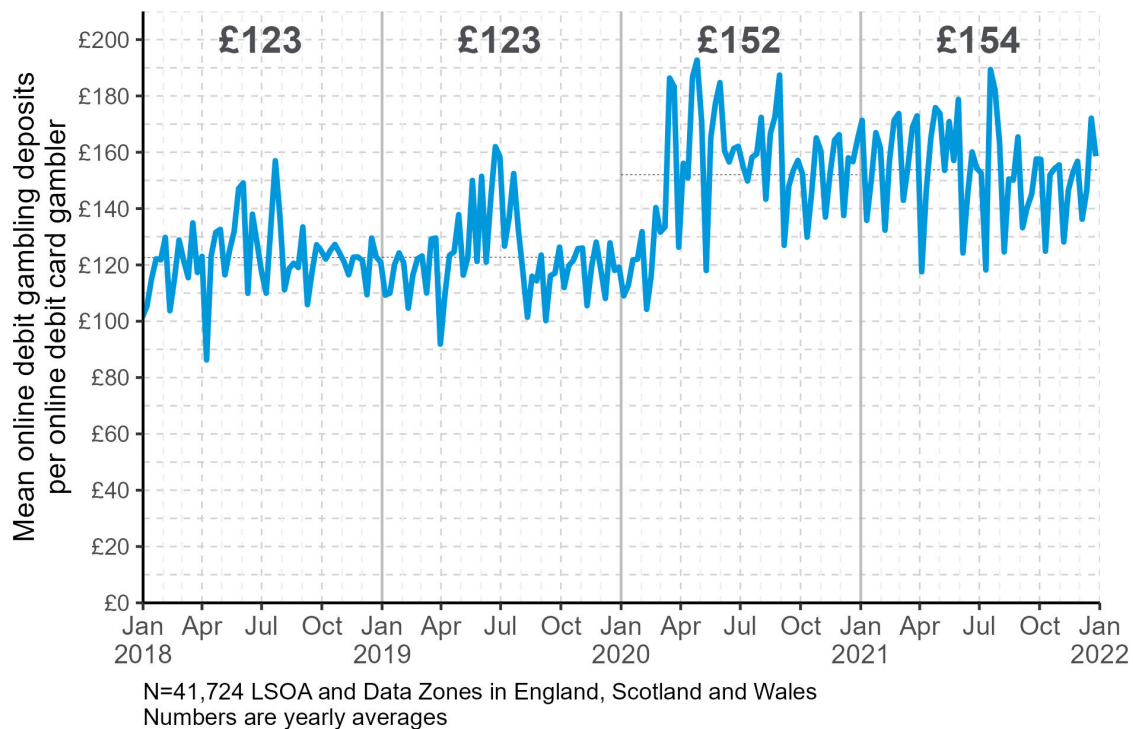
Figure 6: Decomposition of Gambling Budget Share, by week



Despite the increase in the number of people using their debit card to gamble online, the average weekly gambling spend among those gambling online has also increased by approximately £30 between 2018 and 2021 as shown in Figure 7. In 2021, gambling sales online with a debit card averaged £154, compared to £123 in 2018.

In BIT (2021b), for those with a gambling transaction between March 2019 and February 2020, weekly gambling spend averaged £62 in weeks with at least some gambling spend across March 2016 to February 2020. The difference is likely due to our sample removing the national lottery (which are more likely to be low value transactions), the period covered being different, the BIT (2021b) estimate covering all gambling channels - not just online - and the HSBC UK consumers being richer than average. We are not aware of any comparable estimates on the intensity of online gambling spend.

Figure 7: Average weekly gambling sales among customers with any online debit-card gambling spend, by week

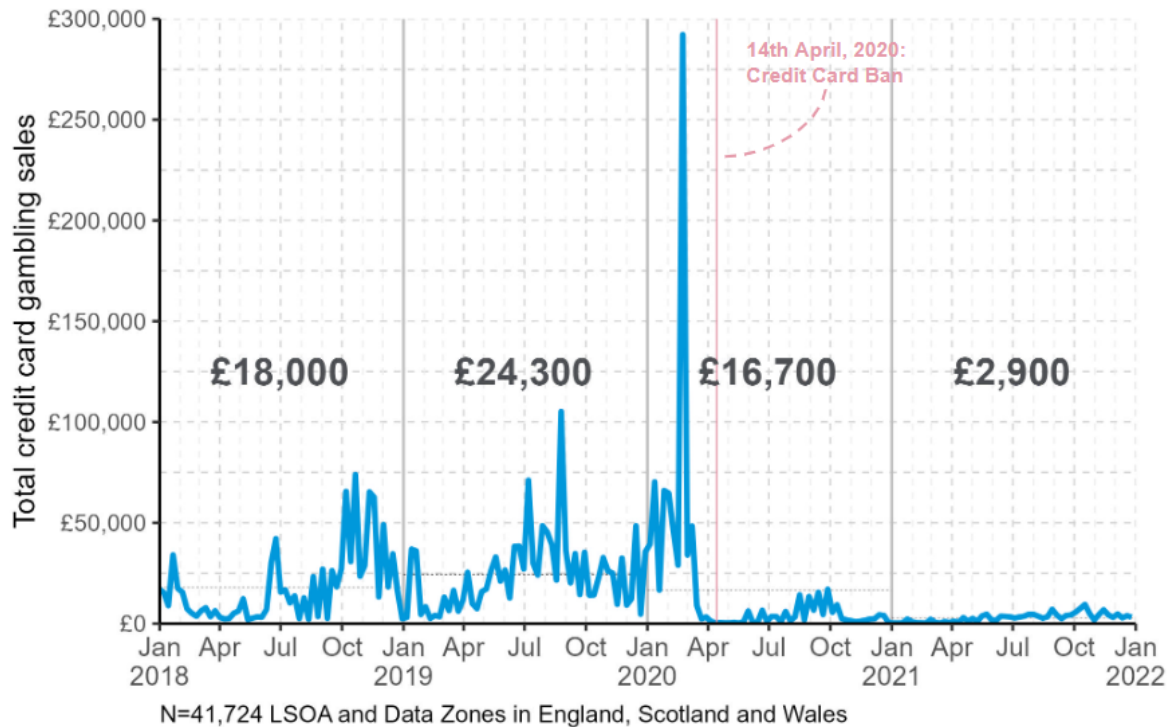


Since we have access to data on the volume of credit card gambling sales during the period the gambling commission banned credit cards to deposit gambling (April 14th, 2020) we can also examine the relative difference in credit card gambling before and after the ban. Figure 8 shows that average credit card gambling spend fell from £24,500 per week before the ban to £3,350 per week after and has remained consistently low³². There are a number of reasons

³² Also noticeable in Figure 8 is that the week commencing 23rd February 2020 saw a total of £292,000 spent on credit card gambling, nearly three times larger than the next largest spending week. This spike is explained by a small number of extremely large transactions occurring in that week. There are 5 transactions which account for more than £222,000 of the £292,000 spent that week, and one single transaction that is larger than more than 95% of other weeks.

why credit card gambling may still be occurring on a British credit card after the ban, for example the ban doesn't cover using a British credit card to gamble in another country. So overall compliance to the credit card ban seems very high.

Figure 8: Total credit card gambling sales, by week



5.2 The geographic distribution of gambling in Britain

Summary:

1. The English and the Scottish have a similar gambling budget share, gambling 3.4p in every pound of card spend, while the Welsh gamble the least at 2.9p per pound.
2. All three nations experienced an increase in gambling budget share during the pandemic, due to large increases in gambling sales rather than the reduction in consumption.
3. The North East of England is the region with the highest propensity to gamble in Britain.
4. Local Authority Districts, who control licensing of offline gambling venues in Britain, show large variation in gambling budget shares that is correlated with deprivation.

One huge advantage of our data in comparison with many other sources is our ability to observe where people who gamble are resident across Britain. In this section we present results exploiting this information to see where in Britain people gamble more/ less and how this compares to overall consumption spending. We explore gambling across nations, regions and local authorities.

We focus primarily on the ratio of gambling to overall consumption in this section because it means the results are less likely to be influenced by differences in the populations of card users across areas in our data.

5.2.1 Gambling across the nations of Britain

Across the four years of our data, cards with a registered address in England and Scotland spent 3.41% and 3.37% of their card consumption on gambling, compared to less than 2.86% in Wales.

Each of the three nations experienced an increase in the share of consumption allocated to gambling over the period. Most of this increase occurred between 2019 and 2020, driven by substantially higher growth in gambling sales compared to consumption (as can be seen in Figure 10). This is consistent with the previous evidence for the whole of Great Britain, Figure 6.

Figure 9: Gambling budget share, by country

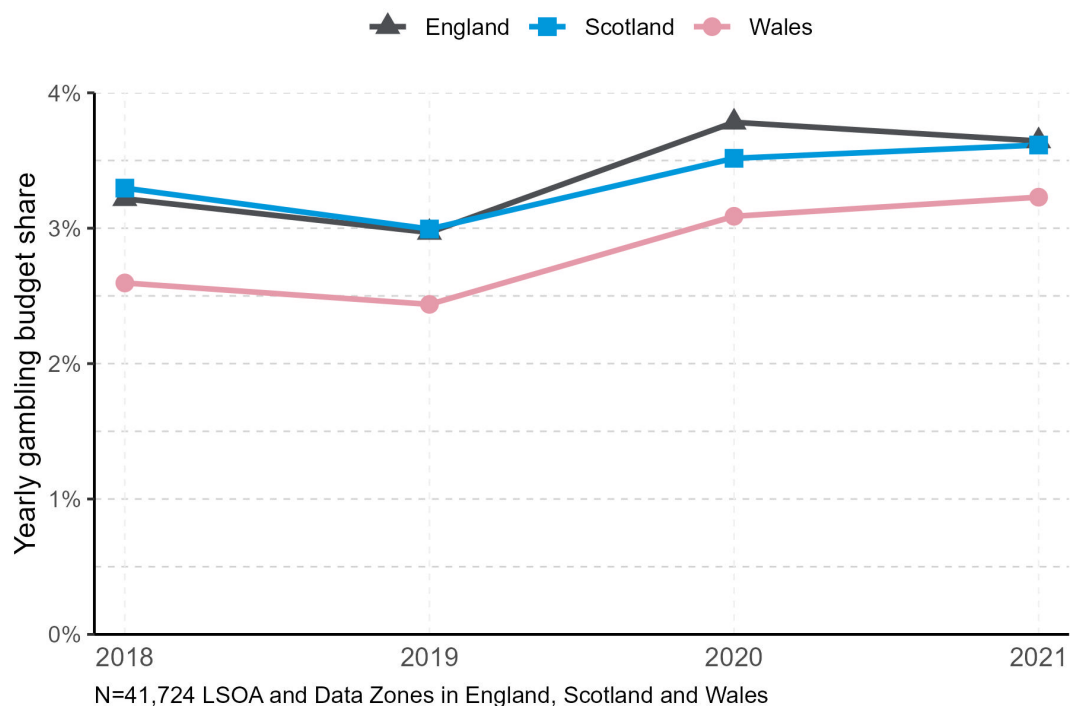
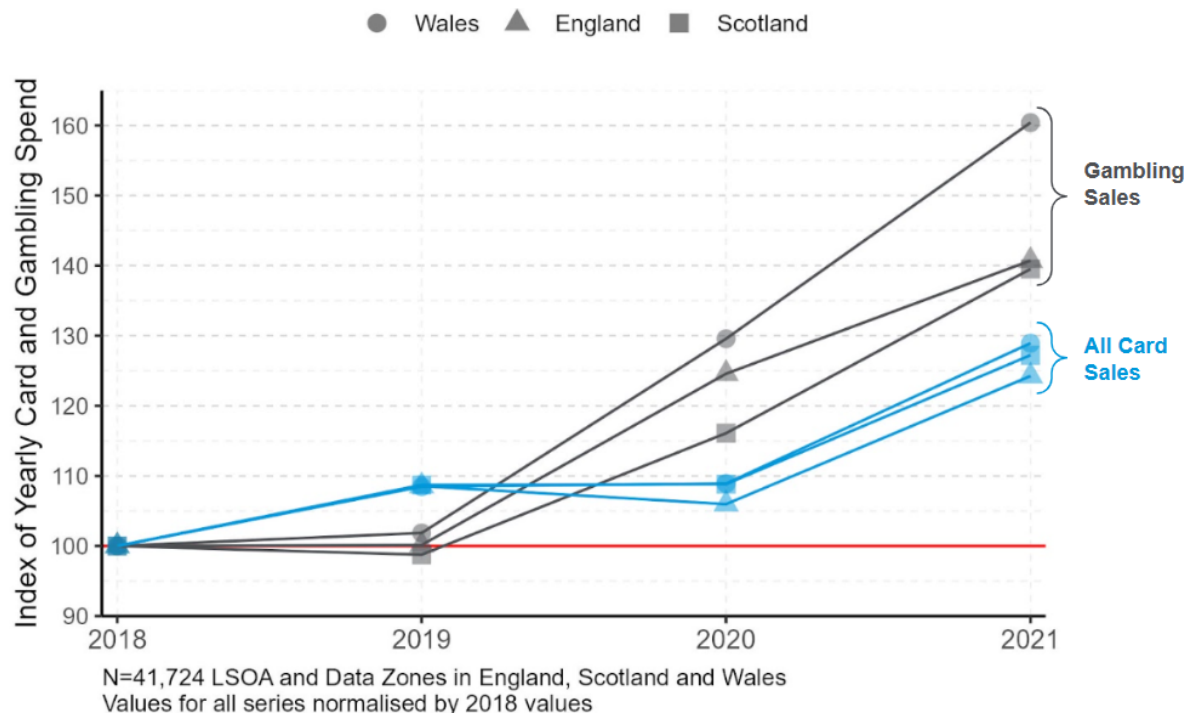


Figure 10 also shows that in our data, total gambling sales in Wales were 60% higher in 2021 compared to 2018, compared to approximately 40% for England and Scotland. In section 5.3.1 we show that the increased gambling share is concentrated in the most deprived fifth of addresses in Britain.

Figure 10: Index of overall and gambling sales, by country-year

5.2.2 Gambling across the regions of Britain

In 2021, the region³³ of Britain with the highest gambling sales as a percentage of card consumption in our sample was the north east of England at 5.0%, with the lowest in the South West of England at 2.8%. This is consistent with results on the prevalence of gambling by region from the Health Survey for England in 2021 (NHS Digital, 2021b). Figure 11 illustrates the distribution of gambling budget share across regions for 2021.

Figure 12 explores the change in gambling budget share over time within regions. Every region in Britain saw an increase in gambling sales as a fraction of all card spending between 2019 and 2020. Whereas London returned to pre-pandemic levels of gambling sales in 2021, the North East persisted at the elevated 2020 levels in 2021.

London's larger fall in gambling budget shares between 2020 and 2021 is driven by total gambling sales growing at a slower rate than other regions in Britain. In 2021, London's total gambling sales were 5% higher than 2020, compared to at least 11% year-on-year increases for other regions.

³³ NUTS I regions, see Appendix A for details

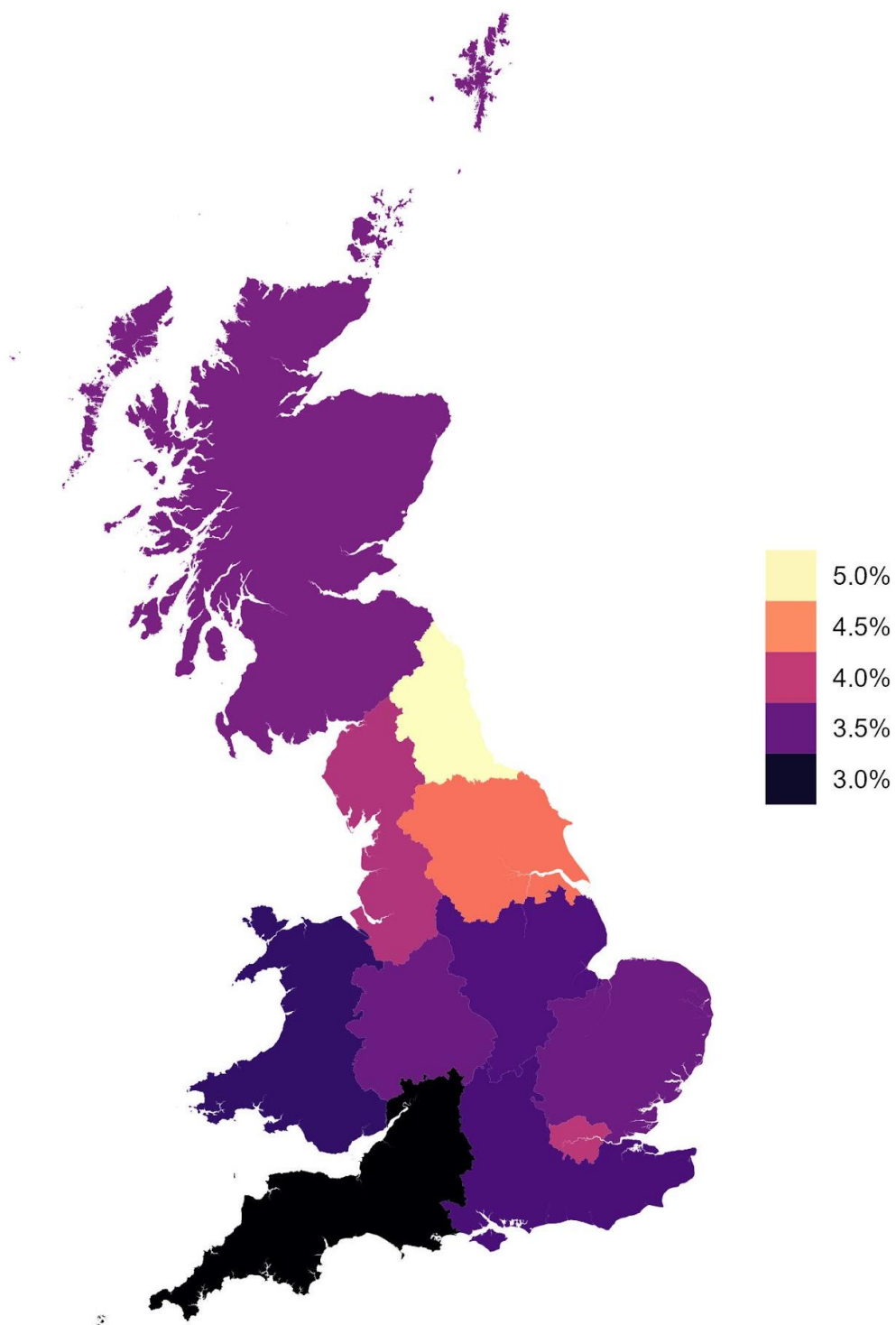
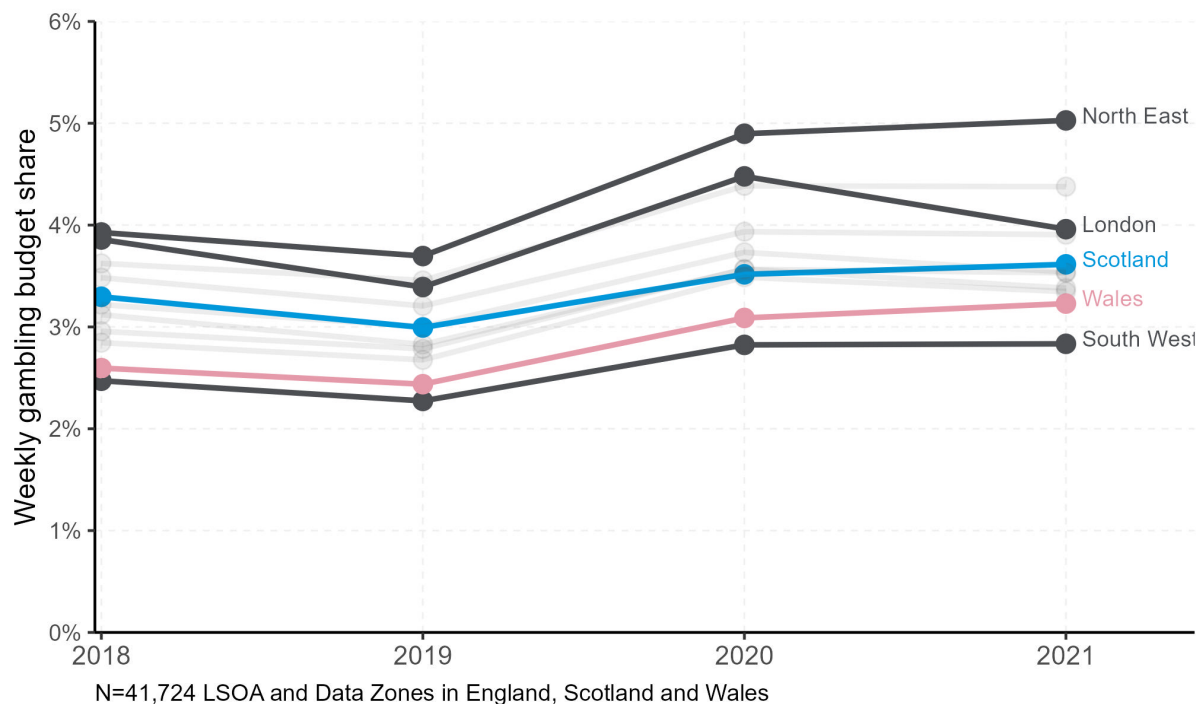
Figure 11: Regional gambling budget share in 2021

Figure 12: Regional gambling budget share by region-year

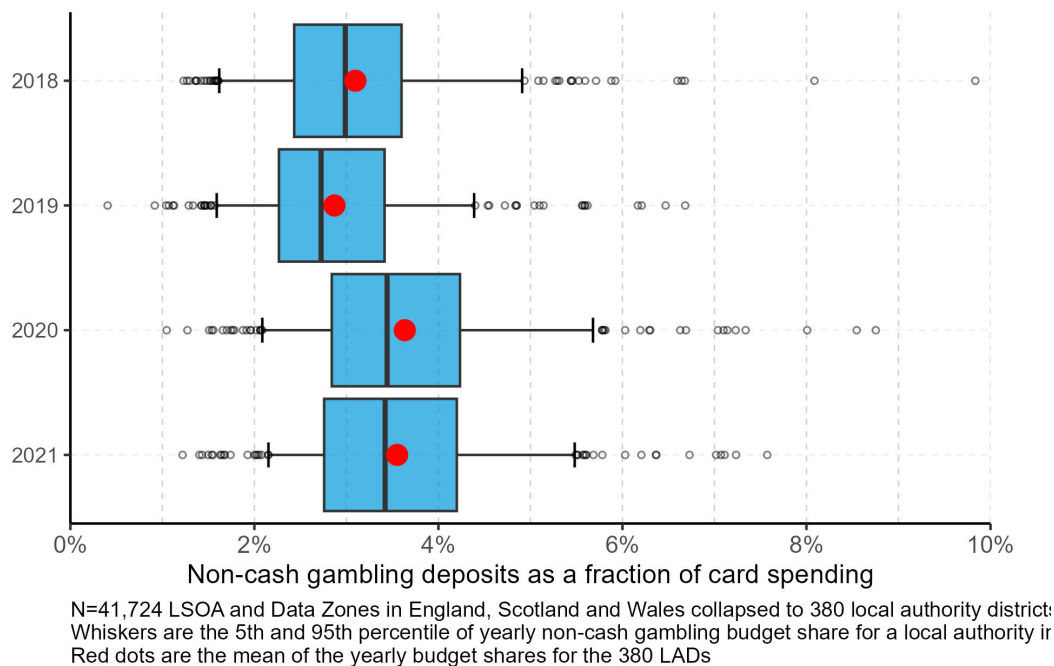
5.2.3 Gambling across Local Authorities

Given the size and coverage of our dataset we are also able to explore gambling at smaller levels of geographic disaggregation. Key amongst these in the UK context is a local authority. Local authorities are the level at which much of the gambling regulation, especially licensing of in-person gambling premises, occurs, see section 3.3 for more detail.

Overall there is substantial variation in the share of gambling sales in total consumption at the local authority level. In 2021 this ranged between around 1% and 8%. Figure 13 shows the variation in gambling budget share across years is fairly consistent, although now centred around a higher mean.

Within this overall variation in gambling budget share, the rankings of local authorities are highly persistent. The spearman rank correlation ranges from 0.83-0.88 when comparing a budget share one year ahead, 0.77-0.78 when looking two years ahead and 0.74 when looking three years ahead.

Figure 13: Distribution of gambling budget share across local authority districts, by year



5.3 Regression results

We now describe the results from the regression analysis described in Section 4.2. Table 2 shows the results of the main regression specification for each outcome, using data for 2021. Estimated effects are converted into interpretable units (percentage-point terms for proportion outcomes and absolute terms in GBP for spending outcomes) by applying them to the reference-group mean. See Appendix B for full regression results and Appendix C for robustness checks.

These results do not exploit exogenous variation in the covariates so the coefficients do not permit a causal interpretation. Instead they should be interpreted as the strength of the association between variables.

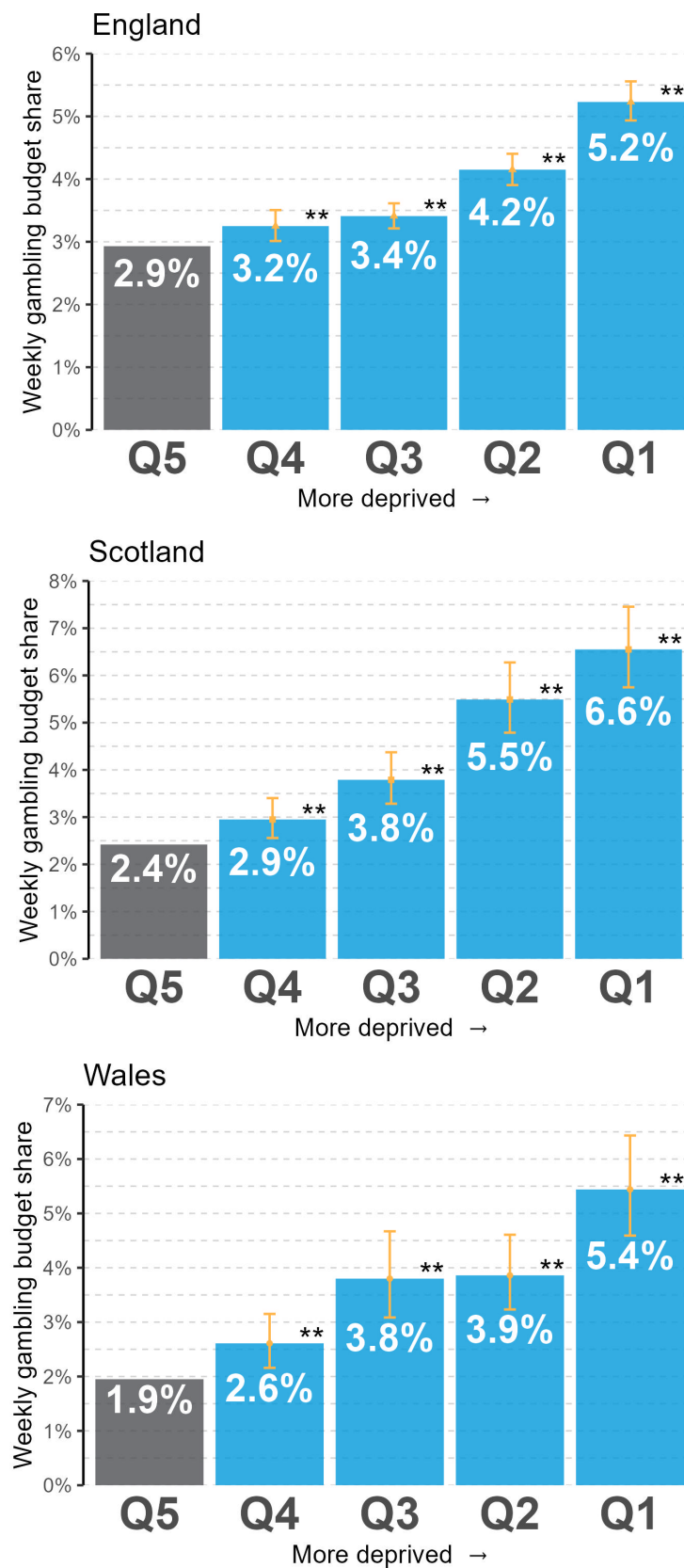
We describe the relationships highlighted by these results in more detail, and provide other contextual non-regression results, in the subsections which follow.

Table 2: Regression results - main specification

	(1)	(2)	(3)	(4)
<i>Outcome</i>	Gambling spend as a proportion of total spend - online and offline activity, debit and credit cards	Proportion of cardholders with any gambling spending - online debit only	Average weekly gambling spend per gambling customer - online debit only	Proportion of gambling spend which is online - online and offline activity, debit and credit cards
<i>Model</i>	Quasibinomial	Quasibinomial	Poisson	Quasibinomial
<i>Weights</i>	Total spend	Number of cards with any spending	Number of gambling customers	Gambling spend
<i>Outcome units</i>	%	%	£	%
<i>Gender (reference: male)</i>	5.76	12.89	163.96	94.76
<i>Gender: not male</i>	-4.10**	-8.50**	-37.33**	2.72**
<i>Age (reference: 25-44)</i>	4.31	9.41	138.11	96.61
<i>Age: 18-24</i>	-0.78**	0.10	-52.60**	1.77**
<i>Age: 45-64</i>	-0.52**	-1.50**	41.58**	-2.02**
<i>Age: 65+</i>	-2.15**	-4.24**	16.49**	-5.43**
<i>Country * IMD quintile (reference: England * IMD quintile 5)</i>	2.93	6.14	187.23	95.83
<i>Country: England * IMD quintile 1</i>	2.30**	5.03**	-42.60**	-2.09+
<i>Country: England * IMD quintile 2</i>	1.22**	2.68**	-32.92**	-0.51
<i>Country: England * IMD quintile 3</i>	0.48**	1.44**	-31.74**	-0.87
<i>Country: England * IMD quintile 4</i>	0.32**	0.82**	-17.78**	-1.24
<i>Country: Scotland * IMD quintile 1</i>	4.15**	11.80**	-73.19**	-0.12
<i>Country: Scotland * IMD quintile 2</i>	3.01**	8.70**	-66.01**	-0.44
<i>Country: Scotland * IMD quintile 3</i>	1.18**	4.92**	-64.20**	1.16

<i>Country: Scotland * IMD quintile 4</i>	0.27	3.46**	-71.24**	1.10
<i>Country: Scotland * IMD quintile 5</i>	-0.30	1.48**	-58.54**	0.07
<i>Country: Wales * IMD quintile 1</i>	2.89**	6.56**	-47.37**	0.64
<i>Country: Wales * IMD quintile 2</i>	1.21**	3.77**	-56.40**	0.20
<i>Country: Wales * IMD quintile 3</i>	1.15**	2.58**	-31.02+	0.81
<i>Country: Wales * IMD quintile 4</i>	-0.13	1.26**	-55.16**	0.89
<i>Country: Wales * IMD quintile 5</i>	-0.83**	0.71**	-77.00**	-1.78
<i>Ethnicity (share of population that is non-white) quintile (reference: quintile 1)</i>	3.05	9.07	119.81	97.11
<i>Ethnicity quintile 2</i>	0.40**	0.15*	9.41**	-0.52+
<i>Ethnicity quintile 3</i>	0.69**	0.30**	14.07**	-1.61**
<i>Ethnicity quintile 4</i>	0.83**	-0.24**	24.16**	-1.37**
<i>Ethnicity quintile 5</i>	0.79**	-2.11**	47.53**	-2.86**
<i>Has no premise in at least one week in 2021</i>	3.50	8.09	150.53	95.58
<i>Has at least one premise</i>	0.27**	0.08	6.43*	-0.67
<i>Observations</i>	14,189,697	13,574,547	4,771,988	4,912,589
<i>Number of unique LSOAs</i>	41,724	41,724	41,605	41,635

Note: Reference-group means are shown in cells shaded grey. Estimated effects are converted into interpretable units (percentage-point terms for proportion outcomes and GBP for spending outcomes) by applying them to the reference-group mean. Region and week fixed effects are used in all regressions. Standard errors are clustered by LSOA. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Figure 14: Gambling budget share by index of multiple deprivation quintile, 2021

Exploratory analysis. ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$

Q5 is least deprived, Q1 most deprived.

N = 41,724 LSOAs in England, Wales and Scotland. 2021 only.

Error bars are covariate-adjusted 95% confidence interval for other IMD quintiles versus least deprived

5.3.1 Gambling and deprivation

Summary:

1. The gambling budget share is 2-3 times higher in the most deprived LSOAs compared to the least deprived LSOAs.
2. Gambling budget shares, as measured by our data, have grown faster in the most deprived LSOAs, especially in Wales.

Gambling budget shares are higher in more deprived LSOAs (i.e. those with a lower IMD), holding other characteristics constant. This applies in England, Scotland and Wales. In England, gambling budget shares are almost twice as high in the most deprived quintile of LSOAs compared to the least deprived (5.2% vs. 2.9%, $p < 0.01$). In Scotland and Wales, it is almost three times as high (6.6% vs. 2.4%, $p < 0.01$ for Scotland; 5.4% vs. 1.9%, $p < 0.01$ for Wales).

Column 2 of Table 4 shows that, controlling for other characteristics, the proportion of cardholders with any online debit-card spend who also gamble (online and with a debit card) in a given week is highest in the most deprived LSOAs. Cardholders are nearly twice as likely to gamble if they are in the most deprived LSOAs compared to being in the least deprived LSOAs (11% vs 6% for England).

Consistent with a larger share of cardholders gambling and lower average incomes, the average weekly online debit-card gambling spend for those who gamble is £42 (29%) lower in England's most deprived fifth of LSOAs versus its most affluent fifth. However, this relationship is less pronounced in Scotland and reversed in Wales (the most affluent fifth who gamble spend £29 less than the most deprived).

Furthermore, as shown in Figure 15, gambling's share of total spending has increased more in the most deprived LSOAs versus the least deprived LSOAs from 2018-21. Specifically, gambling budget share in the most deprived LSOAs (quintile 1) has increased markedly in England (from 4.4% to 5.7%), Wales (from 3.9% to 5.8%), and in Scotland (from 5.6% to 6.3%). Gambling budget share has stayed roughly the same in the 60% least deprived LSOAs (quintiles 3, 4 and 5) in England and Scotland, and in the 40% least deprived LSOAs (quintiles 4 and 5) in Wales. The other quintiles have seen modest growth in gambling budget share.

This increase in gambling budget share could be the result of deprived areas experiencing larger increases in their gambling spending, or through larger reductions in consumption. Combining IMD quintiles across nations in Figure 16, we find that gambling budget share is higher because of disproportionately large increases in gambling sales in the most deprived areas of Britain. Gambling spend is 65% higher in 2021 than 2019 for the most deprived fifth of areas in each nation compared to 30% higher for the least deprived.

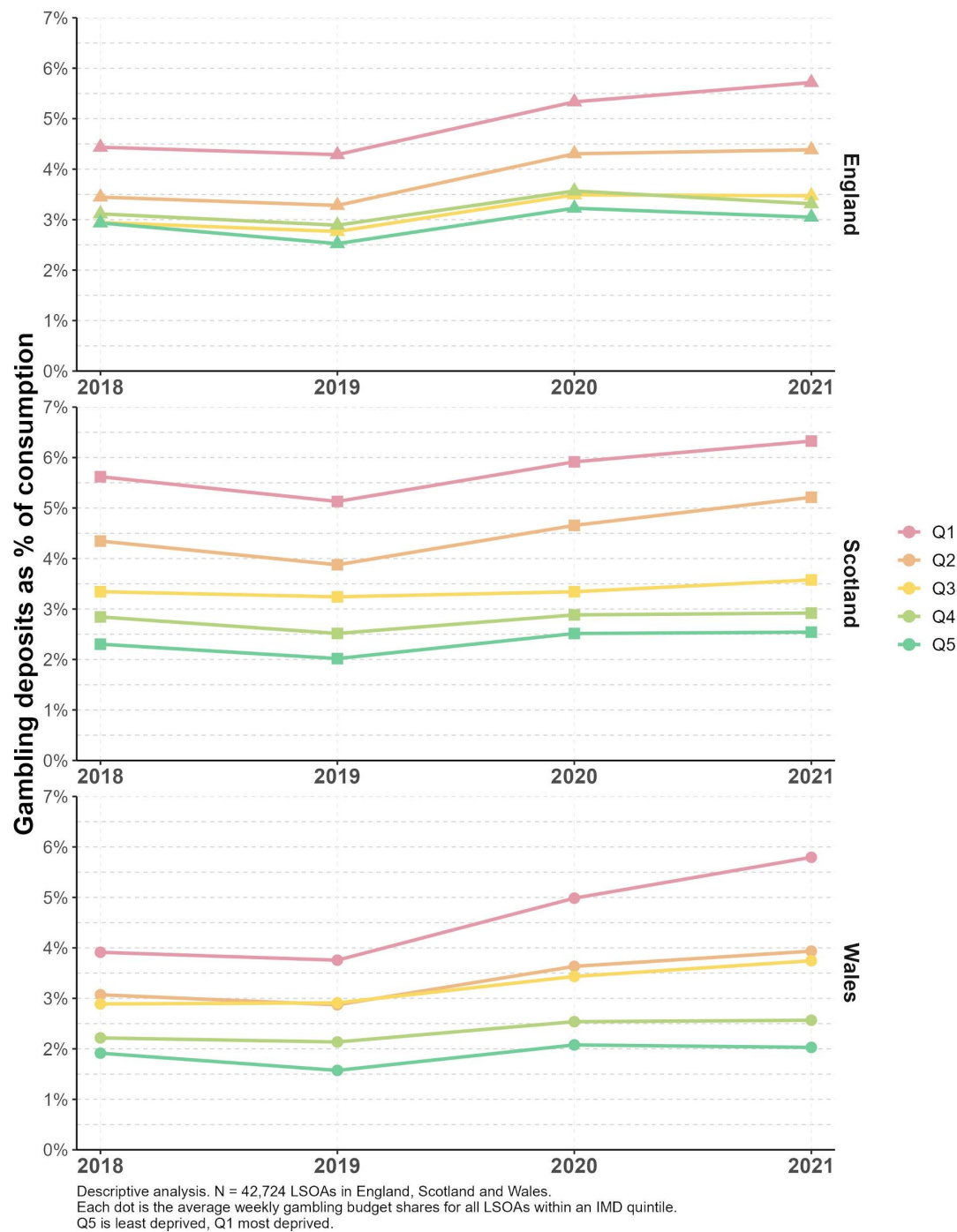
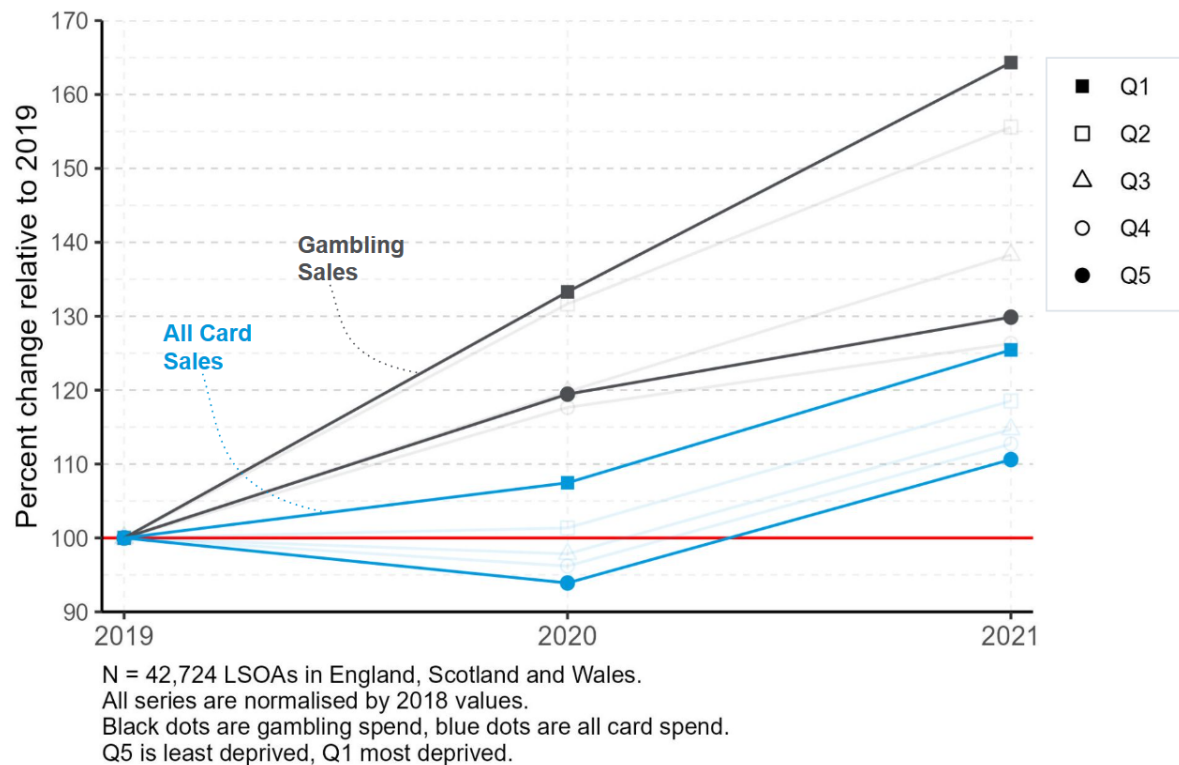
Figure 15: Gambling budget share by index of multiple deprivation quintile, by year

Figure 16 also shows an increase in non-cash consumption by 7% in the most deprived fifth of LSOAs between 2019 and 2020 compared to a 5% fall for the least deprived fifth. This may be due to a larger switch from cash to card spending in more deprived areas, as prior to the pandemic those on lower incomes used cash for a greater share of their consumption (Access to Cash Review, 2019; RSA, 2021). It is possible that this same phenomenon explains some or all of the relative increase in observed gambling in our data. If more deprived areas were more likely to see cash gambling prior to the pandemic then this relative increase in card-based gambling could be consistent with the relative level of gambling budget share remaining unchanged. This relative change could therefore be a shift away

from more in-person type gambling to more online gambling. We cannot distinguish between these two explanations with the data we have. Although we do observe that the percentage of gambling performed online in our data is roughly constant across IMD deciles (Column 4 of Table 4).

Figure 16: Decomposition of gambling budget share by IMD Quintile across all home nations



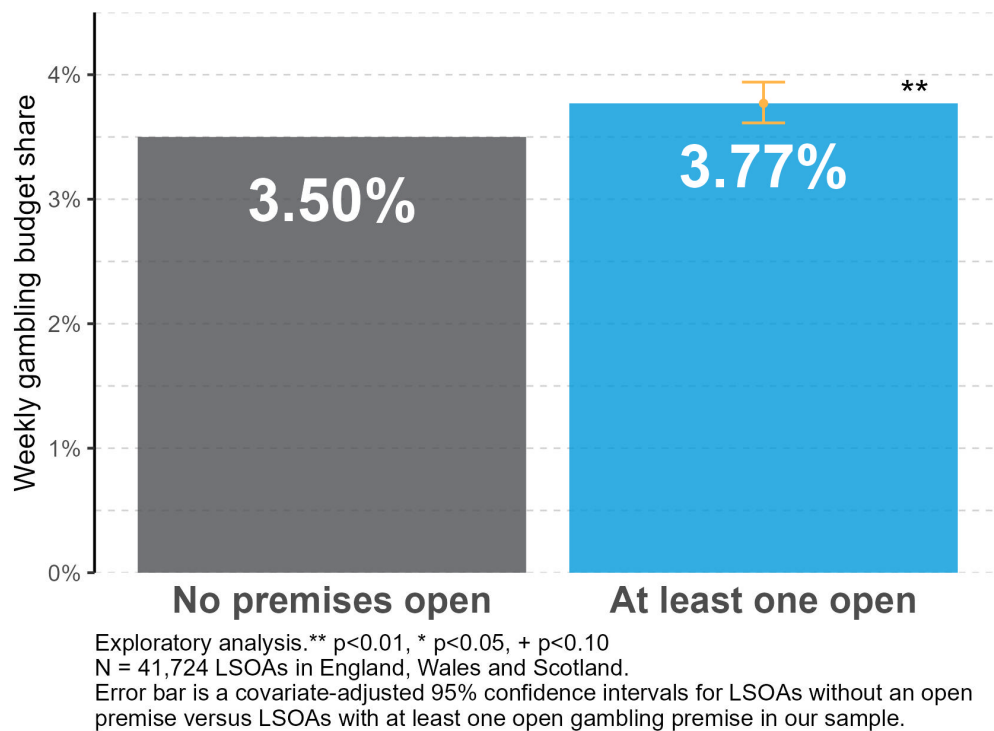
5.3.2 Gambling and licensed premises

Summary:

1. Gambling budget share is higher in LSOAs with at least one gambling premise, but there is no detectable difference in the share of gambling spending done online.

Controlling for other covariates including deprivation, the presence of a physical gambling premise in an LSOA is associated with an increase ($p < 0.01$) of 0.27pp in the budget share spent on gambling (vs. a baseline of 3.50%) by cardholders in that LSOA. It is likely both that betting shops are located in areas where people gamble more, and that having a gambling shop nearby increases the likelihood and amount people gamble. This result therefore cannot speak to the extent to which gambling venues are *causing* additional gambling, but just that they're correlated with more gambling.

Figure 17: 2021 gambling budget share by whether an LSOA has at least one open gambling premise during 2021.



One might also expect that the presence of a licensed premises might not just be associated with overall gambling spend but also the type of gambling spend. However, there is no evidence for this in our data. The share of gambling spend which is online is not significantly lower in LSOAs with a physical gambling premises in 2021 compared to one without (94.91% vs. 95.58% respectively, $p > 0.1$). There is also no difference in the proportion of online debit card users who gambled (online with a debit card) in LSOAs with at least one gambling premise open in 2021.

However, given the gambling budget share is higher in LSOAs with a licensed premises and the share of gambling spend that is online is similar across LSOAs with and without a premises, it must be that card spending on gambling is higher both online and offline in areas with a gambling premises. In Table 4, column 3, there is suggestive evidence that having a gambling premise in an LSOA is associated with a small increase in (online debit-card) gambling spend per week among customers who gamble (roughly £6 on a baseline of £151, $p < 0.1$). Similarly, in our data, average offline gambling spend is higher in LSOAs with at least one gambling premises (£1,809 vs £1,262 in 2021). These results are consistent with the previous literature on availability of gambling options being correlated with gambling spend (Badji et al., 2023), although our analysis looks at the impact of physical premises on an online distribution channel due to problems observing cash gambling.

5.4 Gambling and demographic characteristics

Summary:

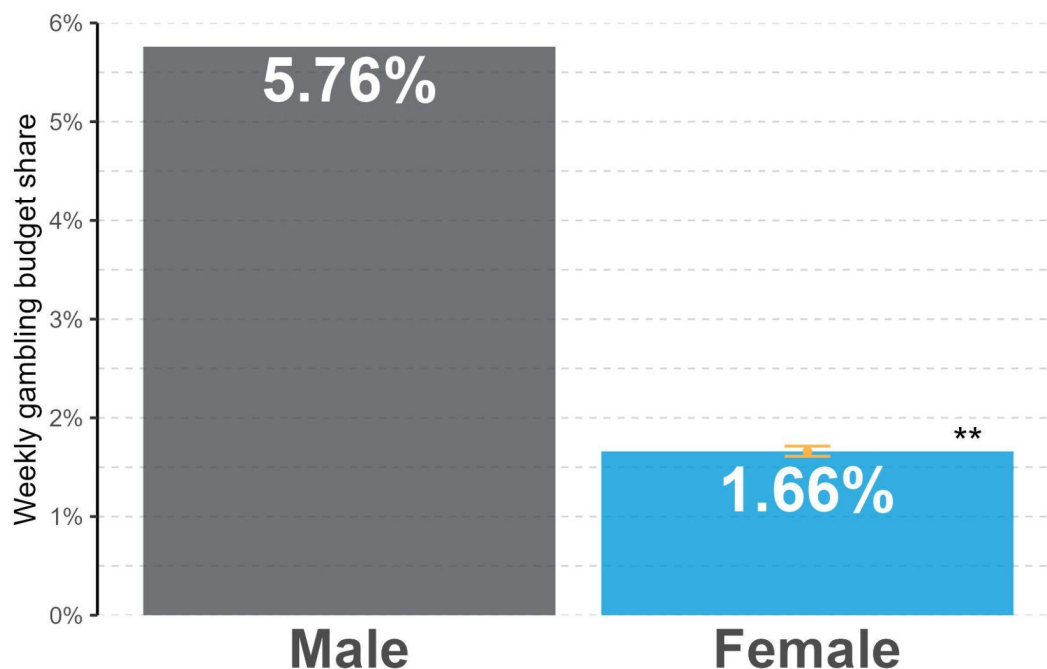
1. Men spend almost 3.5 times as much on gambling as women as a proportion of total consumption.
2. Areas with a higher share of non-white residents, after controlling for deprivation, gamble more as a percentage of non-cash consumption.
3. There is an inverted-U-shaped relationship between age and gambling budget share, though our data setup makes us less certain about our age relationships (see section 4's discussion for details).

This section examines the association between gambling and a number of demographic characteristics. We explore how gambling behaviour is related to gender and age of the cardholder at the individual level. Then, due to data limitations, how gambling behaviour at the LSOA level is related to the ethnicity at the LSOA level.

5.4.1 Gender

Women's gambling share as a proportion of total spend is 1.66%, whereas for men of comparable age and LSOAs the share is 5.76% - roughly 3.5 times higher ($p < 0.01$). This is not explained by differences in overall spend between men and women. Average weekly household spending (online debit card spend among those who spend anything in a given week) is relatively similar for men and women, at £128 and £126 respectively. The large difference in gambling budget shares is due to a difference in absolute gambling spend.

Figure 18: 2021 gambling budget share by gender of the cardholder.



Exploratory analysis. ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$

N = 41,724 LSOAs in England, Wales and Scotland. 2021 only.

Error bar is a covariate-adjusted 95% confidence interval for females versus males

This large difference in gambling share is present despite men being much more likely to gamble than women. Among customers who used a debit card online, men are almost three times more likely to have gambled (4.39% for women vs. 12.89% for men, $p < 0.01$). In addition, those men who gamble spend more on average than females who gamble. Among cardholders who have at least one online debit-card gambling transaction in a given week, average spending is 23% lower for women compared to men ($p < 0.01$).

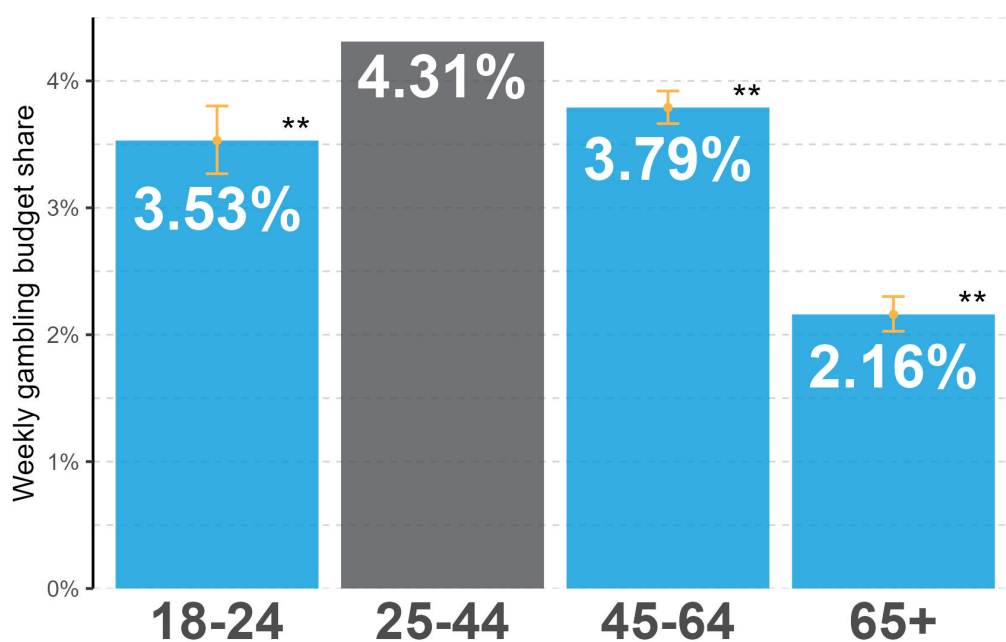
Men also seem to engage in a different portfolio of gambling than women. For example, after accounting for age and other LSOA-level characteristics, the share of gambling spend that is online for men is around double that for women (2.52% vs. 5.24%, $p < 0.01$).

Our results are consistent with a large body of literature that, all else equal, men gamble more intensely than women (Bastiani et. al, 2013; Christensen et al., 2015; Grönroos et al., 2021; Guerra et al., 2022, Castrén et. al, 2018; Salonen et al., 2018). BIT's work with HSBC UK also showed men to be over-represented in groups with higher gambling sales as a percentage of disposable income.

5.4.2 Age

When comparing individuals with the same gender and LSOA-level characteristics, there is an inverted-U-shaped relationship between age and gambling spend as a proportion of total spend. Gambling budget share peaks in the 25-44-year-old group (4.31%). Compared to this reference group, the 18-24 group has a somewhat lower gambling budget share (3.53%, $p < 0.01$), as does the 45-64 group (3.79%, $p < 0.01$); the 65+ group has a considerably lower gambling budget share (2.16%, $p < 0.01$).

Figure 19: 2021 gambling budget share by age of the cardholder.



Exploratory analysis. ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$

N = 41,724 LSOAs in England, Wales and Scotland. 2021 only.

Error bar is a covariate-adjusted 95% confidence interval for other age categories versus 25-44

In contrast to this U-shape, the proportion of cardholders who gamble in a given week (examining online debit-card spending only) is decreasing in age. Although, this proportion is only slightly higher for 18-24-year-olds compared to 25-44-year-olds, and the difference is not statistically significant (9.51% vs. 9.41%, $p > 0.1$). Consistent with this the proportion of gambling spend which is online is highest in the 18-24 year-olds and strongly decreasing in age. However, we caution against interpreting the results for the youngest age group too strongly in light of the sample restrictions in our data, as described in Section 3.4 above. The 18-24-year-old group consists of individuals who were 16-22 in the final week of our data and 12-18 in the first week of our data, and who used the card in the year immediately following January 2018. As a result, individuals in this age group are unlikely to be representative. The use of other characteristics in the regression will not fully account for this. It is, however, broadly aligned with BIT's previous results using HSBC banking data (covering March 2016 - February 2020). In that study we found that those aged 31-40 were the most likely to have high levels of gambling sales as a fraction of disposable income, but that those aged 18-30 were also overrepresented in the most concerning groups of gamblers.

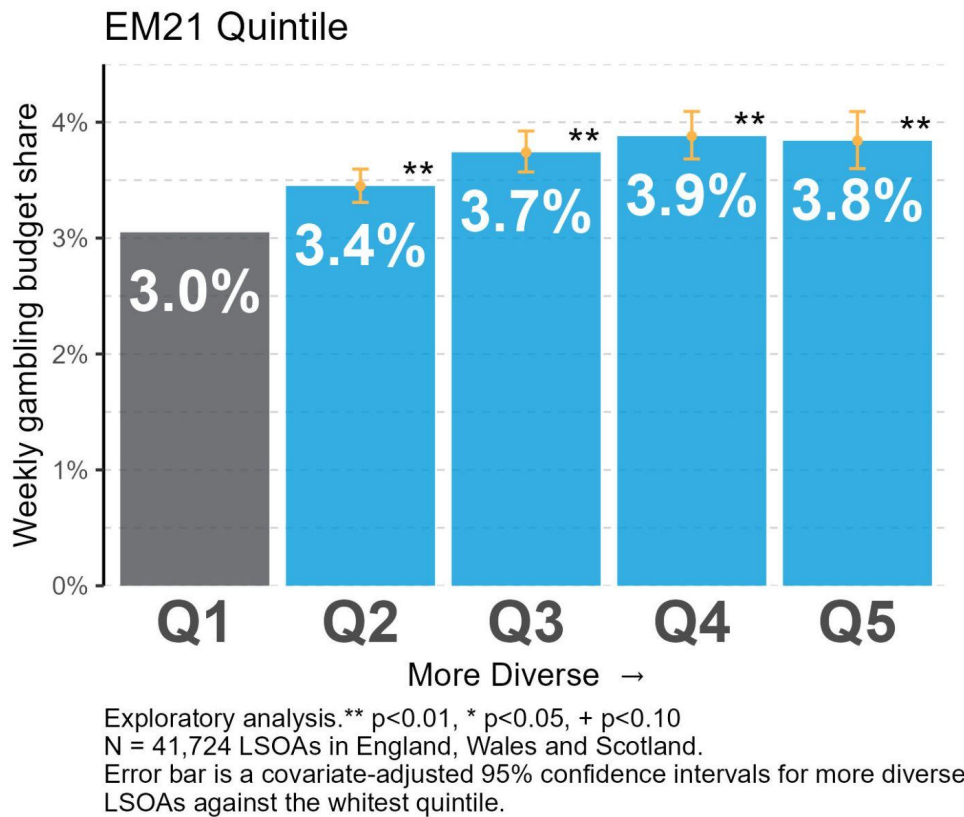
While 18-24 year-olds appear most likely to gamble online in a given week, when they do so they spend less than those in other age groups. Among those who gamble online using a debit card in a given week, average gambling spend per person is increasing in age up to the oldest age group: it is lowest for the 18-24 group (£53 less than the £138 baseline for 25-44-year-olds, $p < 0.01$) and is highest for 45-64-year-olds (£42 more than the baseline, $p < 0.01$).

5.4.3 Ethnicity

Unlike for age and gender we lack individual cardholder data on ethnicity. Thus to examine the relationship between gambling behaviour and ethnicity we use estimates of the ethnicity of LSOA populations from the ONS. Specifically we use 2021 estimates of the percentage of an LSOA population that is non-white and categorise this into quintiles. For an LSOA to be in the bottom quintile by this measure it must have had a non-white population share below 2.9%, to be in the top quintile it must have had a non-white population share above 29.4%.

After controlling for other characteristics, including deprivation, gambling budget share is lowest for LSOAs with relatively smaller ethnic minority populations, 3%. While more diverse LSOAs have higher gambling budget share, peaking at 3.9% in the fourth quintile. However, the third, fourth and fifth quintiles all have similar average budget shares. Similarly there is a clear positive relationship between average gambling spend among those who gamble and ethnic minority quintile. However, this increased gambling spend is less likely to occur online in LSOAs in higher quintiles, as the proportion of gambling spend online is significantly lower in more diverse LSOAs. The proportion of cardholders with any spending who gambled (looking at online debit-card spend only) is also significantly lower in more diverse LSOAs.

Figure 20: 2021 gambling budget share by the quintile of the proportion of ethnic minorities living in a given LSOA.



Overall, individuals in LSOAs with a larger share of non-white residents are less likely to gamble online, spend less money online as a share of all gambling spend, have a higher gambling budget share and spend more money on gambling on average than individuals in less diverse LSOAs. These correlations are consistent with LSOAs in higher quintiles of non-white population share having fewer people gambling, but those who gamble doing so more intensively.

6. Conclusion and discussion

In this paper we have documented a number of novel stylised facts of gambling in Britain and confirmed findings from other studies using a much larger sample. The geographic spread of our data reveals important variation in gambling intensity across Britain. We document important correlates of gambling behaviour at a local level including deprivation, ethnicity, and licensed premises locations. Areas tend to have more gambling spending as a share of total consumption if they are more deprived, have a higher share of ethnic minority residents, and have at least one licensed gambling premises.

In addition to these cross-sectional comparisons we also detail how these characteristics relate to changes in gambling over time, including that recent increases in gambling spend

as a percentage of total spend are highest in the most deprived areas. It is important for future work to determine if this is an increase in overall gambling in more deprived areas, or changing patterns of gambling.

Cards are already the dominant payment method across all consumption spending in Britain. Increasingly, this is also becoming true within the gambling sector. This trend gives researchers new opportunities to investigate gambling at an individual level for large samples, or even whole populations. This paper is an initial exploration of what is possible to understand about gambling in Britain using card transaction data. However, we recognise the huge potential for further work in this area. We hope that our work inspires other researchers and data owners to overcome the often considerable legal challenges involved in sharing these types of data.

The value of card data in examining gambling behaviour is only going to increase in light of proposed changes to regulation on gaming machines (DCMS, 2024) and the general trend towards non-cash payments. We are encouraged by progress in making these data available to researchers (see Visa data with ONS), however we hope any future data sharing will not exclude gambling spending as an available category.

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Appendix

Appendix A: Mapping LSOAs to other geographies

Table A1: Definitions of geographical areas used

Geographic Region	Notes on construction
Britain	We use all LSOAs in our data. 41,724 of the 41,729 total LSOAs.
England, Wales and Scotland	We use the country identifier contained at the beginning of 2011 LSOA codes.
Region	2011 LSOA codes were linked to NUTS-I regions via Local Authority Districts (ONS, 2017). This divides England into 8 regions, together with Wales and Scotland this gives 10 regions in total.
2011 Local Authority Districts (LAD)	We used the 2011 LADs (ONS, 2011) rather than the 2021 LADs since these were in place throughout our period. They are also generally smaller areas since there have been consolidations in the 2021 LADs. Thus we use 380 local authority districts across Britain.

Appendix B: Full regression results

Table B1: Full regression results - main analysis

	(1)	(2)	(3)	(4)
<i>Outcome</i>	Gambling spend as a proportion of total spend	Proportion of cardholders with any gambling spending - online debit only	Average weekly gambling spend per gambling customer - online debit only	Proportion of gambling spend which is online
<i>Model</i>	Quasibinomial	Quasibinomial	Poisson	Quasibinomial
<i>Weights</i>	Total spend	Number of cards with any spending	Number of gambling customers	Gambling spend
<i>Intercept</i>	-2.700** (0.050)	-2.145** (0.013)	5.226** (0.044)	7.649** (0.432)
<i>Gender (reference: male)</i>	5.76	12.89	163.96	94.76
<i>Gender: not male</i>	-1.286** (0.016)	-1.170** (0.005)	-0.258** (0.015)	0.763** (0.086)
<i>Age (reference: 25-44)</i>	4.31	9.41	138.11	96.61
<i>Age: 18-24</i>	-0.209** (0.040)	0.012 (0.013)	-0.479** (0.038)	0.757** (0.134)
<i>Age: 45-64</i>	-0.134** (0.018)	-0.191** (0.005)	0.263** (0.017)	-0.489** (0.111)
<i>Age: 65+</i>	-0.713** (0.033)	-0.645** (0.008)	0.113** (0.034)	-1.014** (0.096)
<i>Country * IMD quintile (reference: England * IMD quintile 5)</i>	2.93	6.14	187.23	95.83
<i>Country: England * IMD quintile 1</i>	0.605** (0.032)	0.654** (0.010)	-0.258** (0.028)	-0.428+ (0.250)
<i>Country: England * IMD quintile 2</i>	0.360** (0.032)	0.391** (0.009)	-0.193** (0.030)	-0.120 (0.164)
<i>Country: England * IMD quintile 3</i>	0.156** (0.031)	0.226** (0.009)	-0.186** (0.030)	-0.199 (0.159)
<i>Country: England * IMD quintile 4</i>	0.107** (0.040)	0.135** (0.009)	-0.100** (0.037)	-0.274 (0.282)
<i>Country: Scotland * IMD quintile 1</i>	0.926** (0.056)	1.207** (0.019)	-0.496** (0.048)	-0.031 (0.389)

<i>Country: Scotland * IMD quintile 2</i>	0.738** (0.058)	0.980** (0.018)	-0.435** (0.052)	-0.105 (0.411)
<i>Country: Scotland * IMD quintile 3</i>	0.351** (0.062)	0.642** (0.020)	-0.420** (0.057)	0.339 (0.364)
<i>Country: Scotland * IMD quintile 4</i>	0.092 (0.060)	0.485** (0.020)	-0.479** (0.055)	0.317 (0.338)
<i>Country: Scotland * IMD quintile 5</i>	-0.112 (0.077)	0.232** (0.020)	-0.375** (0.075)	0.019 (0.408)
<i>Country: Wales * IMD quintile 1</i>	0.718** (0.077)	0.799** (0.028)	-0.292** (0.065)	0.174 (0.373)
<i>Country: Wales * IMD quintile 2</i>	0.360** (0.081)	0.520** (0.028)	-0.358** (0.073)	0.051 (0.443)
<i>Country: Wales * IMD quintile 3</i>	0.343** (0.099)	0.378** (0.028)	-0.181+ (0.093)	0.225 (0.391)
<i>Country: Wales * IMD quintile 4</i>	-0.046 (0.086)	0.200** (0.028)	-0.349** (0.081)	0.249 (0.389)
<i>Country: Wales * IMD quintile 5</i>	-0.344** (0.079)	0.118** (0.027)	-0.530** (0.071)	-0.375 (0.379)
<i>Ethnicity (proportion of EMs) quintile (reference: quintile 1)</i>	3.05	9.07	119.81	97.11
<i>Ethnicity quintile 2</i>	0.127** (0.022)	0.018* (0.008)	0.076** (0.021)	-0.171+ (0.100)
<i>Ethnicity quintile 3</i>	0.212** (0.025)	0.035** (0.009)	0.111** (0.023)	-0.459** (0.172)
<i>Ethnicity quintile 4</i>	0.250** (0.028)	-0.030** (0.009)	0.184** (0.026)	-0.401** (0.132)
<i>Ethnicity quintile 5</i>	0.238** (0.034)	-0.288** (0.012)	0.334** (0.032)	-0.716** (0.135)
<i>Presence of at least one gambling premise in LSOA in at least one week in 2021 (reference: no)</i>	3.50	8.09	150.53	95.58
<i>Yes (at least one premise)</i>	0.078** (0.023)	0.010 (0.008)	0.042* (0.021)	-0.147 (0.136)
<i>Observations</i>	14,189,697	13,574,547	4,771,988	4,912,589
<i>Number of unique LSOAs</i>	41,724	41,724	41605	41,635

Note: Region and week fixed effects are used in all regressions. Clustered standard errors (by LSOA) are in brackets. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Appendix C: Robustness Checks

The results of the robustness checks specified in the text are shown below. The findings from the robustness checks below are qualitatively unchanged from the main specifications.

Table C1: Full regression results - robustness check 1 (use 18-34, 35-54 and 55+ as age categories)

	(1)	(2)	(3)	(4)
<i>Outcome</i>	Gambling spend as a proportion of total spend	Proportion of cardholders with any gambling spending - online debit only	Average weekly gambling spend per gambling customer - online debit only	Proportion of gambling spend which is online
<i>Model</i>	Quasibinomial	Quasibinomial	Poisson	Quasibinomial
<i>Weights</i>	Total spend	Number of cards with any spending	Number of gambling customers	Gambling spend
<i>Intercept</i>	-2.739** (0.049)	-2.246** (0.013)	5.396** (0.044)	7.391** (0.433)
<i>Gender (reference: male)</i>	5.76	12.89	163.96	94.76
<i>Gender: not male</i>	-1.285** (0.016)	-1.168** (0.005)	-0.256** (0.015)	0.743** (0.083)
<i>Age (reference: 35-54)</i>	4.07	8.54	162.90	95.68
<i>Age: 18-34</i>	-0.042* (0.019)	0.099** (0.005)	-0.343** (0.018)	0.338** (0.111)
<i>Age: 55+</i>	-0.356** (0.022)	-0.284** (0.005)	0.046* (0.020)	-0.431** (0.130)
<i>Country * IMD quintile (reference: England * IMD quintile 5)</i>	2.93	6.14	187.23	95.83
<i>Country: England * IMD quintile 1</i>	0.617** (0.032)	0.662** (0.010)	-0.257** (0.028)	-0.401 (0.246)
<i>Country: England * IMD quintile 2</i>	0.370** (0.032)	0.397** (0.010)	-0.192** (0.030)	-0.094 (0.166)
<i>Country: England * IMD quintile 3</i>	0.164** (0.031)	0.231** (0.009)	-0.185** (0.030)	-0.178 (0.162)
<i>Country: England * IMD quintile 4</i>	0.111** (0.040)	0.137** (0.009)	-0.099** (0.037)	-0.277 (0.286)

<i>Country: Scotland * IMD quintile 1</i>	0.949** (0.056)	1.221** (0.019)	-0.488** (0.049)	-0.020 (0.389)
<i>Country: Scotland * IMD quintile 2</i>	0.757** (0.058)	0.993** (0.018)	-0.427** (0.052)	-0.109 (0.418)
<i>Country: Scotland * IMD quintile 3</i>	0.364** (0.063)	0.652** (0.020)	-0.416** (0.057)	0.364 (0.367)
<i>Country: Scotland * IMD quintile 4</i>	0.104+ (0.060)	0.495** (0.020)	-0.477** (0.055)	0.323 (0.343)
<i>Country: Scotland * IMD quintile 5</i>	-0.106 (0.078)	0.237** (0.020)	-0.375** (0.075)	0.024 (0.422)
<i>Country: Wales * IMD quintile 1</i>	0.733** (0.077)	0.813** (0.028)	-0.297** (0.066)	0.179 (0.376)
<i>Country: Wales * IMD quintile 2</i>	0.376** (0.081)	0.531** (0.028)	-0.354** (0.073)	0.069 (0.445)
<i>Country: Wales * IMD quintile 3</i>	0.355** (0.099)	0.388** (0.028)	-0.179+ (0.094)	0.223 (0.387)
<i>Country: Wales * IMD quintile 4</i>	-0.036 (0.086)	0.208** (0.027)	-0.351** (0.081)	0.246 (0.391)
<i>Country: Wales * IMD quintile 5</i>	-0.339** (0.079)	0.122** (0.027)	-0.527** (0.071)	-0.356 (0.389)
<i>Ethnicity (proportion of EMs) quintile (reference: quintile 1)</i>	3.05	9.07	119.81	97.11
<i>Ethnicity quintile 2</i>	0.130** (0.022)	0.022** (0.008)	0.076** (0.021)	-0.174+ (0.101)
<i>Ethnicity quintile 3</i>	0.219** (0.025)	0.043** (0.009)	0.111** (0.023)	-0.451** (0.173)
<i>Ethnicity quintile 4</i>	0.261** (0.027)	-0.019* (0.009)	0.185** (0.026)	-0.392** (0.134)
<i>Ethnicity quintile 5</i>	0.250** (0.034)	-0.275** (0.012)	0.337** (0.032)	-0.701** (0.135)
<i>Presence of at least one gambling premise in LSOA in at least one week in 2021 (reference: no)</i>	3.50	8.09	150.53	95.58
<i>Yes (at least one premise)</i>	0.079** (0.023)	0.010 (0.008)	0.043* (0.021)	-0.137 (0.131)
<i>Observations</i>	12,849,392	12,685,474	4,960,661	5,096,924
<i>Number of unique LSOAs</i>	41,724	41,724	41,605	41,635

Note: Region and week fixed effects are used in all regressions. Clustered standard errors (by LSOA) are in brackets. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table C2: Full regression results - robustness check 2 (use whether IMD is above/below median rank by country in interaction with country)

	(1)	(2)	(3)	(4)
<i>Outcome</i>	Gambling spend as a proportion of total spend	Proportion of cardholders with any gambling spending - online debit only	Average weekly gambling spend per gambling customer - online debit only	Proportion of gambling spend which is online
<i>Model</i>	Quasibinomial	Quasibinomial	Poisson	Quasibinomial
<i>Weights</i>	Total spend	Number of cards with any spending	Number of gambling customers	Gambling spend
<i>Intercept</i>	-2.666** (0.041)	-2.091** (0.012)	5.160** (0.037)	7.551** (0.365)
<i>Gender (reference: male)</i>	5.76	12.89	163.96	94.76
<i>Gender: not male</i>	-1.281** (0.016)	-1.166** (0.005)	-0.263** (0.015)	0.747** (0.080)
<i>Age (reference: 25-44)</i>	4.31	9.41	138.11	96.61
<i>Age: 18-24</i>	-0.198** (0.040)	0.021 (0.013)	-0.479** (0.038)	0.744** (0.136)
<i>Age: 45-64</i>	-0.141** (0.018)	-0.195** (0.005)	0.265** (0.017)	-0.489** (0.114)
<i>Age: 65+</i>	-0.725** (0.033)	-0.655** (0.008)	0.114** (0.034)	-1.011** (0.099)
<i>Country * IMD binary (reference: England * IMD above median)</i>	3.09	6.65	173.02	95.36
<i>Country: England * IMD below median</i>	0.330** (0.019)	0.356** (0.006)	-0.143** (0.018)	-0.094 (0.109)
<i>Country: Scotland * IMD above median</i>	-0.002 (0.049)	0.339** (0.015)	-0.363** (0.045)	0.284 (0.296)
<i>Country: Scotland * IMD below median</i>	0.705** (0.042)	0.951** (0.014)	-0.387** (0.037)	0.136 (0.298)
<i>Country: Wales * IMD above median</i>	-0.138* (0.061)	0.134** (0.019)	-0.320** (0.057)	0.105 (0.291)
<i>Country: Wales * IMD below median</i>	0.465** (0.057)	0.537** (0.019)	-0.217** (0.050)	0.275 (0.303)

<i>Ethnicity (proportion of EMs) quintile (reference: quintile 1)</i>	3.05	9.07	119.81	97.11
<i>Ethnicity quintile 2</i>	0.127** (0.022)	0.021* (0.009)	0.076** (0.021)	-0.192+ (0.102)
<i>Ethnicity quintile 3</i>	0.220** (0.026)	0.046** (0.009)	0.112** (0.023)	-0.484** (0.168)
<i>Ethnicity quintile 4</i>	0.269** (0.027)	-0.006 (0.010)	0.182** (0.026)	-0.433** (0.148)
<i>Ethnicity quintile 5</i>	0.289** (0.033)	-0.227** (0.013)	0.320** (0.032)	-0.768** (0.126)
<i>Presence of at least one gambling premise in LSOA in at least one week in 2021 (reference: no)</i>	3.50	8.09	150.53	95.58
<i>Yes (at least one premise)</i>	0.100** (0.023)	0.032** (0.008)	0.035+ (0.021)	-0.164 (0.146)
<i>Observations</i>	14,189,697	13,574,547	4,771,988	4,912,589
<i>Number of unique LSOAs</i>	41,724	41,724	41,605	41,635

Note: Region and week fixed effects are used in all regressions. Clustered standard errors (by LSOA) are in brackets. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table C3: Full regression results - robustness check 3 (use whether ethnic minority proportion above/below median instead of quintiles)

	(1)	(2)	(3)	(4)
<i>Outcome</i>	Gambling spend as a proportion of total spend	Proportion of cardholders with any gambling spending - online debit only	Average weekly gambling spend per gambling customer - online debit only	Proportion of gambling spend which is online
<i>Model</i>	Quasibinomial	Quasibinomial	Poisson	Quasibinomial
<i>Weights</i>	Total spend	Number of cards with any spending	Number of gambling customers	Gambling spend
<i>Intercept</i>	-2.596** (0.047)	-2.109** (0.012)	5.268** (0.042)	7.490** (0.445)
<i>Gender (reference: male)</i>	5.76	12.89	163.96	94.76
<i>Gender: not male</i>	-1.286** (0.016)	-1.168** (0.005)	-0.259** (0.015)	0.764** (0.082)
<i>Age (reference: 25-44)</i>	4.31	9.41	138.11	96.61
<i>Age: 18-24</i>	-0.210** (0.040)	0.011 (0.013)	-0.479** (0.038)	0.753** (0.133)
<i>Age: 45-64</i>	-0.135** (0.018)	-0.188** (0.005)	0.263** (0.017)	-0.481** (0.111)
<i>Age: 65+</i>	-0.716** (0.033)	-0.641** (0.008)	0.111** (0.034)	-1.007** (0.095)
<i>Country * IMD quintile (reference: England * IMD quintile 5)</i>	2.93	6.14	187.23	95.83
<i>Country: England * IMD quintile 1</i>	0.602** (0.030)	0.602** (0.010)	-0.224** (0.028)	-0.488* (0.223)
<i>Country: England * IMD quintile 2</i>	0.352** (0.031)	0.353** (0.010)	-0.169** (0.030)	-0.162 (0.156)
<i>Country: England * IMD quintile 3</i>	0.149** (0.031)	0.202** (0.009)	-0.169** (0.030)	-0.229 (0.157)
<i>Country: England * IMD quintile 4</i>	0.102** (0.039)	0.123** (0.009)	-0.091* (0.037)	-0.282 (0.280)
<i>Country: Scotland * IMD quintile 1</i>	0.882** (0.055)	1.185** (0.019)	-0.510** (0.047)	0.016 (0.399)

<i>Country: Scotland * IMD quintile 2</i>	0.683** (0.058)	0.957** (0.018)	-0.455** (0.051)	-0.039 (0.429)
<i>Country: Scotland * IMD quintile 3</i>	0.290** (0.061)	0.617** (0.020)	-0.441** (0.055)	0.400 (0.377)
<i>Country: Scotland * IMD quintile 4</i>	0.046 (0.060)	0.465** (0.020)	-0.493** (0.054)	0.355 (0.354)
<i>Country: Scotland * IMD quintile 5</i>	-0.132+ (0.077)	0.224** (0.020)	-0.381** (0.075)	0.002 (0.436)
<i>Country: Wales * IMD quintile 1</i>	0.711** (0.077)	0.766** (0.028)	-0.273** (0.065)	0.112 (0.394)
<i>Country: Wales * IMD quintile 2</i>	0.336** (0.080)	0.499** (0.028)	-0.358** (0.073)	0.068 (0.457)
<i>Country: Wales * IMD quintile 3</i>	0.303** (0.099)	0.357** (0.028)	-0.189* (0.093)	0.257 (0.407)
<i>Country: Wales * IMD quintile 4</i>	-0.083 (0.085)	0.182** (0.028)	-0.355** (0.080)	0.284 (0.406)
<i>Country: Wales * IMD quintile 5</i>	-0.357** (0.079)	0.104** (0.027)	-0.529** (0.071)	-0.365 (0.392)
<i>Ethnicity (reference: EM proportion below median)</i>	3.25	8.79	130.65	96.59
<i>Ethnicity: EM proportion above median</i>	0.157** (0.019)	-0.073** (0.006)	0.148** (0.018)	-0.326** (0.100)
<i>Presence of at least one gambling premise in LSOA in at least one week in 2021 (reference: no)</i>	3.50	8.09	150.53	95.58
<i>Yes (at least one premise)</i>	0.083** (0.023)	0.008 (0.008)	0.047* (0.021)	-0.152 (0.135)
<i>Observations</i>	14,189,697	13,574,547	4,771,988	4,912,589
<i>Number of unique LSOAs</i>	41,724	41,724	41,605	41,635

Note: Region and week fixed effects are used in all regressions. Clustered standard errors (by LSOA) are in brackets. + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Appendix D: Full Descriptive Tables

The following terms will be used in the tables:

1. Gambling spend per week: this is the sum of all credit and debit card spending observable in our dataset. National lottery spending is excluded. We do not capture cash gambling.
2. Gambling budget share: this is the sum of gambling spend divided by the sum of all spend in our data.
3. Proportion of online-debit gamblers: this is the number of customers with a gambling transaction on a debit card online over the number of customers using a debit card online for any sector.
4. Weekly gambling spend per online-debit gambler: this is the average gambling spend for those who used an online debit card to gamble in a week.
5. Average deposit: the volume of gambling spend divided by the number of gambling transactions
6. % gambling spend online: the percentage of gambling spend online rather than offline.

Table D1: Descriptive statistics by year

Outcome	2018	2019	2020	2021	Total
Gambling spend per week	£16.2m	£16.5m	£20.4m	£23.3m	£19.1m
Gambling budget share	3.2%	3.0%	3.7%	3.7%	3.4%
Proportion of online-debit gamblers	9.2%	8.7%	7.9%	8.2%	8.5%
Weekly gambling spend per online-debit gambler	£123	£123	£152	£154	£138
Average deposit	£31	£29	£30	£29	£30
% gambling spend online	90%	91%	96%	95%	93%

Table D2: Descriptive statistics by age

Outcome	18-24	25-44	45-64	65+
Full Sample (2018 - 2021)				
Proportion of online-debit gamblers	9.9%	10.0%	7.7%	5.3%
Gambling budget share	3.3%	4.1%	3.3%	2.0%
Weekly gambling spend per online-debit gambler	£63	£119	£167	£158

Average deposit	£17	£26	£34	£34
% gambling spend online	97%	95%	92%	88%
2021				
Proportion of online-debit gamblers	11.0%	9.4%	7.7%	5.1%
Gambling budget share	4.2%	4.4%	3.7%	2.1%
Weekly gambling spend per online-debit gambler	£87	£140	£179	£156
Average deposit	£20	£27	£32	£30
% Gambling Deposits Online	98%	96%	94%	92%

Table D3: Descriptive statistics by gender

Outcome	Female	Male
Full Sample (2018 - 2021)		
Proportion of online-debit gamblers	4.3%	13.8%
Gambling budget share	1.4%	5.7%
Weekly gambling spend per online-debit gambler	£110	£150
Average deposit	£20	£35
% Gambling Deposits Online	96%	92%
2021		
Proportion of online-debit gamblers	4.5%	12.9%
Gambling budget share	1.7%	6.0%
Weekly gambling spend per online-debit gambler	£129	£165
Average deposit	£20	£34
% Gambling Deposits Online	97%	94%

Table D4: Descriptive statistics by IMD, England

Outcome	Q1 (IMD+)	Q2	Q3	Q4	Q5 (IMD-)
2018-2021: England					
Proportion of online-debit gamblers*	11.8%	8.7%	7.6%	7.3%	6.4%
Gambling budget share	4.9%	3.9%	3.2%	3.2%	2.9%
Weekly gambling spend per online-debit gambler*	£115	£136	£141	£163	£181
Average deposit	£22	£27	£31	£38	£44
% gambling spend online	92%	93%	92%	93%	93%
2021: England					
Proportion of online-debit gamblers*	11.6%	8.5%	7.3%	6.9%	6.1%
Gambling budget share	5.7%	4.4%	3.5%	3.3%	3.0%
Weekly gambling spend per online-debit gambler*	£138	£159	£159	£170	£191
Average deposit	£22	£27	£30	£36	£41
% gambling spend online	95%	95%	95%	95%	96%

Table D5: Descriptive statistics by IMD, Scotland

Outcome	Q1 (IMD+)	Q2	Q3	Q4	Q5 (IMD-)
2018-2021: Scotland					
Proportion of online-debit gamblers*	17.1%	14.2%	10.8%	9.7%	7.7%
Gambling budget share	5.7%	4.5%	3.4%	2.8%	2.3%
Weekly gambling spend per online-debit gambler*	£93	£98	£109	£105	£118
Average deposit	£20	£22	£25	£27	£32
% gambling spend online	94%	95%	96%	95%	93%

2021: Scotland					
Proportion of online-debit gamblers*	16.5%	13.7%	10.2%	9.0%	7.2%
Gambling budget share	6.3%	5.2%	3.6%	2.9%	2.5%
Weekly gambling spend per online-debit gambler*	£110	£117	£119	£114	£132
Average deposit	£20	£23	£24	£26	£33
% gambling spend online	96%	96%	97%	97%	95%

Table D6: Descriptive statistics by IMD, Wales

Outcome	Q1 (IMD+)	Q2	Q3	Q4	Q5 (IMD-)
2018-2021: Wales					
Proportion of online-debit gamblers*	11.9%	9.7%	8.5%	7.3%	6.9%
Gambling budget share	4.6%	3.4%	3.2%	2.4%	1.9%
Weekly gambling spend per online-debit gambler*	£110	£108	£130	£119	£101
Average deposit	£20	£21	£28	£27	£27
% gambling spend online	94%	95%	95%	95%	92%
2021: Wales					
Proportion of online-debit gamblers*	11.8%	9.4%	8.2%	6.9%	6.4%
Gambling budget share	5.8%	3.9%	3.7%	2.6%	2.0%
Weekly gambling spend per online-debit gambler*	£142	£129	£153	£130	£111
Average deposit	£22	£23	£30	£27	£27
% gambling spend online	96%	96%	97%	97%	94%

Table D7: Descriptive statistics by quintiles of non-white population

Outcome	Q1 (EM-)	Q2	Q3	Q4	Q5 (EM+)
2018-2021					
Proportion of online-debit gamblers*	9.5%	9.0%	9.0%	8.2%	6.5%
Gambling budget share	2.9%	3.1%	3.4%	3.7%	4.2%
Weekly gambling spend per online-debit gambler*	£109	£122	£130	£153	£199
Average deposit	£25	£27	£28	£33	£38
% gambling spend online	96%	95%	93%	93%	89%
2021					
Proportion of online-debit gamblers*	9.1%	8.6%	8.7%	8.0%	6.4%
Gambling budget share	3.1%	3.4%	3.8%	4.0%	4.5%
Weekly gambling spend per online-debit gambler*	£121	£138	£148	£169	£217
Average deposit	£25	£27	£28	£31	£36
% gambling spend online	97%	96%	95%	95%	93%

Table D8: Descriptive statistics by gambling premises

Outcome	No open gambling premises	At least one open gambling premise
2018-2021		
Proportion of online-debit gamblers*	8.4%	9.1%
Gambling budget share	3.3%	4.1%
Weekly gambling spend per online-debit gambler*	£137	£141
Average deposit	£30	£29
% gambling spend online	93%	92%

2021		
Proportion of online-debit gamblers*	8.1%	8.9%
Gambling budget share	3.6%	4.6%
Weekly gambling spend per online-debit gambler*	£152	£161
Average deposit	£29	£29
% gambling spend online	95%	94%

Appendix E: Additional data Sources

Variable	Dataset(s)	Comments
Deprivation (IMD rank)	• English indices of deprivation 2019 - GOV.UK • Scottish Index of Multiple Deprivation 2020v2 data zones - gov.scot • [Wales] Index of Multiple Deprivation (IMD) CDRC Data	• IMD deciles are calculated within each country • English/Welsh data is from 2019, Scotland is 2020
Ethnicity (% EM)	• [Contains links to 2021 data] Census 2021 Bulk - Nomis - Official Census and Labour Market Statistics • [2011 data] KS201UK (Ethnic group) - Nomis - Official Census and Labour Market Statistics	• 2021 values are used, but the gambling spend data uses the 2011 definitions of LSOAs. As a result, we map 2021 LSOAs to 2011 LSOAs. • When multiple 2011 LSOAs shared the same 2021 LSOA, we assume that the percentage change in % EM was equal across all 2011 LSOAs. • When multiple 2021 LSOAs shared the same 2011 LSOA, we combined them to calculate % EM. • For Scotland, LSOA-level ethnicity data are not available, so we inflated the 2011 values by the national average.
Existence of gambling premise(s) in LSOA	Data on licensed gambling venues in the UK supplied by the Gambling Commission. Data include the venue type (casino, bingo etc), postcode, open date and close date (if applicable) of the venue, from January 2018 to February 2023	