Commercial Locations and Social Deprivation: A Critical Assessment of Alleged Anti-Social Retailers' Locations and Socio-Economic Deprivation in England

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Declaration of Originality

This thesis is the original work carried out by Oluwole Adeniyi. Contributions from others and literatures used have been acknowledged appropriately.

……. 04/12/2020

Adeniyi, Oluwole **Date**

Copyright Statement

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Abstract

Critics opine that there is a concentration of gambling, payday loans, high yield interest lenders and rent-to-own outlets (referred to in this thesis as alleged anti-social retailers (AASRs) because of the controversial services they offer) in deprived communities. Critics further allege that these concentrations are deliberately targeted at deprived communities. Unfortunately, this notion of deliberate motive lacks adequate empirical evidence. In addition, a comparison of the location preferences of these AASRs and a more conventional retail group which would adequately address this notion of deliberate targeting is regrettably missing. Accordingly, this thesis carried out a critical comparative analysis of the relationship between AASR and food and grocery retail (FGR) locations in relation to neighbourhood socio-economic deprivation in England and developed a synoptic model that best fits AASR locations. The project used advanced spatial and statistical techniques to actualise the aim of the research.

This research undertook a two-phase analysis to critically compare the location preferences of AASRs and FGRs at neighbourhood scale. Phase 1 examined the relationship by carrying out a nationwide study which compared patterns of AASRs and FGRs along the different socio-economic dimensions in England using the English Index of Multiple Deprivation 2015 and three of its sub-domains (i.e. income, employment and education, skills and training deprivation domains). Methods employed include hotspot analysis, Spearman correlation and binomial logistic regression. The results reveal prevalence of AASR and FGR outlets in the most deprived and moderately deprived neighbourhoods respectively across income, employment and education deprivation. Even after accounting for differing levels of commercialisation, AASRs were more prevalent in deprived localities, whereas, FGRs were prevalent in affluent neighbourhoods.

The Phase 2 of the study critically compared the location of AASRs and FGRs across socio-economic aspects in Leeds, Nottingham and Bristol to further unravel complexities in their similarities and differences and further develop a series of models that best fits AASR locations. The results show that although neighbourhood socio-economic characteristic positively influence the location of both retail groups, the effect is more pronounced with AASRs. Results further identified that neighbourhood characteristics alone do not explain the supply of AASRs.

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.

List of Abbreviations

AASRs	Alleged Anti-social Retailers
ANOVA	One Way Analysis of Variance
APPG	All-Party Parliamentary Group
Blacks	Black British/Africans/Caribbean
BLR	Binomial Logistic Regression
EGM	Electronic Gaming Machine
FCA	Financial Conduct Authority
FGRs	Food and Grocery Retailers
FGRs O‰P	Food and Grocery Retail Outlets Per Thousand Persons
FO‰P	Financial Outlets Per Thousand Persons
FOBTs	Fixed Odds Betting Terminals
GO‰P	Gambling Outlets Per Thousand Persons
GC	Gambling Commission
GCPH	Glasgow Centre for Population Health
HCBISC	House of Commons Business Innovation and Skills Committee
IMD	Index of Multiple Deprivation
IPB	Indian Pakistani and Bangladeshi Ethnic Group
KDE	Kernel Density Estimation
LSOA	Lower Super Output Area
LULUs	Locally Unwanted Land Uses
MAUP	Modifiable Areal Unit Problem
MHCLG	Ministry of Housing, Communities and Local Government
MSOA	Middle Super Output Area
NIMBY	Not in My Back-yard Syndrome
NNPF	National Planning Policy Framework
Ns – Sec	National Statistics Socio-economic Classification
O‰P	Outlets Per Thousand Persons
ONS	Office of National Statistics
PCA	Principal Component Analysis

RSPH	Royal Society for Public Health
RTO	Rent-to-Own
SECs	Socio-Economic Characteristics
SED	Socio-economic Deprivation
VIF	Variance Inflation Factor
VLT	Video Lottery Terminal

Chapter 1

Introduction: Thesis Outline, Aim and Objectives

1.0 Introduction

The marketing strategies of certain business, such as high yield interest lenders, pawn brokers, gambling shops and rent-to-own (RTO) establishments, have been marred by controversies surrounding the targeting of vulnerable populations in deprived communities in the UK, but with very little empirical evidence. Thus, this thesis is concerned with examining the relationships between these commercial locations and socio-economic deprivation (SED) by undertaking a critical assessment of the marketing strategies (location strategies) of these business in relation to SED in England. This study is necessary in order to understand whether or not these businesses are deliberately targeting deprived communities. In addition, the results will further assist stakeholders to improve the living conditions and reduce the inequalities in health and well-being between deprived areas and affluent areas.

This introductory chapter discusses the contextual background and research gaps and offers justification for this research. It further discusses the aim and objectives, scope and scale of the research. In addition, it provides a summary of the findings of the overall research and highlights the contributions of this thesis to the body of research. Finally, it outlines the structure of the thesis.

1.1 Background

Socially deprived areas are zones of serious health and environmental challenges which represent great disadvantage to inhabitants in these areas. As a result, ameliorating these challenges to improve the living conditions in underprivileged neighbourhoods remains a growing concern for scholars, policy makers, interest groups and other stakeholders. In attempting to ameliorate the challenges facing underprivileged neighbourhoods, many scholars have argued that an agglomeration of commercial activities in deprived areas is observed in gambling, fringe banking and RTO retailers (Graves, 2003; Ray et al., 2013; Wardle et al., 2014; All Party Parliamentary Group, 2015). For this research, these retailers

(i.e. gambling, fringe banking and RTO) will be referred to as alleged anti-social retailers (AASRs), due to the controversial services they offer.

As a result of the alleged prevalence and high concentration of AASR outlets in deprived areas and the seemingly abundant demand in these neighbourhoods, critics allege that this concentration is targeted (Graves, 2003; Dyall, 2007; Portas, 2011; Sherman, 2013; Pidd, 2017). More importantly, critics strongly infer that the marketing strategies and business models of these AASRs is mostly enhanced by deliberating exploiting poor and vulnerable individuals (Stegman and Faris, 2003). This notion has also been fuelled by the unethical practices which have become a repeated occurrence among AASR establishments (FCA, 2014, 2016, 2017; Davis, 2017; Sembhy, 2017). From this standpoint, if these AASR businesses deliberately flout specific marketing and operational regulations put in place by regulatory bodies to safeguard vulnerable populations to aid revenue generation, then there is the possibility that their location strategies - which are a major determinant of business success - might be deliberately targeting poor and vulnerable communities.

There has been a paradigm shift in the past three decades and the importance of place in improving individual life outcomes has gained attraction from many different stakeholders. Clearly put, there is a relationship between an individual's place in society and the individuals experience of place (Eyles, 1985): a person's locality influences that person's available opportunities and activities, just as a person's status, impacts on that individual's experience of a locality (Kearns, 1993). Therefore, stakeholders have moved from addressing only the individual characteristics to addressing both individual and contextual (environmental characteristics) explanations for inequalities in mortality, employment and dietary conditions for improving public health (Haan et al., 1987; Kearns, 1993; Macintyre et al., 1993; Roux et al., 2010). This has led to unearthing clear linkages between prevailing area characteristics and life outcomes. For instance, empirical studies have found relationships between area characteristics and dietary patterns/obesity rates which are consistent across different geographical locations, with inhabitants of deprived communities having higher unhealthy prevalence rates (Smith et al., 1998; Van Lenthe and Mackenbach, 2002; Singh et al., 2010). Likewise, there are consistencies in the evidence, suggesting that neighbourhood socio-economic characteristics (SECs) are associated with victimisation and skewed towards deprived neighbourhoods (Tesloni et al., 2004; Salisbury et al, 2004; Tseloni and Pease, 2015). Hence, improving the environmental landscape in deprived communities would lead to tremendous improvements in life conditions.

In the retail domain, researchers and stakeholders are constantly seeking to understand the influence of retail structures in a local environment, namely whether the retail environment exerts influences on the life outcomes of individuals in their locale. The players in the food sector have attracted attention because of the importance of diet in wellbeing. Empirical studies have examined the spatial analysis of both fast food and grocery retailers and their linkage to area SECs in the US (Block et al., 2004; Zenk et al., 2005; Raja et al., 2008; Sharkey and Horel, 2008; Gordon et al., 2011) Canada (Smoyer-Tomic et al., 2006; Apparicio et al., 2007; Smoyer-Tomic et al., 2008; Black et al., 2011; Gould et al., 2012;), New Zealand (Pearce et al., 2007), Australia (Burns and Inglis, 2007) and the UK (Guy et al., 2004; Cummins et al., 2005; Macintyre et al., 2005; McDonald et al., 2007; Black et al., 2012; Whysall, 2014; Maguire et al., 2015). These studies have unearthed linkages between area socio-economic deprivation and the presence of food retailers.

In the US, the literature on the linkages between socio-economic deprivation and food retailers (especially grocery retailers) are mixed, with some evidence supporting an absence of supermarkets and food multiples in deprived communities (Zenk et al., 2005; Gordon et al., 2011; Bower et al., 2014), whereas other studies allude to a prevalence of grocers in deprived and underprivileged areas (Sharkey and Horel, 2008; Raja et al., 2008). In the UK, there is also mixed evidence, with some studies highlighting a positive association between the locational patterns of supermarkets, multiples and deprived neighbourhoods (Cummins and Macintyre, 2002; Guy et al., 2004; Smith et al., 2009). Conversely, Black et al. (2014) argues that the prevalence of food and grocery retailers (FGRs) is predominant in moderately deprived areas as opposed to most deprived areas. This has raised public health concerns for dietary patterns, particularly in deprived communities in the UK, with The Social Exclusion Unit (2003) identifying strong linkages between health and food provisioning. Guy et al. (2004) argues that, although food provisioning has improved considerably in deprived areas, there are still pockets of deprived areas which have poor food provisioning.

In addition to food retailers, other retailers have attracted attention, but not much academically in the UK. In particular, the relationship between some neighbourhood spatial structures such as gambling outlets, betting shops, pawn shops, high yield interest lenders and rent-to-own (RTO) and socio-economic deprivation has drawn attention (Graves, 2003; Pearce et al., 2006; Cover et al., 2011; Fowler et al., 2014; Wardle et al., 2014). These studies have found an association between the prevalence of these AASR establishments and area socio-economic deprivation, with the highest prevalence in areas with low socio-

economic status when compared to their counterparts in the UK (Wardle et al., 2014; Astbury and Thurstain-Goodwin, 2015), North America (Graves, 2003; Fowler et al., 2014) and New Zealand (Pearce et al., 2006). This further raise concerns regarding inequalities in deprived areas, as patronage of these AASR services has been linked with negative impacts such as addiction, indebtedness and exploitation (Korn and Shaffer, 1999; Griffiths, 2001; Gibbons et al., 2010; Kubrin et al., 2011; Gibbons, 2012).

1.2 Research gaps and justification (Rationale)

Unarguably, there are numerous empirical studies to suggest that, apparently, there is a concentration and prevalence of AASRs in deprived and impoverished neighbourhoods with corresponding low prevalence in affluent and high socio-economic status neighbourhoods in the UK. Interestingly, there is also evidence from the literature which clearly suggests a socio-economic divide in FGR provisioning with prevalence in deprived and impoverished neighbourhoods in the UK. Therefore, as the evidence suggests that both groups of retailers are prevalent in deprived areas, the notion of deliberate concentration and targeting of the poor and vulnerable, which is attributed to AASR businesses, might be misguided. Therefore, only a critical comparative analysis of AASR locations and an ubiquitous retail group would unravel the relationship between AASRs and socio-economic deprivation, and the extent to which AASRs are targeting deprived areas. This is also echoed in the contributions of Pearce et al. (2007) and Smoyer-Tomic et al. (2008), that carrying out a one-sided location analysis without a comparative analysis may not adequately explain the observed patterns. Therefore, using a more ubiquitous and less controversial retail group for comparison will offer important contributions.

The rationale for comparison lies in the premise that critics allege that there is a concentration of these retailers (AASRs) in deprived areas and that this concentration is actively targeted. Therefore, to address the notion of the targeting claimed by critics, a comparison of AASR locations with more conventional retailers (FGRs) would provide a good contextual basis for the understanding of the locational patterns of these AASRs and aid unravelling of the debate surrounding the extent to which these retailers target poor neighbourhoods. One justification for using FGRs for comparison is because the demand and supply of their products and outlets are ubiquitous across all socio-demographic classifications, and data on their outlets' locations are readily available. Additionally, this will help to further inform the conflicting arguments between scholars, politicians,

community interest groups and other stakeholders regarding the location preferences of these AASRs. Moreover, evaluation of concentrations of FGRs and AASR outlets in socially deprived neighbourhoods would unearth more widespread problems, such as the underlying reasons for the inequalities in these communities.

Another rational for this study is that there is dearth of literature on the spatial analysis of gambling, payday loans, pawn shops and RTO availability in the UK. Only a few studies (Wardle et al., 2014 and Astbury and Thurstain-Goodwin, 2015) have explored the location analysis of gambling availability in the UK using spatial and statistical analysis. Further, no study has yet explored the geographical distribution of pawnshops, payday loans, high yield interest lenders and RTOs in the UK in totality. Available studies focused on their patronage and ill effect on users, as well as their unethical practices (Gibbons et al., 2010; Gibbons, 2010). This gap has also been echoed in a report by Glasgow Centre for Population Health (2016), namely that no study has empirically explored the geographical patterns of fringe banking provisioning in the UK. In addition, the debate in the UK is based on evidence from studies in the United States. Therefore, the results of this thesis will also make an original contribution to knowledge by undertaking a spatial analysis of the locations of fringe banking and RTO retailers in the UK.

1.4 Research aims

In order to address the above research gaps, this study aims at investigating the allegation of deliberate targeting of poor and vulnerable communities ascribed to AASRs by carrying out a comparative analysis of the location preferences of AASRs and FGRs using quantitative and geospatial techniques in England and, at a more localised level, three selected cities in England.

1.3 Research questions

The research gaps and aims above raise some salient questions which this research seeks to answer. The research questions are;

- What is the spatial relationship between SED, AASRs and FGRs?
- Is there a relative concentration of AASRs in deprived neighbourhoods in comparison with FGRs?

- Are there similarities and/or differences in the location patterns of AASRs and FGRs relative to SED?
- Which socioeconomic characteristics (SECs) are most predictive of AASR locations?

1.4 Research objectives

In order to achieve the above research questions, the broad objectives are as follows:

1. To explore the relationship between AASR locations and SED.
2. To confirm/validate whether there is a concentration of AASRs (i.e. gambling, fringe banking and rent-to-own outlets) in disadvantaged neighbourhoods.
3. To explore whether these concentrations are also found in food and grocery retailers' (FGRs) locations.
4. To compare any similarities and differences in the relationships observed between the two groups of retailers (AASRs and FGRs) and SED.
5. To develop a synoptic model that best fits AASR locations using socio-demographic variables.

1.5 Scope of this research

This research was carried out in two phases with each Phase having specific objectives. The first phase involved investigating the relationship between the AASRs, FGRs and SED, comparing their location patterns to carefully identify similarities and differences in their location patterns across all lower super output areas (LSOAs) in England. The second phase of this research was driven by the results of the first phase. This phase involved carrying out more detailed analysis focusing on three cities to further unravel the seemingly complex relationship between AASRs, FGRs and SED.

Evidence from international research reveals that different area SECs influence AASR and FGR locations (Collard and Hayes, 2010; Bower et al., 2014). From evidence in the UK, there is a paucity of research identifying the influences of area SECs on AASR locations, such as occupation, housing composition, ethnicity, income and car ownership. Therefore, the Phase two study identified area SECs that drive AASR location preference in the UK. This offers vital information into the location patterns of AASRs and identifies the roles of different area characteristics in shaping alleged anti-social and grocery retailers' locations.

The next sub-section details the sub-research questions and sub-objectives for each Phase developed from the main research questions and objectives on pages 5 – 6.

1.5.1 Sub-research questions and objectives for Phase 1

The first phase of this research involved a nationwide study aimed at answering the following sub-research questions developed from the main research question on pages 5 and 6. They are:

- What is the relationship between socio-economic deprivation (SED), AASRs and FGRs in England?
- Is there a relative concentration of AASRs in deprived neighbourhoods in England in comparison with FGRs?
- What are the similarities and/or differences in the location patterns of AASRs and FGRs in relation to SED in England?

These research questions were achieved by investigating specific objectives which are linked to broad objectives 1 – 4 only (see page 6).

1 To explore the relationship between AASR locations and SED in England.
2 To confirm/validate whether there is a concentration of AASRs (i.e. gambling, fringe banking and rent-to-own) in disadvantaged neighbourhoods in England.
3 To explore whether these concentrations are also found in food and grocery retailers' (FGRs) locations in England.
4 To compare any similarities and differences in the relationships observed between the two groups of retailers (AASRs and FGRs) and SED in England.

1.5.2 Sub-research questions and objectives for Phase 2

Phase 2 of this research involves the selection of 3 cities in England in order to carry out a comparative analysis of observed location preferences of the groups of retailers and SED as well as answer the following sub-research questions that are sub-aspects of the main research questions on page 5 – 6. These are;

- What is the relationship between the two groups of retailers' outlets (AASRs and FGRs) and area SECs at city level?

- What are the similarities and differences between the 2 groups of retailers and area SECs in small areas in Leeds, Nottingham and Bristol?
- Which socioeconomic characteristics (SECs) are most predictive of AASR locations?

The selection of cities for Phase 2 was driven by the results of the investigations in Phase 1. Therefore, Phase 2 sub-research objectives formulated from main objectives on page 6 were as follows:

1. To explore the relationship between SECs and AASRs location in Leeds, Nottingham and Bristol.
2. To explore whether these associations are also found for FGRs in Leeds, Nottingham and Bristol.
3. To develop an area classification map for Leeds, Nottingham and Bristol using socio-economic variables**.**
4. To compare any similarities and differences in the relationships between the FGRs, AASRs and SECs in Leeds, Nottingham and Bristol.
5. To develop a synoptic neighbourhood model that best fits AASR locations using socio-economic variables in Leeds, Nottingham and Bristol.

1.6 Summary of findings and contributions

The Phase 1 study identified that there is concentration of AASRs and FGRs in established urban centres in England. There are also positive linkages between both retail groups and SED in deprived communities, highlighting the similarities in the location preferences of these retailers. In addition, the study further identified distinct difference in their location patterns, with AASRs also prevalent in deprived commercial neighbourhoods, compared to FGRs. Deprived commercial neighbourhoods in the context of this research refers to localities which have a presence of either FGRs or AASRs. The implication of this is that there seem to be peculiar characteristics in these deprived locations which appear favourable for gambling and financial retailers. These might be the deprived characteristics of these communities.

However, the contrary is the case for FGRs, with best provisioning being in moderately deprived neighbourhoods and affluent commercial tracts. This has important implication in terms of dietary concerns. If there is poor provisioning in some pockets of deprived areas, this would mean that inhabitants of these communities would need to travel greater distances

to purchase food, and those with limited mobility options would be most affected. This would further put a strain on the already fragile living conditions of inhabitants of deprived areas.

Phase 2 of this study further identified a complex relationship between retail location preferences and different socio-economic themes. Neighbourhood characteristics which are positive correlates of SED generally impact retail location preferences, but their effect is higher with AASRs compared to FGRs. In addition, affluent areas have very limited presence of all AASRs compared to FGRs. The analysis in Leeds, Nottingham and Bristol also highlighted that neighbourhood SECs alone do not account for the prevalence of retailers. This is evident because the analysis identified some very deprived areas that have low concentrations of both types of AASR. Furthermore, these areas also have limited presence of FGRs. In addition, there are some deprived areas that have high presence of both retailers. This suggests that some areas, although deprived, offer attractive opportunities for both AASRs and FGRs, due to other characteristics such as accessibility, available markets, proximity to city centre and transport links. These factors are in line with the tenets of classical theories that assume accessibility to markets as a basis for retail location. These classical theories also assume identical consumers, which is illogical. Therefore, it is likely that these classical theories do not adequately explain retail locations because of differences in consumers, which are central to notions of deprivation.

In addition, the abundant presence of AASRs in deprived areas might also be a result of the concept of identity, place attachment and sense of community (Manzo and Perkins, 2006). According to Manzo and Perkin higher levels of community bond, attachment and sense of belongingness increase social cohesion and bring about active participation in community development and planning. However, deprived areas have high levels of migrant populations, individuals and households encountering multiple forms of deprivation. In addition, a high proportion of households are usually renters with high turnover rates. Consequently, it is highly likely that there will be very low sense of belongingness and emotional attachment in these neighbourhoods, which would hinder positive community efforts to influence the spatial structures in their immediate environment. Hence, there might be a proliferation of gambling and financial retailers in these areas.

The findings reveal that deprived areas exhibit different dimensions of deprivation. That is, deprivation clusters are distinct entities, but literatures allude to concentration of AASRs in

deprived areas, without careful consideration of which deprived characteristics offer stronger attraction. The findings not only identify important attractors for AASRs, but also identified deprived neighbourhood characteristics which do not offer attractions to AASRs, showing that deprived SECs alone cannot account for the patterns of gambling and financial retailers in the UK. Rather, an interplay of location and economic factors is at work.

This study contributes to the extant literature by advancing further away from a one-side analysis and carrying out a robust comparative analysis of the location preferences of gambling, financial and food retailers, using a unique approach. In addition, this study has further examined the spatial analysis of high yield interest lenders, payday loans, pawn shops and RTO (financial retailers) location, using a geo-statistical approach which has not been previously attempted in the UK. Furthermore, this study is the first to attempt to model the relationship between gambling, financial retailers and SECs in the UK. Therefore, development of policy to address the dangers of proliferation of gambling and high interest financial retail outlets should focus on the peculiarities of each area, rather than adopting a 'one policy fits all' approach.

1.7 Thesis structure

In order to achieve the research objectives, set out in section 1.3, this thesis has been structured into seven different chapters. Each chapter aim to achieve one or more of the previously stated objectives.

Chapter 1, the introductory chapter provides the background and rationale for this study by identifying and explaining gaps in the literature. It further introduces the research questions, aim and objectives of this research. The scope of this research is further discussed in this chapter. Finally, it details the structure of the thesis and explains how each chapter sets out to actualise the stated aim and objectives.

Chapter 2 is the literature review, and it reviews extant literature on retailers (AASRs and FGRs) and deprivation. It also further reviews the various economic theories that have been used to explain retail formation. This chapter starts by reviewing the concept of deprivation, the various drivers of deprivation and measurement of deprivation over time. It then moves on to explaining trends in food retailing and the various factors that have impacted on food provisioning in the UK. The chapter further reviews literature on the relationship between food provisioning and SED (i.e. if food provisioning varies along socio-economic

dimensions) and the influence of different area SECs on FGR locations. Thereafter, it further investigates the literature on AASRs and the interplay between the prevalence of gambling, fringe banking outlets, RTO and SED, as well as other SECs. It also seeks to isolate the drivers of the demand and supply of these AASRs from international and UK studies. The chapter further reviews retail location theories and key issues in retail development, especially in the UK. This chapter then proposes a conceptual framework to support this research.

Chapter 3 explains the methodology for this research. It critically discusses major philosophical standpoints and presents justification for the approach selected for this thesis. It further identifies the sources of the various data to be utilised and the collection, sorting and coding of the different data to aid achievement of the aim and objectives of the research. In addition, the chapter discusses the study area for this research and the strategy which used to actualise the research objectives. It explains Phase 1 and Phase 2 of this research and offers justification for the adoption of the strategy and the different data utilised for each Phase of the research. explains the study area for this research and gives reasons for selecting the geographical boundaries adopted. Thereafter, the chapter explains the geographical and statistical techniques adopted for the study and provides justification for the selected techniques in detail.

Chapter 4 reports the results of the first phase of this research by addressing the objectives listed in sub-section 1.5.1. These are concerned with the relationship between AASRs and SED as well as FGRs and SED in all lower super output areas (LSOAs) in England. The chapter addresses the objectives by using the index of multiple deprivation 2015 (IMD 2015) and the three domains (income, employment and education skills and training) identified from the review of literature in chapter 2 to be the major drivers of AASR and FGR location strategies. It also examines similarities and differences between the observed linkages between the two retail groups and SED and discusses the different methodological considerations adopted to ensure that the objectives were systematically and exhaustively addressed. Geographical methods such as kernel density estimation (hotspot mapping) and statistical techniques (one-way analysis of variance (ANOVA) and binary logistics regression (BLR) were adopted to explore the locational preferences of retailers in relation to areas of deprivation and compare the patterns of AASRs and FGRs.

Chapter 5 reports the analytic approach used and the results of Phase 2 of the study and the actualisation of the objectives listed in sub-section 1.5.2. The data for the chapter were obtained from the 2011 UK Census. Based on the literature review, socio-economic census data identified as major drivers of AASRs and FGRs location preferences were adapted to build an area classification using K-mean clustering technique. This technique is based on the principles of geodemographics which is explained in detail in chapter 3. This technique was adopted to classify the LSOAs in the three selected cities. In addition, ANOVA and BLR were used to undertake an extensive comparative analysis to determine the relationship between AASRs and FGRs and area SECs. Thereafter, this chapter advances 4 different synoptic neighbourhood models using BLR to identify area SECs that are salient predictors of AASR locations.

Chapter 6 discusses the results of Phase 1 and Phase 2 (chapters 4 and 5) by explaining the results of the analysis conducted to achieve the objective of each Phase. It further links the results of the thesis to existing literature and explores new understanding and insights generated from the results. The chapter begins by considering the research objectives and how each objective was achieved to guide the discussion. In addition, this chapter discusses various methodological considerations.

Chapter 7 is the concluding chapter and provides a summary of the findings of the thesis. It presents an overview of the implications of the study, offers theoretical and methodological contributions, and discusses policy recommendations and overall contribution to knowledge. In addition, it highlights the study's limitations and offers suggestions for future research.

Chapter 2

Literature Review

2.0 Introduction

Retailers need to be profitable. Therefore, one of their key strategies is location. In retailing, the location of a store plays a great role in its success or failure (Ghosh and MacLafferty, 1987; Current et al., 1990; Clarke et al., 1997). What is more, in determining the best locations, emphasis is laid on neighbourhood demand for offered products or services. In selecting the best locations, strategies such as targeting, segmentation and profiling are employed (Dibb and Simkin, 1991; Gonzalez-Benito and Gonzalez-Benito 2005; Dibb and Simkin, 2013). As a result, there is the need to effectively manage retail locations in order to tackle and reduce consumer exploitation.

In the UK, location patterns and preferences of retailers have received extensive attention from scholars and policy makers. In the food sector, many empirical studies have discovered a concentration of take-aways, fast foods and restaurants (especially unhealthy food retailers) in deprived neighbourhoods (Cummins et al., 2005; Macdonald et al., 2007). Other researchers unearthed abundant presence of all types of food retailers, grocery stores, supermarket, convenience stores, discounters (heathy and quality food retailers), also in deprived localities (Cummins and Macintyre, 1999; 2002; Smith et al., 2009; Macdonald et al., 2009). In addition, Smith et al. (2009) and Macintyre (1999; 2002) alluded that, in totality, neighbourhoods with high deprivation actually have better access to food provisioning.

As an extension of these studies, scholars have also examined the locations of other retail establishments (gambling, fringe banking, payday loans, pawn brokers and high interest lenders and rent-to-owns (RTOs)), which this research refers to as "alleged anti-social retailers" (AASRs) because they offer products and services that many perceive as exploitative and controversial. These studies also found a concentration of AASRs in deprived communities in the UK (Wardle et al., 2014; Whysall, 2014; Astbury and Thurstain-Goodwin, 2015; Townshend, 2017). In addition, a report by Royal Society for Public Health (RSPH, 2018) asserted that payday lenders, betting shops, RTOs and pawnshops damage the fabric of the local environment and are signifiers of poor living conditions. Critics, including policy makers, scholars and the public are concerned that these

AASRs are not only concentrated in deprived areas, but that the concentrations are also targeted towards disadvantaged neighbourhoods, where they seemingly prey on and exploit poor and vulnerable populations (Graves, 2003; Stegman and Faris, 2003; Dyall, 2007; Kubrin et al, 2011; Portas, 2011). Unfortunately, however, critics have only explored the locations of AASRs in isolation rather than in comparison with other types of retailers in the UK.

The next section reviews the literature on socio-economic deprivation, FGRs and AASRs, for a clear understanding of the linkages between AASRs, FGRs locations and social-economic deprivation. In order to fully understand observed retail location patterns, the next section also extensively examines each AASR type (fringe banking, gambling and RTO) in terms of factors that have affected both their demand and supply dynamics. Furthermore, it also reviews several theories such as central place theory, principle of minimum differentiation, bid rent theory and spatial interaction theory, all of which have traditionally been used to explain retail location patterns. This will help to understand whether or not the location preferences of these AASRs is adequately explained by these theories. Finally, this section proposes the conceptual framework to be utilized in achieving the aim of this study, which is to investigate the allegation of deliberate targeting of poor and vulnerable communities ascribed to AASRs by carrying out a comparative analysis of the location preferences of AASRs and FGRs using quantitative and geospatial techniques in England and, at a more localised level, three selected cities in England.

2.1 Deprivation

The concept of deprivation has no clear-cut definition (Carstairs and Morris, 1989). Attempts at conceptualizing deprivation and associated terms such as poverty and lack have always emphasised relativity. Hence, the definition has never been standalone; rather it entails comparison to a wider measure (Herbert, 1975; Holman, 1978; Townsend, 1987). One accepted definition of deprivation, according to Herbert (1975) is a quality of life or living standards that are below that of the majority of the populace in a given community or society, including hardship, underprivileged and limited access to resources.

If this underprivilege is not addressed and continues to be persistent, it becomes a cycle which affects every aspect of an individual's lifecycle. Taking the case of a recently unemployed individual as an example, the loss of employment leads to income deprivation,

which if not tackled will, over time, lead to the individual's inability to pay rent as well as afford a healthy diet. This would gradually lead to loss of shelter, poor dietary conditions, poor health, etc. As illustrated, employment deprivation has led to income, health and housing deprivation. Moreover, "deprivation may therefore be transmitted temporarily and because basic causes lead to more than one expression of deprivation, it may also be aggregative" (p. 363), thus leading to multiple deprivation (Herbert, 1975). Multiple deprivation is a situation whereby groups or individuals suffer different constellations of under-privilege such as low income, unemployment, education and poor housing conditions simultaneously (Holman, 1978). In furtherance, as deprivation is relative, it also varies over time and space, resulting in marked differences in area composition with individuals experiencing similar life challenges usually clustering and inhabiting similar neighbourhoods (Herbert, 1975). This consequently creates a 'neighbourhood effect' as described by Johnson (1973) whereby behavioural traits associated within a particular neighbourhood are transferred to inhabitants of the whole community over a period of time.

2.1.1 Drivers of deprivation

As deprivation is multi-faceted, the factors influencing deprivation can be explained through the micro and macro scale. From the macro scale perspective, the drivers of deprivation are social policy and demographic and labour market factors (Bradshaw et al., 2004). Demographic factors include those processes that bring about changes in the population structure; mainly fertility, single parenting, ageing, household formation and migration. Drivers relating to the labour market include income, employment and labour market policies affecting employment. Deprivation drivers in terms of social policy encompass benefit systems, and changes in taxation and public spending, as well as insufficient health and social services programmes to address growing societal needs. In addition, according to the Prime Minister's Strategic Unit, (2005, p.42) drivers of area deprivation are complex and interwoven and can be further classified into three major categories: "(i) low levels of economic activity (high level of worklessness, low levels of business activities), (ii) poor housing and local environment, unstable communities (crime, fear of crime, antisocial behaviour, litter, graffiti) and (iii) public services and delivery systems (poorly performing education, health and transport services, regeneration programmes not achieving maximum impact)"

There are also clear linkages between deprivation and government policies. Different government social policies over time have impacted levels of deprivation. For instance, in the UK, governments take pro-active steps by introducing a wide range of social policies to address different social ills including poverty, unemployment and inequalities in health and education, which are major determinants of socio-economic deprivation. Thus, there is a demonstrable linkage between policy and deprivation (Stewart and Hills, 2005). This linkage is also clearly emphasised that "overall poverty in 2008-09 would have been up to six percentage points higher and child poverty up to 13 percentage points higher under a continuation of the previous government's tax-benefit policies. Adding in the value of health and education spending strengthens the redistributive impact of fiscal policies and substantially improves the relative position of the poorest" (Hill et al., 2009, p. 44). This clearly shows linkages between policy and deprivation.

Therefore, deprivation is a result of inadequate material provision induced through individual and neighbourhood characteristics. Individual characteristics include low income, under/unemployment, receipt of benefits, age (youth and aged population), poor mobility, poor health, little or no education, minority ethnic groups, poor household facilities, and marital status. Neighbourhood characteristics, on the other hand, include housing provision, high minority ethnic composition, low economic activities, poor transportation systems, poor access to health facilities, high proportions of unemployed individuals and people reliant on benefits, high crime, anti-social behaviour and high proportion of vulnerable residents, to name but a few.

2.1.2 Measuring deprivation

The impact of multiple deprivation on individual and societal health and well-being has driven various stakeholders to adopt methodologies to quantify deprivation and create measures that are for policy and research purposes. However, rather than measuring individual stress, methods of measuring inequalities have been developed from the neighbourhood or area perspective (i.e. holistic approach), which entails creating a single composite variable for each area, based on key deprivation indicators mostly driven by census data. Pioneering this classification was Holtermann's (1975) study of urban deprivation in Great Britain through their analysis of 1971 Census small area statistics. Different measures have been developed by researchers and government agencies over time in the UK, including the Townsend Index (Townsend, 1987), Carstairs Index (Carstairs and

Morris, 1989), Breadline 1983 and 1990 (Mack and Lansley, 1985; Gordon and Pantazis, 1997), and the Index of Local Conditions (DoE, 1983; 1994). Likewise, in Canada (Langlois and Kitchen, 2001; Apparicio et al., 2007), Australia (McLennan, 1998), New Zealand (Salmond and Crampton, 2012) and the US (Messer et al., 2006; Singh et al., 2008) deprivation indices were also been developed using both census and other administrative datasets.

Creation of these indices entailed extracting and combining numerous variables believed to represent different categories of deprivation from national census sources. What is more, due to the relative nature and lack of a single acceptable definition for the concept of deprivation, variable selection was subjective, with choice of variables mainly based on purpose of study (Townsend, 1987). For instance, the Carstairs Index was created using low social class, no car ownership, overcrowding and male unemployment variables, while the Townsend Index was created using unemployment, non-car ownership, non-home ownership and household overcrowding. This non-uniformity in variable selection generated widespread debate in academia leading to the creation of a more robust official measure of deprivation called the Indices of Deprivation (Noble et al., 2000).

This measure was developed through the fusion of both census and other administrative data by the Department of Environment, Transport and Regions (Noble et al., 2000; Noble et al., 2006). Several modifications based on consultations have occurred with the indices over the years, resulting in the Indices of Multiple Deprivation (IMD). The IMD is a measure of relative area deprivation at lower super output area (LSOA) geography level across England. The IMD consists of a single deprivation index, with seven individual domains of deprivation. These domains are income deprivation, employment deprivation, education skills and training deprivation, health deprivation and disability, crime, barriers to housing and services and living environment deprivation. Furthermore, each of these domains is a composite created from different indicators relating to the domain concerned. The overall index of deprivation consists of the aggregate of each of the domains and it is the official measure of deprivation in England (Smith et al., 2015). Similar exercises have also been undertaken in Scotland, Wales and Northern Ireland, although indices are not directly comparable.

2.1.3 Socio-economic deprivation

This is the aspect of deprivation which focuses on the effect of social and economic factors on life expectancy. Socio-economic deprivation is a very important concept, which has attracted widespread attention in various discipline because of the influence it plays on individual life experiences (Carstairs, 1995). The term socio-economic deprivation is an all-encompassing term relating to lack of access to materials regarded as necessities of life brought about by SECs such as income, ethnicity, employment and education. Consequently, numerous researchers have linked socio-economic deprivation to individual or neighbourhood health outcomes, including obesity (Evan et al., 2000; Taylor et al., 2005; Rossen, 2014), coronary diseases (Smith et al., 1998; Bhopal et al., 2002) and poor dietary intake (Darmon and Drewnowski, 2008; Craig et al., 2010). Likewise, linkages between socio-economic deprivation and prevailing environmental landscapes, such as infrastructure (Crawford et al., 2008) and retail formation (Clarke et al., 2002; Whysall, 2014; Bower at al., 2014; Burgoine et al., 2017), have also attracted attention.

2.2 Food Retailers and socio-economic deprivation

Concern for the relationship between food retailers and socio-economic deprivation was amplified based on some key contextual issues in the UK. A key explanation is the "waves of decentralization" (Schiller, 1988, p.18), which were mainly driven by the food and grocery retailers (FGRs) in the 70s. The first wave saw the movement of FGRs from inner city centres to large out-of-town sites. This trend continued into the 80s, which heralded in a new era in UK grocery, referred to by Wrigley (1987) as the "golden-age" as the sector experienced a large inflow of capital from three major retailers (Tesco, Safeway and Sainsbury's). This period also birthed the 'store-wars' era (Wrigley, 1994) which saw the big retailers compete with each other by aggressively investing huge capital into the development of massive city-edge superstores.

This trend continued until the early 90s and heralded in the closure of many multiple and small independent grocery stores which had once occupied the suburban and city centres as was evident in the retail landscape in cities like Cardiff (Lord and Guy 1991; Guy, 1996) and most especially in impoverished neighbourhoods (Wrigley et al., 2002). Furthermore, these closures also featured in a report carried out by the Department of Health (1991, p.1) which noted that, "the majority of shops that traditionally served those living in deprived

neighbourhoods were small, independent, convenience type stores. While the number of superstores in this country has increased from 457 in 1986 to 1102 by 1997, some eight independent shops disappeared everyday between 1986 and 1996. The number of independent stores has declined by almost 40% in the eleven years between 1986 and 1997. For people on low income, shopping journeys by car and the average distance travelled to shops has increased".

This fuelled the notion of 'food deserts' described as "those areas of inner cities where cheap, nutritious food is virtually unobtainable. Car-less residents, unable to reach out-of-town supermarkets, depend on the corner shop where prices were high, products are processed, and fresh fruits and vegetables are poor or non-existent" (Lawrence, 1988; in Whitehead, 1998, p.198). This notion of food deserts generated much controversy and attracted numerous studies in the UK (Maguire et al., 2017; Maguire et al., 2015; Beaulac et al. 2009; Clarke et al., 2002: Guy et al., 2004) from stakeholders concerned with food provisioning and accessibility. In addition, the aforementioned conjecture birthed the second reason for the interest in food provisioning and socio-economic deprivation. Arguably, if there is an absence of grocery retailers who offer healthy and affordable grocery products in low socio-economic areas, inhabitants of these areas would have limited and pricey healthy options, thereby resulting in poor dietary conditions. This would in turn have serious impact on their health and well-being, including obesity and other associated chronic diseases. Empirically, there is a link between prevailing environmental contexts (area socio-economic deprivation) and life outcomes (Singh et al., 2010; Tseloni and Pease, 2015). Therefore, the need arose to investigate whether there is poor access to healthy and affordable food items in addition to an abundance of poor and low-quality food retailers in low socio-economic status areas compared to their counterparts.

The "store-war' era also saw the entry of European discounters into the UK market because of a gap created by the major food retailers, coupled with the effect of the economic recession of the 90s which eroded the capital of these major retailers (see Wrigley, 1994). In addition, the period also saw the introduction of more stringent planning policy, most especially the PPG6 guidance legislation which focused on social inclusion, regeneration and renewal of the worsening landscape of the UK's inner city and suburban centres and introduced 'sequential-testing' before the approval of out-of-store centres. Therefore, to increase their market share, the major firms had to develop new strategies. These strategies included store enlargement programmes, e-commerce and small store formats (Wood et al., 2006). The

latter, therefore, saw the re-emergence of small stores (convenience formats) in inner city locations and suburban areas previously neglected because they were not suitable for large store formats. This preference for the convenience store formats has continued until the present day (Hood et al., 2015). These convenience formats are characterised by limited selections due to small floor space, less nutritional offerings, and relatively expensive pricing because of high land values.

Consequently, various studies have attempted to explain food accessibility and socio-economic deprivation (Clark et al., 2002; Cummins and Macintyre, 2002; Block et al., 2004; Guy et al., 2004; Zenk et al., 2005; Macintyre et al., 2005; Cummins et al., 2005; Smoyer-Tomic et al., 2006; Macdonald et al., 2007; Burns and Inglis, 2007; Pearce et al., 2007; Apparicio et al., 2007; Sharkey and Horel, 2008; Raja et al., 2008; Beaulac et al. 2009; Maguire et al., 2015; Maguire et al., 2017), in addition to the linkages between health outcomes and food availability vis-à-vis socio-economic deprivation (Casey et al., 2008; Davies and Carpenter, 2009; Lee, 2012). The studies that examined food deserts and food availability and health outcomes used two main types of food retailers to study the relationship between socio-economic deprivation and food provision. A number of studies adopted food multiples and supermarkets (Clarke et al., 2002; Guy et al., 2004; Smoyer-Tomic et al., 2006; Apparicio et al., 2007; Smith et al., 2009; Maguire et al., 2015), whilst others used fast food outlets (Macintyre et al., 2005; Macdonald et al., 2007; Pearce et al., 2007; Zenk and Powell, 2008), with some carrying out a comparative analysis of both groups of outlets (Boone-Heinonen et al., 2011; Smoyer-Tomic et al., 2008; Pearce et al., 2007).

The next section reviews the literature on food retailers and socio-economic deprivation with a focus on those studies which utilized multiple retailers, supermarkets and food grocers rather than fast food retailers in the UK and other parts of the world, as they represent a 'fairer' retail form of provision as opposed to service establishments.

2.2.1 Food and grocery retailers (FGRs) and SEDs

In Canada, there is strong evidence that deprived areas have better access to supermarkets and multiple retailers, bringing to question the validity of the notion of food deserts (Smoyer-Tomic et al., 2006; Apparicio et al., 2007; Gould et al., 2012; Lu and Qiu, 2015). These studies measured accessibility using presence or absence of retail outlets and various measures of distances to assess provisioning while socio-economic status was calculated

using socio-economic variables. Lu and Qiu (2015) found a positively significant association between children, senior citizens and low-income areas and food markets, with densely populated and inner-city localities having the best provisioning. In addition, Smoyer-Tomic et al. (2006), in their study in Edmonton, allude that although there are cases of under-provisioning of grocers in some poor neighbourhoods and inner-city localities, areas that are largely occupied by low-income households with no car have better access to supermarkets.

In contrast, similar studies found a somewhat different relationship between area SECs and food availability. A longitudinal study by Larson and Gilliland (2008) in Ontario found a complex relationship between food accessibility and a deprivation index created using lone parent family, incidence of low education, low education attainment and unemployment rate. The study found that impoverished neighbourhoods had the poorest access to supermarkets while the mid group had the best access. Further analysis of public transport availability and food accessibility revealed similar trends, with the worst access in the most deprived and most affluent areas. Likewise, Black et al. (2011) discovered minority ethnic areas (predominantly African American and Hispanic neighbourhoods) had the worst access to supermarkets. However, overall, the study found that an increase in income reduced the likelihood of supermarkets. Black et al. (2011) further examined urban land systems, neighbourhoods and accessibility and concluded that the contextual explanation for the spatial distribution of food retailers lies in the prevailing land use regulations, as results show that the disparity between affluent and impoverished neighbourhoods can largely explained by zoning regulations. This introduces a new perspective in the literature on spatial access to food and neighbourhood characteristics i.e. urban land use and planning policies further shape retail provisioning in Canada.

In the US, there is a divide in the literature on food provisioning. Zenk et al. (2005), in their study which examined the relationship between area racial composition, poverty, and supermarket provisioning, found more limited accessibility in poor areas compared to affluent neighbourhoods. They further alluded that even within poor neighbourhoods, area racial characteristics further influenced supermarket accessibility, with areas having large minority ethnic groups (African-Americans) having the poorest access by having to commute farther distances to a supermarket compared to the impoverished white neighbourhoods. Similarly, another study that explored the notion of 'food deserts' in New York using income and racial composition divides, found a negative relationship between area distress and supermarket availability (Gordon et al., 2011). Predominantly white

middle-income areas had the best access to supermarkets compared to Black and Hispanic neighbourhoods. Furthermore, Bower at al. (2014), in their nationwide analysis of food availability in relation to area racial composition, poverty and urban/rural characteristics, revealed a significant negative relationship, with fewer supermarkets as area SECs worsened. More importantly, ethnic composition plays a significant role in supermarket access with areas dominated by persons of Black ethnic origin having the lowest access to supermarkets at all levels of socio-economic classification while areas dominated by Hispanic and White groups had better access across the country. Lamichhane et al. (2013) further stress the presence of food deserts, with supermarket provisioning limited in ethnic minority and deprived communities. The study further identified that affluent areas and areas with low minority representation have better access to supermarkets.

Conversely, Sharkey and Horel (2008) examined the relationship between socio-economic deprivation and ethnic minority composition in relation to disparity in food access in Texas. The study revealed that neighbourhoods with the highest levels of socio-economic deprivation and racial composition had the best access to food retailers, even after stratifying with population density. Likewise, Raja et al. (2008) examined the relationship between the spatial distribution of supermarkets and area racial composition, highlighting that disparities exist in food access across ethnic lines with predominantly white neighbourhoods having better access to supermarkets compared to ethnic minority neighbourhoods. Findings also indicated that despite the disparities, these ethnic minority neighbourhoods did had access to smaller retailers and stores which compensated for the absence of supermarkets. Therefore, it would be inaccurate to conclude that inequality exists based on racial differences. A more recent study (Myers et al., 2016) found that co-location is a major factor that accounts for retail distribution patterns. This study found better access to supermarket in very deprived neighbourhoods, although these areas also had the highest presence of fast food, recreation centres and parks.

New Zealand and Australia have also had a fair share of studies attempting to examine clear cut linkages between area deprivation and retail provisioning. Wiki et al. (2019) examined whether or not the patterning of food provisioning conforms to a social gradient. Results reveal dense food provisioning (fast food and supermarkets) in deprived areas. The study further implies that central areas with high population density, large commercial spaces and businesses had the best provisioning. The study concludes that although socio-economic deprivation drives retail location preferences, other factors such as accessibility, urban

zoning regulations and land values are also determinants of the observed patterns. In addition, another comparative study (Pearce et al., 2007) which compared the patterns of fast food and super market provisioning in New Zealand along socio-economic disparities detected a similar pattern, with inhabitants of deprived neighbourhood travelling the shortest distances to food retailers, even after rural urban stratification. The authors further explained that higher consumer demand and resistance to retail establishments in deprived and affluent areas, respectively, might be one of the explanatory mechanisms. It was further conjectured that land values, planning, historical neighbourhood antecedents and population density might be other possible influences.

Similar evidence was uncovered by Pearce et al. (2008) in New Zealand which further examined food patterning and other retail uses along different socio-economic criteria. The study dismissed the notion that deprived neighbourhood had limited access to food retailers. Rather, it discovered the best provisioning in the most deprived neighbourhoods and also concluded that similar factors identified in previous literature (Pearce et al., 2007; Wiki et al., 2019) exert considerable pressure on patterns of food retailers. A comparative study (Burns and Inglis, 2007) in Melbourne, which also compared food provisioning (fast food and supermarkets), discovered a different situation compared to the New Zealand studies (Wiki et al., 2019). In this study (Burns and Inglis, 2007), access to supermarket largely depended on car ownership, with deprived neighbourhoods having to travel farther distances compared to affluent communities. This disparity in findings might relate to definition of food provisioning as the study did not include independent supermarket retailers. Irrespectively, this raises salient questions for health practitioners.

Evidence in the UK is mixed, based on findings from different studies. Cummins and Macintyre's (1999; 2002) empirical research in Glasgow on price and food availability along areas' socio-economic gradient, identified an even geographical distribution in food provisioning across central parts of the study area. Statistical findings further evidenced a concentration of discounters and multiple supermarkets in poor communities compared to affluent areas, contrary to the notion of "food deserts" amplified by many scholars. Notwithstanding, the authors called for similar studies in other areas in the UK to further confirm the results of their study and further enlighten the food desert debate. Likewise, Smith et al. (2009) carried out an analysis of food environment and area deprivation by classifying areas based on socio-economic deprivation and along an urban and rural divide in Scotland. The study found a contrary situation to the "deprivation amplification"

hypothesis which emphasises that inhabitants of impoverished communities have limited access to grocery stores. Stratified analysis across the rural/urban divide evidenced that urban areas across all socio-economic groups had better access to food retailers compared to their counterparts in rural area neighbourhoods, leading to the conclusion that linkages between SED and food provisioning also varies along environmental characteristics. In addition, McDonald et al. (2009) found patterns in their study, with deprived localities having best access to different ranges of food retailers. Furthermore, important site location determinants such as accessibility and distance to central business districts and other establishments seem to play a role in the observed patterns.

A repeated cross-sectional study (Maguire et al., 2015) which examined supermarket outlets density in Norfolk over an 18-year period (1990 – 2008) in relation to area SED, found that supermarket density increased over time in both impoverished and affluent neighbourhoods and there were no significant linkages between SED and food provisioning. Black et al. (2012) examined food varieties and neighbourhood SED in southern England. To measure deprivation, the study reclassified the income domain of the index of multiple deprivation data (2007) from deciles 1 – 10 deciles to 1 – 5 quintiles and counts of food outlets (supermarkets, world stores, forecourts and convenience stores) per LSOA to measure food availability. Interestingly, the results of the study revealed that the mid-deprived LSOAs had the highest supermarket and food outlet provision. Clarke et al. (2002) identified that, although food provisioning was accessible in many parts of Cardiff, the study unearthed poor provisioning in some deprived localities in Leeds and Bradford. Clearly put, "the series of 'what if' analyses have shown that planners must consider the full set of implications when attempting to alleviate 'food deserts' because of the trade-off between increased provision per household and deflections from existing stores. Problems could be increased in small areas of deprivation and low mobility causing closure of local shops" (Clarke et al., 2002, p. 2059).

To follow up this study, Guy et al. (2004) explored the notion of "food deserts" using longitudinal data (1989 – 2001), by examining changes in the retail floor space per household ratio, new store openings and deprivation in Cardiff. Low socio-economic status areas had better access to food retailers and, in respect to store closures, deprived areas experienced more store closures which had little or no impact on food provisioning in these areas. In addition, Guy et al. (2004) used a spatial interaction model, which incorporated demand, supply and interaction to model consumer behaviour. The results of the analysis showed that

although provision greatly increased for low socio-economic status areas, affluent areas seem to have better provisioning over time, which further emphasises linkages in food provisioning and neighbourhood characteristics. A recent paper (Burgoine et al., 2017) provides further evidence to suggest that systematic patterns of "food deserts" are present within the UK food landscape, with systematic absence in deprived localities. The study identified that education deprivation is a major determinant of access to supermarkets, with inhabitants of areas with high proportions of persons with low education having to travel the farthest distances to supermarkets.

From the above review of the literature on food availability and socio-economic deprivation, it can be concluded that evidence around the world (i.e. findings from the UK, Canada, New Zealand and Australia) revealed mixed findings. Some literatures debunk the notion of 'food deserts' or the 'deprivation amplification' hypothesis and allege that no systematic patterns of poor access to food retailers were identified in deprived areas, while others raise questions and suggest that within deprived areas, level of provisioning varies, with some deprived neighbourhoods having challenges and limited options to food retailers thus calling for intervention to improve food provisioning in poor areas.

The studies reviewed above have several limitations which are discussed here. These studies failed to carry out a critical comparative analysis of the location preferences of these FGR retailers across different localities by comparing FGRs with other retail types (Guy et al., 2004; Zenk et al., 2005; Smoyer-Tomic et al., 2006; Apparicio et al., 2007; Larson and Gilliland, 2008; McDonald et al., 2009; Black et al., 2011; Gordon et al., 2011; Gould et al., 2012; Black et al., 2012; Burgoine et al., 2017). In addition, some of the studies examined the location characteristics of different retail types but in a single geographical location (Pearce et al., 2007; Smoyer-Tomic, 2008; Pearce et al., 2008; Lamichhane et al., 2013; Maguire et al., 2015; Myers et al., 2016; Wiki et al., 2019). A comparative analysis of retail preferences looking at different geographical locations and different retail types would further unearth any clear linkages between food provisioning and area deprivation because of seemingly complex patterns.

In addition, the deprivation measures adopted by some of the studies such as Zenk et al., 2005; Smoyer-Tomic et al., 2006; Larsen and Gilliland, 2008; MacDonald et al 2009; Bower et al., 2014; Lu and Qiu et al., 2015; Gould et al., 2015; and Wiki et al., 2019had limited variables. For example, Lu and Qiu et al., 2015 only considered senior citizens, children

under 15 and low income, whereas, Smoyer-Tomic et al., 2006 adopted low income, low vehicle ownership, low income and high proportions of elderly. From the literature review, deprivation is an all-encompassing term and it relates to lack of access to resources brought about by SECs such as employment, income, ethnicity and education. In addition, adoption of composite measures (Gould et al., 2012; Maguire et al., 2015; Wiki et al., 2019; Macdonald et al, 2009) do not allow for a clear understanding of the influence of individual characteristics on FGR locations.

Location plays a pivotal role in retail success and optimum locations are those that offer accessibility, demand, favourable regulations and, especially, vacant premises. Unfortunately, many of the studies (Cummins and Macintyre,1999; Zenk et al., 2005; Smoyer-Tomic et al., 2006 ; Apparicio et al., 2007; Larsen and Gilliland, 2008; Macdonald et al., 2009 ; Maguire et al., 2015; Lu and Qiu, 2015) did not attempt to examine the influence of commercialisation and land use patterns on FGR location, although the studies acknowledged that other factors such as proximity to central business district and planning regulations might influence FGR locations.

2.3 Gambling establishments

Globally, gambling has become widespread and gained popularity over the years. Due to an increase in demand for gambling activities, there has also been a corresponding increase in gambling establishments. According to the Global Betting and Gaming Commission (GBGC), (2016), the worldwide gambling market is estimated to be worth at least $464 billion. These establishments continually try to increase their market presence through different expansion strategies, most especially mergers and acquisitions. In 2014, the largest merger in the industry occurred between Amaya Gaming and the Rational Group (Financial Times, 2014), while others include Paddy Power and Betfair (Guardian, 2015) and Ladbrokes and Coral (Kollewe, 2015). Interestingly, the UK accounted for the highest number of mergers and acquisition in the gambling market in 2015 (Thomas, 2015). Consequently, these retailers are constantly looking for ways to improve their market share through various marketing techniques, including the opening of new outlets.

2.3.1 Impacts of participation in gambling

Aside from the influence of locations of food retailers on SEDs, there has been considerable discussion on the location patterns of gambling establishments. This attention has been deemed necessary because of the ills associated with participating in gambling activities (Lorenzo and Yaffee, 1986, 1988; Korn and Shaffer, 1999; Griffiths, 2001; Welte et al., 2004).

The psychological and social health risks associated with participation in gambling activities are well documented (Lorenzo and Yaffee, 1986, 1988; Korn and Shaffer, 1999; Griffiths, 2001). There is increasing evidence that gambling exacerbates income inequality (Mckee and Sassi, 1995) which is a critical topic in inequality. An empirical study by Wilkinson (1992) concluded that income inequality has a negative bearing on life expectancy in developed countries. Similarly, an editorial by Griffiths (2001) highlighted that further research should be conducted to better understand the associated health risks inherent with participation in gambling activities, as well as raise awareness among health practitioners of its dangers. Furthermore, pathological gambling or problem gambling, (i.e. "patterns of gambling behaviour that compromise, disrupt or damage health, personal, family or vocational pursuits", Abbott and Volberg (2000, p. 11)), not only pose serious negative consequences to participants as families, friends and colleagues of problem gamblers, but they are also usually victims of the indirect consequences of pathological gambling (Blume, 1988; Lorenzo and Yaffee, 1988; Lesieur and Rothchild, 1989; Korn and Shaffer, 1999; Griffiths, 2001; Nower 2003; Afitti et al., 2010). The social and health risks associated with participation in gambling activities are aggravated by increasing accessibility to gambling opportunities (Volberg, 2000). Literature alludes that the social and health risks associated in gambling, and especially problem gambling, are fuelled through continued opportunity to gamble (Abbott and Volberg, 1999; Griffiths, 1999; Barratt et al., 2014). The empirical study by Barratt et al. (2010) also discovered that there is a relationship between gambling accessibility (electronic gaming machines) and call rates to Gamblers Helpline.

2.3.2 Gambling locations and area socio-economic deprivation

In North America, evidence suggests that there is a relatively high concentration of gambling opportunities in deprived communities. In Canada, Gilliland and Ross (2005) and Robitaille and Herjean (2008) explored the availability of gambling opportunity. To measure gambling

provisioning, the studies utilized the availability of video lottery terminals (VLT) licenses in alcohol stores and amusement centres, among others, using different dynamics. Gilliland and Ross (2005) estimated VLT licenses per 10,000 people, per location and per area to represent prevalence, adoption and density respectively, whereas Robitaille and Herjean (2008) measured gambling accessibility, using a gravity model which incorporated all premises with a VLT license, as well as travel distance to each venue.

To measure socio-economic deprivation Gilliland and Ross (2005) created an index from three indicators: low education attainment, unemployment and single parenthood. Results revealed a lack of VLT licenses in low stress areas and marked concentration in highly stressed areas, even after controlling for boundary difference. Furthermore, correlation and regression analysis revealed a positively significant relationship between the three VLT availability estimates and each of the stress variables highlighted above, with low education predicting over 50% in adoption of VLTs (Gilliland and Ross, 2005). Alternatively, Robitaille and Herjean (2008) created an index from both socio-economic (income and education) and socio-demographic variables (age and gender) and found similarities in the geographical distribution of vulnerable populations and VLT permits, with a dense availability in distressed areas as well as in former commercial hubs. Furthermore, significant positive associations were uncovered, with the socio-economic variables showing the strongest positive correlations.

Likewise, another study in Canada (Wilson et al., 2006) examined VLT terminal access and gambling behaviours among school students in order to uncover if there is a positive relationship between gambling opportunities and classification of schools according to area socio-economic status. Results uncovered easy accessibility of VLTs in inner city neighbourhoods and schools in economically disadvantaged areas compared to suburban areas. Although Gilliland and Ross (2005) recognised the influence of area SECs in shaping the prevailing gambling landscape, they concluded that other factors such as historical land use zoning and alcohol licensing patterns were also evident in the observed VLT distributions.

Similarly, in Australia, there is a consensus that higher accessibility to gambling machines in low socio-economic status areas exists. A longitudinal study (Marshall and Baker, 2002) examined area characteristics and gaming machines in Melbourne and Sydney identified a random distribution of machines, with no specific patterns along socio-economic lines when

the machines were introduced in Melbourne. Subsequent years witnessed a rapid shift in the machine location patterns, with a sharp increase in deprived locations. Likewise, for 1998 in Sydney the result was the same, with high distribution in disadvantaged areas. Marshall and Baker (2002) further ascribed that aside from socio-economic deprivation, high market demand in these areas encouraged betting retailers to further increase supply. In addition, existing government regulations which capped the total number of electronic gaming machines (EGM) per state resulted in re-distribution of machines from low performing areas to "hot" zones, leading to "a polarization" effect (p. 283), namely a sharp decline in affluent areas and the opposite in disadvantaged neighbourhoods.

Another longitudinal study (McMillen and Doran, 2006) explored the relationship between problem gambling and EGM density in Victoria by explaining how localised contextual elements impact EGM expenditure in different political contexts. The study used a kernel density method to estimate EGM spending per gaming machine and compared it to the spatial patterns of deprivation. Contrasting relationships emerged in the three study areas. Results in two of the study areas revealed very weak or no linkages between EGM expenditure patterns/gaming venues and disadvantaged socio-economic neighbourhoods, with some relative hotspot incidents in advantaged areas. For the third city, the patterns of concentration were observed in both advantaged and disadvantaged neighbourhoods. The study concluded that possibly, rather than SECs, other factors such as venue location (proximity to shopping centres and residential areas), venue characteristics (e.g. opening times, local policies and marketing strategies) and customer preferences (demand factors), are important considerations. However, there are methodological issues that could explain these conflicting results. Failure to incorporate changes in SECs over time and machine expenditure might be an accurate representation of gambling participation because evidence from the literature suggests that, although gambling prevalence is very high among low socio-economic status individuals, the affluent tend to spend more on gambling (Suits, 1979). In addition, areas with higher numbers of venues and machines would have lower spending estimates because the estimates measure expenditure as a function of venue.

In Victoria, Australia, Pickernell et al. (2013) extensively researched the distribution of EGM and local contextual characteristics using multivariate regression analysis to explain the relationship between EGM patterns and other socio-economic indicators revealing significant positive and negative relationships between unemployment and income respectively, with machine counts per adults, whereas EGM spending per venue had no

significant relationship with unemployment and income, re-iterating that expenditure per venue is not a good measure for exploring gambling distribution.

Likewise, in New Zealand, the literature suggests that inequality exists in the distribution of gaming machines between disadvantaged and non-disadvantaged communities, with greater concentration in deprived communities. Wheeler et al. (2006) examined the association between non-casino gaming machines and poverty and their links to problem gambling using the New Zealand deprivation index and ethnic minorities aged 19 – 39. Results revealed a positive relationship between gaming machine venues and gaming machines per venue and area characteristics, with a concentration in disadvantaged and ethnic minority areas. In addition, a national study by Pearce et al. (2008), which examined the distribution of gambling opportunities vis-à-vis gambling behaviour, found a concentration of gaming machines in deprived neighbourhoods. In this study, travel distances indicated that the most advantaged neighbourhoods travel twice the distance to a gaming venue compared to the most deprived neighbourhoods. However, as availability measures were not weighted with area population or households, there might be over/under estimation of the actual machine density.

In the UK, there is conflicting evidence on the distribution of gambling opportunities in deprived areas. Literatures allude that betting shops are prevalent in deprived neighbourhoods (Portas, 2011; Wardle et al., 2014; Townshend, 2017). A study which employed GIS techniques (Astbury and Thurstain-Goodwin, 2015) to map the spatial distribution of gambling retailers also found a concentration of fixed odds betting terminals (FOBTs) in areas with high levels of unemployment, resident deprivation, crime and ethnic diversity. Likewise, an empirical study by Wardle et al. (2014), which explored the distribution of FOBTs and socio-economic deprivation, found a significant relationship between high density machine zones, impoverished neighbourhoods and SECs (age and occupational classification) in the UK.

In Wardle et al. (2014) gambling availability was estimated by using a 400m buffer radius to classify neighbourhoods into machine density zones, using the total number of FOBTs in all licenced venues (including amusement parks, alcohol outlets, casinos, bingo clubs etc.) per 1000 persons. Results further revealed high machine density zones in New Towns and seaside resorts. Wardle et al. (2014) concluded that although an area's SECs are linked with gambling availability, retail formation and population dynamics, pre-existing cultural

landscape and local policies might also influence the machine locations. In Australia, Young et al. (2009) suggested that neighbourhood deprivation alone does not account for the observed patterns and explained that other variables such as venue accessibility, as well as rules and regulations guiding admittance into different venues, were relevant factors. Whysall's (2014) study explored the relationship between different retail brands and socio-economic deprivation and found contrasting relationships between different groups of retailers. The study discovered that both conventional retailers and betting shops appear to favour disadvantaged neighbourhoods. The study further argues that there might be an influence of regionalism, size of retail chain, retailers' historical location patterns and past marketing strategies on the observed retail patterns.

A drawback of most of these studies (Marshall and Baker, 2002; Wheeler et al., 2006; McMillen and Doran, 2006; Wilson et al., 2006; Gilliland and Ross, 2005; Robitaille and Herjean, 2008; Pickernell et al., 2013; Wardle et al., 2014) which used gaming machines to measure availability, is that they introduced an element of bias into their research. Their availability measures included gaming machines in amusement parks, casinos, pubs, alcohol outlets and other locations, which only offer gambling opportunities as side attractions. It can thus be argued that most individuals patronizing these locations are not primarily interested in gambling. In addition, many patrons of facilities such as amusement parks are not local residents (i.e. non-localised demand). Wardle et al. (2014) further included gambling machines in pubs, restaurants, casinos, bingo clubs and amusement/family arcade centres. This introduces bias in the results obtained. For example, their findings showed a concentration of gaming machines in seaside areas. This is expected because amusement parks/family arcade centres are holiday destinations and their presence are found along the coastlines of the UK. Moreover, their catchment areas far surpass their immediate neighbourhoods. Likewise, casinos halls are widely situated in neighbourhoods with good access to tourist/transient populations, most especially town centres. Interestingly, the MHCLG (2012) classifies casinos as main town centre use in its the National Planning Policy Framework (NNPF) Annex 2. Furthermore, as regards casinos, evidence shows that a casino's catchment area goes far beyond its immediate neighbourhood (Eadington, 1998).

Most of the above studies agree that not only socio-economic deprivation account for the observed distribution of gambling opportunities in deprived areas, location context such as historical land use planning, venue accessibility, prevailing government rules and regulations also impact on gambling locations. Therefore, it is possible that that all the

patterns observed could be similar to those of other conventional retailers but, unfortunately, these studies generally failed to carry out a comparative analysis of the gambling locations or a more conventional group of retailers to understand the peculiarities and differences ((Marshall and Baker, 2002; Wheeler et al., 2006; McMillen and Doran, 2006; Wilson et al., 2006; Gilliland and Ross, 2005; Robitaille and Herjean, 2008; Young et al., 2009; Pickernell et al., 2013; Wardle et al., 2014). The only study (Whysall, 2014) which attempted a comparison used IMD index scores to explain the relationship between gambling and retailers. A drawback of this approach is that the scores are very difficult to interpret and not recommended for research purposes (Smith et al., 2015). In addition, the IMD index scores in a composite index which includes other indicators such as long-term limiting illness and crime deprivation, for example, for which no evidence exists to support linkage with gambling locations. Furthermore, the study did not look at the totality of food outlets. Rather, it compared selected retail brands.

2.4 Fringe banking establishments

The financial system in the UK, just like the US, has evolved into a two-tiered market which consists of the mainstream institutions offering traditional banking services such as savings and chequing accounts, and alternative financial institutions offering very short-term loans, usually for one month. The short-term financial services provided by the latter attract high interest rates due to the unsecure nature of the credit. Empirical studies in the US relate the growth in the industry to the concept of spatial void hypothesis (Smith et al., 2008; Smith et al., 2013) which implies that these establishments are filling a void created by the absence of mainstream financial institutions.

Contrary to this assertion, Sawyer and Temkin (2004), Fellowes and Mabanta (2008) and Fowler et al. (2014), discovered that these establishments are also present in locations where mainstream financial organisations are located. Cover et al. (2011) further revealed disparate findings, with mainstream and alternative financial providers' locations co-existing in similar locations in three cities, thereby questioning the validity of the spatial void hypothesis. Perhaps this 'void' is less spatial and more about different groups' socio-economic ability to access mainstream providers. This view strongly supports a more socio-economic type analysis in order to examine the void, as against purely spatial analysis. In addition, another study identified that limited access to mainstream banking facilities is a further factor that promotes patronage of fringe banking services (Lim et al., 2014).

2.4.1 Fringe banking outlets and socio-economic deprivation

The literature on the geography of fringe banking outlets, like that of gambling, suggests that they favour disadvantaged neighbourhoods. Studies on fringe banking locations are mostly from the United States. Graves (2003) suggested that payday lenders are targeting deprived neighbourhoods after carrying out a comparative analysis of payday loans and mainstream financial institutions' locations in eight different counties in the US. Area characteristics were determined using socio-economic indicators (including ethnicity, household income, poverty level, renters and median house value). Analysis of mean differences revealed that payday loan outlets have higher presence in areas with high proportions of minority ethnicity, renters and poor households, compared to mainstream banks. He further explained that the patterns are not clearly defined in areas with low populations where available retail spaces exert the highest influences on the location of these retailers.

Gallmeyer and Roberts (2009) examined the relationship between the geographical distribution of payday lenders and economic and demographic characteristics also in the US. The study found significant differences in the means of outlets across various SECs, with higher means in areas with high proportions of deprived households consisting of ethnic minorities, immigrants, young adults, low incomes, poverty rates and military affiliations. Regression showed a curvilinear relationship with payday loan locations not concentrated in the poorest areas, but rather in mid-poverty areas. Analysis further revealed that the following socio-economic variables are significant predictors of payday loan locations, even after controlling for income; areas with high proportions of senior citizens military personnel, foreign born and low incomes remaining significant predictors. It concluded that income factors and labour force composition are the major driving forces in payday loan distribution. Due to the small size of the study area, regional and local variations in economic indices might reduce the generalisability of the results of this research.

Cover et al. (2011) explored the spatial distribution of fringe banking services in four American cities using a regression model to establish the influences of market factors, poverty and ethnic area characteristics on observed patterns. The market factors models reveal that levels of commercial activities are a major determinant of location of fringe banking services, even after controlling for other factors, in all the study areas. Likewise, poverty indicators play a significant effect on the distribution of fringe banking locations revealing a curvilinear relationship, signifying that these retailers prefer middle

impoverished areas compared to the poorest communities. Presumably, the very poorest have the lowest likelihood to meet repayment obligations, so these areas do not offer any attractiveness to these retailers. In particular, Hispanic ethnic minority is a major positive correlate of fringe banking locations.

Burkey and Simkins (2004) carried out a study which examined the factors that affect the location of payday lenders and mainstream financial services in North Carolina in order to explain the location preferences of these retailers relative to SECs. Regression analysis revealed that traditional banks were more decentralised in their location patterns, whereas payday lenders were concentrated in areas of high population density. Both retailers tended to favour high income inequality areas, usually highly commercialised areas. Black ethnic minority areas were significant predictors of payday lenders and not bank locations, while high and low education levels were negative and positive correlates of traditional bank and payday lender locations, respectively. Very low income and benefit claimants had a negative relationship with payday lenders only. Lack of comparative analysis with a different locality is a strong limitation of this research.

A national study by Fowler et al. (2014) compared the location of fringe banking retailers and traditional banks with area SECs (income and ethnicity), by examining the location of each fringe banking group (pawnbrokers, cheque cashing and payday lenders). These retailers were prevalent in neighbourhoods with few college-educated residents and in mid-poverty areas. In addition, poverty was a significant predictor of fringe banking location, but these retailers were significantly pronounced in mid-poverty areas compared to the very poor areas. Hence, socio-economic status alone did not explain the concentrations of fringe banks in Black, Hispanic and reservation communities. Barth et al. (2015) also carried out a national investigation on the location of payday lenders using regression analysis and discovered that African American residents had a significant positive effect on the locations of payday loan outlets. Even after accounting for multicollinearity among key variables, African- American residents remained significant. Poverty rates and persons aged 15 and under were also positive explanatory variables. In addition, higher education had a significantly negative effect on payday loan locations. Similarly, Prager (2014) identified the key socio-economic correlates of the location of alternative financial service providers with a strong presence in communities with high proportions of Black minority individuals, persons with little or no education and individuals with poor or no credit score. A limitation of these studies (Fellowes and Mabanta, 2008; Fowler et al., 2014; Prager 2014) is the scale

of the analysis. At national level, it is difficult to disentangle the complex relationships, thus more localised analysis would unravel clear cut patterns.

In the UK, although there has been increasing generalisation that these fringe banking retailers particularly cluster in poor neighbourhoods (Hurst and Blackwell, 2016; Townshend, 2017), and based on evidence from North America, the geography of high yield interest lenders has not been fully researched empirically (Glasgow Centre for Population Health (GCPH), 2016). An empirical study by Whysall (2014) attempted to examine the relationship between these retailers and socio-economic deprivation. The study found a significant relationship between payday loan outlets and the Index of Multiple Deprivation (2004). In addition, the available evidence in the UK suggests that there are limited studies to demonstrate that fringe banking outlets are located in areas of high socio-economic deprivation. This resonates the need for local research in the UK.

2.4.1 Effects of patronage of fringe banking services

The major concern regarding these high yield interest lenders is that interest charges for their products are extremely high, which raises the question of 'predation', highlighted by a number of North American scholars (Graves, 2003; Stegman and Faris, 2003; Lawrence and Elliehausen, 2008). Although there is a large demand for high interest loans, the success of the industry "is significantly enhanced by the successful conversion of more and more occasional users into chronic borrowers" (Stegman and Faris, 2003, p.25). This is achieved by continuous renewal of loans after their initial term (King et al., 2006). What is more, Gallmeyer and Roberts (2009, p. 533) contend that "pay day lenders have become an indicator of economically distressed communities just as they function as an aggravating factor in distress" (p. 533).

In the UK, Gibbons et al. (2010) reviewed the pay day loan market and arrived at two salient conclusions: pay day loans are expensive and there is a very high probability of indebtedness and repeated borrowing by users. Therefore, there is a high risk that agglomeration of these lenders in deprived neighbourhoods in the UK will continue to damage their delicate 'eco-system' thereby adding to the problems of inhabitants of deprived neighbourhoods. Furthermore, the reviews carried out in the UK by the House of Commons Business Innovation and Skills Committee (HCBISC, 2014) and Glasgow Centre for Population Health (GCPH, 2016) both revealed the negative aspects of these retailers. GCPH

emphasised that there is an inherent risk of burgeoning debt, financial hardship and psychological ill-health for most of the customers patronising these retailers. Similarly, the HCBISC (2014) review alluded that payday loan borrowers are susceptible to the danger of exacerbating debt and argues that there is a need for a general review of the industry.

2.5 Rent-to-Own (RTO) Establishments

RTO retailers are gradually becoming household names in the UK. They mainly provide consumers with household goods on hire-purchase. The market is dominated by two retailers in the UK: BrightHouse and PerfectHome. These retailers offer household appliances on credit to customers without the conventional credit checks.

This market has been under scrutiny because of the nature of their services and questions about whether customers patronise these retailers to buy or to lease their products. Lacko et al. (2002) discovered in their nationwide study in the US that in the long run, most customers use RTOs to purchase household appliances rather than lease them, initiating their transactions with the motive of eventually purchasing the products, and most did eventually purchase the products.

These retailers allow customers to make payments for purchased or leased products on weekly instalment plans. Similar to fringe banking services, RTO offerings are quite expensive in the long run. According to a UK study (Gibbons, 2012), this is due to three major factors: price mark-up compared to other high street retailers, repayment plans attracting extra charges and insurance cover cost included in the contract package.

2.5.1 RTO locations and area socio-economic deprivation

Recent trends have shown that there is an agglomeration of these retailers in poor and deprived neighbourhoods in the US. Graves (2003) concluded that the concentration of RTOs in poor and deprived neighbourhoods is deliberate and very evident in highly populated deprived areas compared to low populated neighbourhoods. Similarly, research which employed qualitative techniques to analyse the RTO market revealed that poor communities in the US have access to a larger array of RTO products, compared to those provided by other retailers (Hill et al., 1998). In addition, Whysall (2014) discovered a concentration of these RTO retailers in impoverished neighbourhoods with a significant relationship between store locations and IMD (2014). In the UK, this is the only study that

has attempted to explore the location of these retailers and compare the observed findings with other retailers in the UK. There is also a dearth of literature on spatial organisation of RTO in other parts of the world.

2.5.2 Effects of patronage of RTOs

There is wide disapproval of RTO services because interest rates are extremely high, and the dynamics of their transactions are usually very favourable for these retailers, to the detriment of the customers (Fogarty, 1994). This allegation has also been echoed in the UK. A report by the All-Party Parliamentary Group (APPG, 2015) raised concerns that these services are very expensive, and the compulsory added-on insurance is usually of poor value to the consumer. RTOs employ questionable tactics like non-transparent pricing, exorbitant interest rates, unnecessary insurance cover and product mismatch (APPG, 2015) in order to maximise revenue. Likewise, not only are these services expensive, retailers lack transparency in their treatment of customers and pricing disclosures are typically vague and misleading (Gibbons, 2012).

The dangers of patronage of RTOs have been identified across different empirical studies (APPG, 2015; Fogarty, 1994; Gibbons, 2012). Customers of RTO are overcharged leading to excessive financial burden. For example, a report by APPG highlighted that initial prices are high and it also illustrated that "in January 2015, the Centre for Responsible Credit discovered that the lowest cost washing machine available at BrightHouse cost a total of £1092 (the base 'cash' price being £568.96). By contrast the same machine is sold by Co-op Electricals for £295," (APPG, 2015, p. 11). Fogarty (1994) also emphasised this issue with RTO customers in the US who pay $730 more for a TV set. Hence, the situation of already vulnerable clienteles is further worsened. Likewise, defaulting (i.e. failure to meet minimum obligations) is also very expensive and overly exploited by these businesses.

2.6 Demand for alleged anti-social retailers

The emergence of the economic recession in 2008 saw many countries including the UK introduce austerity measures such as increased taxation and spending cuts in order to reduce deficits. More importantly, there were serious cuts to capital expenditure. Not only that, welfare packages and housing were also not spared (HM Treasury, 2010). Although, the UK government tried to reduce the effect of the austerity measures by protecting some of the

most vulnerable populations, empirical research by different scholars discovered that low income groups were worst hit (Browne and Levell, 2010; MacLeavy, 2011; Kennett et al., 2015).

According to Browne and Levell, "the biggest losers from the austerity budget in 2010 are low income households of working age, while better off working-age households without children lose the least." (Browne and Level, 2010, p.26). Browne (2012) further identified a reduction in income especially for households with more than three children and those living in rented community as a result of the austerity measures. This was also echoed by Kennett et al., in their study of Liverpool and Bristol that "… within both cities, it is increasingly the more disadvantaged households, particularly those with dependent children, who are feeling the greatest effects of austerity and retrenchment in welfare benefits and public services and are seeing the biggest impact in their everyday lives" (Kennett et al., 2015, p. 640).

Due to the after-effects of the economic recession, already disadvantaged consumers - and most especially low-income groups who were also adversely affected by the austerity measures - encountered additional problems such as unemployment and pay cuts (Kennett et al., 2015). Contraction in the post office and bank networks, plus tighter regulations placed on conventional lending and access to banking services further introduced hardship, which made meeting daily needs increasingly challenging. In order to survive, these consumers had to resort to other means, leading to greater demand for AASR services like high interest loans and gambling.

These trends further emphasise that the driving force for AASR services is deeply rooted in consumer behaviour. Hill and Stephens (1997) identified three key factors for that drive disadvantaged consumer behaviour: exchange restriction, consequences of restriction and coping strategies. For e.g. low income, under-employment and unemployment bring about a reduction in the purchasing power of disadvantaged consumers which leads to difficulties in meeting basic consumption needs. Thus, consumers are faced with consequences such as poor nutrition, non-payment of bills and rent arrears. Consequently, to cope with these issues, alternatives are sought in gambling, high interest loans and RTO services. Thus, understanding the socio-economic correlates of demand for these AASRs might help to uncover factors that may be responsible for the proliferation of these retailers in deprived areas.

2.6.1 Demand for gambling

Demand for gambling varies across different groups of people, but the demand pull can be categorised into three elements: namely the rational desire to make economic gains and improve financial and socio-economic status, action seeking and, finally, ego enhancement (Fisher, 1993). However, Fisher went further to say that these three factors alone cannot account for the overall demand for gambling, although one singular motive dominated: "the aim of winning money is an extrinsic end, which unified all players and provided a rational justification for their involvement" (p. 471). Similarly, the demand for gambling develops from the belief that there is the possibility of winning big and getting out of poverty, as well as being better able to cope with daily life and get away from boredom (Dyall and Hand, 2003).

Other scholars (e.g. Anderson and Brown, 1984; Coventry and Brown, 1993) ascribe demand for gambling (in different forms) as directly associated with sensation seeking. In Malaysia, Tan et al. (2010) further attributes demand for gambling to be prominent among male headed, younger and non-white collared job households. The higher the level of education, the lower the prevalence of gambling. In addition, there is evidence to show that demand for gambling among low-income earners is high (Barnes et al., 2011). In the UK, socio-economic correlates for gambling opportunities cut across gender, ethnicity, educational qualification, marital status, employment and age group (Wardle et al., 2010).

In addition, although high-income earners spend more on gambling related activities, the percentage of income spent on gambling is lower than for low-income earners (Mikesell, 1991). Coups et al. (1998) also found a direct relationship between low education and demand for gambling. From the above evidence, it is clear that demand for gambling services is drawn from low income earners, young adults, individuals in low paid employment or little or no employment, men and high-risk takers.

2.6.2 Demand for Fringe Banking Services

Payday lending demand has been explained using rational choice theory (Friedman and Hechter, 1990), which posits that human decisions are based on the availability of resources in the environment, taking into consideration various constraints. Therefore, the prevailing circumstances surrounding access to credit and financial policies have given users no other option than to access high interest loans in the face of financial challenges (Graves, 2003).

The demand for high yield interest services was exacerbated by consolidations in the financial industry in America which led to reductions in banks within poor neighbourhoods, banks focusing on high income customers and little interest in customers with poor credit records (Karger and Ebrary, 2005). In the US, demand for high interest loans largely originates from households with poor credit histories who are in employment and have a steady source of income (Stegman, 2007).

Similarly, Johnson and Johnson (1998) described the customers of high yield interest lenders as a vulnerable group with family issues, as well as large households in low-level jobs due to little or no education. In Canada, demand for payday loan services originated from young families aged 35 – 44 and couple families on low incomes (Pyper, 2007). In the UK, Collard and Hayes (2010) found that demand for high yield interest loans (pawnbroking) was largely drawn from hard pressed families with dependents living in council homes fuelled by the need to meet day-to-day consumption. They further identified them as households with low incomes mostly living in rented accommodation, with the majority having weekly household incomes lower than £300. A major factor that fuels this demand is the fact that these people perceive no alternative (Flannery and Samolyk, 2005). From the above review, high interest lender customers are usually in low paid employment, they usually either do not a have good credit history to enable them access cheaper mainstream credit facilities or have accessed the maximum credit available, hence the need for alternative sources.

2.6.3 Demand for RTO Services

In the US, the demand for rent-to-own was higher among individuals with low household incomes, single parent households, and (largely) women aged 30 – 34, and the study highlighting that "liquidity constraints, time preferences, payment structure and risk attitudes are possible explanations for this demand" (Zikmund-Fisher and Parker, 1999, p. 199). That is, uncertainty in the future financial capacity in relation to disposable incomes, the even spread of payment over a long period, and, most especially, factors which prevent the accumulation of savings, are the major drivers of demand for these retail services. McKernan et al. (2003) described the demography of users as low-income earners from minority ethnic groups living in large household families with low education. McKernan et al. (2003) further attributed use to financial illiteracy, lack of access to credit, geographic location and life stage. Lacko et al. (2002) related demand to individuals with low education, low income levels with bank or credit card account and mostly employed with at least a car

in the US. In the UK, the APPG (2015) findings attributed demand to users who are mostly reliant on benefits, aged 22- 49, low income, mostly female and living in rented accommodation.

2.7 Supply of alleged anti-social retailers

Before explaining supply factors that have impacted the proliferation of AASRs, it is important to highlight a major influence that has also caused widespread attention to AASRs in recent times, especially in the UK. This is the incessant flouting of regulations and marketing ethics by these AASRs. In recent times, the activities of these AASRs have been marred with series of unethical practices which have further focused attention on their activities, especially their operations and marketing strategies. In the RTO and Payday Loan segments, the Financial Conduct Authority (FCA) fined Wonga, CFO Lending and BrightHouse a total of £51.4m between 2014 – 2017 for charging exorbitant interest rates, unethical debt collection practices, poor accounting practices and irresponsible lending (FCA, 2014, 2016, 2017). In addition, numerous retailers in the gambling sector have also been penalised for various mal practices. For example, in 2017, Ladbrokes Coral was fined £2.3m and 888sports was sanctioned to pay £7.7m by the Gambling Commission (GC) for failing to protect vulnerable customers from problem gambling and their failure to safe-guard self-excluded customers from participating in gambling activities on their website (Davis, 2017; Sembhy, 2017). Likewise, in 2018, Skybet were also sanctioned by the regulatory authorities for exploiting vulnerable customers by accepting bets and sending marketing emails to self-excluded customers and failure to return funds to self-excluded customers on account closure (GC, 2018).

The supply of alleged AASRs has seen increases in recent times in the UK. Although each market player has specific factors attributed to its growth, there are some general factors that have positively impacted on their growth alongside the socio-economic demand-side drivers identified in previous sections. Supply-side factors include planning regulations and changing retail fascia. In the 1970s and 1980s, the UK retailing market experienced a decentralization which substantially impacted the existing retail outlook and shifted attention from city centres to out-of-town retail formats. Schiller (1988) attributed this to an increasing preference of key retail players to large store formats. Due to burgeoning costs of high street properties, as well as increasing rates of congestion, retailers shifted attention to cheaper out of town facilities which offered large spaces, opportunity for product enrichment and parking.

As earlier explained in section 2.2, Schiller (1988, p.18) termed it "waves of decentralization", which occurred with the food and grocery retailers, clothing and retail warehouses as well as with some service retailers vacating British city centres. This gradually created vacant premises and provided more opportunities for small independent and service-based retailers to the city centre. It also reduced footfall within high streets (Portas, 2011), which culminated in closures of businesses and further increased vacant premises, especially in deprived areas (Portas, 2011; Grimsey, 2013). This decline is also evident especially in inner cities (Whysall, 2011). However, the Planning Policy introduced in the 90s to discourage out-of-town retail centres and tackle the perceived decay in high streets shifted the attention of big retailers back to high streets and into opening convenience store formats (Wood et al., 2006). Unfortunately, as deprived high streets offered little gains and attractiveness due to low retail spending, these areas were neglected by the big retailers and the trend of empty vacant premises persisted. This continued growth in vacant premises in these deprived localities further led to cheaper rents and an influx of other businesses, including AASRs.

2.7.1 Supply of gambling activities

Gambling establishments on the other hand, claim that they provide recreational activities. These retailers offer many incentives to participants and their marketing activities stimulate participation in gambling. Furthermore, the belief for potential large monetary wins also fuels demand (Thomas et al., 2012) and, consequently, according to the law of demand and supply, the higher the demand, the higher the supply ceteris paribus. In addition, due to the high revenue generated from gambling related activities for the retailers and government, retailers continually seek ways to increase their market share. Accordingly, retailers are constantly looking for suitable locations to site their stores. More importantly, as relaxation of restrictions on gambling supply occurred following the Betting and Gaming Order (BGO,1996), it allowed for more gaming and jackpot machines at previously restricted venues and increased the supplementary facilities that could be offered to improve gambling experiences at licensed facilities.

The Order also permitted sales of refreshments, shop window marketing and introduced gaming to betting shops. Similarly, rules on fixed odds betting terminals (FOBT) also increased the supply of gambling. In addition, the growth of on-line betting caused betting shop owners to seek other revenue streams, notably FOBT, and since the BGO failed to

classify FOBT as gaming machines, there was a rapid increase in their presence in betting shops. All these concerns led to the amendment of the Gaming Act in 2005 and also the introduction more stringent code of practice by the limiting of FOBTs to four per store. To circumvent this code of practice, according to Portas (2011), betting retailers "simply opened another unit just doors down" (p.29) as vacancies already existed as explained above. This invariably led to a "proliferation of betting shops, often in low-income areas" (p.29)

2.7.2 Supply of fringe banking services

A report in the US summarised payday loan customers as being working class and single parent mostly headed by a female with low to moderate paying jobs (Fox and Mierzwinski, 2001). High yield interest loans design which to allows for no conventional credit checks, speed of approval and the ability to rollover debt month after months attracted these financially struggling individuals to these financial services (Stegnam and Faris, 2003). Furthermore, as suggested earlier, fringe banking is linked to chronic borrowing. Therefore, the more indebted consumers are, the higher the propensity to patronise high yield interest earners, thereby causing a pull effect on supply. As the demand for unsecured credit and short term and low-value credit increased in the US, this demand induced a corresponding increase in supply of high yield interest loans (Stegman, 2007) and further accounted for the higher presence of fringe banking services. In addition, Graves (2003) attributed the increase in supply of high yield interest loans to government policies of the 70s which ushered in a two-tier financial system, thereby, extremely disadvantaging the poor and exacerbating their inability to obtain mainstream financial services.

2.7.3 Supply of RTO Services

From the supply side, the dynamics of RTO credit services required no credit checks and there is ease of process and prompt approval which increased the attractiveness of their services (Francis, 2009; Anderson and Jaggia, 2009). Lack of credit checking further allowed struggling borrowers to seek to buy from several RTO lenders. In addition, the payment model which allows for weekly equal instalments for a long period further adds to its attractiveness to potential consumers (Zikmund-Fisher and Parker, 1999). What is more, these retailers employ marketing tactics that are not transparent about the price. Rather, emphasis is placed on their ability to grant immediate credit for household appliances and has flexibility of payment as well as the advantage of being able to return products after use.

Furthermore, as identified in the opening paragraphs, the availability of vacant premises in poor neighbourhoods likewise facilitates the expansion of these retailers (Portas, 2011).

2.7.4 Summary of key findings

The previous sections have reviewed the literature on socio-economic deprivation and AASR and FGR location preferences. The review has identified complex linkages between gambling, fringe banking, RTO and FGR locations and socio-economic deprivation both in the UK and internationally. In the UK, results of the review on FGRs are mixed. The majority of the studies indicate that deprived areas have better access to supermarkets and grocery retailers, but further highlight that irrespective of this, there are some deprived areas that are worse off in terms of food provisioning. Other studies indicate poor provisioning in deprived areas compared to affluent neighbourhoods. In addition, evidence of food provisioning asides from being complex is also rather confusing by shifting emphasis on store provisioning/healthiness of stores. Therefore, the linkages are not fully understood, highlighting the need for further research. For AASRs, however, strong evidence suggests a concentration of these retailers in low socio-economic status areas. The review also identified that for both AASRs and FGRs SECs alone do not explain the location preferences of these two groups of retailers. Historical antecedents, zoning regulations, accessibility, agglomeration factors and cumulative attraction, as well as other site location preferences, are also determinants of these retailers' locations. Neighbourhood socio-economic correlates of these retail groups include age composition, housing tenure, car ownership, occupation, ethnicity and family composition.

2.8 Retail Location Theory

Various theories have been used to explain retail locations. Prominent among these theories are central place theory, law of minimum differentiation, bid rent theory and spatial interaction theory (Brown, 1993; Clarkson et al., 1996). Each of these theories will be discussed below with the view of establishing whether they can contribute to explaining the observed retail locations and, if not, reject them.

2.8.1 Central Place Theory

Central Place Theory was developed in the field of Economic Geography by Walter Christaller (1933) to provide a theoretical framework for retail location at a regional level. It seeks to explain the spatial processes that lead to the observed spatial structures in any location. More importantly, it advocates that there is an order/hierarchy in the development of cities or markets that serve adjourning areas, and that the transportation network plays a vital role in that development (Berry and Garrison, 1958). The theory is based on two concepts: the range and threshold of a good or service. The range refers to the maximum distance that buyers are willing to travel to purchase a good or a service, while the threshold is the minimum demand required to provide a market for a particular good or service.

The theory is based on a set of assumptions which are: uniformly inelastic distributed customers with equal demand, customers behaving rationally, transportation being equally available and uniform in all directions, consumers utilising the nearest centre able to meet their demands, sellers being rational and competitive pricing as distance increases (Christaller, 1933). Based on these assumptions, the theory predicts that a hierarchical formation of centres will develop where centre size and product offerings are said to be perfectly associated with one another (Berry & Garrison, 1958). Christaller's basis for the theory rests on the effect of transportation on the demand and supply of a good. According to Litz and Rajaguru (2003), ''central-place theory focuses on the role of transportation costs and predicts that demand for a good or service declines with distance from the source of supply'' (p. 477). Therefore, there is a minimum threshold of demand which will ensure supply of the product is available and a maximum range to which consumers are willing to travel. Central place theory has formed an important theoretical framework in the analysis of retail location patterns (Berry and Garrison, 1958), because location forms a central theme in the success of any retailer. Consequently, the theory emphasises that observed location patterns of retailers in a locality result from an inter-play in the forces of demand and supply. As a result, firms need to locate within the minimum threshold for supply and maximum range for demand, which Berry and Garrison (1958) emphasized in their review of the theory.

The Central Place Theory assumes that all consumers are equal, have the same needs as well as the same purchasing power. However, this is a false generalization of reality because consumer needs vary (Brown, 1992) and this variation influences consumer behaviour, which is what forms the basis of demand/consumption. Moreover, population is not constant

and varies over space, so its assumption of uniformity in population is unrealistic (Brown, 1992; Clarkson et al., 1996). Aside from the assumption of uniformity in population and homogeneity in consumers, it has also been criticised for over-simplification of reality (Kivell and Shaw, 1980; Golledge et al., 1996). Furthermore, Colenutt and Hamnett (1982) and Brown (1993) criticise the theory because the underlying principles are not in tandem with the present-day retailing environment, which is very dynamic and has evolved through so many phases over time, as opposed to the static nature that the theory adopts. Not only that, it also assumes single-product trips (Hanson, 1980; i.e. consumers choose one a shopping location per trip). In reality, shopping trips are multipurpose and "it is widely recognized that individuals make travel decisions under a variety of constraints, particularly those of time and mode availability, and multipurpose travel can be viewed as an attempt by the traveller to pursue, within the set of operating constraints, the sequence of activities that has the maximum utility for him or her at a particular point in time" (p. 248).

These limitations have led to various modifications in the theory. One important modification by Berry and Garrison 1958) led to the development of the more realistic assumptions which emphasise that, in a non-uniform world, population and demand vary over space. Furthermore, from the empirical literatures, scholars have identified that the retail composition and forms resulting from central place theory do not conform with reality because analyses of various cities show that income (Davies 1972), socio-economic status income (Garner, 1966) and ethnicity (Pred, 1963), among others, are central in the observed spatial patterns of urban centres. However, the Central Place Theory has influenced approaches of planners to hierarchical schemes. The viewpoint here emphasises the idea that supply and demand vary across a population in relation to socio-economic variations and this is central to this research. Hence, Central Place Theory seems to have very limited value for this research because it does not incorporate the effect of socio-economic characteristics on retail location highlighting the need to investigate how socioeconomic characteristics impact retail locations.

2.8.2 Bid Rent Theory

Bid rent theory (also known as urban rent or land value theory) is derived from theoretical discussion on the study of land use by Murray Haig (1926, 1927). It postulates that the spatial structure within an urban centre is a result of demand and supply factors. The assumptions of this theory include a hypothetical setting made up of a uniform plain where transport is

uniform and available in all directions. According to Haig (1926), the land use in urban areas is determined by the going rent. That is, the observed formation in urban centres is a function of competitive bidding for available sites. This is because, due to the savings on transport costs by situating businesses in the city centre, rent and land value will continually increase in the city and urban centres. Consequently, over time, these centres will be occupied by economic activities capable of paying the highest competitive rent (Goodall, 1972; Egan, 1983; Jones, 1991).

Various drawbacks of the bid rent theory have been identified by scholars and include the assumption that maximized accessibility is at the city centre, a city is monocentric, availability of an assortment of independent buyers and sellers who are very aware, logical, and utility maximising. The misconception of these generalisations stems from the fact that it is practically impossible to find buyers and sellers who exhibit these characteristics (Goldberg and Chinoly, 1984). Another drawback, in recent times, city centres have become increasingly saturated, especially for car owners, making accessibility difficult. In addition, this theory fails to acknowledge the dynamic nature of urban centres i.e. urban centres evolve over time and patterns observed could be because of developmental growth/decline through various stages (Colenutt and Hamnett, 1982). Furthermore, Garner (1966) discovered that in Chicago, rent value alone did not account for the pattern of retail nucleation, rather rent value and socio-economic and income characteristics resulted in the formation of retail structures. Therefore, from this thesis viewpoint, this theory recognises the importance of rent in determining/constraining retail location choices. However, the significance of SECs emphasised by Garner (1966) seems fundamental to the process being researched, yet unfortunately, this theory fails to acknowledge this.

2.8.3 Spatial Interaction Theory

Spatial interaction theory is derived from mathematical formulations utilized for analysing and predicting interaction patterns between an origin and a destination (Haynes and Fotheringham, 1984). The theory emphasises that in the selection of which retail outlet to patronise, consumers trade off the attractiveness of alternate shopping locations in relation to distance. This model explains the existence of behavioural interactions between consumers and retail location, as against buyers considering only proximity in deciding where to shop (Clarkson et al., 1996).

The introduction of this theory to retail location studies developed from the work of Reilly (1931), whose 'Law of Retail Gravitation' likened Newton's law of gravity to consumer behaviour and shopping destinations. The law states that "two cities draw trade from an intermediate town in the vicinity of the breaking point approximately in direct proportion to the square of distances from the two cities and in inverse proportion to the square of the distances from the two cities to the intermediate town" (Reilly, 1931 p.9). The foundation for this theory is based on consumer behaviour and it has contributed immensely to the body of knowledge in demand estimation (Newing et al, 2013), design and estimation of trade areas (Yrigoyen and Otero, 1998), market share estimation (Okoruwa et al., 1988), sales prediction (Ghosh and McLafferty, 1987), the retail store selection process (Wood and Browne, 2007) and retail location analysis (Davies and Rogers, 1984; Nakaya et al., 2007).

Although this theory has proved to be applicable in real world situations, various drawbacks have been identified which have led to continuous improvement in the theory's parameters. According to Huff (1963), issues in the model as proposed by Reilly relate to the realisation that the population and distance parameters sometime fail to conform to real world situations and that the theory fails to explain "observed regularities" (pg. 85). As a result, Huff (1963) refined the theory and focused on consumers rather than retail centres, and suggesting that product offerings, retail centres and travel time play the most significant role in consumers' choice of retail centres. Importantly, the major difference in Huff's and Reilly's contributions is that the former is probabilistic while the latter is deterministic. Lakshmanan and Hansen (1965) also made some modification to Huff's model that retail centres compete in an overlapping manner and that sales are directly related to the size of a retail centre. It does not take into consideration the known fact that the retail environment is a microcosm of the environment, which changes over time (Thorpe, 1975). Hence, this viewpoint suggests that the idea of catchment and patronising local facilities is very relevant, as it seeks to explain how local demographics influence retail locations.

2.8.4 Principle of minimum differentiation

The principle of minimum differentiation holds that two competing retailers extract the most advantage in close proximity to each other in a linear market (Hotelling, 1929). According to Hotelling (1929), retailers in the same market sector will reach location stability when the available market is equally shared among the two retailers if they are concentrated in the same place and customers' decisions are based on best total (i.e. purchase plus 'travel') price.

The principle makes assumptions in relation to pricing, consumer behaviour, location, competition, transportation cost and market size. It also assumes a homogenous market, duopolistic competition, completely inelastic and identical demand and an even distribution of utility maximizing consumers. Unfortunately, these assumptions are rarely, if ever, accurate in reality (Eaton and Lipsey, 1979). They further criticized the assumptions and practicality of the principle that, in reality, the principle is only justified in a market with just two complimentary retailers and once the assumptions of the principles are made to fit real world situation, the principle predicts there should be no complementary cluster. However, the application of this principle has been widespread and there has been considerable evidence of close agglomeration of retailers in various studies worldwide.

Brown (1993) alludes to the idea that the failure of the principle is that "Hotelling-type models are predicated on essentially negative premise – that clustering is socially wasteful; that if not colluding firms engage in destructive competition, etc.". (p. 201). In reality, agglomeration helps reduce the inherent risk of uncertainty for both consumers and retailers, because it allows for healthy competition between retailers (Webber, 1972). Agglomeration refers to assemblage of phenomena. Agglomeration of retail trade has received widespread attention from scholars (Nelson, 1957; Brown, 1987). To advance the principle, a relaxation in the assumptions of the principle by Weber (1972), resulted in the clustering of business activities at the centre of the market. Another reason for clustering lies in the fact that the presence of a retailer in a location diminishes the risk inherent in that location to other retailers in the same market sector and will eventually lead to an agglomeration of the competing retailers in that location (Pascal and McCall, 1980). This agglomeration concept was termed "cumulative attraction" by Nelson (1957) and is whereby similar businesses cluster in the same locality and then this clustering acts as an attraction for other retailers. In summary, an important lesson from this principle is that there are supply-side justifications for retailers to cluster. Therefore, it is inaccurate to automatically assume that clustering of like establishments is solely a reflection of catchment (demand-side) characteristics.

2.9 Place, place attachment and sense of community

The concept of place and place attachment gained momentum from the work of human geographers (Tuan, 1974; Relph, 1976). It emphasises the bond and emotive experiences of people to places. Places are given meaning through individual, group or traditional processes (Low and Altman, 1992). Thus, the term place is defined as an environment made up of the

structural characteristics of a locality, together with the social and psychological processes that take place within its borders (Relph, 1976; Brandenburg and Caroll, 1995).

Fisher et al. (1977) define attachment as an "individuals' commitment to their neighbourhood and their neighbours" (p. 139). As summarised by Brown and Perkins (1992, p. 284), “place attachment involves positively experienced bonds, sometimes occurring without awareness, that are developed over time from the behavioural, affective and cognitive ties between individuals and/or groups and their socio-physical environment”. Hence, place and place attachments can help to understand how emotional attachment, preferences and commitments influence social cohesion, which in turn impacts on development and planning practice (Manzo and Perkins, 2006). Research has further linked place attachment with sense of community (Pretty et al., 2003). Shamai (1991) argues that sense of community varies with individuals and relates to attitudes and behaviour to one’s community. Rightly put “sense of place consists of knowledge, belonging, attachment, and commitment to a place or part of it” (Shamai, 1991, p. 354).

Therefore, communities where inhabitants have strong place attachment and sense of place will experience strong opposition to “locally unwanted land uses” (LULU), which invokes the “not in my back yard” (NIMBY) response (O’Hare, 1977; Popper, 1981). Different researchers have unearthed linkages between property values and retail locations (Caceres and Geoghegan, 2017; Burkhardt and Flyr, 2019). In addition, some retail structures (AASRs) have been linked with harmful consequences on their local communities and are signs of community distress (Gallmeyer and Roberts, 2009; RSPH, 2018; Association of Convenience Stores, 2019). NIMBY, place attachment, sense of community and overall social cohesion are weaker in deprived neighbourhoods. Therefore, planning authorities in these neighbourhoods characterised by high residential mobility, low SECs and high vacant premises in need of rejuvenation come under less pressure from residents to limit LULUs (i.e. AASRs).

2.10 Theoretical and Conceptual Framework

From the above review, it emerges that the development of a suitable conceptual model to analyse the relationship between alleged AASR locations and social deprivation is complex and multi-faceted. From the review of central place theory, bid rent theory and principles of minimum differentiation, a central issue with the assumptions of these theories is that all

consumers are equal in terms of quality and quantity of their demand. This review has highlighted that demand is determined by consumer behaviour, which varies across socio-economic groups (Foxall, 1990; Hoyer and Maclinnis, 2010). The effect of socio-economic factors was also demonstrated by Garner (1996) in his study, where he discovered that area SECs plays an important role in store formation and retailer types in a study area. In addition, the demand for AASR services varies in relation to SECs (Fisher, 1993; Johnson and Johnson, 1998; APPG, 2015).

These classical theories (central place, bid rent and principle of minimum differentiation) also assume a perfect market with inelastic demand and supply, and therefore retailer locations are in response to demand (Christaller, 1966), whereas selection of retail location sites in reality involves strategic planning which takes into consideration competitors' behaviour, changes in consumer behaviour, economic conditions and preferences (Ghosh and Craig, 1983). Ghosh and Craig's (1983) conclusion; further strengthens the argument that retailers not only respond to demand but also develop distinct strategies and policies to guide their location choices. These strategies are what critics are particularly concerned with, as the major criticism levelled against AASRs is that a key part of their location strategy involves deliberate targeting of deprived consumers and neighbourhoods (Graves, 2003; Stegman and Faris, 2003; Kubrin et al., 2011).

These theories also fail to recognise the dynamic nature of retail environments (Colenutt and Hamnett, 1982; Brown, 1993). Studies show that the retail environment is very dynamic and constantly changing (Ghosh and Craig 1983; Craig et al., 1984). A typical example is the British retailing environment as explained by Schiller (1971; 1988), who identified some major retail services preferring out-of-town locations as opposed to city centres, resulting in decentralisation 'waves' from high streets to out-of-town centres by major retailers. This dynamic adversely affected the less attractive town centres (deprived high streets) and created good opportunities for the spread of these AASRs (as explained in previous sections) because it created vacant premises on deprived high streets (Portas, 2011; Grimsey, 2013).

Given the above criticisms, these classical theories cannot fully explain the location of AASRs, but still make a significant contribution by highlighting how supply and demand forces in interaction may impact location preference. Spatial interaction theories on the other hand, do not assume homogeneity of customer demand but rather recognise the influence of consumer behaviour in shaping demand. Spatial interaction theories suggest that in the

analysis of consumers' geo-demographics - by examining how socio-economic forces within different localities interplay to inform retail locations - lies the solution to retail location issues (Davies and Rogers, 1984; Clarkson et al., 1996; Nakaya et al., 2007). A major drawback is that they are not primarily employed to explain the patterns of retailing but, rather, to explain consumer behaviour which then informs retail location choices (Brown, 1993). This introduces the notion of micro-scale spatial analysis (i.e. careful exanimation of different retail locations and observed retail location patterns taking into consideration neighbourhood characteristics and other external factors). Brown (1993) argues that the explanation of location decisions depends on micro-scale analysis. This concept was also echoed by Craig et al. (1984) who implied that microscale factors need to be examined to understand the role of the local area in retailers' site selection, as central place theory only provides theoretical insights at a macro-scale level. Therefore, research is required to better understand the clustering tendencies seen in retailers. This could hold the key to understanding the clustering (if any exists) of AASRs in deprived neighbourhoods.

Explanation for these micro-spatial scale location issues, which usually results in agglomeration of similar retailers, lies at the centre of two major theories (Brown, 1993) both of which have been extensively reviewed (i.e. principle of minimum differentiation and bid rent theory). As described by Brown (1993b):

> "although different in many respects, both concepts are predicated on positivist, neoclassical premises, which assume, essentially, that there is an identifiable order in the material world, that people are rational, utility maximizing decision makers and that economic activity takes place in a freely competitive manner. The theories, what is more, are deductively derived and normative in ethos. In other words, they are based on stated, often highly simplified assumptions, not empirical observations, and thus predict spatial patterns of retail activity that ought to occur, given the underlying assumptions, not ones that necessarily do" (pp.10-11).

The principle of minimum differentiation posits that agglomeration of competitive retailers offers advantages is evident in different countries where retailers of the same product, such as clothing, banks, and car dealers, among others, agglomerate in the same location (Brown, 1992). As mentioned earlier, Nelson (1957) referred to this as cumulative attraction, whereby agglomeration of similar retailers offer advantage and attract more businesses. These

viewpoints bring another dimension in spatial patterning as the retail landscape will consist of agglomerations of competing retailers based on neighbourhood needs. Therefore, if concentration is observed in the locations of alleged anti-social retailers, it is possible that these locations offer the best advantage to the retailers (principle of minimum differentiation). On the other hand, bid rent theory emphasises that rental value plays the most important role in the spatial patterns of retailers. In attractive centres, rent is usually higher, which allows higher order retailers capable of paying competitive rental values to occupy these locations, while lower rent paying retailers move/locate farther from the centres. Meanwhile, unattractive retail centres, including deprived neighbourhoods which have been adversely affected by decentralization and the gradual shift to online shopping, offer less value to many retailers and progressively lose their attractiveness and businesses to other areas (Schiller, 1971), leading to more vacant premises. This could also have facilitated an influx of these AASRs into these neighbourhoods which are also highly characterised by the individuals with low SECs that are drivers of demand for AASR services.

As explained above, the various changes experienced in retailing environment attributed to planning regulations shifted retailers' focus back to high streets but failed to attract retailers to declining high streets. In addition, the 1996 Gaming Order and the ABB Code of Practice introduced to the gaming environment further allowed for continued supply of gambling activities and the opening of more outlets. Likewise, the lack of adequate laws regulating the activities of fringe banking and RTO retailers might be major factors responsible for the proliferation of these AASRs in deprived neighbourhoods.

Therefore, the explanation for the observed patterns rests in the interplay of many factors. According to Brown (1993b), micro-scale retail landscapes can be explained based on the tenets of the principle of minimum differentiation and bid rent theory, analysis of demand and supply factors, consumer behaviour, planning policies/government regulations and retail organisation strategies. Consequently, the total choices of consumers shape the overall patterns of retail activities (Craig et al., 1984). In addition, Brown (1980) further implied that customer decisions are in themselves shaped by the spatial patterns of retail and supply activities.

This chapter has identified and discussed the key themes explaining the location preferences of AASRs. An issue regarding the location preference of these retailers is that critics allege that they are deliberately targeting deprived individuals and neighbourhoods. In order to

address this concern, this review has examined the demand and supply of AASR services. The demand for their services is largely influenced by deprived socio-economic status, which influences consumer behaviour, fuelled by the economic downturn. On the other hand, the supply of these services, as identified, has been driven largely by an increase in demand for their services, the changing retail fascia and various planning regulations. Furthermore, evidence abounds that these retailers are concentrated in deprived and disadvantaged communities, which has further fuelled the controversy around their location preferences. To account for the location patterns of these retailers and theories explaining retail location patterns, namely central place theory, bid rent theory, spatial interaction theory and principle of minimum differentiation, have been reviewed. These theories emphasise that demand and supply play a major role in retail locations, yet they do not adequately explain the concentration of these retailers in deprived neighbourhoods. In addition, agglomeration of retail trade, which Nelson (1957) termed cumulative attraction and further echoed by Brown (1992), might also be a factor accounting for the concentration of these retailers in deprived areas. This review has also identified the various waves of decentralisation and planning policies that have impacted retail location patterns. Although these give a general view of some of the reasons that could have resulted in the observed AASR location patterns, they may be quite limited as critics have alleged that rather than responding to demand or dynamics of retailing, these retailers employ location strategies that deliberately target deprived communities.

From the review of literature on linkages between FGRs and SED, socio-economic deprivation also influences their location preferences, although evidence is mixed. In addition, FGR locations are also affected by policies (Pearce et al., 2008; Black et al., 2011; Wiki et al., 2019). Figure 2.1 below shows the proposed conceptual framework to explain the observed patterns of AASR locations. As shown in the framework, retail location lies at the centre of the interplay between various factors. From the framework, demand for AASRs/FGRs is affected by consumer behaviour which is largely driven by individual SECs (level of income, employment status, ethnicity and family composition, among others) while individual SECs are affected by laws, policies and regulations. Supply of retail outlets is determined by rules and regulations, the retailers' marketing strategies and availability of vacant premises. Therefore, it is conjectured that AASR/FGR location lies in the interplay of demand, supply, law policies and regulations and availability of vacant premises. Thus, the major question attempted by this research is:

"are the socio-economic drivers that influence AASR locations similar to the drivers of FGR locations?"

From the conceptual model in Figure 2.1, is it clear that retail location selection is a function of numerous complex and interwoven factors. Therefore, this study focuses on just a segment

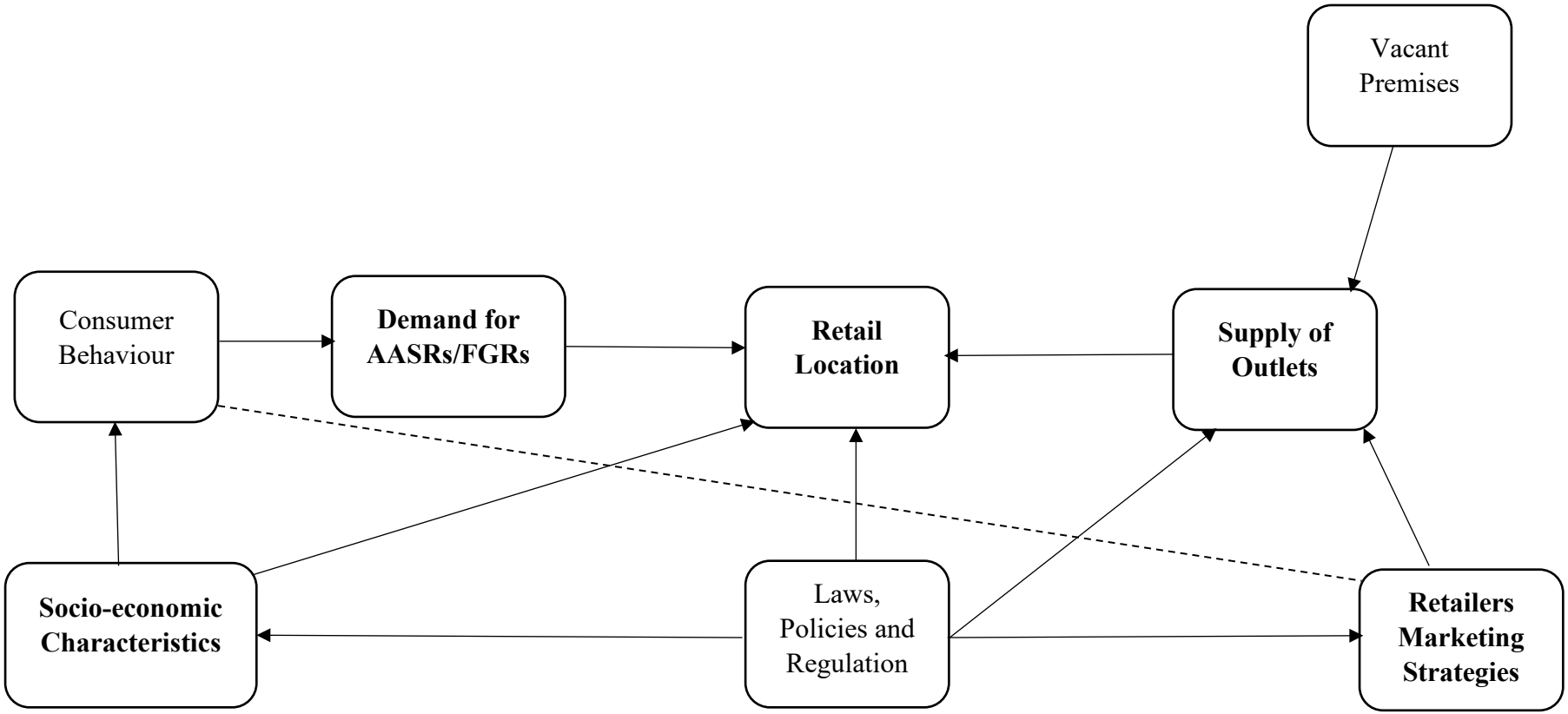

Figure 2.1 Proposed Conceptual Framework

of the conceptual framework. This thesis focuses on examining the linkages between different SECs and AASR and FGR locations. This research does not extensively focus on influence of existing laws, policies and regulations or retail marketing strategies. Rather, it takes the existing locations of FGRs and AASRs as a measure of both rules and regulations and marketing strategies. For instance, urban zoning systems (commercial and residential) influence retail locations and any neighbourhood with retail establishment are a commercial tract. This research only explores the bolded components of the conceptual framework in Figure 2.1.

Chapter 3

Methodology

3.1 Research methodology and design

This chapter presents and reviews the data employed for this research and their sources. It also explains in detail the research philosophy, approach and methods used to achieve the research aim and objectives. The aim of the research is to investigate the allegation of deliberate targeting of poor and vulnerable communities ascribed to AASRs by carrying out a comparative analysis of the location preferences of AASRs and FGRs using quantitative and geospatial techniques in England and, at a more localised level, three selected cities in England. based on the evidence from the review of the literature. To achieve the aim of this research, the objectives are as follow;

1. To explore the relationship between AASR locations and SED.
2. To confirm/validate if there is a concentration of AASRs (i.e. gambling, fringe banking and rent-to-own outlets) in disadvantaged neighbourhoods.
3. To explore if these concentrations are also found in food and grocery retailers' (FGRs) locations.
4. To compare any similarities and differences in the relationships observed between the two groups of retailers (AASRs and FGRs) and SED.

And additionally, for Phase 2:

5. To develop a synoptic model that best fits AASR locations using socio-demographic variables.

This chapter is divided into the following major sections: Section 3.2 explains the research philosophy adopted in this thesis and the basis for its adoption. Section 3.3 describes, critically reviews and justifies the design adopted for the research. Section 3.4 explains the research process and different stages of the research. Section 3.5 details data and sources employed while section 3.6 details the rationale for selection of the three different cities and the final selections. Section 3.7 discusses the different geo-spatial techniques utilised and the major statistical techniques adopted for the thesis and outlines their strengths and weaknesses. The analytic techniques were carried out at neighbourhood level (LSOAs) and are fully explained in section 3.7. These techniques include choropleth mapping, kernel

density estimation method, correlation analysis, one-way analysis of variance (ANOVA), clustering and regression analysis. Cross tabulations and descriptive statistics were also adopted. Section 3.8 concludes this chapter.

3.2 Research Philosophy

This section provides the philosophical context of this research and seeks to give justification for the paradigm adopted. It begins with defining and explaining the concept of research philosophy and moves on to critically examine the major research traditions in social sciences. It also examines the concepts of epistemology and ontological beliefs, the different approaches to research and provides justification for the philosophical considerations adopted for this thesis.

Research philosophy is concerned with the process of knowledge development. It therefore guides every facet of the research, from the beginning to the end of knowledge creation (Saunders et al., 2009). The research philosophy adopted for any research indicates the underlining assumptions which underpin the selected research strategy and design. Therefore, this section describes the various types of research philosophies, explains and provides justification for the chosen philosophy for this study. Research philosophy is examined in two ways: epistemology and ontology. These two concepts influence choice of research philosophy (Saunders et al., 2009).

3.2.1 Ontology

Ontology is concerned with the make-up of reality, namely what constitutes reality, how to identify reality and the nature of existence (Saunders et al., 2009; Bryan and Bell, 2011). The assumptions of reality influence how phenomena are studied. There are two major ontological considerations which are realism and relativity (Easterby-Smith et al., 2015). Realism, which is an ontological assumption, emphasises that the world is true knowledge and it can only progress from objective observation of the entity under focus (Easterby-Smith et al., 2015). In addition, realism stems from the belief that social sciences and physical sciences commit to the point of view that reality is external and different from personal belief (Bryman and Bell, 2015). Therefore, realism emphasises that researchers remain neutral throughout the research process (Saunders et al., 2016).

Relativist ontology, on the other hand, emphasises that there is no single reality (Easterby-Smith et al., 2015). As Collins (1983) rightly espouses, the opinion of what constitutes reality has subjective context and it varies spatially (i.e. over time and space). Relativist ontology further emphasises that knowledge is dependent on the viewpoint of the researcher (Easterby-Smith et al., 2015). Based on the above, this study adopts the assumption of realism ontology that knowledge is derived from observation which is devoid of researcher's viewpoint. This study adopts a practical approach by analysing different numerical datasets and makes recommendations based entirely on the findings of the results, as opposed to the researcher's point of view.

3.2.2 Epistemology

Epistemology is concerned with what is acceptable knowledge i.e. how things are done, how true reasoning is recognised from false reasoning or how is truth deduced (Bryman and Bell, 2011; Saunders et al., 2016;). In business management, because of its multi-disciplinary nature, different concepts of knowledge derived from various methods, such as numerical, text, narratives and stories, are valid (Saunders et al., 2016). Based on the above, there are three major research philosophical standpoints: positivist philosophy, interpretivist philosophy and pragmatist philosophy. These three major philosophies are explained in the subsequent sub-sections below.

3.2.2.1 Positivism

Positivist philosophy adopts the natural scientists' methods of social research. The positivist philosophy developed from the ontological standpoint that only one truth/reality exists and is derived objectively and independently of human perception (Nagel, 1986; Sale et al., 2002). It strives to propose a valid contribution to the body of research/knowledge. Evidence, rather than judgment or discourse, is required and the "end product of such research can be derivation of laws or law-like generalisations similar to those produced by the physical and natural scientists" (Remenyi et al., 1998, p. 32). From the epistemological perspective, the researcher and the phenomenon under observation are distinct entities, making it possible for the phenomenon to be studied without bias (Sale et al., 2002). Furthermore, the philosophy describes a research which is objective, and the results are devoid of the researcher's viewpoint and based on empirical observation and analysis of reality. Put simply, "there are independent causes that lead to the observed effects, but evidence is critical, that

parsimony is important and that it should be possible to generalise or to model, especially in the mathematical sense, the observed phenomena" (Remenyi et al., 1998, p. 33). Therefore, positivism largely emphasises finite observations that can be analysed using statistical methods (Remenyi et al., 1993; Saunders et al., 2009). Thus, highly structured methodologies are adopted for positivist philosophy in order to enable replication (Gill and Johnson, 2002).

However, several criticisms have been raised against this research philosophy. The notion that research should be carried out objectively and that results should not be influenced by the researcher's viewpoint has been widely criticised because a researcher's beliefs affects observation of the real world (Onwuegbuzie, 2002; Willmott, 2003), especially in the field of Social Science. Hence, "the conduct of full objective and value-free research is a myth, even though the regulatory ideal of objectivity can be a useful one" (Johnson and Onwuegbuzie, 2004, p.16). Another criticism levelled against positivism is that the world of business is too complex to be explained with laws, which is the norm in the natural sciences (Saunders et al., 2009). However, "the strength of positivism lies in the fact that it works with observable realities and the end product of such research can be law-like generalisation" (Remenyi et al., 1982, p. 32).

3.2.2.2 Interpretivism

This philosophy is associated with the idealism position and connotes diverse positions including phenomenology, hermeneutics and social constructivism. It explains that due to the complex nature of the world, the need arises for the business researcher to have a grasp of the dynamic influences of the human role in the environment i.e. there is the need to recognise the peculiarities in conducting research with people, as opposed to inanimate objects (Saunders et al., 2009; Bryman and Bell, 2011). The ontological position of this philosophy stems from the assumption that reality is socially constructed and, therefore, there are multiple realities and these realities are constantly changing (Berger and Luckmann, 1991; Sale et al., 2002). According to Remenyi et al. (1998) this philosophy "does not consider the world to consist of an objective reality, but instead focuses on the primacy of subjective consciousness" (p. 34). Thus, the circumstances of the individual players involved in each situation determine the observed realities. From this epistemological viewpoint, there is a relationship between the researcher and observed reality (Wheatley, 1992; Sale et al., 2002; Bryman and Bell, 2011) and the researcher and reality are not independent.

This philosophical standpoint attempts to understand the complexities in the real world, not in an objective manner, but rather with an accepted understanding that the observed world and the players (objects) within it are important contributors to its meaning (Collins, 2010). Therefore "the interpretivist approach allows the focus of research to be on the understanding of what is happening in a given context. It includes consideration of multiple realities, different actors' perspectives, researcher involvement, taking account of the contexts of the phenomena under study and the contextual understanding and interpretation of data" (Carson et al., 2001, p.5.).

Critics of this philosophical viewpoint claim that the results of interpretivist research cannot be used to make generalisations because prevailing realities might cease to exist over time (Remenyi et al, 1998) and, in addition, can vary between researchers, as each researcher's judgment and life experiences influence perceived results. Interpretivists argue that because the world is complex, adopting the scientific context in research is only be narrow-minded, but also the complexity of the world is reduced and lost in "law-like generalisations" (Saunders et al., 2009, p.116)

3.2.2.3 Pragmatism

Pragmatism as a philosophical research paradigm is an approach that seeks to understand the "practical meaning of knowledge within specific contexts "(Saunders et al., 2016 p. 137). More importantly proponents of pragmatism advocate that there are multiple ways of explaining observed reality and it is impossible for any one viewpoint fully to unravel all its complexities (Feilzer, 2010; Saunders et al., 2016). As a result, the focal point of a pragmatic investigation is purposeful inquiry and critical reasoning (Shield, 1998). More importantly, most pragmatists emphasis that rather than focus on examining reality from a metaphysical dialogue, a process-based approach to knowledge should be adopted, where inquiry is the defining process and the discussion of reality should encompass the contextual, social and emotional (Morgan, 2014). A pragmatic research starts with a conceptualised problem and the pragmatist seeks to provide a practical solution which would inform future practice. As such, in providing practical solutions, pragmatism philosophy adopts wide range of approaches, methods and realities driven by the nature of the research (Saunders et al., 2016).

A major criticism levelled against pragmatism is that antagonistic beliefs that knowledge needs to be objectively tested against reality and reality should be anchored in "certainty of

knowledge" but unfortunately pragmatism advocates some form of "make believe…virtually every idea is warranted, or every expedient idea is warranted." (Blake, nd).

3.2.2.4 Justification of Research Philosophy

The review above explains the major research philosophies employed in business and management science research and outlines the strengths and limitations of each of the philosophical approaches. Hence, after careful consideration and based on the research questions, aim and objectives (see chapter 1), a pragmatic philosophy has been adopted. This philosophy is adopted because it is assumed that knowledge is derived from practical and rigorous investigation, taking into consideration the contextual effect. This study starts from the conceptualisation of a problem and seeks to provide practical solutions to inform policy. For the ontological considerations, this study assumes that existing realities can be explained in multiple ways using multiple inquiry approaches. This study adopts a practical approach which utilises quantitative and statistical methods to explain spatial processes as against laws (Fotheringham, 2006). Although, the study adopts statistical approaches which unearth truth about existing realities, but for the problem investigated in this study, " absolutism is extremely difficult to find in most instances …but hold to the more acceptable goal of simply acquiring sufficient evidence on which to base a judgement about reality that most reasonable people will find acceptable " (Fotheringham, 2006, p. 241).

3.3 Research design

Research design explains how a research study addresses its research questions (Saunders et al., 2012). Research approach and strategy form an integral part of the research design. This section identifies the various research approaches and strategies considered by the researcher and provides justification for the selected approach. According to scholars (Saunders et al., 2009; Collins, 2010) the choice of approach and strategy is dependent on the clarity of the theories to be adopted for the proposed research. There are three major research approaches which are the deductive, inductive and abductive approaches. In addition, there are three major research strategy, namely: quantitative, qualitative and mixed research (Bryman and Bell, 2011; Bell et al., 2018). These are explained in the subsequent sub-sections and concluded in a sub-section on justification of the selected research design.

3.3.1 Deductive research approach

Deductive research finds its roots in natural sciences, where laws and theories provide the framework for knowledge creation (Collis and Hussey, 2003). It consists of 5 sequential stages: (1) developing a testable hypothesis (2) proposing how variables are to be measured (3) testing the developed hypothesis (4) reviewing the results to identify conformity or non-conformity with theory or if theory modification is necessary and (5) consequently modifying existing theory (Collins, 2012). A key advantage of deductive approach is its suitability when searching for causal relationships between phenomena. In this approach, it is necessary for the researcher to take an objective stance by ensuring that data collection, analysis and results obtained are always devoid of personal views (Saunders et al., 2009; Collins, 2012).

This approach also utilizes quantitative techniques to test research hypotheses. Therefore, data collected must be adaptable to quantitative techniques and must be drawn from a relatively large sample in line with the scope of the proposed research (Saunders et al., 2009). This further enhances the generalisability of the research, which is a very strong advantage for adopting the deductive stance (Sanders et al., 2016). Yet critics of this approach ask how a social scientist can arrive at a salient conclusion without incorporating the human perspective? In addition. it does not give room for alternative justifications to findings because of its dependence on rigid methodologies (Saunders et al., 2009). Irrespective, the generalisability of the results of deductive approach, its suitability to search for causal relationships and its suitability to scientifically test hypotheses using statistical analysis rebuff the criticisms of this approach.

3.3.2 Inductive research approach

The inductive approach is a theory generating method which originates from the social sciences domain as a consequence of criticisms levelled at the deductive approach explained above. This approach lays emphasis on understanding the subject matter taking into consideration time and context, as against investigating causal effect, using a flexible method which enables the researcher to find alternative justification for observed realities (Collins, 2012). Therefore, the inductive approach follows this sequence – the observation stage, discovering trends and patterns, drawing up conjectures or tentative hypothesis and then developing theory.

For this approach, the researcher utilizes their experiences, intuitions and knowledge to formulate research questions rather than depend on theoretical explanation (Remenyi et al., 1998). Using this approach, researchers do not concern themselves with developing hypothesis at the initial stages of the research, but rather develop paradigms from the data based on dominant themes (Thomas, 2006). What is more, the sample size suitable for this approach is usually small and therefore does not allow for generalisation. Hence, the small sample sizes and subjective nature of the approach affect the representativeness of the results (Saunders et al., 2009).

3.3.3 Abductive Research Approach

The abductive approach starts with a surprising (or a set of premises) and moves back and forth between the inductive and deductive research approaches. The approach allows the researcher to switch from induction to deduction and vice versa to generate new insights and conceptions of the observed reality. (Suddady, 2006), "that is, reasoning from an observation to its possible explanations" (Aliseda, 2007, p.261). It does not move from data to theory (induction) or from theory to data (deduction). Instead as it moves back and forth between the two and allows the researcher to combine both deduction and induction approaches (Saunders et al., 2015). The abduction approach begins with identifying a problem and then linking it to acceptable realities. As explained "as a foundation for inquiry, abduction begins with an unmet expectation and works backward to invent a plausible world or a theory that would make the surprise meaningful (Van Mannen et al., 2007, p. 1149). The abductive approach involves three major processes which are mnemonics (getting familiar with the data), de-familiarisation and revisiting observations (see Tavory and Timmermans, 2014, for details).

To adopt an abductive research approach, a major consideration is to ensure that available data is rich and robust enough to allow for development of important themes and conjectures regarding the subject matter to enhance development of plausible explanations; by so doing, researchers can link the explanations to appropriate theories (Van Mannen et al., 2007). There are some criticisms levelled against abduction for instance, "if abduction is a two-stage process, how are the two stages different? Do they use the same argument form or different ones?" (Plutynski, 2011, p. 230). However, a major advantage of the abductive approach is that because it allows the researcher to move from induction to deduction, it allows for robust findings.

3.3.4 Quantitative research

The term "quantitative" is used to describe numerical measurement of an observation. Therefore, quantitative research provides valid answers to raised research questions by adopting numerical measurements to attempt to understand the relationship between phenomena (Saunders et al., 2015). Bryman and Bell (2011); Bell et al., (2018) and explain that quantitative research adopts a deductive stance and is embedded in the positivist philosophy and an ontological assumption that there is only one truth. It involves the gathering of numerical data to understand the linkages between research and theory. Quantitative research not only concerns itself with describing how things are, but also moves further to understand the underlying reasons for the observed reality. Four concerns are attributed to quantitative research, namely: measurement, causality, generalisation and replication (see Bell et al., 2018 for details).

Many advocates of the interpretivist philosophical and qualitative research stance have levelled numerous criticisms against quantitative research. A strong criticism is that probabilistic analysis of relationships between phenomena implies a static relationship independent of people's realities (Bell et al., 2018). Put simply, "they argue that conceptualizing the social world in terms of variables and the relationships among them abstracts away the character of social life…" (Hammersley, 1989). Advocates of quantitative research rebuff this criticism by opining that because of the random and large sample sizes usually employed for quantitative analysis, results are generalizable across different contexts (Carr, 1994; Muijs, 2010)

3.3.5 Qualitative research

Qualitative research on the other hand is based on idealism philosophies (interpretivism and constructionism; Guba and Lincoln, 1994; Seeker et al., 1995) Qualitative paradigm takes the standpoint that interaction between individuals creates social properties and people actively create their own social worlds (Bell et al., 2018). Methods associated with this research paradigm are ethnography, focus groups, interviews, conversation analysis and thematic analysis. In addition, samples sizes are usually relatively small, which allows for purposeful articulation of the respondents' viewpoints. According to Duffy (1986), a major strength of qualitative research is that it puts the researcher and the respondents in close proximity thereby allowing the researcher to obtain valuable data through direct contact.

This proximity also facilitates genuine understanding of participants' reality, directly observed from their lens (Bryman and Bell, 2011). A major criticism against qualitative research is its subjective nature because of reliance on the researcher's viewpoint (Bell et al., 2018). Other criticisms levelled against qualitative research are lack of transparency, generalisation problems and it being very difficult to replicate due to its unstructured nature (Bell et al, 2015).

3.3.6 Mixed research

The various criticisms levelled at qualitative and quantitative research brought about this research strategy. This strategy combines the qualitative and quantitative strategies within a research (Bell et al., 2018). According to Johnson et al. (2007), mixed research attempts to consider the qualitative and quantitative viewpoints to develop knowledge. This strategy triangulates the results obtained from the quantitative perspective to those gained from the qualitative standpoint to validate knowledge. As summarised by Denscombe (2008), mixed research is used to aid sampling, further develop and improve findings, reduce the level of bias associated with the qualitative and quantitative perspectives, provide a comprehensive perspective using different data and validate the accuracy of results.

There are two major arguments against the use of mixed research. Critics opine that qualitative and quantitative methods are underlined by different epistemological underpinnings and also from two different paradigms (Bell et al., 2018). Qualitative and quantitative strategy are underpinned by interpretivist and positivist epistemologies respectively and combining these creates irreconcilable interpretations of social reality. However, a major advantage of mixed methods is that it allows the researcher to adopt both exploratory and confirmatory type analysis tin the same study (Teddlie and Tashakkori, 2009).

3.3.7 Justification for research approach and strategy

For this research, an abductive approach is adopted to achieve the aim and objectives. Selection of this approach was influenced by several factors. Firstly, this research is driven by a very practical problem which is to understand if AASRs disproportionately target vulnerable consumers. In addition, from the research questions, this study is exploratory in nature. Therefore, data used for the research were drawn from a large population and can be

subjected to rigorous statistical and geographical information systems techniques to obtain a result that is representative of the underlying spatial process. The data are also very robust and allow for development of important themes and conjectures regarding the subject matter (Van Mannen et al., 2007) to enhance understanding and explanation of the drivers of the location patterns of the concerned retail groups. Furthermore, to explore spatial processes responsible for the observed location patterns, it is important to recognise the role of perception of the real world as most spatial decisions (location decisions) are based on the perception of reality as against reality itself (Fotheringham, 2006). Hence, the need for abduction (which incorporates both inductive and deductive reasoning).

The research begins with the appraisal of various retail location theories as well as incorporating other themes on deprivation, SECs and retail location based on a critical review of literature. What is more, the researcher is skilled in analysis of spatial patterns using statistical and GIS technologies. Therefore, these factors must be considered before the selection of a research design (Creswell, 2009). More importantly, this research is not only interested in the patterns of retail distribution statistically, which is a key characteristic of quantitative study (Saunders et al., 2009), it goes further to provide plausible explanations for the observed patterns of AASRs and FGR distributions, an abductive approach. Furthermore, the study did not test hypotheses, because the outliers are also as important as the model fitting, hence the approach is abductive and explanatory.

A major justification for not adopting a qualitative strategy was based on the aim and objectives of this research. This research is concerned with understanding whether there is an ethical issue regarding the location strategies of AASRs. Therefore, interviewing retailers might not have been the most suitable approach to achieve this because there could have been a high possibility that the responses that would be provided would be socially acceptable responses, and as such unreliable. Hence, the need for a quantitative strategy.

3.4 Research process

This thesis adopts two phases to achieve the aim of this research (the broad objectives of this research stated in section 3.1). Each phase has specific objectives which were developed from the broad objectives in order to achieve the aim of the research. The results of Phase 1 informed some of the approach to Phase 2.

3.4.1 Phase 1

The first phase covers all LSOAs in England. It is important to note that there are differences in the indicators, administrative boundaries and periods used for the IMD in England, Scotland and Wales (Smith et al., 2015). As a result, the study area for this research is all LSOAs in England only.

For the first phase, the initial step explored the distribution of the two groups of retailers and SED using descriptive statistics. Following this, a hotspot analysis was employed to uncover concentrations of these retailers and SED and the results mapped and compared to the geographical distribution of deprivation. Thereafter, the observed patterns were further investigated by examining the level of association between income, employment and education domain ranks and the retailers' outlets using the relevant correlation analysis. In addition, the patterns of distribution of the two groups of retailers were examined by analysing mean differences between the retailers' outlets across the income, employment and education deciles. A regression analysis was used to model the effect of income, employment and education on FGR and AASR patterns. The results of these analyses were then compared to uncover key similarities and differences.

These research sub-objectives for Phase1 are listed below as follows:

1. To explore the relationship between AASR locations and SED in England.
2. To confirm/validate whether there is a concentration of AASRs (i.e. gambling and fringe banking and rent-to-own) in disadvantaged neighbourhoods in England.
3. To explore whether these relationships and concentrations are also found in food and grocery retailer (FGRs) locations in England.
4. To compare any similarities and differences in the relationships observed between the two groups of retailers (AASRs and FGRs) and SED in England.

3.4.2 Phase 2

The second phase of the analysis deviated from the initial England wide analysis to city level. As identified in the gaps, this approach has not yet been explored in the UK. Analysis at city level allowed for in-depth analysis of the complex linkages between AASRs and SED. Based on the results of the analysis for the first phase, three cities were selected, and the relationships critically reviewed at the same spatial scale (LSOAs) to determine whether the

results of the nation-wide analysis are similar or different from the city level analysis. This enabled this research to uncover more in-depth local patterns. In addition, rather than using the IMD domains, area SECs identified to have strong linkages with patronage of AASR services were sourced from the UK National Census 2011. An area classification map was then created using a clustering technique that will group similar LSOAs in the three cities based on their socio-economic characteristics. The area classification maps created for these cities were then compared with distributions of the two groups of retailers using a series of statistical analysis and further compared with each other to reinforce the similarities and differences in the retailers' location preferences. Finally, a model which best fit the distribution of AASRs location preference was developed through a binomial logistic regression analysis using socio-economic characteristics.

As mentioned in chapter 1, the objectives 1 – 4 for the second phase are sub-aspects of the main research objectives already identified on page 6 and objective 5 is specifically related to Phase 2. They are as follows:

1. To explore the relationship between socio-economic characteristics and AASR locations in Leeds, Nottingham and Bristol.
2. To explore whether these associations are also found for FGRs in Leeds, Nottingham and Bristol.
3. To develop an area classification map for Leeds, Nottingham and Bristol using socio-economic variables**.**
4. To compare any similarities and differences in the relationships between FGRs, AASRs and SECs in Leeds, Nottingham and Bristol.

And additionally, for Phase 2:

5. To develop a synoptic neighbourhood model that best fits AASR locations using socio-economic in Leeds, Nottingham and Bristol.

3.5 Data and sources

This section seeks to explain the various data used in this research, and the rationale for selection and adoption of all the data used in this thesis. It details the SED and retail location data used for this research, and also explains the process of obtaining, sorting and coding the data.

3.5.1 Socio-economic deprivation data

As explained in Chapter 2 (literature review), the concept of SED has evolved over time. Likewise, methods of quantifying the phenomenon have also evolved. In the UK, deprivation measures have evolved from the work of Townsend (1987) to Carstairs (Carstairs and Morri, 1989), Breadline 1983 and 1990 (Mack and Lansley, 1985; Gordon and Pantazis, 1997, DoE (1983: 1984) to Indices of Deprivation (Noble et al., 2000; 2006 and Smith et al., 2015). It has evolved from measures developed by individuals or groups of researchers to complex methods developed by government organisations. Presently, the most widely used and accepted measure of neighbourhood deprivation at lower super output area (LSOA) level in the UK is the Index of Multiple Deprivation.

The index were developed for the Department of Communities and Local Government and are made up of different social-economic data obtained from various sources and combined together using a very complex but well explained methodology. It provides deprivation measures for all LSOAs in England. The Index of Multiple Deprivation 2015 domain indices and the supplementary indices, together with the higher-level geography summaries, are collectively referred to as the Indices of Deprivation 2015. Therefore, the Indices of Deprivation data 2015 was selected for this research for being both the generally agreed best measure and being available at the most detailed spatial scale. As stated previously, this data was adopted for the Phase 1 study.

A concept in the creation of the Indices of Deprivation data is that rather than measuring deprivation using an individual level approach, the method adopts measures of area level deprivation (i.e. classifying areas based on characteristics of its inhabitants thereby enhancing comparison of one area to another, as indicated by Smith et al., 2015a). The Indices of Deprivation consist of the Index of Multiple Deprivation (IMD), deprivation domains and other supplementary data. The IMD index is a composite constructed from different measures of relative deprivation based on seven key divisions called domains, namely: income, employment, education skills and training, health and disability, crime, barriers to housing and services and living environment deprivation. In addition, each of these domains is made of up multiple related variables and are assigned weights based on their importance in order to construct the IMD index. The variables that make up each of the domains are explained in subsequent sub-sections.

3.5.1.1 Income deprivation domain

This measures the number of individuals in an area who experience all forms of deprivation relating to low income (Smith et al., 2015a). For the index, low income is described as those individuals who are in low paid jobs and those who are currently not in gainful employment (Smith et al., 2015b). The income deprivation domain is made up of six different indicators. These indicators are: (1) adults and children in income support families, (2) income-based jobseekers allowance households, (3) employment and support allowance households, (4) adults and children in pension guarantee households, (5) adults and children in working tax credit families not in receipt of other benefits and (6) asylum seekers in receipt of subsistence and (or) accommodation support (Smith et al., 2015b). To create a single income deprivation index, the total counts of all individuals in these groups were calculated for each LSOA and a shrinkage statistical method employed whereby estimates in LSOAs with large counts are shrunk to compensate for LSOAs with very low counts (Smith et al., 2015a).

3.5.1.2 Employment deprivation domain

Employment deprivation represents the estimates of individuals excluded from the labour market involuntarily who are within the working age population in an LSOA, namely those individuals seeking gainful employment but are yet to find it and those unfit to work due to health, disability or life challenges (Smith et al., 2015b). These indicators include persons between ages 18 – 59 claiming job seekers allowance, employment and support allowance, incapacity benefit, severe disability allowance and careers allowance. To create a single income deprivation index, an averaged quarterly count for each indicator and population of persons aged 18 – 64 as numerator and denominator respectively were used and shrinkage was further applied to create the final employment deprivation score per LSOA (Smith et al., 2015a).

3.5.1.3 Education skills and training deprivation domain

As the name implies, this measures the proportion of individuals who lack educational achievements and or skills in an area within two broad groups – children/young people and adults (Smith et al., 2015b). The children/young people group includes key stage 2 attainment, key stage 4 attainment, secondary school absence, proportion of young individuals not staying on in education post 16 and proportion of individuals not advancing

to higher education. The adult domain represents adults within working age with low or no qualifications and the proportion of persons within the ages of 25 – 64 with very low English-speaking capabilities. To combine all these measures to create a single index, a factor analysis was employed to combine each estimate within the children/young people group and then the average weighting was applied to the two groups to create a single education deprivation index score (Smith et al., 2015a).

3.5.1.4 Health deprivation and disability domain

The health domain encompasses factors such as life outcomes due to physical and mental health issues, exposure to premature death, disability and illness in an area. The variables used to create this domain are divided into four broad groups, namely years of potential life lost, comparative illness and disability ratio, acute morbidity and mood/anxiety disorders (Smith et al., 2015a). Years of potential life lost measures death before age 75 (premature death). Comparative illness and disability ratio comprise of benefit claimants resulting from ill health. Acute morbidity encompasses indicators related to admissions into hospital derived from inpatient admission records, while mood and anxiety disorders measure all indicators relating to different forms of mental illness obtained from prescription data, hospital episode data, suicide mortality data and health benefits data. All these indicators were combined for each sub-category and a factor analysis employed to assign weights to each broad group to create a single health deprivation domain index (see Smith et al., 2015a, for details).

3.5.1.5 Crime deprivation

Research has identified that crime is an important aspect of deprivation. Therefore, omission of a crime domain will not adequately represent deprivation. The crime deprivation domain measures individual and material victimization rates at area level (Smith et al., 2015a). This domain was created from 4 indicators: violence, burglary, theft and criminal damage. Violence indicator is created from the rate of violence per 1000 at-risk population; burglary measure was created from the burglary rate per 1000 at-risk properties; theft indicator from theft rate per 1,000 at-risk population; and, lastly, criminal damage from the rate of criminal damage per 1,000 at-risk population. Shrinking estimates were applied to each of the indicators and factor analysis was used to generate weights for each group to combine the four groups into a single crime deprivation domain score.

3.5.1.6 Barriers to housing and services

This domain measures the financial and physical accessibility of local services and housing infrastructure and is classified into two sub-groups, namely geographical and wider barriers. The former represents nearness to local services and the latter measures access to housing infrastructure in terms of affordability (Smith et al., 2015a). For geographical barrier, the measure includes mean distance to post office, mean distance to a supermarket or store and mean distance to a GP surgery per LSOA. For wider barriers, indicators include proportion of households with insufficient housing space to meet the household's requirements, rate of acceptance of housing assistance as classified by the 1996 Housing Act, and inability to afford to own or privately rent housing accommodation for each LSOA. As with other domains, shrinkage was applied at LSOA level with assignment of weights to each group to aid combining to a single index using factor analysis.

3.5.1.7 Living Environment Deprivation Domain

This domain seeks to indicate the quality of local environment (i.e. in terms of housing quality, air quality and traffic accidents). It is classified into two broad sub-domains: indoor living and outdoor living environment characteristics. "Indoors" sub-domain relates to the proportion of households without central heating and households in social/private tenures in sub-standard houses. The "outdoor" sub-domain includes air quality based on emission rates for nitrogen dioxide, benzene, sulphur dioxide and particulates, plus traffic accidents involving cyclists and pedestrians. To create a single component index for this domain, two third weight was allocated to the outdoor environment while the indoor subdomain was allocated one-third weight.

3.5.2 Categories of IMD Data

There are 32,844 LSOAs in England and the IMD data and its domains are available for each of the LSOAs. The IMD index was created by combining the calculated seven domain score estimates. To combine the domains, each domain was given a predefined weight. The weights for each domain are income (22.5%), employment (22.5%), health deprivation (13.5%), education, skills and training (9.3%), crime (9.3%) and living environment deprivation (9.3%). These weights are assigned to the scores for each LSOA and combined to form the Index of Multiple Deprivation. In addition, each deprivation domain has three

categories called scores, ranks and deciles. The estimates created from combining the indicators for each domain are called scores. The ranks are then constructed by ranking the scores from 1 – 32,844, 1 representing the most deprived LSOA while 32,844 represents the least deprived LSOA. The deciles are constructed by dividing the LSOAs into 10 equal parts consisting of 3,284 LSOAs classified from 1 – 10, 1 representing the 10% most deprived LSOAs and 10 representing least deprived 10% LSOAs.

3.5.3 IMD Selection and Justification

From the above, the Indices of Deprivation 2015 data is a suitable measure for area deprivation in England. In addition, the domains and categories (scores, ranks and deciles) further provide additional data to allow adoption of various statistical techniques which will drive robust analysis. For this research, the IMD index will only be utilised for the initial mapping, while its sub-domains with links to demand and supply of AASR outlets will be deployed for subsequent analysis in Phase 1. The rationale for this decision is because, as explained in previous sections, the IMD index was derived from a combination of the seven domains. On the other hand, not all these domains largely influence AASRs locations. From the seven domains, only three (income, employment and education skills and training) have strong links with AASR and FGR locations. It will also help to understand how individual domain impact retail locations. Furthermore, for this research, the domain scores are not utilized, only the domain ranks and deciles are used for this research. The justification for this is that the scores are difficult to interpret because they are not linear for the IMD and indices of deprivation domains (Smith et al., 2015b).

3.5.4 Data: Retail location

This sub-section introduces the data on the AASR and FGR outlets utilised for this research. It further seeks to explain the sources of the data, as well as the steps involved in sorting and coding the data into applicable format. The software used in sorting the data are IBM SPSS 24 and Microsoft Excel 2016. The data collection, sorting and coding exercise started in September 2016 and lasted for six months.

3.5.4.1 Data: AASR locations in England

AASRs location data includes gambling, payday loan outlets, pawnshop outlets and RTO outlets in England. The data on all gambling locations was obtained from the UK Gambling Commission (GC), which contained all registered and licensed gambling locations in the UK as at April 2015. Only the addresses in England were selected. The Commission provides a comprehensive list of addresses of all gambling establishments (betting shops, family entertainment centres, and casinos) which contained retailers' names, addresses and postcodes for all outlets in the UK. Therefore, all gambling shop establishment addresses, and postcodes were extracted, with the exception of casinos and family entertainment centres. From the dataset, some of the addresses and postcodes were incorrect, but these were then largely corrected

Table 3.1 The final number of gambling and financial outlets in England

Retailer	**Total Outlets**
Gambling	10,813
Financial (Fringe Banking and RTO)	1,334
Total	**12,147**

The locations (addresses) of all financial outlets (payday loans, pawnbrokers and high yield interest loans and RTO establishments) were also collected. For this set of retailers, effort was made to obtain the shop addresses from the respective retailers or regulatory bodies but yielded no results. Therefore, the addresses were obtained manually from the website of each of the retailers and for those retailers that did not have their shop addresses on their websites an online directory[1] was used. This task was time-consuming but was painstakingly carried out to ensure that the all known shop addresses were collected. For the RTOs, only two retailers (BrightHouse and PerfectHomes) have physical shop locations in England. BrightHouse and PerfectHomes have a list of all their locations on their websites. The list of postcodes was extracted manually from their websites. (table 3.1 above shows the total number of gambling and financial outlets finally extracted and corrected in England).

[1] The National Pawnbrokers Association has an online directory found at https://www.thenpa.com/

3.5.4.2 Data: FGR locations in England

Shop addresses of all major FGRs were also collected. A UK company called Geolytix Ltd has comprehensive open source data on all major food and grocery retailers and so the data was downloaded from their company website. Like the gambling data, the data contained information on the name of the retailers, shop addresses and postcodes in the UK. All England postcodes were extracted. The extracted file contained addresses of 22 chains of grocery retailers including all big multiples (Asda, Sainsbury and so on.) as well as some independent retailers (see table 3.2). Geolytix constantly updates the file, but the available version utilised for this research is the April 2016 version. The file had 26 incorrect postcodes, all of which were corrected by doing a search with each shop address and respective retailer name on google map.

Table 3.2 Major food and grocery retailers in England

	FGR Outlets
England	11,034

3.5.4.3 Sorting, Coding and Processing the location and deprivation data

Sorting and coding the data involved several processes in order to enable linking each retail outlet to its corresponding indices of multiple deprivation data. For the retail location data file, each outlet represented a case. Therefore, there were numerous postcodes which had more than one retail outlet. Therefore, all the multiple postcodes were consolidated, and each group of retailer outlets was aggregated for each corresponding postcode using the consolidate function in Microsoft Excel. In addition, as the Indices of Deprivation data is at LSOA geography, each postcode and its corresponding outlets was then linked to its corresponding LSOA. This was done using a look-up table provided by UK Data Service and an IMD to postcode look-up developed by the Ministry of Housing, Communities and Local Government[2].This process was undertaken both groups of retailers' location data. In addition, for the AASRs, which consist of betting shops, fringe banks and RTOs, the data was further grouped into two sub-sets: betting and financial retailers. The betting retailers

[2] http://imd-by-postcode.opendatacommunities.org/

consist of all gambling locations, while the financial retailers consist of all fringe banks and RTOs. The RTOs and fringe banking outlets were grouped together because of their smaller numbers as well as the similarities in their services. Thereafter, the Geo-convert and Communities and Local Government look-up tables were used to link each LSOA to its corresponding indices of deprivation estimates.

3.5.4.4 Geocoding retailers' outlets

The above process consolidated all retail outlets per LSOA. Therefore, to display the data in a GIS, the LSOA location was geocoded to represent the location of its corresponding retail outlet(s). "Geocoding" refers to the process of converting physical addresses into geographic coordinates (Boscoe, 2008). At this point, since all the addresses had been consolidated into LSOAs, each LSOA location represented the shop address(es). To achieve this, consideration needed to be given to the actual population distribution and geographical boundaries of each LSOA. Using the centroid of each LSOA assumes that the population is evenly distributed in each LSOA. However, this assumption is incorrect because population is not evenly distributed across space (Moon and Farmer, 2001). Therefore, a method which creates a geo-referenced population centroid was developed by the Office for National Statistics (ONS, 2011) at Output Area (OA), LSOA and Middle Super Output Area (MSOA) levels. This method created a single geographic reference point for each geographical unit (LSOA).

The Excel file, which contains the population weighted centroid geographic co-ordinates (ground reference point) for each LSOA, was downloaded from the ONS website. The ground reference points are in two different projections, namely "longitude and latitude", and "easting and northing". It should be noted that either of the two projections can be used, but final choice depends on the coordinate system used for the boundary data (as explained in later sections). Subsequently, the population centroid file was merged with the retailers' data using the LSOA (present in both files) as the reference point in Excel. The final file therefore contained FGRs, AASRs and gambling and financial outlets, as well as the indices of deprivation estimates (rank and deciles) for income, employment and education, skills and training domains for each LSOA.

3.5.4.5 Data: Collection, sorting and coding challenges

Challenges were encountered during the collection, sorting and coding of the retailers' location data. The GC's Excel sheet had several errors with the postcodes and some addresses. Some of the postcodes were wrongly inputted, for example, the number '0' was written as a letter 'O', 'I' was written as one '1' and vice versa, while some addresses were not present and some of the available ones incorrect. This created some initial problems. Fortunately, the list also contained the majority of the retailers' addresses. Therefore, to correct the errors, the physical addresses were entered into Google Map and Royal Mail online directory, which produced accurate postcodes. For those which had incorrect addresses, their postcode and name of retailer were used to narrow down the search locations, which aided finding the correct locations. Furthermore, some of the retailers' websites failed to include complete addresses for some shop locations. For example, Belle Vale, Liverpool store address was not displayed on the Brighthouse website. Google map was also used to resolve these problems.

Difficulties arose during the process of linking up the retailers' location data to the indices of deprivation estimates. The fringe banking, RTO and grocery retailer location data had only very minor problems (as explained previously), that were corrected using google map services. The major challenges, however, occurred with the gambling data provided by the GC. The geo-convert website failed to match a substantial portion of the gambling retailers' postcodes to their corresponding area deprivation estimates, and they returned as un-matched. Further investigations on the website revealed that "genuine codes may remain unmatched where the centroids of the postcodes that cover them all fall outside their boundaries" (GeoConvert, nd). Some of the issues arose due to re-development or planning reasons, as well as the termination of some postcodes. After a series of troubleshooting and fact finding, a look-up table created by the Ministry of Housing, Communities and Local Government assisted in solving the majority of these challenges. Unfortunately, seven of the gambling outlets could not be matched so these outlets were eventually removed from the final data (see tables 3.1 and 3.2 for the final list).

3.5.5 Socio-economic variables

This section outlines the socio-economic variables used in this research, their attributes and justification for each of the selected variables. These socio-economic variables were adopted

for the Phase 2 study. These variables were selected from the UK 2011 National Census Data. Decisions on which appropriate socio-economic variables to use for measuring area socio-economic deprivation were solely driven by the review of the literature. Evidence from the literature review indicates that area SECs such as education, age, ethnic minority group, family composition and employment, among others, are key determinants of the demand and supply of retail outlets, including the specific AASRs focused on in this research (Burkey and Simkins, 2004; Collard and Hayes, 2010; Wardle et al., 2010; Bower et al., 2014; Prager et al., 2014).Thus socio-economic variables relating to these characteristics were the ones collected from the National Census.

UK Census data for 2011 is available from InFuse[3] and Nomis[4]. The InFuse portal provides data from the 2001 and 2011 censuses. Nomis, on the other hand provides data on the UK labour market dynamics and is a part of the ONS data. Nomis provides data at different spatial scales including output areas, super output areas (lower and mid layer), postal areas and health geographies. For this research, the data was obtained through Nomis because of the relative ease in navigating the website. In addition, Nomis not only provides the raw estimates for all census data, but it also provides these estimates in percentages. Therefore, percentage estimates were collected at LSOA geography.

3.5.5.1 Minority ethnic variable

Data relating to ethnic characteristics was obtained from key statistics table KS201EW[5]. According to Nomis, this table classifies the local resident populations based on their perceived cultural backgrounds and ethnic groups (Nomis, nd). The ethnic groupings comprise five major groups which are further divided into specific subgroups. The broad ethnic groups are 'White', 'Mixed/multiple ethnic groups', 'Asian/Asian British', 'Black/African/Caribbean/Black British' and 'Other Ethnic Groups'. From these broad groups, just 2 were selected 'Asian/Asian British' and 'Black/African/Caribbean/Black British'. 'Asian/Asian British' consists of 'Indian, Pakistani, Bangladeshi' and 'Chinese'. 'Indian', 'Pakistani' and 'Bangladeshi' were grouped together as a variable while 'British Chinese' was taken as a single variable. 'Indian/Pakistani/Bangladeshi' represents South East Asian while the second represents Chinese/British Chinese descent. The

[3] http://infuse.ukdataservice.ac.uk/
[4] https://www.nomisweb.co.uk/census/2011
[5] The key statistics (KS) tables are found on the Nomis website https://www.nomisweb.co.uk/census/2011 for each variable.

‘Black/African/Caribbean/Black British’ renamed as one-group. The final ethnic minority variables are therefore:

- Indian/Pakistani/Bangladeshi (IPB)
- Black/African/Caribbean/Black British (Black)
- British Chinese/Chinese

Justification for non-selection of the ‘White’ Ethnic group is that they are not classified as a minority ethnic group in England. Also, for the ‘mixed/multiple’ ethnic groups their inclusion would likely create an anomaly as one of its sub-groups is classified as ‘White and Asian’ and it categorises all ‘Asian’ together. Hence, it fails to indicate which Asians sub-group (either South East or Chinese/Other Asian). Therefore, it was concluded that this broad group be excluded from the analysis.

3.5.5.2 Family composition

Data relating to housing characteristics was obtained from key statistics table KS105EW. This data classifies all households in the UK based on family composition. The categories include ‘one-person household’, ‘one family household’ and ‘other household types’. The ‘one family households’ is further categorised into different sub-groups. Only one family household group was considered here because this research is only interested in couple and lone parent households. Therefore, the variables of interest are:

- Married or same sex civil partnership – Couple Households
- Lone Parents Households

3.5.5.3 Age Structure

Data on area age composition was obtained from key statistics table KS102EW which classifies the usual resident population into different age structures consisting of ‘age 0 to 4’, ‘age 5 to 7’, ‘age 8 to 9’, ‘age 10 to 14’, ‘age 15’, ‘age 16 to 17’, ‘age 18 to 19’, ‘age 20 to 24’, ‘age 25 to 29’, ‘age 30 to 44’, ‘age 45 to 59’, ‘age 60 to 64’, ‘age 65 to 74’, ‘age 75 to 84’, ‘age 85 to 89’ and ‘age 90 and over’. Considering that the legal age for patronage of AASR services is age 18 and over, age categories lower than 18 were excluded. The remaining age categories were further merged into four categories, as described below:

- 18 – 24 - obtained from the merging of age categories 18 – 19 and 20 – 24
- 25 – 44 - obtained from the merging of age categories 25 – 29 and 30 – 44

- 45 – 64 - obtained from the merging of age categories 45 – 49 and 60 – 64
- 65 and above - obtained from merging the remaining 65 – 74, 75 – 84, 85 -89 and 90 and over.

3.5.5.4 Educational qualifications

For educational qualifications, the UK Census asked question about residents' highest level of education. This information is represented in key statistics table KS501EW and captures the qualification of the usual resident population age 16 and over. The various categories of educational qualification are persons with 'no qualification', 'level 1 qualifications', 'level 2 qualifications', 'apprenticeship', 'level 3 qualifications', 'level 4 qualifications and above', other qualifications, fulltime students age 16 – 17 and age 18 - 74. For this study, the student group in this category was not included here but was included as a standalone variable (see below).

3.5.5.5 Fulltime students

This variable is represented in table KS501EW. To select the student variable, careful consideration was given to the various categories reported in the National Census. The categories include 'school children and fulltime students: age 16 to 17', 'school children and fulltime students: age 18 and over', 'fulltime students: age 18 to 74: economically active: in employment', fulltime students: age 18 to 74: economically active: unemployed', 'fulltime students: age 18 to 74: economically inactive'. For this selection, as the legal age for patronage of AASR services is age 18+, only age 18 years and above categories were considered. In addition, as this study is interested in all fulltime students 18 and above irrespective of their employment status, the fulltime students age 18 and over was selected, irrespective of whether economically active or inactive.

3.5.5.6 Car ownership

Car ownership levels were obtained from table KS404EW on the Nomis Portal which estimates cars or vans per household. The inclusion of this variable is because the UK Census has no income variables. Therefore, previous research on deprivation driven by the national census data has used car ownership as a proxy for income/affluence (Galobardes et al., 2006). More importantly, previous research shows that car ownership is a good measure of socio-economic deprivation, especially in urban areas (Christie and Fone, 2003). The categories included in table KS404EW include 'no car', 'one car', 'two cars', 'three cars' and 'four or more cars' per household.

3.5.5.7 National Statistics Socio-economic Classification (NS-Sec Occupation)

This variable classifies individuals based on their occupation. There are three variables depicting occupation in the national Census: 'industry by sex', 'occupation by sex' and 'NS-Sec by sex'. The NS-Sec (KS611EW – KS613EW) is derived from occupation and gender based on the Office for National Statistics classification and is a widely acceptable variable in socio-economic research, which is why this variable was selected. This classification has eight main categories and subcategories. They are 'higher managerial, administrative and professional occupations' which has two sub categories ('large employers and higher managerial and administrative occupations' and 'higher professional occupations'), 'lower managerial, administrative and professional occupations', 'intermediate occupations', 'small employers and own account workers', 'lower supervisory and technical occupations', 'semi-routine occupations', 'routine occupations' and 'never worked long-term unemployed' and not classified. The classifications were consolidated into four groups, excluding the not classified which was dropped:

- **Managers and professionals** - made up of higher and lower managerial, administrative and professional occupations
- **Intermediate occupations** – made up of intermediate and small employers and own account workers
- **Routine and lower occupations** – made up of lower supervisory, technical, semi-routine and routine occupations.
- **Never worked and long term unemployed** – made up of persons who have never worked and long-term unemployed persons.

3.5.6 Spatial framework

This section outlines the official UK boundary level data and sources utilised for this study. It further explains the various geographies at which all analysis for this thesis was carried out. As identified in section 3.5, the research focuses on two main geographical boundaries: England in general and 3 different cities. The boundaries of these datasets are officially produced by EDINA and are readily available on the UK data service website[6].

There are numerous boundary data from pre-1973 to the present-day for different geographical boundaries. For both analyses, the LSOA classification was utilised for all

[6] http://infuse.ukdataservice.ac.uk/help/definitions/2011geographies/index.html

analysis. In addition, from the census geography, the 'English Census Merged Ward, 2011' boundary was used to display the LSOA data sets for aesthetics and easy representation. In addition, data on the geographical coordinates for each LSOAs was necessary for this research. This data was also provided by the Office for National Statistics (ONS) and created a centroid for each LSOA using the population of each LSOAs. According to ONS (2011), "these centroids represent the spatial distribution of the population in each instance of those geographies, as recorded in the 2011 Census, as a single summary reference point on the ground" (p.1). This data provides geographical reference (co-ordinates) for each LSOA.

3.6 Selection of cities for the Phase 2 study

This approach follows on from the first phase, which explored the aim of the research across all areas in England. The selection of cities for the second phase was undertaken after careful consideration, taking into cognisance various criteria, as explained next. One major factor that influenced the selection of cities is that the final selections needed to be members of the UK Core Cities Group. The Core City Initiative was set up in 1985 to foster development of the UK economy by driving growth and economic development in selected strategically positioned cities, which would in turn act as a catalyst for development in neighbouring towns (Core Cities, 2006). The cities are Birmingham, Bristol, Leeds, Liverpool, Manchester, Newcastle, Nottingham and Sheffield. More importantly, these cities are strong commercial hubs with dense populations in England. Therefore, the dynamics of these cities would provide a good blend of characteristics that was needed for this research, as they represent the powerhouses of England.

Careful consideration was also given to the geographical location of the cities. It is a known fact that a good sample size should be representative of the total population and therefore, the cities needed to reflect the regional variations of England. This stance was also informed by the results of the first phase analysis (see chapter 4). Therefore, the selected cities needed to be geographically located in the North, the South and the Midlands. Another important factor that influenced selection of final cities was that they needed to include both relatively deprived and affluent populations as this would ensure that the results reflected dynamics in area deprivation. Furthermore, the cities also needed to have a good share of retail presence. These last two considerations are of significant importance because this research is concerned with retailing and area deprivation.

Accordingly, the selected cities are Leeds, Bristol and Nottingham. From the four cities in the North – Leeds, Manchester, Liverpool and Newcastle – Leeds was selected because the city is regarded as the UK third best retail city and categorised among the top five cities in England for wealth creation (Core Cities, 2017). Its LSOAs are also amongst the most and least deprived LSOAs in England. In addition, there are numerous studies on grocery retailing using Leeds. Bristol was selected in the South not only because it is the only city in the south among the 8 core cities, but it is also a relatively less deprived city and has a strong economic base and an economically active population (Core Cities, 2017).

The third city is Nottingham. Nottingham was selected because of its central location (Midlands) and rich history. More importantly, among all the core cities, it is the most deprived city with over one third of its LSOAs classified in the most deprived 10% of LSOAs, based on the IMD 2015. At this point, it is important to note some prevailing issues with regards to Nottingham. The Nottingham City Boundary is tightly drawn geographically (Punter, 2009; Porter and Smith, 2013; Nottingham City Council, 2018) with its relatively affluent suburban neighbourhoods such as Rushcliffe and Beeston not classified as Nottingham City.

3.7 Geospatial and statistical techniques

This section outlines the various statistical techniques employed to achieve the aim and objectives of this study. It lists and explains the geospatial and statistical techniques utilized in this research.

3.7.1 Geospatial techniques

The subsection outlines the geographical techniques used in this research as well as explaining the rationale for their selection.

3.7.1.1 Choropleth mapping

The spatial analysis in this research was carried out using Microsoft Excel 2016, IBM SPSS and ArcGIS 10.3. Excel and SPSS were used to collate, sort and code the data, while ArcGIS was used to map and visualise the data sets. Choropleth mapping is a widely used technique for the displaying of geographical data related to a phenomenon. It provides an excellent method to visualise area SED and SECs using different colour scales to represent different intensities/categories of the measured phenomenon.

3.7.1.2 Hotspot detection

This technique was used for the Phase 1 study. Hotspot detection is a popular approach that has been utilized to identify distributions of sets of occurrences. Adoption of the method is widespread and applicable in various subject areas. Hotspot detection has been used to analyse disease clustering (Openshaw et al., 1988; Sabel and Loytonen, 2004), crime patterns and crime prediction (Ratcliffe and McCullagh, 1999; Chainey et al., 2008; Ratcliffe, 2010), retail store formation and market share prediction (Donthu and Rust, 1989; Jansenberger and Staufer-Steinnocher, 2004; Pavlis and Singleton, 2018). Hotspot detection became more widespread due to the extensive availability of georeferenced datasets as a result of the development of GIS (Gatrell and Rowlingson, 1994). Hotspot analysis has been carried out using different clustering techniques, including DBSCAN (Ester et al., 1996), Kernel Density Estimation (KDE) (Silverman, 1986), Geographical Analysis Machine (Openshaw et al., 1987) and Getis Ord Gi* (Getis and Ord, 1992). From the various methods available, this research adopted the KDE techniques, owing to its widespread use in retail location analysis.

Kernel density estimation (KDE), also referred to as Prazen's Window (Prazen, 1962), is one of the most widely utilised methodologies for estimating the probability density function of a random variable (Anselin et al., 2000; Chainey et al., 2008; Tabingin et al., 2008). It is a non-parametric approach which measures the density of features in the neighbourhood around a location (Silverman, 1986; Bailey and Gatrell, 1995). In the retailing domain, the method has been used to analyse spatio-temporal patterns of various activities such as measuring changes in food retailing (Jansenberger and Staufer-Steinnocher, 2004), and estimating customer density for marketing purposes (Donthu and Rust, 1989). It has also been adopted by public health researchers to access tobacco outlet density and neighbourhood deprivation (Rodriguez et al., 2012; Marashi-Pour et al., 2015). According to Donthu and Rust (1989) the KDE has great potential in retail and marketing. For the kernel function, this research adopted the approach of Silverman (1986 p. 76) due to its suitability for 2-dimensional data as well as the ease of computing. It is also the method adopted by the ESRI for ArcGIS 10.3.

3.7.2 Geodemographics

It involves the analysis of behavioural and socio-economic data about individuals in the context of a particular location and local community (Harris, 2003). The term developed

from a blend of two concepts, “demography” and “geography”. As Birkin and Clarke (1998) noted that “Demography is the study of population types and their dynamics therefore geodemographics may be labelled as the study of population types and their dynamics as they vary by geographical area” (p.88). Essentially, geodemographics is the analysis of people based on the characteristics of where they live (Sleight, 1997). This method was adopted for the Phase 2 study. Area classification involves identifying similarities and dissimilarities between areas by grouping together area patterns (Webber and Craig, 1978). Area classification has its origin in geodemographics.

It is also based on a belief that individuals with similar characteristics usually reside, visit and shop in similar areas and have the same behavioural tendencies. Hence, identifying spatial patterns within a locality is a crucial step towards understanding the spatial processes and resulting spatial structures within that locality (Harris et al., 2005). Although linkages exist between people and places, the linkages are however, complex and multi-faceted. Therefore, the characteristics (social, demographic and economic) of a place echo the ideals, preferences, and consumer lifestyles of both past/present inhabitants as well as echoing government regulations.

According to Harris et al. (201, p. 15), “interrelationship suggests that measures of physical, social and economic properties of settlements can yield useful information about the characteristics, preferences and lifestyle choices of the populations within these settlements, because people and places are dependent on each other”. Therefore, geodemographics assumes that not only do individuals in close proximity relate to each other, but also individuals tend to belong to same neighbourhood class. This does not mean that people living in the same areas are not identical, but that they share similar characteristics (Harris et al., 2005).

The origin of geodemographics can be traced back to Charles Booth (Rothman, 1989), evidenced in his book published in 1889 and entitled ‘the Life and Labour of People of London’, where he grouped all houses in London into seven classes. His work on poverty are archived at the Charles Booth Online Archive at the London Business School of Economics (LSE, 2005). Modern geodemographics, on the other hand, has its roots in the work of Weber and Craig (1976 and 1978) which used population and key Census variables to create three national classifications. Although geodemographics lacks theoretical or statistical grounding, its use has continued to grow and has been adopted by the private sector

(CACI, ACORN, MOSAIC, CAMEO and PRIZM). More importantly, the availability and ease of obtaining Census data has played a very important role in the development of geodemographics.

A major theory that supports geodemographics is a notion in geography, which says that objects close to each other are likely to be similar compared to objects that are far away (Tobler, 1970), but researchers have challenged its theoretical and statistical underpinning. Notwithstanding, it is a sound method with proven evidence, Flowerdew and Leventhal (1998) argue that "there is no formal proof and no 'theory of geodemographics' either, only the concept that 'birds of a feather flock together'" and, in addition, "the systems are used simply because they work and have become established" (Flowerdew and Leventhal 1998, p.36).

Therefore, a major advantage of area classification is that it allows for targeted marketing (Harris et al., 2005). Therefore, geodemographics benefits research trying to ascertain the linkages between vulnerable areas or clusters of population targeted by a particular retail fascia or group. More importantly, it can also help to uncover the location preferences of retailers because it is primarily rooted in consumer and lifestyle behaviour. In addition, a multivariate classification of neighbourhoods offers a simplistic and valuable summary of the characteristics of areas (Openshaw and Wymer, 1995). Yet a major criticism levelled against geodemographics is that it is highly subjective, and resultant classifications are a function of the operational decisions made during the development process (Openshaw and Gillard, 1978). Usually, the decision process in creating an area classification is dependent on the research area and application and no one classification fits all. In contrast, subjectiveness is not necessarily an issue as long as decisions are critically evaluated (Openshaw and Gillard, 1978). In addition, as geodemographics lacks strong theoretical and statistical backing, there is the possibility that the classification might not reveal or provide robust evidence of the observed neighbourhood effects when subjected to the rigours of statistical analysis (Harris et al., 2007). Notwithstanding, the applicability of geodemographics in resource allocation by public sector institutions and customer segmentation and targeting by business is not questionable (Harris et al., 2007). This process involves carrying out clustering analysis and it is discussed below.

3.7.2.1 Clustering analysis

Clustering involves classification of variables based on similar characteristics. Clustering is a very common technique in biological and ecological research areas and is also used for geodemographic classifications. In recent times, numerous academic domains have also adopted the methodology due to its applicability and robustness. In marketing, clustering analysis has been applied to marketing mix, customer segmentation, targeting and positioning, to name but a few. In other words, it has been applied to the concepts of product development, price discounts, advertising, sales and promotion, competitor analysis and branding strategies (Rao and Sabavala, 1981; DeSarbo et al., 1993; Moroko and Uncles, 2009).

Clustering analysis is a data exploration technique that seeks to gain information from a dataset by splitting the data into separate groups with members of the same groups having homogenous characteristics (Jain and Dubes, 1988; Hastie et al., 2001). The resulting classifications are not mutually exclusive but, rather, fuzzy groups where the edges of each classification can overlap (Voas and Williamson, 2001). Therefore, this technique is used in this thesis for the classification of LSOAs based on SECs relating to AASR services.

The execution of clustering analysis involves a series of calculated steps (Milligan and Cooper, 1987), and omitting any step jeopardizes the accuracy of the classification. At this point, a distinction needs to be made between clustering method and clustering analysis. Clustering method represents a step in the overall clustering process, while clustering analysis represents the sum total of all the steps taken to achieve the classification. Although these steps can be altered to fit specific applications, researchers have discussed the necessary steps involved in clustering analysis (Milligan et al., 1987; Milligan, 1996; Everett et al., 2011). Milligan (1996) summarized seven sequential steps essential for executing a clustering analysis, with each step representing a critical decision point as follows:

Step 1. Clustering elements – This involves the selection of objects to be clustered and should adequately reflect the principal population and provide total coverage to enable generalisation of the results to a wider population.

Step 2. Clustering variables – This refers to measurements obtained from the elements/objects to be clustered. There should be strong empirical evidence for each variable to be added to the clustering process. Irrelevant/masking variables should be avoided, otherwise they could obscure the underlying cluster in the data.

Step 3. Variable standardization – Decision to standardise each of the variables must be taken appropriately. In clustering analysis, there are potentially two false assumptions that can be made by researchers: (1) it is necessary to standardise variables and (2) z-score is the most appropriate method for clustering (Milligan, 1986). Nonetheless, variable standardisation and method are at the discretion of the researcher.

Step 4. Measure of association – For clustering analysis to be executed, a dissimilarity or similarity measure must be adopted. This measure indicates the extent of closeness or separation (i.e. distance) between objects/entities to be clustered. For this step, there is no consensus or general guideline.

Step 5. Clustering method – This is a very important step in successfully executing a cluster analysis. The selection of method should be based on the perceived clustering within the data because different methods are suitable for different clustering patterns. The method should also be robust in order to detect underlying clusters.

Step 6. Number of clusters – Selecting the number of clusters is a very subjective process and the most difficult step in running a cluster analysis, especially when there is no prior knowledge of the underlying clusters. A major rule of thumb is that the final number of clusters must have relevant interpretation within the context of this study.

Step 7. Interpretation, testing and replication – Results must be interpreted based on the context of the investigation which requires extensive knowledge in the subject area. In addition, it is necessary to ensure that re-run of the clustering analysis will produce similar results. The classification can also be cross validated against a known measure of the observed objects where possible.

3.7.2.2 K-mean clustering method

There are numerous methods for carrying out clustering analysis, but this research utilizes K-means clustering technique (Forgy, 1965; Hartigan and Wang, 1979). K-means is one of the most commonly used clustering algorithms (Duda et al., 2012; Harris et al., 2005). Harris et al. (2005) attribute its common usage to two major benefits: it produces cluster solutions that retain a high proportion of the variance of the initial input variables and it creates cluster solutions relatively equal in (population) size. On the other hand, its major drawback is that the number of clusters must be specified based on the researcher's experience, making it somewhat subjective in nature as there is no universal technique available (Xu and Wunsch,

2009). To overcome this, the process is usually repeated with different cluster numbers and the most suitable solution finally selected (Gordon, 1999). In addition, different cluster numbers can also be selected based on the results of running another cluster method (Everitt et al., 2011).

The 'K' represents the total number of clusters generated which has to be indicated before the algorithm is executed. K-means is a non-parametric method which adopts an iterative optimization procedure which seeks to minimize a squared-error criterion function (Duda et al., 2012). The basic principle which informs the algorithm is to move an entity from one cluster to another, with a view to minimizing the sum of squared deviations within each cluster (Aldenderfer and Blashfield, 1984). This process is reiterated until a final classification is reached, i.e. when no movement/re-classification occurs between an iteration process, after which the means of each cluster for each input variable can be examined to determine the uniqueness of each cluster. The steps in the clustering algorithms (Everitt et al., 2011) are:

a. Find and initialize a partition of the entities into 'K' clusters and calculate the mean for each cluster for all entities, as well as the sum of squared deviations (clustering criterion) from the group mean for the entity,
b. transfer each entity from the initial cluster to the nearest cluster and re-calculate the respective clustering criterion,
c. adopt the change which offers the best improvements in the clustering criterion, and
d. repeat steps b and c till there is no movement that produces an improvement in the clustering criterion.

3.7.3 Statistical techniques

This section identifies and outlines the various statistical techniques used in this research.

3.7.3.1 One-way analysis of variance (ANOVA)

A one-way ANOVA is a parametric statistical test used to compare the differences between the means of more than two groups. "ANOVA is a way of comparing the ratio of systematic variance to unsystematic variance" (Fields, 2014, p. 430). This method is a well-established statistical tool and has been deployed in various empirical studies. Deploying ANOVA is

based on some assumptions (Warner, 2008; Rayner and Best, 2013), which are explained below:

a) The dependent variable should be measured on a continuous scale (i.e. interval or ratio), whereas the independent variable should be measured on a categorical scale (nominal or ordinal) and consists of more than 2 groups.
b) There should be independence of observation. Each measurement or participant should be a member of only one group. In relation to this research, this means that no LSOA should be in 2 or more different socio-economic classifications.
c) There should be homogeneity of variances between the groups, as with all parametric tests. To investigate this, Levene's test of equality of variances is adopted. If the test statistic is not significant ($p > .05$), then it is assumed that the data meets this assumption. On the other hand, if the test violates the assumption ($p < .05$), then a different ANOVA test called the Welch Test is employed because of its robustness in handling violation of this assumption (Elmore and Woehlke,1988; Glass et al.,1972).
d) The distribution of the dependent variable should be approximately normal across the different groups. This can be examined using the skewness and kurtosis statistics. However, if the sample sizes are large enough (> 30), the effect of violating this assumption is minimal (Pallant, 2016). In addition, there is also strong evidence that suggests that the Welch technique is robust, and violation of non-normality does not have a strong bearing on the accuracy of the probability results (Glass et al., 1972; Hopkins and Weeks, 1990).

The main purpose of ANOVA is to examine if there are significant differences within the groups' means as mentioned above. Therefore, a significant ANOVA ($p < .05$) demonstrates that the mean differences between the groups differ significantly. Then the question as to which groups significantly differ from each other arises. This is difficult to know because there are three or more groups. To examine this, a post-hoc/multiple comparison test (Turkey's or Games Howell test (the former for non-violation and the later for violation of homogeneity of variances) is employed (Field, 2013; Pallant, 2016). Therefore, for this thesis, a one-way ANOVA is used to compare the mean differences between the distribution of FGRs and AASRs across different SED classifications, where the FGRs and AASRs are the dependent variables and SED classifications are the independent variables.

3.7.3.2 Binary logistic regression (BLR)

Regression analysis was used in this thesis to assess the best fitting model for describing the relationship between retail presence (dependent variable) and SED (independent variable). After careful review of the available datasets, as expected, the retail outlet datasets contained both LSOAs with and without retail presence (FGRs, gambling and financial outlets). As a result, the data failed to meet the normality assumptions for a linear regression i.e. that residual of dependent variables should be approximately normally distributed (Pallant, 2016).

To solve this, a different regression model known as Binary logistic regression (BLR) can be applied. BLR can be used to analyse data where the outcome/dependent variable is dichotomous or binary in nature (Warner, 2008). i.e. it has only 2 possible outcomes (such as 'yes' or 'no' or 'male' and 'female') while the predictor/independent variables can be continuous, categorical or dummy. Therefore, the outlet datasets are categorised into 2 outcomes 'present' and 'absent' i.e. LSOAs with no retail presence are recoded to 'absent' and those with retail presence are recoded as 'present' and represented by 0 and 1 respectively. This helps to uncover the effect of neighbourhood deprivation on presence or absence of FGRs and AASRs. A major strength of the BLR is the very strict assumptions of the parametric models do not apply and hence is a very robust method (Hair et al., 2018).

To use a BLR, the data has to meet the following assumptions:

a) Outcome variable is dichotomous (Wright, 1995; Hair et al., 2018). The responses of the dependent variable need to be binary as the name implies (i.e. yes or no, present or absent, male or female etc.).
b) One or more predictor or independent variables which can either be continuous, ordinal or nominal (Hair et al., 2018).
c) Outcome variable measurements must be statistically independent of one another (Wright, 1995)**. T**hat is, the measurement of the variable should not originate from a repeated process.
d) The model must include all relevant predictors (Wright, 1995).
e) The different categories of the outcome variables must be mutually exclusive (Wright, 1995) and the members of each group only belong to one group, not both. For instance, in the case of this research, each LSOA must belong to just one group i.e. presence or absence.

The validity of a BLR is greatly impacted by the sample size (Pallant, 2016; Hair et al., 2018). Thus, the method requires very large sample sizes. In addition, BLR is also susceptible to multi-collinearity issues. To assess multicollinearity, the correlation matrix needs to be examined and variables with high correlations (.80 and above) will signify multicollinearity. In addition, collinearity statistics (variance inflation factor (VIF) and tolerance values) are employed.

- **Tolerance Statistics** – Tolerance gives a very direct measure of multi-collinearity. It quantifies the variability of a selected predictor variable that is not explained by other predictor variables i.e. how much of an independent variable is not explained by other independent variables in the model (Hair et al., 2018). The minimum threshold value for tolerance adopted for this thesis is 0.2 (Menard, 1995).
- **Variance Inflation Factor (VIF) -** The VIF is an indicator of the strength of the linear relationship between one predictor variable and other predictor variables (Field, 2014).

Variables that show multicollinearity are not used together in the same model. Rather, they would be interchanged (Wang, 1996).

3.8 Summary and conclusion

This chapter has explained and provided justification for the research approach, philosophy and design that this thesis is anchored on. It has also explained the various data and their sources to be used in order to achieve the aim and objectives of this thesis. Furthermore, all aspects of data sorting, coding and the challenges encountered have been explained in this chapter. It has also explained the rationale and justification for the study area selection and the spatial scale to which the analysis was explored. Additionally, it has described the phases of each analysis and how each analysis feed into each phase. More importantly, the chapter has also critically explained the major techniques (statistical and geo-spatial) utilised to ensure actualisation of the aim and objectives of this research.

Chapter 4

Exploring the Relationship between Retailers and Socio-economic Deprivation in England – Phase 1

4.1 Introduction

This chapter seeks to explain the results of the analysis of the relationship between alleged anti-social retailers (AASRs), food and grocery retailer (FGR) locations and socio-economic deprivation (SED) and critically compare the results for the two groups of retailers in England. The broad aim of this study is to investigate the allegation of deliberate targeting of poor and vulnerable communities ascribed to AASRs by carrying out a comparative analysis of the location preferences of AASRs and FGRs using quantitative and geospatial techniques in England and at a more localised level, three selected cities in England. In order to achieve the above aim, the specific Phase 1 objectives for this chapter were as follows:

1 To explore the relationship between AASR locations and SED in England.
2 To confirm/validate whether there is a concentration of AASRs (i.e. gambling, fringe banking and rent-to-own) in disadvantaged neighbourhoods in England.
3 To explore whether these relationships and concentrations are also found in food and grocery retailer (FGRs) locations in England.
4 To compare any similarities and differences in the relationships observed between the two groups of retailers (AASRs and FGRs) and SED in England.

To achieve these objectives, this study has undertaken analysis at two different levels. The first level, which is detailed in this chapter, examines objectives 1 - 4 by critically assessing the distribution of these groups of retailers in relation to SED in all LSOAs in England.

To investigate the objectives and research questions addressed in this chapter, the IMD 2015 income, employment and education, skills and training domains are used to represent area SED rather than the IMD index. This is because the index was constructed with numerous variables, some of which are not related to this research's scope. Furthermore, critical review of literature that identified the major SECs directly linked to the demand for AASRs services, informed the selection of the three IMD domains. Various techniques identified in the previous chapter are utilized, including kernel density estimation, mapping, correlation, one-

way ANOVA and binomial logistic regression. For AASRs, the results show the statistics for group and sub-groups i.e. AASRs, gambling and financial retail groups (fringe banking and rent-to-own).

4.2 Exploring retailer distribution and SED in England

Table 4.1 shows the distribution of AASR and FGR outlets by LSOA. From table 4.1, of the 32,844 LSOAs in England, AASRs and FGRs have no presence in 27,272 and 25,108 LSOAs respectively. Table 4.1 also shows the descriptive statistics for gambling and financial outlets, with these outlets being in 5502 and 662 LSOAs with means of 1.97 and 2.02, respectively. From the table, although FGRs have fewer outlets compared to AASRs, FGRs are located in more LSOAs, initially suggesting greater dispersion.

Table 4.1 Descriptive statistics of AASR and FGR outlets in all LSOAs in England

Retailer Type	Total Outlets	Total LSOAs	Mean	Std. Dev.	Min	Max
AASRs	12,147	5572	2.18	2.805	0	39
Gambling	10,813	5502	1.97	2.238	0	31
Financial	1,334	662	2.02	1.46	0	8
FGRs	11,034	7736	1.43	.891	0	24

Figure 4.1 (A, B and C) contains the stacked bar charts showing the distribution of FGR and AASR (gambling and financial) outlets by income, employment and education, skills and training (hereafter called education) deprivation deciles in England. Figure 4.1 indicates that generally, there is larger presence of AASRs in the lower deciles compared to the higher deciles. This pattern is also similar for gambling and financial outlets, with financial outlets having the highest presence in the lower deciles. Decile 1 (which contains the most deprived 10% LSOAs) has the highest distribution compared to all other deciles. Decile 10

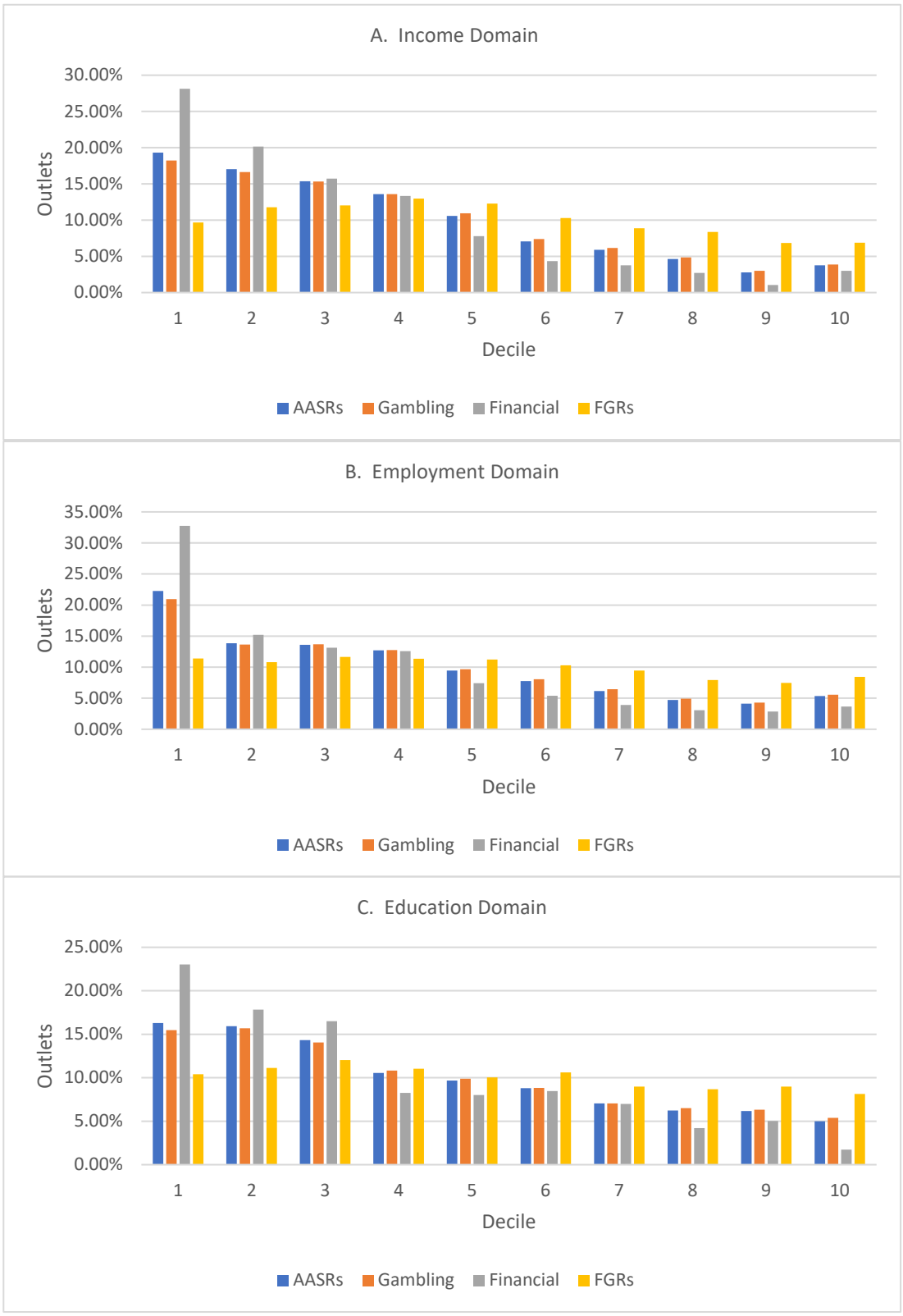

Figure 4.1 Distribution of AASRs and income, employment and education deprivation deciles. Source: Department of Communities and Local Government

(which contains the least deprived 10% LSOAs) has the lowest distribution. Furthermore, approximately almost half of all AASRs are in decile 1 – 3, with only around 11%, 14% and 17% in decile 7 – 10 for income, employment and education, skills and training domains respectively. Further looking at each group of AASRs from Figure 4.1 reveals that for the three domains of deprivation, deciles 1 – 3 have at least 45% of all gambling outlets. Financial outlets have at least 57% of their outlets in decile 1 – 3 for the three domains, showing a large presence in deprived areas and indicating a positive relationship between AASRs and deprivation; as deprivation reduces, so does the number of AASRs.

For FGRs, Figure 4.1 shows a different pattern of distribution, with the deciles 4, 5 and 3 having the highest distribution for income, employment and education domains respectively. In addition, deciles 1 – 3 have approximately 34% each of the total outlets for the three domains. This represents around a third of the total outlets in England. Furthermore, deciles 4 – 7, which are the medium deprived deciles, have the highest number of outlets with at least 40% across all three indicators, while deciles 8 – 10 (least 30% deprived LSOAs) have approximately 21%, 23% and 25% for income, employment and education domains respectively. What is more, the distribution does not depict a linear relationship between FGRs and the three deprivation indicators, as the largest presence is observed in middle deciles.

Comparison of both AASRs and FGRs across the three deprivation indicators in Figure 4.1 further shows that there is a high distribution of the AASRs in deprived areas. Furthermore, AASRs and their two sub-groups have their highest presence in decile 1 and, as deprivation reduces, their distribution also reduces, except for decile 10 which has a greater number of outlets compared to decile 9 across the income and employment domains. Contrastingly, for FGRs, the mid-deciles have the highest distribution of retail outlets compared to the most and least deprived LSOAs. Interestingly, decile 10 has a higher number of outlets compared to decile 9 for all the retailers. Additionally, the distribution of AASRs in decile 1 is almost double compared to that of FGRs. In contrast, FGRs have approximately double compared to AASRs in decile 10. Additionally, gambling outlets in decile 1 have almost twice the presence of FGRs, while the presence of financial outlets is more than twice the proportion of FGRs in decile 1 across all deprivation indicators.

4.3 Spatial distribution of retailers and SED in England

To further explore this relationship, a kernel density method, as explained in the previous chapter, was deployed using the spatial analyst extension toolbox in ArcGIS10.3.1 to represent the outlets as a density surface, rather than as points, in order to reveal areas of high concentrations. To execute the density function, the data was mapped at LSOA level. A weighing variable - total population per LSOA contained in the IMD2015 data was used to weight the data to provide a more accurate distribution. Figure 4.2 shows the density maps of the AASRs, FGRs and the distribution of SED (IMD index) in England.

From a visual examination of Figures 4.2B, 4.2D and 4.2E, South East England, most especially London, shows a very high concentration of all the retailer outlets. Concentrations of gambling and financial outlets are also evident in areas around the West Midlands, as well as the North West, the North East, West Yorkshire and various coastal locations in the South. Essentially, these concentrations appear to be in the more urbanised parts of England. The FGR density map shows quite similar patterns to AASRs (see Figure 4.2 A), but with a more even spread across England compared to the AASRs. Considering that AASRs have more outlets compared to FGRs in the data (Table 4.1), AASRs are more clustered with presence in many areas.

To examine the patterns of the relationship between SED and the two group of retailers, the IMD Index decile was mapped and compared to the density map of these two groups of retailers. The map in Figure 4.2C shows the patterns of SED in England at LSOA geography. The IMD 2015 decile divides the LSOAs into 10 equal groups and categorises them from 1 – 10. Visual comparison of the maps (Figures 4.2A 4.2B, 4.2D, 4.2E to 4.2C) broadly reveals that areas with high concentration of AASRs' and FGRs outlets also correspond with most of the deprived LSOAs in England.

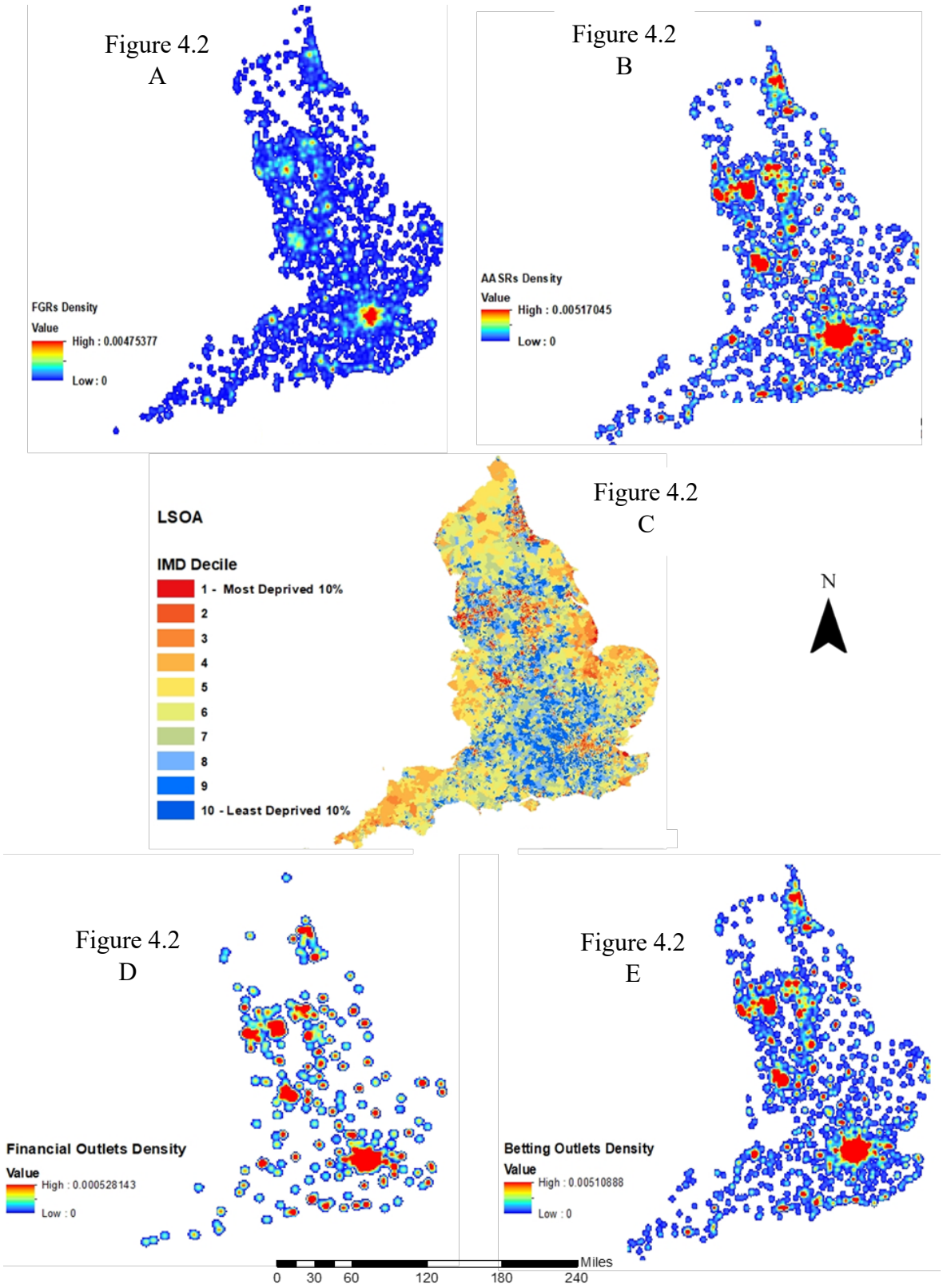

Figure 4.2 Kernel density and index of multiple deprivation map showing the distribution of AASRs, gambling retailers, financial retailers and FGRs and SED in England

Table 4.2 Distribution of top and bottom 20 LSOAs and their IMD decile classifications for all groups of retailers

	FGR		AASRs		Gambling		Financial	
IMD	**Count**	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
				Top 20 LSOAs				
1	6	30	10	50	8	40	14	70
2	3	15	2	10	3	15	1	5
3	4	20	6	30	5	25	4	20
4	2	10	1	5	2	10	1	5
5	3	15	0	0	0	0	0	0
6	1	5	0	0	0	0	0	0
7	1	5	1	5	2	10	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
Total	**20**		**20**		**20**		**20**	
				Bottom 20 LSOAs				
1	0	0	2	10	2	10	6	30
2	2	10	2	10	1	5	4	20
3	4	20	2	10	3	15	5	25
4	2	10	7	35	7	35	1	5
5	2	10	2	10	2	10	0	0
6	2	10	1	5	1	5	2	10
7	2	10	1	5	1	5	2	10
8	2	10	0	0	0	0	0	0
9	2	10	1	5	1	5	0	0
10	2	10	2	10	2	10	0	0
Total	**20**		**20**		**20**		**20**	

Table 4.2 shows the IMD decile classification of the 20 top and bottom LSOAs in terms of presence of FGRs and AASRs in England. The Table reveals that of the 20 LSOAs with the highest retail presence, decile 1 has the highest occurrence across both group of retailers whereas the least deprived deciles 8 – 10 have no representation within the top 20 categories for both AASRs and FGRs. Irrespective of this similarity, there are notable differences between the distributions of the LSOAs with highest AASR and FGR presence. For AASRs, 90% of the LSOAs in the top 20 categories are in deciles 1 – 3, which represents the most deprived LSOAs. On the other hand, only 55% of the LSOAs are within decile 1 – 3 for FGRs. This suggests a far greater concentration of AASRs in the most deprived areas compared to FGRS, especially for financial retailers.

Looking at the bottom 20 category also in Table 4.2, the distribution seems to be more dispersed across all the 10 deciles compared to the top 20 categories, but there seems to be striking differences in the distribution of FGRs compared to AASRs. The bottom 20 LSOAs

in terms of FGR presence do not have any representation in the most deprived 10% LSOAs while only 20% of the LSOAs in this category are in decile 3. The remaining 80% are evenly distributed across decile 2 and 4 – 10. On the other hand, the bottom 20 LSOAs in terms of AASRs presence, have the highest occurrence in decile 4. Further examination of gambling and financial, retailers reveals similar patterns with the overall AASRs. In summary, the LSOAs in the top 20 categories across both AASRs and FGRs are highly characterised by highly deprived neighbourhoods. On the contrary, the bottom 20 LSOAs have a relatively even distribution across all different socio-economic categories in relation of FGR presence, compared to AASRs with high presence in majority of the bottom 20 LSOAs in deprived neighbourhoods especially for financial retailers.

4.4 Exploring the relationship between retailer locations and SED in England

This section describes the findings of the statistical analysis of the relationship between retailers and SED. To achieve this, a correlation analysis was used to explore whether or not the visually observed patterns are statistically significant. This section also discusses some methodological considerations for the LSOAs included in the analysis. It further describes considerations made before selecting the most suitable scale for the analysis. In addition, it reports the results of the one-way ANOVA used to explore the mean distribution of each group of retailers' outlets and the different SED classifications.

4.4.1 LSOA Considerations

Before running the analysis, the need arose to decide which sets of LSOAs to include in the analysis. This issue arose because, of the 32,844 LSOAs, only a little above one third of these LSOAs had at least one retailer present. Removing the LSOAs with no presence would have introduced a methodological bias because the research is also interested in areas with no retail presence. In deciding what approach to use, three different options were considered;

- Remove all LSOAs with no retail presence for each retail type.
- Include any LSOA that has retail presence of either FGR, gambling or financial outlets (i.e. only commercial LSOAs).
- Include all LSOAs since the research is interested in areas both with and without retail presence.

After careful consideration, it was decided that all three methods needed to be adopted as this would ensure an encompassing approach. Consequently, for ease, only the results of commercial LSOAs and all LSOAs were reported. For results of the analysis for only LSOAs with each corresponding retail presence, see appendix 1.

4.4.2 Correlation Analysis Between AASRs and FGRs and Income, Employment and Education Deprivation Domains

To examine whether or not the visually observed patterns between retailers' outlets and SED classifications of LSOAs (see Figure 4.2) are statistically significant, the relationship was tested by carrying out a correlation analysis between AASRs, gambling, financial and FGRs outlets and each deprivation domain identified above (income, employment and education). In general, selection of an appropriate correlation test is dependent on the types of data available. The IMD rank data is ordinal and ranks each LSOA from 1 – 32,844 (i.e. the most deprived to the least deprived LSOA in England), while the outlets data is continuous. To find the correlation between a ranked variable and a continuous variable, a non-parametric correlation analysis test - Spearman's Rank Correlation Coefficient (Spearman rho) - which measures the strength and direction of monotonic relationships between 2 variables, is appropriate.

Prior to running statistical tests, the retailers' outlets data is standardized by dividing the total outlets for each LSOA by its corresponding population per thousand persons (‰ persons). This new variable now represents AASRs/Gambling/Financial outlets ‰ persons (AASRs' O‰P, GO‰P and FO‰P) and FGRs' outlets ‰ population (FGRs' O‰P) for each LSOA. Furthermore, for the retailer's O‰P to be suitable to run the selected statistical testing, transformation of the data to a ranked variable is necessary. Therefore, the variables are ranked using SPSS 'rank' function from highest to lowest, with the 1 representing the LSOA with the highest O‰P and the 32844 representing the LSOA with the least O‰P to match the polarities of the deprivation domain ranks.

Table 4.3 shows the results of the Spearman's correlation tests between the retailers' outlets and the rank of the three deprivation indicators in England. For all LSOAs (irrespective of presence or absence of retailers), there is a highly significant positive association between rank of income, employment and education deprivation domain ranks and rank of AASR outlets ‰ persons (.206, .182, .128 and $p < .001$), gambling outlets ‰ persons

(.203, .180, .127 and p < .001) and financial outlets ‰ persons ranks (r_s = .107, .099, .069 and p < .001) respectively. This shows that an increase in the area socio-economic deprivation has a positive association with AASR distribution with income deprivation levels having the highest positive association with AASRs in England. Comparison of the sub-groups for AASRs shows that gambling locations have the highest association with income, employment and education domain ranks compared to financial outlets.

Table 4.3 Spearman Rank correlation coefficients for the group of retailers (AASRs and FGRs) and SEDs (income, employment and education domain ranks) for different LSOA considerations.

Deprivation Domain		All LSOAs				Commercial LSOAs			
		AASRs	**Gamb**	**Fin**	**FGRs**	**AASRs**	**Gamb**	**Fin**	**FGRs**
Income	r_s	.206**	.203**	.107**	.064**	.269**	.260**	.153**	-.124**
	n	32844				10151			
Emp.	r_s	.182**	.180**	.099**	.054**	.250**	.242**	.143**	-.086**
	n	32,844				10151			
Edu	r_s	.128**	.127**	.069**	.042**	.160**	.157**	.094**	-.069**
	n	32844				10151			

**. Correlation is significant at p < 0.001 level (2-tailed).
N = number of LSOAs
Rank of all outlets per ‘000 persons

For FGRs (Table 4.3), similar patterns of association are observed for all LSOAs. Therefore, there is a highly significant positive relationship between the rank of FGR O‰P and income, employment and education deprivation ranks (r_s = .064, .054 and .042, with p < .001 respectively), with income showing the highest positive association with FGRs. Comparison of the relationship between the three deprivation domains and the groups of retailers reveals a higher significant positive correlation with AASRs and its sub-groups compared with FGRs in England.

For commercial LSOAs (areas which have presence of at least one retailer), correlation analysis shows a highly significant association between the rank of AASR outlets ‰ persons and income, employment and education domain ranks (r_s = .269, .250 and .160, p < .001 respectively). Similar relationships are also uncovered for rank of income, employment and education deprivation ranks and ranks of gambling outlets ‰ persons (rs = .260, .242 and .157 and p < .001 respectively) and financial outlets ‰ persons (r_s = .153, .143, .094

and p < .001 respectively). This shows that the higher the income, employment and education deprivation, the higher the distribution of AASRs in England with income also having the strongest association with AASR locations. From Table 4.3, there is a highly significant negative correlation between rank of FGRs' O‰P and income, employment and education (r_s = -.124, -.086 and -.069, with p < .001respectively). Thus, an increase in income, employment and education deprivation will have a negative association with the distribution of FGRs in England. Comparison shows a marked difference in the patterns of AASRs, its sub-groups and FGRs, showing that an increase in area deprivation will have a negative association in the distribution of FGRs, while a similar increase in area deprivation would have a positive association in the distribution of AASRs and sub-groups.

4.4.3 Analysis of mean distribution

To further explain the relationship between retailers and SED, the means for the retailers' O‰P for all deprivation indicators was important. The analysis of mean would help to understand the level of concentration of the group of retailers in different SED classifications Figure 4.3 shows the mean distribution (A) and standard deviation (B) of groups of retailers' outlets O‰P and income deprivation for all LSOAs. As income deprivation reduces, the means also reduce for group AASRs and gambling and financial retailers except decile 10 (Figure 4.3A). Figure 4.3A shows a different pattern for FGRs with the two highest means in decile 4 and 5, which are mid-deprived deciles.

Comparison of the two groups of retailers (AASRs and FGRs) shows AASRs having a mean that is more than twice that of FGRs in the most deprived decile. Furthermore, for AASRs, the mean of decile 1 compared to decile 10 is almost 5 times higher, while that of FGRs is only 43% higher. Further examination of the standard deviations (4.3B) additionally shows a very wide variation in the distribution of AASRs and its sub-groups compared to FGRs, especially in decile 1. Consequently, there is a concentration of AASRs in the income most deprived areas while FGRs have more presence in mid-deprived income areas. In addition, within deprived LSOAs, there is wide variation in the concentration of AASRs.

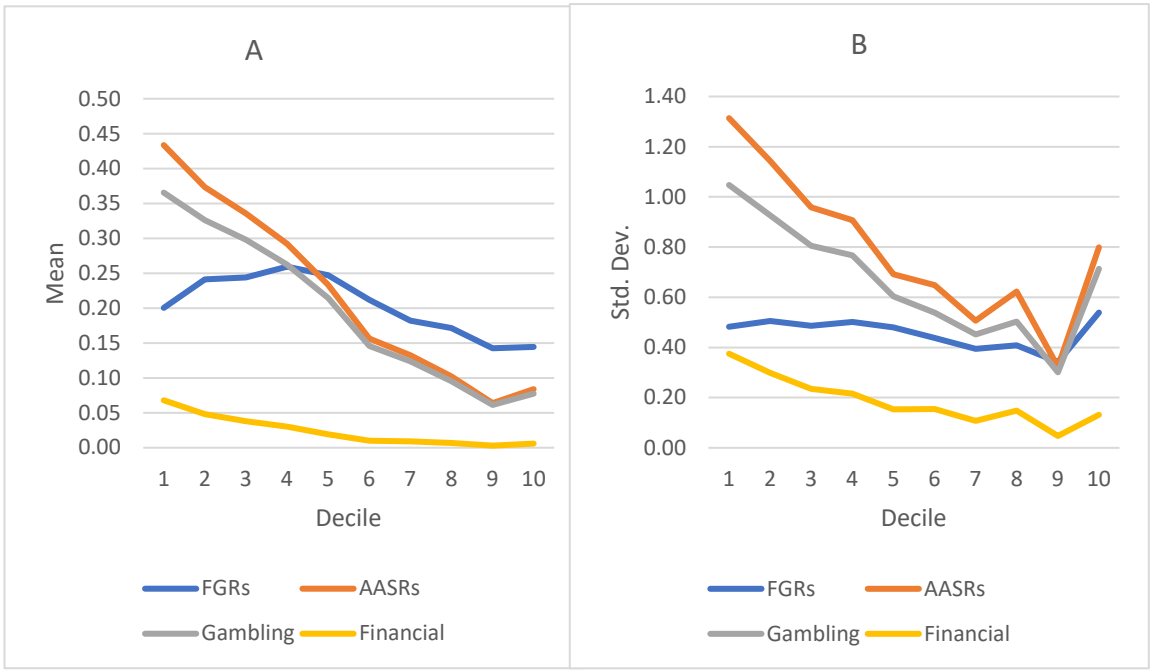

Figure 4.3 Means (A) and standard deviation (B) of the group of retailers outlets per '000 persons and income deprivation domain deciles for all LSOA

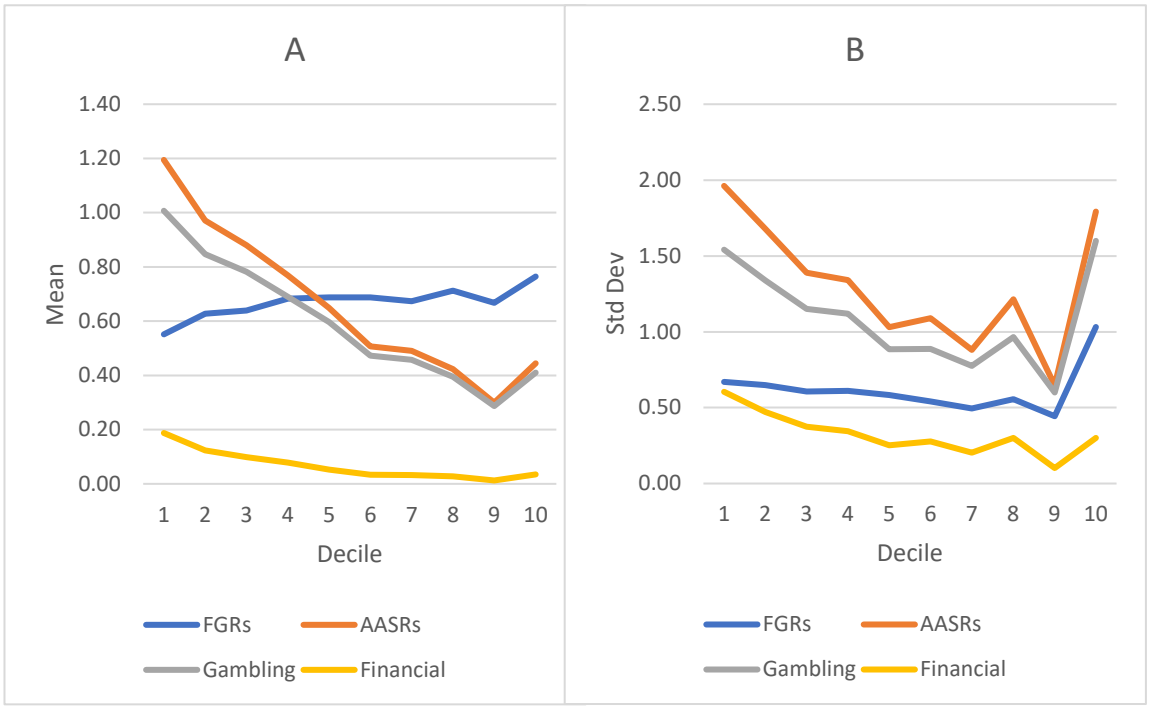

Figure 4.4 Means (A) and standard deviation (B) of the groups of retailers outlets per '000 persons and income deprivation domain deciles for commercial LSOAs.

Figure 4.4 above shows the mean (A) and standard deviation (B) for the groups of retailer outlets in all commercial LSOAs as well as income deprivation in England. For AASRs and its sub-groups, decile 1 has the highest mean and as income deprivation reduces, the mean

of these outlets reduces (with the exception for decile 10, which has a higher mean compared to decile 8 – 9 for AASRs and its sub-groups). Figure 4.4A shows a different pattern for FGRs with the highest mean in decile 10, which consists of the least deprived 10% commercial LSOAs. Interestingly, decile 1, characterised by the most deprived commercial LSOAs, has the lowest mean. Comparison of the two groups of retailers from Figure 4.4A shows the mean of AASRs in decile 1 (the most deprived commercial LSOAs) is more than twice that of FGRs. Furthermore, the mean of AASRs in deciles 1 – 5, which together represents the most deprived 50% commercial LSOAs have higher means compared to FGRs, with the opposite being the situation for deciles 6 – 10 which represent the least deprived commercial LSOAs, with all having lower means compared to FGRs. The standard deviation in Figure 4.4B reveals large variations in distribution within deciles, especially for the AASRs. Consequently, for income deprivation, there is a concentration of AASRs in the most deprived commercial areas while FGRs have more presence in mid-deprived and affluent commercial LSOAs.

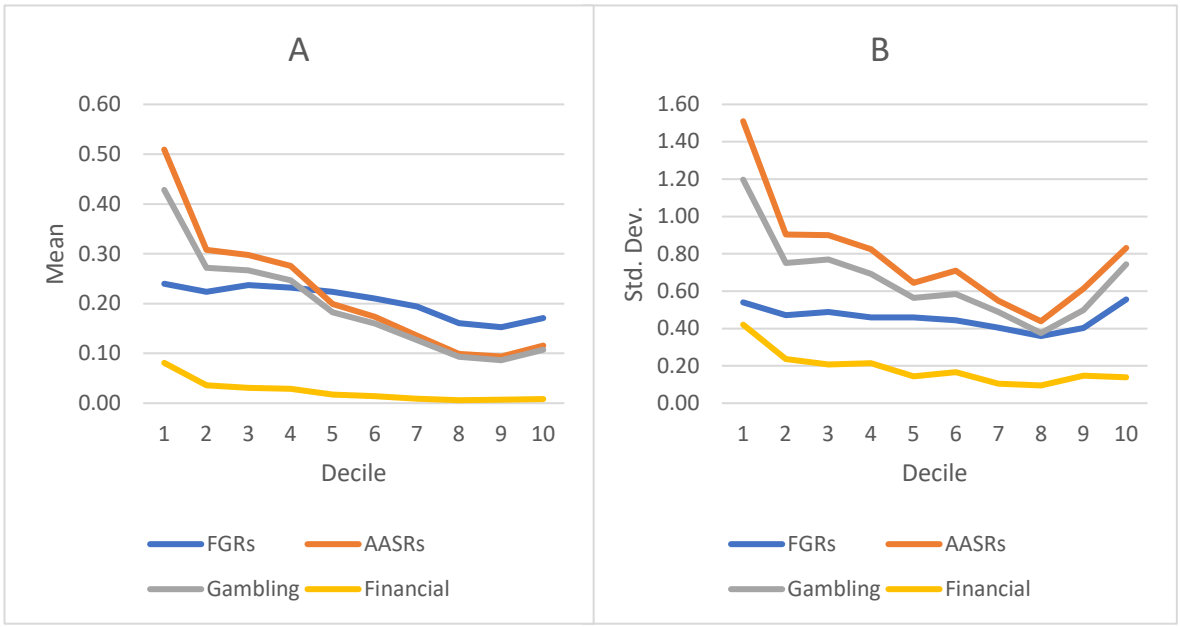

Figure 4.5 Means (A) and standard deviation (B) of the groups of retailers outlets per '000 persons and employment deprivation domain deciles for all LSOAs

Figure 4.5A shows the mean distribution of the groups of retailer outlets and employment deprivation for all LSOAs. It shows that the higher the level of employment deprivation, the higher the means of gambling and financial outlets. In addition, there is also wide variation evidenced from large standard deviations (Figure 4.5B) for AASRs and its sub-groups. Figure 4.5A shows a different pattern for FGRs with the highest mean in LSOAs in deciles1

and 3, which also have similar means. In addition, the differences in the means for deciles 1 – 5 for FGRs are quite small, showing no clear differences within the means.

Comparison of the two groups of retailers (AASRs and FGRs) shows AASRs having mean outlets more than twice the amount when compared to FGRs in decile 1- the most deprived 10% LSOAs. The mean of outlets in decile 1 is also more than 3 times higher compared to that of decile 10 for AASRs, while that of FGRs is less than twice. Examination of the standard deviations further shows a very wide variation in the distribution of AASRs and its sub-groups compared to FGRs (Figure 4.5B). Consequently, there is a concentration of AASRs and FGRs in employment-deprived areas, but the concentration found in AASRs is greater compared to FGRs.

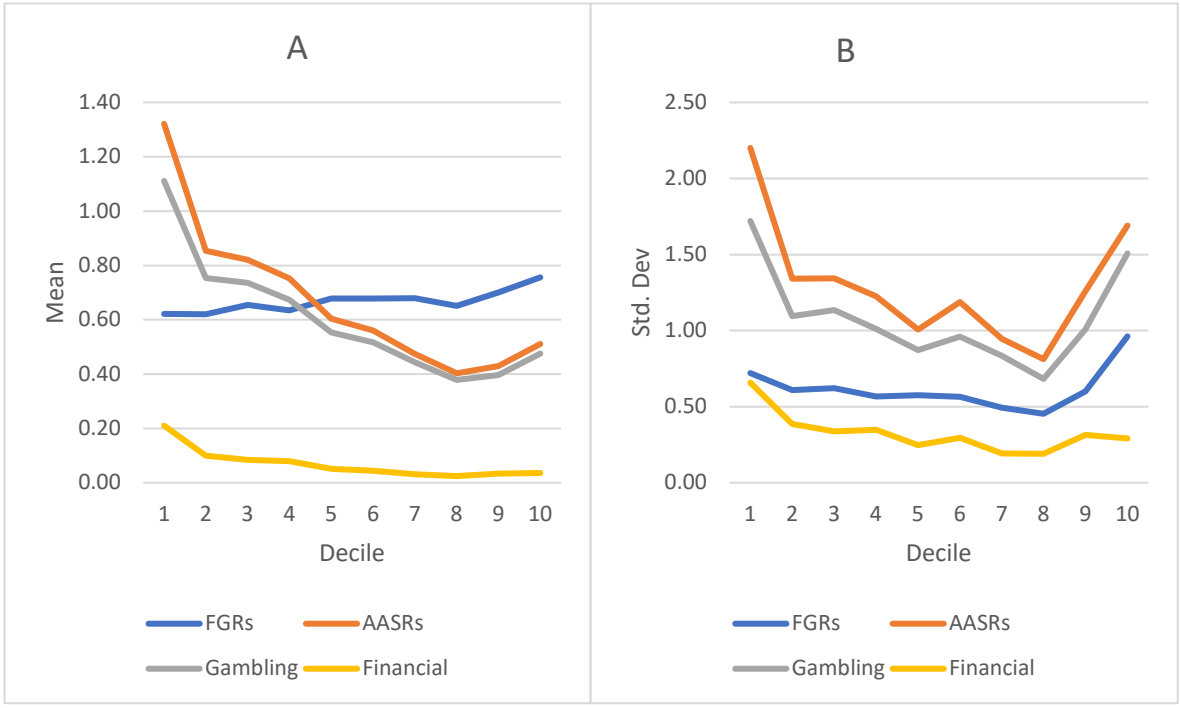

Figure 4.6 Means (A) and standard deviation (B) of the groups of retailers outlets per '000 persons and employment deprivation domain deciles for commercial LSOAs.

For Commercial LSOAs, Figure 4.6A shows that decile 1 has the highest mean. Generally, as employment deprivation reduces, mean of outlets also reduces for AASRs, gambling and financial retailers (with the exception for decile 10, which has a higher mean compared to decile 7 – 9). On the other hand, Figure 4.6A shows a different pattern for FGR distribution with the highest mean in decile 10, and as employment deprivation increases, the mean of outlets reduces with deciles 1 and 2 having the lowest mean. Comparison reveals that the mean of outlets for decile 1 for AASRs is more than twice that of the decile with the lowest mean (decile 8). More importantly, the mean for financial outlets is over 9 times greater compared to decile 6, 7, 8, 9 and 10 which have the lowest means, whereas that of decile 10, which has the highest mean is less than double that of decile 1 for FGRs. The standard deviations show that for FGRs, the affluent commercial LSOAs have very high variations while deprived commercial LSOAs have high variations for AASRs (Figure 4.6B).

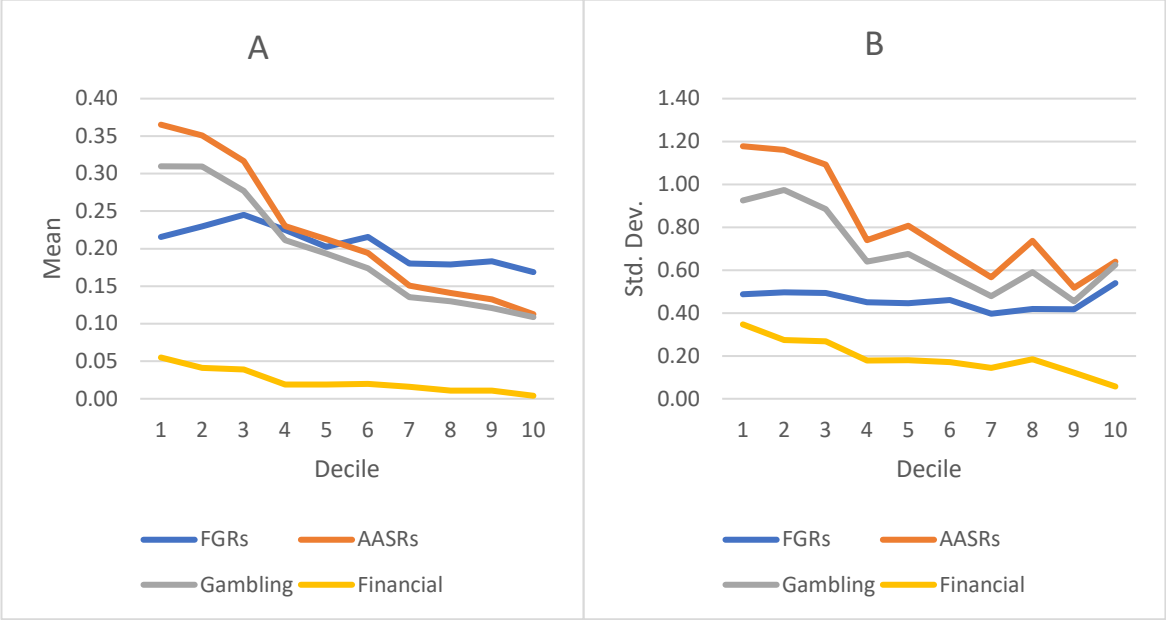

Figure 4.7 Means (A) and standard deviation (B) of the groups of retailers outlets per '000 persons and education deprivation domain deciles for all LSOAs

Figure 4.7A (all LSOAs) shows that as education deprivation reduces, the mean of outlets also reduces, showing relatively linear patterns between the domain deciles and mean of AASRs and its two sub-groups, with decile 1 having the highest mean. Figure 4.7A also shows a different pattern for FGRs, with the highest mean in decile 3. The most deprived decile also has a similar mean compared to decile 6, a relatively affluent decile.

Figure 4.7B further reveals similar variations in standard deviation compared to income and employment deprivation, with high variations in AASRs, especially in deprived LSOAs compared to FGRs. Consequently, for education, there is a concentration of AASRs in the most deprived areas while FGRs have more presence in mid-deprived areas.

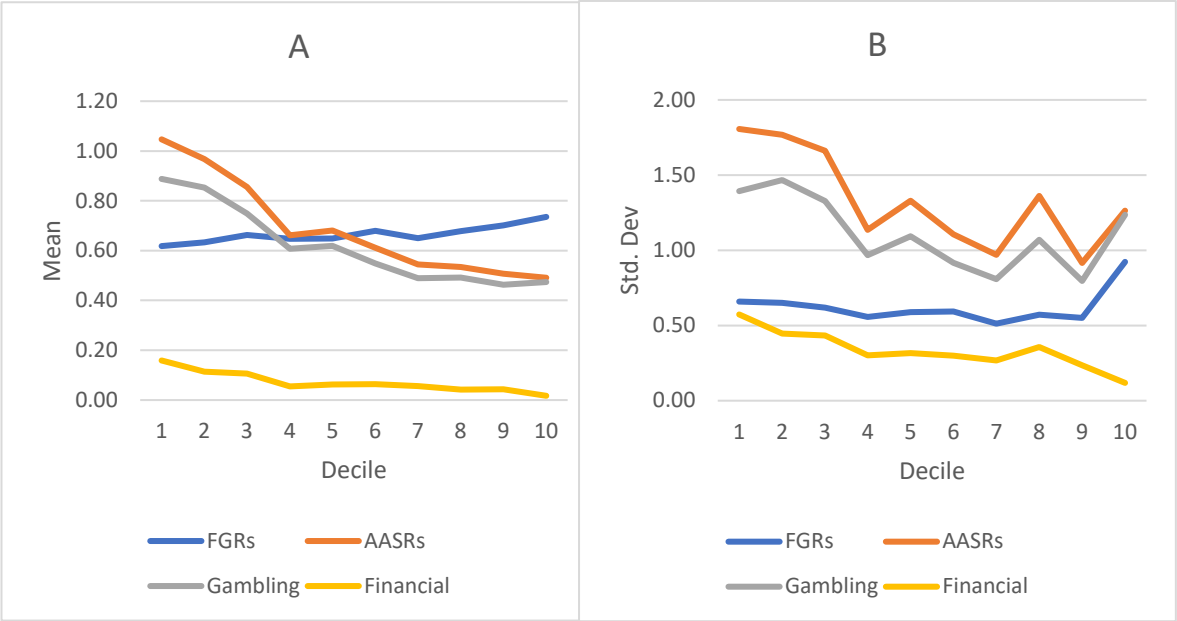

Figure 4.8 Means (A) and standard deviation (B) of the groups of retailers outlets per '000 persons and education deprivation domain deciles for commercial LSOAs

Largely, as education deprivation reduces, the decile means also reduce for AASRs and its two sub-groups in all commercial LSOAs (Figure 4.8A), with the most and least deprived commercial deciles having the highest and lowest means, respectively. FGRs show a different pattern with its highest mean in decile 10 (made up of the least deprived 10% LSOAs) and, as deprivation increases, the mean of outlets reduces generally (with only decile 6 as an exception, which has a higher mean compared to decile 7). Interestingly, deciles 1 and 2, which consist of the most deprived LSOAs, have the lowest mean. Further examination of the standard deviations shows a very wide variation in the distribution of all AASRs compared to FGRs (4.8B). Consequently, for education deprivation, there is a concentration of AASRs in the deprived commercial areas while FGRs have more presence the mid and affluent commercial LSOAs.

4.4.5 One-way analysis of variance (ANOVA)

After careful analysis of the means carried out above, it is appropriate to ascertain if the differences between the decile outlets means are statistically significant. Therefore, a one-

way analysis of variance (ANOVA) test was performed to compare the means of the groups. Selection of a one-way ANOVA test depends on some key assumptions: homogeneity of variances, dependent variable being interval or scale data, independent variable having three or more groups, independence of observation and normal distribution (Rayner and Best, 2013). To meet these assumptions, retailers' outlets per '000 persons, which is a continuous variable, was selected as the dependent variable and independent variables were income, employment and education deciles, which group all LSOAs into 10 equal groups. To assess the assumption of homogeneity of variances, a Levene's test was performed, which was significant ($p < .05$) for all three independent variables (i.e. income, employment and education), indicating that the assumption of homogeneity of variance is violated.

Table 4.4 Welch ANOVA for all retailer outlets per'000 and income, employment and education domain deciles for all LSOAs and commercial LSOAs.

Deprivation Domain Decile	Retailers' Outlets '000 Persons	All LSOAs			Commercial LSOAs		
		Statistic[a]	SS	Sig.	Statistic[a]	SS	Sig.
Income	FGRs	30.907	13362.642	.000	6.300	3834.299	.000
	AASRs	89.292	13220.049	.000	48.470	3877.456	.000
	Gambling	91.440	13258.127	.000	46.684	3867.513	.000
	Financial	31.895	12966.344	.000	23.768	3913.618	.000
Employment	FGRs	18.499	13365.787	.000	2.839	3934.744	.002
	AASRs	59.053	13317.171	.000	34.131	3951.796	.000
	Gambling	62.332	13319.942	.000	34.368	3951.282	.000
	Financial	21.383	13296.957	.000	15.890	3973.053	.000
Education	FGRs	9.790	13371.557	.000	2.229	4006.242	.018
	AASRs	34.159	13334.670	.000	18.187	4038.689	.000
	Gambling	34.472	13340.244	.000	17.909	4031.382	.000
	Financial	23.107	13040.284	.000	16.577	4077.396	.000

Asymptotically F distributed.
[ss] Sum of squares.

Although the retail outlets' variables violate the assumptions of normality, the effect of a non-normality does not have a serious consequence when using a Welch One-way ANOVA (Glass et al,1972; Elmore and Woehlke,1988) if the violation is not caused by outliers. It is

also robust enough to adequately limit the effect of unequal variances (Glass, et al., Sanders, 1972). Hence, a Welch ANOVA test was performed on the group of retailers' outlets per '000 persons (AASRs, gambling retailers, financial retailers and FGRs) and each deprivation indicator. Table 4.4 shows the results of the ANOVA for each deprivation domain and the retailers' outlets per '000 persons for the two LSOA considerations. Table 4.4 also indicates that there are significant differences in the decile means between each retailer group and income, employment and education deprivation indicators with $p < .05$ for commercial areas and all LSOAs.

As there are significant differences in the means of O‰P, a Games Howell multiple comparison post-hoc test (for unequal variances) was used to identify which decile group means significantly differed compared to the others. Tables 4.5, 4.6 and 4.7 show the results of the post-hoc multiple comparison test for the two LSOA considerations and income, employment and education deprivation decile 1, compared to other deciles. For income deprivation (Table 4.5), there is a highly significant difference between the mean of decile 1 (which has the highest mean) compared to the means of deciles 4 – 10 ($p < .001$) for AASRs and gambling and financial retailers in all LSOAs. In addition, the mean of decile 1 significantly differs to that of decile 3 for AASRs and financial retailers only ($p < .05$), in all areas.

Table 4.5 Games Howell post-hoc multiple comparison test showing the mean differences for deciles 1 and 2 compared to other deciles for income deprivation

Income Deprivation		FGRs		AASRs		Gambling Retailers		Financial Retailers	
(I) Decile	(J) Decile	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs
1	2	-.04112*	-.07592	.06018	.22364	.03967	.15975	.02052	.06389
	3	-.04384*	-.08825*	.09776*	.31411*	.06724	.22503*	.03052*	.08908*
	4	-.05928**	-.13124**	.14136**	.42557**	.10320**	.31674**	.03816**	.10883**
	5	-.04696*	-.13592**	.20041**	.54594**	.15111**	.41063**	.04930**	.13531**
	6	-.01164	-.13586**	.27729**	.68734**	.21968**	.53377**	.05761**	.15358**
	7	.01811	-.12179**	.30112**	.70463**	.24184**	.54961**	.05928**	.15502**
	8	.02851	-.16052**	.33154**	.77123**	.27022**	.61171**	.06132**	.15952**
	9	.05762**	-.11631**	.36970**	.89521**	.30429**	.72013**	.06541**	.17508**
	10	.05564**	-.21303**	.34961**	.75028**	.28804**	.59711**	.06157*	.15317**
2	1	.04112*	.07592	-.06018	-.22364	-.03967	-.15975	-.02052	-.06389
	3	-.00272	-.01233	.03758	.09047	.02758	.06528	.01000	.02519
	4	-.01816	-.05532	.08118*	.20194*	.06353	.15699*	.01764	.04494
	5	-.00584	-.06000	.14022**	.32230**	.11144**	.25088**	.02878**	.07143**
	6	.02948	-.05993	.21711**	.46370**	.18002**	.37401**	.03709**	.08969**
	7	.05924**	-.04587	.24094**	.48099**	.20217**	.38986**	.03876**	.09114**
	8	.06963**	-.08460	.27135**	.54759**	.23055**	.45196**	.04080**	.09563**
	9	.09874**	-.04038	.30952**	.67157**	.26462**	.56038**	.04489**	.11119**
	10	.09676**	-.13711	.28943**	.52665**	.24837**	.43736**	.04106**	.08929**

**The mean difference is significant at $p < .001$ level
*The mean difference is significant at $p < .05$ level.
LSOA considerations - all LSOAs and commercial LSOAs.
Decile 1 = 10% most deprived deciles.
Decile 10 = 10% least deprived decile.
Mean difference - differences in mean outlets per '000 persons for each decile compared to the others

In contrast, FGRs show quite different patterns, with the mean of decile 1 significantly lower compared to deciles 2 – 5 and higher compared to deciles 9 - 10. Comparison of FGRs in decile 2 to other deciles shows a highly significant mean difference to deciles 7 – 10 ($p < .001$) for all areas. Hence, there is a high concentration of AASRs in all income-deprived areas, while FGRs are more concentrated in the mid-deprived LSOAs.

For commercial LSOAs (Table 4.5), the mean differences for AASRs show similar patterns to those of all areas, with significant mean differences between income decile 1, compared to 3 – 10. Comparison of decile 2 to other deciles show quite similar patterns to decile 1 with a significant mean difference in the mean of outlets in decile 2 compared to deciles 3 – 10. For FGRs (commercial LSOAs, Table 4.5), comparison shows a more distinct pattern with a significantly lower mean in income decile 1 compared to deciles 3 – 10 ($p < .05$), with the least deprived commercial areas having the highest mean, whereas there is no significant difference between decile 2 and all other deciles. Therefore, AASRs are highly concentrated in all income-deprived commercial areas, while FGRs are more concentrated in the least deprived commercial LSOAs.

For employment deprivation (Table 4.6), comparison of the mean differences of decile 1 (which has the highest means) for AASRs and its sub-groups shows that they are highly significant compared to deciles 2 – 10 ($p < .001$), showing decile 1 as having far higher concentrations compared to other deciles for all LSOAs. This pattern is also similar for commercial LSOAs (Table 4.6). Comparing AASRs and its sub-groups in decile 2 to other deciles shows a highly significant mean difference to deciles 5 – 10 for both LSOA considerations (Table 4.6), i.e. a high concentration of AASRs in both employment deprived LSOAs and deprived commercial LSOAs.

Meanwhile, for FGRs (Table 4.6), there are only significant differences in the mean of outlets in employment deprivation decile 1 compared to deciles 7 – 10. Comparison of the mean of decile 2 shows no significant mean difference ($p > .05$) with deciles 1 – 7, but a significant difference to deciles 8 -10 for all LSOAs. Therefore, these relatively affluent deciles have higher means compared to the most deprived decile. For commercial LSOAs (Table 4.6), the mean difference of decile 10 is significantly higher compared to decile 1 ($p < .05$). Consequently, for employment deprivation, FGRs are more concentrated in least deprived LSOAs as well as in least deprived commercial LSOAs.

Table 4.6 Games Howell post-hoc multiple comparison test showing the mean differences for deciles 1 and 2 compared to other deciles for employment deprivation

Employment Deprivation		FGRs		AASRs		Gambling Retailers		Financial Retailers	
(I) Decile	(J) Decile	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs
1	2	.01617	.00178	.20148**	.46732**	.15647**	.35705**	.04500**	.11027**
	3	.00265	-.03207	.21197**	.50103**	.16146**	.37503**	.05051**	.12601**
	4	.00768	-.01213	.23389**	.56867**	.18174**	.43738**	.05215**	.13129**
	5	.01598	-.05623	.30990**	.71683**	.24562**	.55740**	.06428**	.15942**
	6	.02986	-.05587	.33573**	.76062**	.26829**	.59430**	.06744**	.16632**
	7	.04536*	-.05724	.37373**	.84747**	.30149**	.66798**	.07224**	.17949**
	8	.07939**	-.02928	.41011**	.91829**	.33512**	.73264**	.07499**	.18565**
	9	.08716**	-.07804	.41560**	.89129**	.34196**	.71499**	.07364**	.17630**
	10	.06902**	-.13402*	.39386**	.80996**	.32083**	.63519**	.07303**	.17478**
2	1	-.01617	-.00178	-.20148*	-.46732**	-.15647*	-.35705**	-.04500**	-.11027**
	3	-.01353	-.03385	.01050	.03371	.00499	.01798	.00550	.01574
	4	-.00849	-.01391	.03242	.10135	.02527	.08033	.00715	.02102
	5	-.00019	-.05801	.10842**	.24951**	.08915**	.20035**	.01927*	.04916*
	6	.01369	-.05765	.13425**	.29330**	.11181**	.23725**	.02244**	.05606*
	7	.02919	-.05903	.17226**	.38015**	.14502**	.31093**	.02724**	.06922**
	8	.06322**	-.03106	.20863**	.45097**	.17865**	.37559**	.02998**	.07539**
	9	.07098**	-.07983	.21413**	.42397**	.18549**	.35794**	.02864**	.06603*
	10	.05284*	-.13580*	.19238**	.34265**	.16436**	.27813**	.02803**	.06451*

**The mean difference is significant at $p < .001$ level.
*The mean difference is significant at $p < .05$ level.
LSOA considerations - all LSOAs and commercial LSOAs.
Decile 1 = 10% most deprived deciles.
Decile 10 = 10% least deprived decile.
Mean difference is difference in mean outlets per '000 persons for each decile compared to the others

Table 4.7 Games Howell post-hoc multiple comparison test showing the mean differences for deciles 1 and 2 compared to other deciles for education deprivation domain

Education Deprivation		FGRs		AASRs		Gambling Retailers		Financial Retailers	
(I) Decile	(J) Decile	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs	ALL LSOA	COM. LSOAs
1	2	-.01384	-.01482	.01438	.07919	.00038	.03460	.01400	.04459
	3	-.02939	-.04399	.04864	.19135	.03266	.13909	.01598	.05226
	4	-.00920	-.02861	.13507**	.38474**	.09854**	.28024**	.03653**	.10449**
	5	.01326	-.03006	.15246**	.36535**	.11646**	.26873**	.03600**	.09662**
	6	.00002	-.06162	.17111**	.43479**	.13583**	.33948**	.03527**	.09531**
	7	.03555*	-.03202	.21433**	.50201**	.17442**	.39918**	.03991**	.10282**
	8	.03672*	-.06006	.22420**	.51220**	.17996**	.39578**	.04424**	.11641**
	9	.03259	-.08357	.23303**	.53996**	.18902**	.42491**	.04401**	.11505**
	10	.04693*	-.11720	.25258**	.55572**	.20106**	.41396**	.05151**	.14176**
2	1	.01384	.01482	-.01438	-.07919	-.00038	-.03460	-.01400	-.04459
	3	-.01555	-.02917	.03426	.11216	.03228	.10449	.00198	.00767
	4	.00465	-.01379	.12069**	.30555**	.09815**	.24565**	.02254*	.05990*
	5	.02710	-.01525	.13808**	.28616*	.11608**	.23413*	.02200*	.05203*
	6	.01387	-.04681	.15673**	.35560**	.13545**	.30488**	.02128*	.05072*
	7	.04940**	-.01720	.19996**	.42281**	.17404**	.36458**	.02592**	.05823*
	8	.05056**	-.04524	.20982**	.43300**	.17958**	.36118**	.03024**	.07182*
	9	.04644*	-.06875	.21865**	.46077**	.18864**	.39031**	.03001**	.07046**
	10	.06078**	-.10238	.23820**	.47653**	.20068**	.37936**	.03752**	.09717**

**The mean difference is significant at p < .001 level.
*The mean difference is significant at p < .05 level.
LSOA consideration - all LSOAs and commercial LSOAs
Decile 1 = 10% most deprived deciles.
Decile 10 = 10% least deprived decile.
Mean difference is difference in mean outlets per '000 persons for each decile compared to the others

Table 4.7 shows the comparison of the means of deciles 1 and 2 to all deciles for education deprivation. For all LSOAs, decile 1 (which has the highest mean) has a highly significant mean difference compared to deciles 4 – 10 ($p < .001$) for AASRs and its sub-groups. However, for FGRs, there is a significantly higher mean difference between decile 1 and 2 compared to only deciles 7, 8 and 10 and deciles 7, 8 and 9 ($p < .05$) respectively for all LSOAs. Hence, deciles 1 – 3, which consist of the 30% most deprived areas, have the highest concentration of AASRs, whereas FGRs have similar patterns in the most and mid-deprived deciles for education deprivation.

For commercial LSOAs (Table 4.7), the distribution for AASRs and its sub-groups are similar to that of all LSOAs, with the most deprived deciles (deciles 1 – 3) having significantly higher mean differences compared to the mid/least deprived commercial deciles ($p < .001$). However, the mean difference for FGRs in decile 1 and 2 compared to other deciles is not significantly different across all commercial LSOAs (Table 4.7). Therefore, the most deprived commercial LSOAs have the highest concentrations of AASRs, while FGRs have similar patterns across all commercial areas for education deprivation.

4.4.6 Binomial Regression analysis

To understand the seemingly complex location patterns of these retailers, a regression analysis was employed to understand the influence of area deprivation on retail location. To achieve this, because the dataset violates the assumptions for a linear regression, a binary logistic regression was adopted. Therefore, the retail outlet data was recoded to binary format i.e. presence or absence of each of the retailers' outlets per LSOAs. This was undertaken for all retailers to meet the assumptions of the binary logistic regression test procedure. Therefore, the independent variables are income, employment and education deprivation deciles while the dependent variables are the recoded retail outlets.

Table 4.8 shows the odds of the likelihood of FGRS and AASRs, gambling and financial outlets across deciles 1 – 9 compared to decile 10 (the reference decile) for income, employment and education deprivation indicators. For all areas, the odds of the presence of AASRs, gambling and financial outlets in neighbourhoods in decile 1 are the highest compared to the reference categories across the three deprivation indicators.

Table 4.8 Odds of the likelihood of FGRs, AASRs, gambling and financial retail outlets across all deciles in comparison to the reference decile (decile 10) for income, employment and education

	All LSOAs				Commercial LSOAs			
	FGRs	**ASSRs**	**Gambling**	**Financial**	**FGRs**	**AASRs**	**Gambling**	**Financial**
Decile 10 (Reference)				**Income Deprivation**				
1	1.320**	5.910**	5.893**	9.587**	.164**	6.393**	6.241**	5.350**
2	1.725**	5.738**	5.702**	7.733**	.244**	4.837**	4.718**	3.972**
3	1.849**	5.235**	5.172**	7.478**	.297**	4.041**	3.908**	3.867**
4	1.974**	4.685**	4.655**	5.293**	.360**	3.263**	3.204**	2.695**
5	1.959**	3.952**	3.950**	3.881**	.449**	2.715**	2.700**	2.069**
6	1.663**	2.736**	2.726**	1.534**	.537**	1.993**	1.976**	.937*
7	1.403**	2.343**	2.337**	1.772	.540**	1.981**	1.966**	1.242
8	1.281**	1.658**	1.658**	1.059	.710*	1.411*	1.410**	.826
9	1.122	1.15	1.14	0.705	.794	1.014	1.003	.619
Constant	.204**	.062**	.062**	.005**	8.554**	.451**	.444**	.028**
Decile 10 (Reference)				**Employment Deprivation**				
1	1.266**	4.251**	4.244**	8.449**	.232**	4.646**	4.556**	5.319**
2	1.343**	3.328**	3.294**	4.899**	.320**	3.173**	3.075**	3.185**
3	1.445**	3.107**	3.084**	4.753**	.378**	2.696**	2.637**	3.065**
4	1.490**	3.076**	3.063**	4.036**	.396**	2.576**	2.540**	2.554**
5	1.439**	2.269**	2.248**	2.806**	.551**	1.856**	1.820**	1.951*
6	1.345**	1.904**	1.912**	1.598	.589**	1.565**	1.574**	1.166
7	1.278**	1.519**	1.511**	1.459	.735*	1.262*	1.251*	1.153
8	1.045	1.225*	1.228*	0.954	.705*	1.177	1.179	.872
9	0.953	0.95	0.95	0.909	.972	.982	.981	.940
Constant	.246**	.094**	.093**	.007**	6.894**	.613**	.603**	.031**
Decile 10 (Reference)				**Education Deprivation**				
1	1.239**	2.680**	2.675**	7.361**	.353**	2.561**	2.530**	5.141**
2	1.381**	2.694**	2.689**	6.231**	.404**	2.307**	2.284**	4.119**
3	1.566**	2.380**	2.352**	5.875**	.521**	1.699**	1.658**	3.784**
4	1.475**	2.106**	2.110**	3.149**	.560**	1.566**	1.569**	2.108*
5	1.305**	1.782**	1.776**	3.434**	.598**	1.467**	1.456**	2.585**
6	1.426**	1.650**	1.625**	3.722**	.759*	1.239*	1.207*	2.765**
7	1.165*	1.378**	1.352**	2.920**	.691*	1.195	1.157	2.478*
8	1.140*	1.187*	1.188**	1.673	.812	1.023	1.025	1.466
9	1.161*	1.13	1.121	2.181*	.941	.965	.953	1.949*
Constant	.241**	.116**	.115**	.006**	5.444	.826**	.813**	.024*

**odds ratio significant at p < .001
*odds ratio significant at p <.05

Additionally, as deprivation reduces, the likelihood of AASRs and its subgroups reduces with financial retailers having the highest prevalence, whereas for FGRs, the mid deprived deciles have the highest likelihood of the presence of food retailers across the three deprivation indicators compared to the reference deciles (Table 4.8). Therefore, there is a higher likelihood of AASRs in the most deprived neighbourhoods, while FGRs have highest likelihood of being in the mid-deprived neighbourhoods in England. Across the three deprivation indicators, education deprivation has the lowest influences on all groups of retailers' outlets across all areas.

For commercial LSOAs (Table 4.8) the patterns of likelihood of AASRs, gambling and financial outlets in deprived LSOAs compared to the least deprived LSOAs is similar, with the highest odds of presence in decile 1 across the three deprivation indicators. In addition, gambling retailers have higher prevalence across most of the deciles in all areas compared to commercial areas. However, financial retailers have the highest odds of presence in all areas compared to commercial areas. For FGRs, the likelihood contrasts with AASRs, which have the highest prevalence in the least deprived commercial areas compared to the most deprived commercial areas across all indicators. As area deprivation reduces, the odds of presence of FGRs increases. Therefore, in commercial areas, there is a higher possibility of FGRs in affluent areas, while for AASRs the opposite is the situation. Likewise, overall, education deprivation has the lowest influence on retail location preference across all commercial areas.

4.5 Summary of retailers and deprivation in England

This chapter has explored the relationships between AASR and FGR retailers with SED and compared the patterns of both groups of retailers to explain the similarities and differences in their location patterns vis-a-vis SED. In addition, it has also examined individual business types which make up the AASR and FGR groups and compared their location patterns to SED. To achieve these ends, it used spatial and statistical techniques, namely kernel density estimation, correlation, analysis of variance and binary logistic regression, to achieve the objectives highlighted at the beginning of this chapter. From the kernel density maps, results show that the location patterns of FGRs and AASRs closely follow the distribution of regional commercial centres and urban configuration in England, with high concentration in deprived commercial centres.

Correlation analysis showed a positive association between gambling, financial and food and grocery retailers and SED for all LSOAs, with a higher and more pronounced concentration in deprived areas by AASRs. In contrast, when only looking at commercial areas (i.e. only LSOAs with retail presence), the relationship is very different, with only AASRs having a positive association with all three dimensions of deprivation, but with subtle differences existing to suggest that the form of deprivation does impact AASR locations in complex ways. Analysis of the means of outlets using a one-way ANOVA reveals that AASRs have a higher concentration in deprived LSOAs, with the highest distributions mainly in impoverished areas, whereas affluent areas have a significantly lower presence of these retailers. More importantly, even within deprived deciles, there is wide variation in the distribution of AASRs. For FGRs, both deprived and relatively affluent areas have statistically similar distribution. Also, least and mid-deprived commercial areas have a higher distribution of food retailers.

Evidence from the binomial logistic regression further confirms the results of the correlation and means analysis, with greatest prevalence of AASRs in deprived areas, as well as deprived commercial areas. In contrast, there is a higher prevalence of financial outlets in all LSOAs, compared to commercial areas interestingly. Whereas, FGRs have the highest of being located in moderately deprived LSOAs and most affluent commercial LSOAs. Overall, there are emerging contrasts between AASRs and general food retail stores in terms of their location characteristics relative to measures of deprivation in England.

Chapter 5

Retailers and Area Socio-Economic Characteristics in Leeds, Nottingham and Bristol - Phase 2

5.1 Introduction

This chapter sets out to establish the relationship between retailers (AASRs and FGRs) outlets and socio-economic deprivation (SED) in England. The results of the first phase of the research analysis in the previous chapter (chapter 4) show very interesting findings. As demonstrated, the hotspot maps show that there is indeed a concentration of AASRs and FGRs in deprived LSOAs in England, but the concentration seems to be more pronounced with AASRs compared to FGRs. Careful examination of these concentrations shows a pattern of high concentration in urban centres in England. Further statistical analysis reveals that there is a significant positive relationship between these retailers' outlets and area socio-economic deprivation domains (income, employment and education). What is more, the robust analysis using a Welch one-way ANOVA and Games Howell Post-hoc test also reveals significant relationships between the IMD domains, with a higher concentration of AASRs in deprived deciles compared to the least deprived deciles.

Therefore, following the exploration and analysis across all areas in England, the next priority was to further investigate the relationship between these groups of retailers and SECs at small area level, using selected cities as case studies to further explore the relationships observed with these retailers and SED. This chapter seeks to address the following sub-research questions. They are:

- What is the relationship between the two groups of retailers outlets (AASRs and FGRs) and area SECs in small areas?
- What are the similarities and differences between the 2 groups of retailers and area SECs in small areas?
- Which socioeconomic characteristics (SECs) are most predictive of AASR locations?

The sub-research objectives are as follows:

1. To explore the relationship between SECs and AASRs location in Leeds, Nottingham and Bristol.

2. To explore whether these associations are also found for FGRs in Leeds, Nottingham and Bristol.
3. To develop an area classification map for Leeds, Nottingham and Bristol using socio-economic variables**.**
4. To compare the similarities and differences in the relationships between FGRs, AASRs and SECs in Leeds, Nottingham and Bristol.
5. To develop a synoptic neighbourhood model that best fits AASR locations using socio-economic variables.

These research questions will help to identify: (a) if England-wide relationships are present at intra-city level and (b) if similar relationships exist across a sample of areas (Leeds, Nottingham and Bristol). This will enable an in-depth analysis of the observed relationships at a more precise and accurate level, thereby allowing for salient conclusions and inferences to be made about the nature of the relationships between AASRs and SED. This will also aid a better and clearer comparison of the two groups of retailers' location patterns and preferences and enable this research to address the notion of the targeting of the poor ascribed to these AASRs by numerous stakeholders (policy makers, scholars and other stakeholders).

For this phase of the analysis, rather than use the Indices of Deprivation domains to measure area SED, selected socio-economic and demographic variables related to SED were selected from the 2011 UK National Census for the study areas. Justification for using socio-economic variables is to further establish the linkages between individual area SECs and retailers' location preferences in the UK. Thus, building on the linkages explored in other parts of the world, as seen in the literature review. Selected SECs based on evidence from the literature review will be adopted, as these have not been adequately researched in the UK. The research will further use the most appropriate of these socio-economic and demographic variables to create an -area classification map using techniques similar to those utilised by Vickers (2006). Accordingly, the classification will be driven by variables related to socio-economic deprivation and used to represent area socio-economic deprivation. This approach to area classification finds its roots in geo-demographics.

5.2 Data and methods

As identified in section 5.1, this chapter seeks to further understand the linkages between retail locations (AASRs and FGRs) and area SECs. Evidence from the literature review,

especially international scholarly publications, reveal that particular SECs influence AASR and FGR locations. The literature also alludes that area characteristics of housing tenure (Graves, 2003; Burkey and Simkins, 2004; Smoyer-Tomic et al., 2008), car ownership (Smoyer-Tomic et al., 2006), income (Burkey and Simkins, 2004; Robitaille and Herjean, 2008; ; Gallmeyer and Roberts, 2009; Black et al., 2011; Black et al., 2012; Pickernell et al., 2013; Liu and Qui, 2015), age composition (Burkey and Simkins, 2004; Robitaille and Herjean, 2008; Smoyer-Tomic et al., 2008; Gallmeyer and Roberts, 2009; Wardle et al., 2014; Liu and Qui, 2015;), family composition (Burkey and Simkins, 2004; Larson and Gilliland, 2008; Smoyer-Tomic et al., 2008), minority ethnic characteristics (Wheeler et al., 2006; Raja et al., 2008; Smoyer-Tomic et al., 2008; Sharkey and Horel, 2008; Black et al., 2011; Gordon et al., 2011; Bower at al., 2014), educational qualifications (Burkey and Simkins, 2004) and occupational status (Gilland and Ross, 2005; Larson and Gilliland, 2008; Gallmeyer and Roberts, 2009) are determinants of gambling, food and financial retailers' locations.

Most of these socio-economic variables are also major drivers of demand for and supply of AASR services (Coups et al., 1998; Karger and Ebrary, 2005; Wardle et al., 2010; Tan et al., 2010; Collard and Hayes, 2010). Therefore, the variables within these socio-economic themes are adopted for this part of the research. These variables were obtained from Nomis (see chapter 3 for more details). To explore and explain the relationships, correlations, k-means clustering and mapping, analysis of variance and binomial logistic regression are utilised (see chapter 3 for more details).

5.3 Relationship between retailers and socio-economic (SE) characteristics

This section compares the results of the Spearman's correlation co-efficient test on the relationship between the two groups of retailers' outlets (AASRs and FGRs) and various groups of SE variables (housing tenure, dwelling type, ethnic composition, age group, family composition, socio-economic classification (NS-SeC), fulltime students and educational qualifications). From a cursory look at the results of Nottingham (see appendix 2a), there were few or no significant correlations between most of the seven groups of socio-economic variables and AASRs, especially gambling outlets, which is unusual when compared to the other cities. Hence, before reporting the results of this phase, the next sub-section shows the results of the investigation of the patterns of distribution in Nottingham compared to Leeds

and Bristol in an attempt to explain the likely causes of this disparity. It also details the necessary steps taken thereafter.

5.3.1 The Nottingham Situation

To examine the distribution in Nottingham, the IMD 2015 data was used to carry out the investigation. The distribution of LSOAs and AASR outlets in Leeds, Nottingham and Bristol across the 10 deciles were compared to their respective IMD deciles. Table 5.1 shows the distribution of AASRs across the different IMD deciles in Leeds, Bristol and Nottingham. From the table, there is a very clear patterns of deprivation across the different cities. Table 5.1 shows that 21.8%, 16.0% and 33.5% of the LSOAS in Leeds, Bristol and Nottingham respectively are within the most deprived 10% of LSOAs in England, with Nottingham having the highest representation in this category.

Further investigation from Table 5.1 reveals that approximately 47% and 55% of the LSOAs in Leeds and Bristol respectively are in the deciles 1 – 4, which altogether represents 40% of England's most deprived neighbourhoods. Meanwhile, in Nottingham over 80% of the total LSOAs are in decile 1 – 4, showing a high concentration of the neighbourhoods in Nottingham to be classified as highly deprived compared to the other two cities (i.e. Leeds and Bristol). On the other hand, from Table 5.1, less than 5% of LSOAs in Nottingham are in deciles 8 – 10, which contain the least deprived neighbourhoods, whereas in Leeds and Bristol, these deciles contain about 26% and 17% respectively.

Looking at the distribution of AASRs, approximately 74%, 76% and 91% of all AASRs are in decile 1 – 4 in Leeds, Bristol and Nottingham respectively with Nottingham having the highest distribution. This further signifies a high presence in these deprived deciles in Nottingham compared to Leeds and Bristol. Distributions of AASRs further show similar patterns with Leeds having over three times and Bristol having almost eight times more AASRs compared to Nottingham. Thus, this investigation revealed two salient findings. Firstly, the majority of the neighbourhoods in Nottingham are classified as deprived and over 90% of AASRs are in these deprived neighbourhoods. Therefore, the findings for

Table 5.1 Distribution of AASR outlets across all LSOAs and IMD 2015 deciles in Leeds, Nottingham, Bristol and Nottingham/Rushcliffe/Broxtowe

	IMD Deciles	LSOA		AASRs	
		Count	%	Count	%
Leeds	1	105	21.8	55	31.1
	2	43	8.9	9	5.1
	3	45	9.3	65	36.7
	4	34	7.1	1	0.6
	5	38	7.9	13	7.3
	6	40	8.3	13	7.3
	7	50	10.4	13	7.3
	8	46	9.5	4	2.3
	9	40	8.3	1	0.6
	10	41	8.5	3	1.7
	Total	**482**	**100**	**177**	**100**
Bristol	1	42	16.0	16	16.7
	2	35	13.3	14	14.6
	3	36	13.7	28	29.2
	4	32	12.2	15	15.6
	5	20	7.6	5	5.2
	6	23	8.7	7	7.3
	7	30	11.4	3	3.1
	8	22	8.4	6	6.3
	9	12	4.6	2	2.1
	10	11	4.2	0	0.0
	Total	**263**	100	**96**	**100**
Nottingham	1	61	33.5	22	29.7
	2	49	26.9	17	23.0
	3	23	12.6	16	21.6
	4	14	7.7	12	16.2
	5	13	7.1	4	5.4
	6	7	3.8	1	1.4
	7	8	4.4	1	1.4
	8	0	0	0	0
	9	6	3.3	0	0.0
	10	1	0.5	1	1.4
	Total	**182**	100	**74**	**100**
Nottingham/Rushcliffe / Broxtowe	1	61	19.0	22	21.8
	2	53	16.5	19	18.8
	3	26	8.1	16	15.9
	4	21	6.5	15	14.6
	5	26	8.1	8	7.9
	6	22	6.8	7	6.9
	7	25	7.8	6	5.94
	8	17	5.3	4	4.0
	9	23	7.2	1	0.9
	10	47	14.6	3	3.0
	Total	**321**	**100**	**101**	**100**

Nottingham, which show mainly non-significant associations, might be because the distributions are highly skewed towards those in the lowest deciles.

To further explain the factors that might be responsible for the Nottingham situation, investigation of the literature reveals that the Nottingham City Boundary is tightly drawn geographically (Punter, 2009; Porter and Smith, 2013; Nottingham City Council, 2018). Hence, its suburbs and outer areas are classified under suburban local authorities (Punter, 2009). Furthermore, as reported by BBC (2006), a crime report published in 2006 was criticised and rejected by the police, politicians and university leaders in Nottingham because, they argued, the result was flawed. According to the report (BBC, 2006) Graham Allan who was the Nottingham North MP as at the time, criticised the report, saying that "it was based on flawed statistics because it included a tightly drawn boundary for Nottingham compared to other cities where suburbs and parklands were included" (p.1).

Therefore, based on the above premise, the first option was to either remove Nottingham City from the analysis and include another city or, alternatively, to incorporate more affluent areas of the suburbs and outer city areas to produce a better blend of affluent and deprived LSOAs. The second option was subsequently selected because it offers the opportunity to maintain inclusion of Nottingham in the study and it also allows further exploration of what otherwise might appear an unexplained, non-conforming case. Therefore, the LSOAs in Broxtowe and Rushcliffe districts were merged with Nottingham. The justification for the selection of only Rushcliffe and Broxtowe is that they are both relatively affluent with a good contrast of deprivation characteristics compared to the other suburbs of Nottingham, allowing for a good blend of LSOAs. Table 5.1 further shows the distribution of LSOAs and AASRs in Nottingham with the inclusion of Rushcliffe and Broxtowe. Investigation of distribution as a result of the merger in Table 5.1 shows that deciles 1 – 4 now have approximately 50% of the total LSOAs, while deciles 8 – 10 have over 25% with the addition of Rushcliffe and Broxtowe. This indicates a similar distribution in comparison with Leeds and Bristol. Hence, the skewness towards highly deprived deciles observed in Nottingham has been tackled appropriately. Accordingly, only results of Leeds, (Greater) Nottingham[7] and Bristol are reported henceforth.

[7] The merger of Nottingham, Broxtowe and Rushcliffe will be referred to as Nottingham hereafter.

5.3.2 Associations between retailers and socio-economic (SE) characteristics in Leeds, Nottingham and Bristol

The results of the comparison between Leeds, Nottingham[7] and Bristol are now explored here. The comparisons reveal several similarities and differences in the relationships between each retail group and SE variables in Leeds, Nottingham and Bristol (see Table 5.2). The key findings are summarised in subsequent paragraphs.

For housing tenure, the higher the area distribution of households in owner occupied tenure, the lower the AASR outlets in the three areas, while area variations in households in owner occupied tenure have no significant association with FGR outlets. In addition, the lower proportion of households in socially rented tenure, the lower the distribution of AASRs in Leeds with no significant relationship with FGRs. For private rented tenure, the higher the household type the higher the distribution in both AASR and FGR distributions, but the relationship is higher with AASRs compared to FGRs (see Table 5.2).

For area ethnic composition, area variations in minority ethnic groups (Black and Chinese) have little or no relationship with FGR outlets, while it has a positive relationship with AASR distributions. Area variations in persons from Indian/Pakistani/Bangladeshi ethnic groups have no relationship with either group of retailer distributions. Results also reveal that there is a significant relationship between area distribution of the two groups of retailers outlets and household car ownership level. AASR distribution has a very significant positive relationship with low level of car ownership in the three areas compared to FGR outlets which only has a positive relationship in Leeds. In addition, areas with high distributions of households with more than one car have a very low presence of AASR outlets, while an increase or decrease in these households has little no relationship on FGR distribution (see Table 5.2).

Comparison of the relationship between level of qualifications and the groups of retailers outlets reveals that an increase in persons with no qualifications will lead to an increase in the observed AASR outlets while the same pattern will lead to a decrease in the observed FGR outlets. Furthermore, an increase in the area variation in persons with Level 2 qualifications will lead to a significant reduction in the observed AASR outlets, while it has little or no effect on the presence of FGR outlets. In addition, in terms of area distribution in age categories, areas with high proportions of young population between 18 – 24 and 25 – 44 have a high presence of AASRs compared to FGR outlets. AASRs also have a stronger

positive relationship with these age compositions. In contrast, the higher the distributions of persons aged 46 and above in an area, the lower the presence of AASR outlets, while an increase or decrease in these households has no relationship with FGR outlets.

For occupation types based on NS-Se categories, areas with high proportions of person in managerial or professional occupations have low presence of AASR outlets and an increase in their distribution will have a negative relationship with AASR distribution. The relationship is similar with area distribution of intermediate occupations while area variations in the distributions of persons in managerial or professional positions have no relationship with the distribution of FGRs. Furthermore, areas with a large presence of fulltime students have a positive relationship with higher presence of AASRs and no significant relationship on FGR outlets. Finally, in terms of household family composition, areas with large presence of AASR and FGR outlets have very low presence of couple family households. Comparison shows AASRs having a higher negative relationship compared to FGRs. In terms of lone parent family households, an increase in their distribution will result in a decrease in the distribution of FGR outlets, while an increase or decrease in the above variable has no relationship on the distribution of AASR outlets (see Table 5.2).

Table 5.2 Correlation between retailers and socio-economic characteristics in Leeds, Nottingham and Bristol

	All Areas				Leeds				Nottingham				Bristol			
	FGRS	**AASRs**	**Gamb.**	**Fin.**	**FGRs**	**AASRs**	**Gamb.**	**Fin.**	**FGRs**	**AASRs**	**Gamb.**	**Fin.**	**FGRs**	**AASRs**	**Gamb.**	**Fin.**
Housing Tenure																
Owner Occupied	-.093**	-.201**	-.201**	-.136**	-.108*	-.220**	-.219**	-.144**	-.087	-.153**	-.153**	-.128*	-.067	-.198**	-.202**	-.114
Social Renters	-.013	.074*	.079**	.044	-.007	.104*	.101*	.041	.007	.086	.086	.101	-.057	.001	.027	.007
Private Renters	.150**	.221**	.217**	.137**	.173**	.236**	.239**	.145**	.160**	.169**	.168**	.107	.100	.244**	.226**	.176**
Family Composition																
Couple Family	-.117**	-.218**	-.217**	-.130**	-.137**	-.243**	-.240**	-.148**	-.133*	-.191**	-.191**	-.118*	-.060	-.184**	-.191**	-.124*
Lone Parent Family	-.087**	-.016	-.011	-.042	-.009	.024	.021	.005	-.138*	-.027	-.027	-.030	-.151*	-.073	-.052	-.141*
Ethnic Composition																
Black	.028	.120**	.119**	.084**	.041	.129**	.125**	.116*	.025	.105	.106	.070	-.029	.073	.083	.055
IPB	.055	.067*	.068*	.075*	.049	.050	.050	.094*	.064	.090	.090	.018	.050	.092	.094	.116
Chinese	.099**	.105**	.102**	.113**	.094*	.072	.072	.087	.106	.149**	.149**	.158**	.096	.107	.094	.159**
Age Composition																
18 - 24	.083**	.186**	.179**	.125**	.093*	.176**	.171**	.121**	.055	.174**	.174**	.124*	.118	.209**	.191**	.170**
25 - 44	.024	.129**	.121**	.090**	.045	.159**	.155**	.110*	-.024	.040	.040	.047	.016	.138*	.123*	.079
45 - 64	-.090**	-.172**	-.171**	-.113**	-.087	-.167**	-.171**	-.112*	-.093	-.148**	-.147**	-.103	-.088	-.179**	-.173**	-.121
65+	-.025	-.094**	-.087**	-.083**	-.003	-.093*	-.090*	-.073	-.004	-.032	-.032	-.088	-.068	-.151*	-.132*	-.097
Educational Qualifications																
No qualifications	-.040	.035	.040	.019	.040	.098*	.094*	.108*	-.075	.066	.066	-.033	-.122*	-.071	-.047	-.087
Level 1	-.110**	-.056	-.052	-.049	-.069	-.043	-.051	-.006	-.179**	-.048	-.047	-.033	-.096	-.077	-.057	-.128*
Level 2	-.131**	-.144**	-.139**	-.103**	-.111*	-.130**	-.133**	-.106*	-.159**	-.131*	-.130*	-.062	-.117	-.150*	-.131*	-.141*
Level 3	.029	.020	.015	-.001	-.051	-.062	-.061	-.095*	.089	.063	.063	.069	.087	.095	.075	.125*
Level 4 and above	.034	-.020	-.026	-.010	-.027	-.066	-.062	-.076	.070	-.053	-.054	-.009	.072	.040	.015	.079
Car Ownership																
No Car	.093**	.208**	.210**	.158**	.112*	.228**	.226**	.193**	.092	.188**	.188**	.125*	.050	.195**	.209**	.118
One Car	-.012	-.062*	-.069*	-.103**	.024	-.058	-.063	-.122**	-.014	-.097	-.098	-.102	-.127*	-.097	-.107	-.088
Two Cars	-.092**	-.215**	-.215**	-.164**	-.124**	-.241**	-.239**	-.202**	-.078	-.173**	-.173**	-.121*	-.035	-.204**	-.215**	-.142*
Three Cars	-.053	-.176**	-.178**	-.145**	-.098*	-.229**	-.226**	-.187**	-.037	-.136*	-.136*	-.126*	.021	-.136*	-.150*	-.085
Four Cars Above	-.045	-.162**	-.165**	-.119**	-.086	-.232**	-.232**	-.147**	-.021	-.099	-.099	-.137*	-.009	-.142*	-.153*	-.077
Ns-Sec Classification																
Managers and Professionals	-.007	-.088**	-.093**	-.065*	-.045	-.108*	-.105*	-.122**	-.006	-.127*	-.127*	-.058	.046	-.121	-.128*	-.085
Intermediate occupations	-.088**	-.151**	-.148**	-.099**	-.078	-.175**	-.175**	-.121**	-.060	-.127*	-.127*	-.094	-.024	-.137*	-.027	.005
Lower and Routine Occupations	-.061*	.036	.041	-.003	.019	.088	.083	.069	-.103	.036	.037	-.038	-.047	-.125*	-.008	.030
Never-worked/Long-term Unemp.	-.001	.090**	.094**	.057	.054	.127**	.121**	.124**	-.026	.106	.106	.051	.009	-.100	-.081	-.060
Fulltime students	.070*	.124**	.120**	.091**	.072	.090*	.095*	.047	.065	.162**	.162**	.115*	.073	.127*	.107	.176**

****Correlation is significant at the 0.01 level (2-tailed).**
***Correlation is significant at the 0.05 level (2-tailed).**

Generally, these initial results appear to confirm explanations of the relationships between deprivation related characteristics and AASRs, but comparable results for FGRs are frequently less clear.

5.4 Area classification

The purpose of this section is to create a classification of Leeds, Nottingham and Bristol at LSOA level using socio-demographic variables. One of the research questions is "what is the relationship between AASR distribution and socio-economic variables?". To explore this research question, the objectives were to build an area classification at small area level (LSOA) and explore if the relationships found from the England wide study are similar to those observed at city level.

Although there is a recent Output Area classification (Vickers, 2006) for the whole of England, this classification is a multi-purpose classification and does not suit the purpose of this research. This research seeks to build an area classification which will serve as a basis to understand the complex relationship between AASRs, FGRs and area SECs. In addition, although the method is complex and technical, it is much easier to interpret because it only requires as much data needed to achieve the aim of this research. Furthermore, this area classification is created with those SE variables that the literature review section has identified as having a relationship with the demand for AASR and FGR services. Moreover, the results of the correlation analysis in the previous section will also inform variable selection to ensure that the classification suits its purpose.

To carry out the classification, K-means technique will be used. Due to the subjective nature of selecting the final clusters usually encountered using K-means, different cluster number solutions will be carried out to identify the most suitable for this research purpose. In addition, the average distance for each cluster solution will also be analysed. Thereafter, the optimal number of clusters would be selected after careful examination of the cluster characteristics.

5.4.1 Variables selection

Selection of the final variables involved several steps. The first consideration was that because this classification was for three different areas, the final selected variables needed to be the same across the board, ensuring similarities of the classification within the three cities as opposed to selecting different variables for each city. Furthermore, as this research

critically reviews the relationship between AASRs and socio-economic deprivation, very important consideration has been given to those variables that have strong significant relationships with AASR outlets in the 3 areas. Finally, evidence from the literature review also informed variable selection (as it did for the initial choice for the wider set of variables).

The relationships between these variables and AASR outlets in the three areas were explored in the previous chapter. A summary of the relationship between AASRs and the variables in the three cities are shown in Table 5.3 below.

Table 5.3 Summary of variables with significant relationships with AASR Outlets areas

	Relationship	
Variables	**Positive**	**Negative**
Accommodation Tenure	Private and Social rented	Owner Occupied
Family Composition	NIL	Couple Family
Age	18 – 24 and 25 - 44	45 – 64 and 65 and over
Car Ownership	No Car	2 Cars, 3 cars and 4 or more cars
Educational Qualifications	No qualifications	Level 2 Qualifications
Occupations (Ns – Sec)	Never Worked/Long Term Unemployed and Full Time Students 18 Over	Managers/ Professional and Intermediate Occupations
Ethnicity	Blacks and British Chinese	NIL

Aside from examining the relationship between the variables and AASR outlets, the relationship between each variable needed to be explored using a correlation test. This would allow discovery of any highly correlated variables. For example, most students are aged 16 – 24, therefore, students will likely have a high correlation with people aged 16 – 24. Conversely, a negative correlation between two variables means that the presence of one would lead to the absence/reduction of the other. For example, most house owners have at least one car, therefore, no car household will have limited presence in areas dominated by owner occupied households. In addition, there would be within group correlation between variables in one group. More specifically, if two variables are from the same sample group, there will be correlation between the variables. For instance, the various classifications of housing tenure will correlate with each other because they are drawn from the same group. Therefore, if two variables are auto correlated (i.e. have a correlation co-efficient of approximately 0.80 and above), one variable is dropped for the other. The correlations between important SECs for the three areas are shown in appendices (2b – e).

Table 5.4 Descriptive statistics of all the variables in descending order

Descriptive Statistics				
Variable	Minimum	Maximum	Mean	Std. Deviation
Owner Occupied Households	2.4	95.7	57.9482	23.42937
No Car Households	2.5	80.1	30.9784	17.07081
Private Rented Households	2.1	90.3	19.0964	15.91427
Level 4 Qualifications	4.6	68.4	27.9258	14.73145
Fulltime Students 18 and Over	0.9	86.5	8.7195	14.16676
Managers/Professionals	4.2	63.9	30.248	13.95169
Routine/Lower Occupations	3.6	58	31.9014	13.39185
Persons aged 18 – 24	3.02	84.93	12.667	12.74621
2_Car/van Households	1.3	52.1	21.5001	11.26716
Couple Family Households	3.5	67.6	29.2069	11.2576
No qualifications	0.5	53.9	23.3779	11.01635
Level 3 Qualifications	4.9	70.8	13.7975	8.98623
IPBs	0	63.87	5.1764	7.7503
Age 25 – 44 Persons	10.01	66.86	29.1204	7.5624
Age 65+ Persons	0.14	36.89	14.5575	6.82951
Persons aged 45 – 64	2.15	37.91	23.0408	6.42266
1 Car/Van Households	18.3	55.9	42.4031	6.39686
Blacks	0	64.96	4.1781	6.32978
Lone Parent Family Households	0.3	37	11.0391	6.03512
Intermediate Occupations	1.9	32	19.83	5.43514
Never Worked/Long-term Unemployed	0.7	28.4	6.0903	4.74402
Level 1 Qualifications	2.1	22.3	12.6345	4.33739
Level 2 Qualifications	4.2	21.8	13.8962	3.14832
British Chinese	0	28.57	2.1324	2.74924
Three car/van Households	0	15.7	3.8826	2.56433
Four and over car/van Households	0	9.7	1.2346	1.072

Table 5.5 List of all variables and reasons for selection/exclusion in the classification

Variable	Reason for Selection/ Rejection
Owner Occupier	Rejected– Although shows strong correlations with AASRs, has strong negative correlation with no car households and subsequently dropped.
Social Renters	Rejected. – Only show correlation with AASRs in one city. Also dropped because another housing tenure variable already selected.
Private Renters	**Selected – Shows strong correlation with AASRs. It also represents housing tenure in the classification**.
Couple Family	Rejected- Shows high positive correlation with owner occupied households.
Lone Parent Family	Rejected – No relationship with AASRs in the 3 areas.
IPB	Rejected – No correlation with AASRs in all 3 areas.
British Chinese	Rejected – Although shows correlation with AASRs, adds little to the classification because it has very low variations across the 3 areas. It also created a cluster with less than 2% of total LSOAs.
Black	**Selected – Has a correlation with AASRs. Very important ethnic minority in relation to socio-economic deprivation in the UK and demand for AASRs.**
Person aged 18 - 24	Rejected - Not adding new information to the classification (Replaced with full time students 18 over).
Person aged 25 – 44	Rejected - Not adding new information to the classification.
Person aged 45 – 64	Rejected – Low standard deviation and not adding any relevant information to the classification.
Person aged 65+	Rejected - Old and economically in-active population with low variations across the study area.
No qualifications	**Selected – Has relationship with AASRs and very strong evidence from review of the literature.**
Level 1 Qualifications	Rejected - No relationship with AASRs.
Level 2 Qualifications	Rejected - Low variance across study areas.
Level 3 Qualifications	Rejected - No relationship with AASRs.
Level 4 Qualifications	Rejected - No relationship with AASRs and strong positive correlation with Managers and Professionals.
Fulltime Students	**Selected - Very important in the group with good variation in the study areas (included as 18 – 24 has been rejected).**
No Car	**Selected – Strong correlation with AASRs, a proxy for low income which has very strong evidence from review of literature.**
1 Car or Van	Rejected - Hardly depicts status - Borderline variable.
2 Cars/Vans	Rejected - Highly correlated with Owner Occupied households.
3 Cars or Van	Rejected - Very low variation across study areas.
4 or Over Cars	Rejected - Very low variation across study areas.
Managers and Professional	**Selected – Has correlation with AASRs. It is also an indicator for affluence and relatively high education.**
Intermediate Occupations	Rejected – Has nothing new to add to the classification and dropped for managers and professionals.
Routine Occupation	Rejected - No relationship with AASRs and high correlation with persons with no qualifications.
Never Worked/Long Term Unemployed	**Selected - Very important socio-economic variable with strong evidence from literature review**

From the correlation matrix of the variables for the three areas, there are significant relationships between most of the 27 selected variables. This is because the variables are all related to SECs of deprivation and because some are drawn from the same category. Following realisation of this, the need to examine within variable correlations became very necessary. For instance, owner occupied households have a positive correlation of .919 with couple family households. This strongly suggests that these people are likely to inhabit the same areas with one explaining about 85% ((0.919^2) *100) of the variance within the other. Furthermore, no car households have a negative correlation of 0.919 with couple family households. This strongly suggests that these people do not co-habit in the same areas, with one able to explain 85% of the variance within the other. To explore all within relationship, the three areas are merged together as one and the correlation between all important variables are explored. This also allows for selection of similar variables across the three cities (see appendix 2a).

It is also good to examine the standard deviations across variables (Vicker, 2006), as this will highlight variables that have the largest variations within the LSOAs in the study areas. Variables with high variation are more suitable because the classification is better when driven by variables that show wider differences within the areas. The next step was to examine the standard deviations of the variables to decide on the final classification variables. The standard deviations in Table 5.4 reveal interesting variations within the variables across the study areas. Based on all the methods explained above, Table 5.5 shows all the 27 variables and specific reasons for their selection or rejection from the area classification. From Table 5.5, the final selected variables (bolded) are private renters, black ethnic minority, persons with no qualifications, households with no car, full-time students 18 and over, managers and professionals and never worked/long term unemployed. After careful consideration, only these 7 variables were selected.

5.4.2 Clustering process

The previous section explained the process of selection of the final variables to be included in the classification. This section explains the processes involved in creating the area classification. Classifying the LSOAs was carried out on a city by city basis, to allow for treating of each city as a separate entity. Therefore, this section explains the standardisation process, selection of the number of clusters, running the clustering algorithm and naming the clusters.

5.4.2.1 Variables standardisation

After final selection of the variables, the next step was to standardise them. This was to ensure that variables with high distribution across the study areas did not dominate the other variables, and hence invalidate the clusters. The z-score standardization technique was selected because it is based on deviations from the mean. Therefore, it accounts for variances within the areas and still identifies extreme values.

5.4.2.2 Running the clustering algorithm

To run the clustering, the K-mean technique was used to classify the LSOAs using the selected SE characteristics. As identified, the major problem with using K-means techniques is selecting the most appropriate number of clusters (Harris et al., 2005). To overcome this limitation, 2, 3, 4, 5, 6 and 7 cluster classifications were executed in SPSS 24 (data for the three cities was merged together to ensure that the same cluster number was selected for the three cities in order to aid comparison). The various results were then checked for applicability and usefulness for the research. Selecting the most appropriate classification from the different cluster solutions required further exploration. In addition, the mean distance between data points and their cluster centroid was also considered (i.e. examining the mean distance of each cluster solution in relation to the number of clusters).

Each cluster solution was also checked to ensure that it had a good proportion of LSOAs (at least 10%), although it is important to note that less than 10% could represent an important demographical unit that might just be under-represented in the sample areas. Therefore, visual examination of each cluster solution was also used to ascertain if each cluster was meaningful and determine which solution best fit the purpose of this research. Finally, after all the above had been undertaken, the final cluster classifications needed to be validated to confirm if it adequately measured area SECs. In this case, as the area classification groups LSOAs were based on their level of deprivation, the final cluster classifications were cross tabulated against the IMD index deciles.

5.4.2.3 Selection of the final cluster classification

The first step was to examine the average distance of each cluster number solution to the centroid. The line graph in Figure 5.1 shows the average distance of each cluster solution to its cluster centroid for cluster numbers 2 - 7. The idea of the best possible cluster number

solution is at the point where there is a sharp drop in the average within cluster distances to the centroid. From Figure 5.1, the average cluster distance ranges from 1.16 – 1.83. A relatively sharp drop is observed at the 3 and 4 cluster solutions. In addition, the drop is steeper at 3 compared to 4. Therefore, this suggested that either a 'three' or 'four' cluster classification would be the most suitable.

Therefore, the 3 and 4 cluster solutions were adapted for the 7 selected variables for the three cities[8]. Visual examination of the 3 and 4 cluster solutions in SPSS revealed that the 3-cluster solution did not adequately partition the variables well for Bristol. It did not partition the affluent clusters well enough (see appendices 3a and 3b for the 3 and 4 cluster solutions). On the other hand, however, the 4-cluster classification performed better for all 3 areas. Furthermore, the 4-cluster classification also provided a very good fit based on the purpose of this research because it distinctively grouped the areas along important socio-economic classification lines, reflecting the major themes of this research. Therefore, a 4-cluster classification was selected.

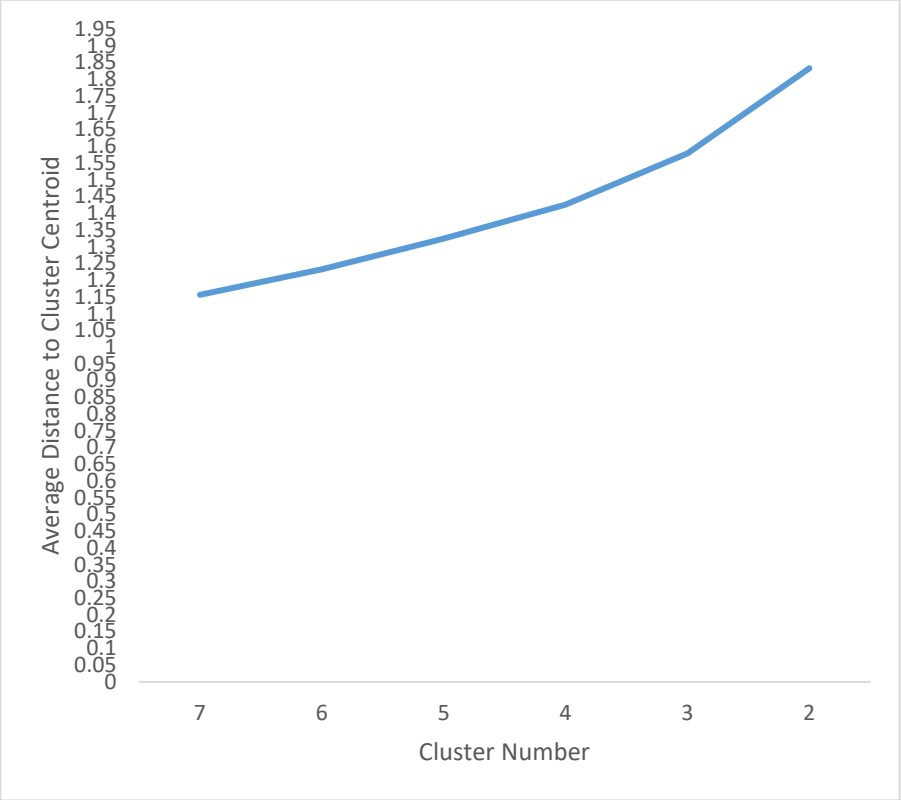

Figure 5.1 Average distance for each cluster solution to its centroid

[8] The clustering algorithm was deployed individually for each city to retain local dynamics

5.4.2.4 Classification Output

Table 5.6 shows the classification of LSOAs in Leeds, Nottingham and Bristol. It shows the number and percentage of LSOAs in each cluster in the three areas. Cluster 2 has the lowest representation with 7.7% and 8.4% in Leeds and Nottingham respectively, while in Bristol, cluster 1 has the lowest representation (6.1%). Figure 5.2 present the clustered bar graphs showing the classification output of the 4-cluster algorithm for Leeds, Nottingham and Bristol respectively. They show the mean z-scores of each variable for each cluster and also show which variables have high or low representations within each of the clusters.

Table 5.6 LSOA Classification

City	Cluster	No. of LSOAs	Percentage (%)
Leeds	1	56	11.6
	2	37	7.7
	3	254	52.7
	4	135	28.0
	Total	482	100
Nottingham	1	60	18.7
	2	27	8.4
	3	144	44.9
	4	90	28.0
	Total	321	100
Bristol	1	16	6.1
	2	31	11.8
	3	103	39.2
	4	113	43.0
	Total	263	100

Households characteristics with a negative z-score signify that those households have below the group mean representation, which in turn signifies that they have low presence in that cluster. In contrast, households with positive z-scores have above the group mean representation and, therefore, high presence in that cluster.

5.4.2.5 Cluster 1

From Figure 5.2 (A, B and C), cluster 1 shows similar characteristics within the three areas, with the corresponding LSOAs typified by Black households with no car and never worked/unemployed persons. It is also typified by the presence of persons

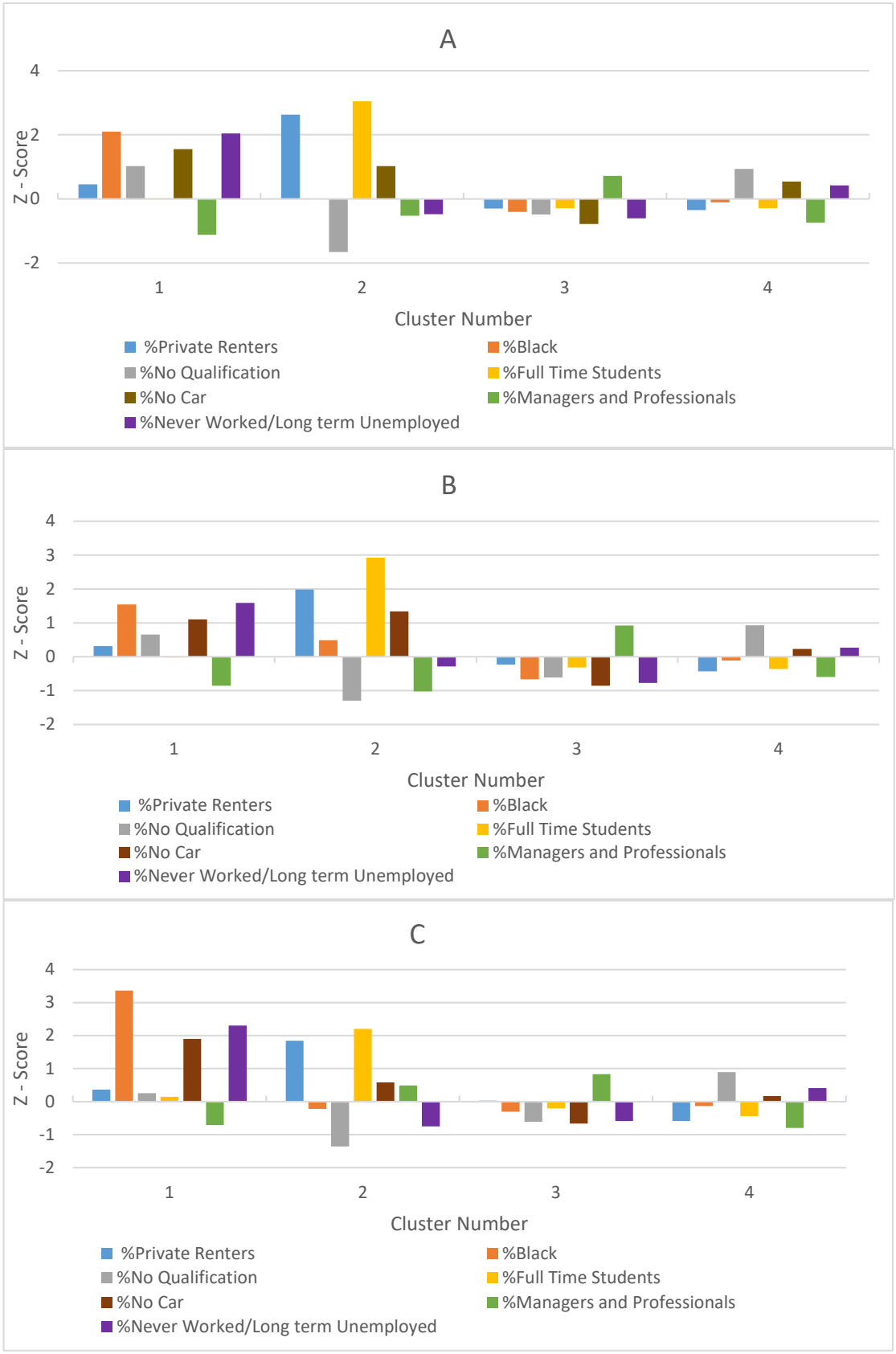

Figure 5.2 Four Clusters Classification for Leeds (A), Nottingham (B) and Bristol (C)

with no qualifications and private renters. This cluster also has a very low presence of people in managerial and professional occupations. From Table 5.6, it can be seen that the cluster consists of 11.6%, 18.7% and 6.1% of the total LSOAs in Leeds, Nottingham and Bristol respectively with the highest representation in Leeds and the lowest in Bristol. Bristol has the highest representation for black ethnic persons (3.365), households with no car (1.897) and for never having worked and long-term unemployed persons (2.305).

5.4.2.6 Cluster 2

This cluster is made up of 7.7%, 8.4% and 8.11% of all LSOAs in Leeds, Nottingham and Bristol, with Bristol having the most representation. Cluster 2 has the fewest LSOAs in Leeds and Nottingham compared to other 3 clusters (Table 5.6). From the cluster bar charts in Figure 5.2, cluster 2 is typified by LSOAs with large presence of private rented households, fulltime students and households with no car in the 3 areas. Leeds and Bristol have the highest representation of fulltime students with z-scores of 3.048 and 2.203 above the cluster group mean respectively. Likewise, Leeds and Bristol also have the highest and lowest representation of private renters with z-scores of 2.626 and 1.847 above the cluster mean respectively. Nottingham, on the other hand, has the highest representation of no car households with z-score of 1.339 above the group mean. Across the three areas, the cluster has very low presence of persons with no qualifications and never worked/long-term unemployed persons. In addition to large presences of the aforementioned SECs, each area also has some peculiar differences. LSOAs in cluster 2 for Nottingham further shows presence of black ethnic minorities above the group mean (Figure 5.2B). Further, LSOAs in this cluster have above group mean distribution for managers and professionals and low presence of black ethnic persons (Figure 5.2C) in Bristol.

5.4.2.7 Cluster 3

Cluster 3 is made up of 52.7%, 44.9% and 39.25% of the total LSOAs in Leeds, Nottingham and Bristol respectively. This cluster has the highest LSOAs in Leeds and Nottingham (Table 5.6). From the clustered bar charts in Figures 5.2A, 5.2B and 5.2C, cluster 3 is typified by LSOAs with large presence of managers and professionals in the three areas, with Nottingham and Leeds having the highest and lowest z -score distribution of 0.9217 and 0.7174 above the group mean respectively. Cluster 3 also has very low presence of all of the other 6 SECs selected in creating the area classification. No car households have the lowest

representation in these LSOAs, with z-scores of -0.7824, -0.8549 and -0.6612 in Leeds, Nottingham and Bristol below the cluster group mean respectively.

5.4.2.8 Cluster 4

Cluster 4 is characterised by 28.0%, 28.0% and 43.0% of the total LSOAs in Leeds, Nottingham and Bristol respectively, with Bristol having the highest distribution of these LSOAs in the three areas (Table 5.6). Figure 5.2 shows that the LSOAs in cluster 4 are typified by presence of persons with no qualifications, households with no car and never worked and long-term unemployed persons in the three areas. Persons with no qualifications has the highest representation in this cluster in the three areas, with z-scores of 0.935 (Leeds), 0.928 (Nottingham) and 0.8942 (Bristol) above the cluster group mean, with the highest representation in cluster 2 for Leeds. The cluster is also typified by low presence of private renters, persons of black ethnic minority, full time students and persons in higher managerial and professional occupations. Managers and professionals have the lowest representation in this cluster, with z-score of -0.7437, -0.5988 and -0.7923 below the cluster group mean in Leeds, Nottingham and Bristol respectively (Figures 5.2A, 5.2B and 5.2C).

5.4.3 Naming the Clusters

Naming the clusters is based on the SECs of their corresponding LSOAs. As explained in the previous section, there are differences in the variable compositions of each cluster as well as overlap of variables. Nevertheless, they are named based on the dominant variables common in each cluster within the 3 areas. Therefore, the common dominant variables in each cluster in the three areas drive the cluster naming process. It is important to note that the appellations ascribed to these clusters are only to attenuate the dominant categories of people in these LSOAs and does not in any way mean that only people with this sets of

Table 5.7 Summary of dominant characteristics and cluster name

Cluster	Dominant Characteristics	Name
Cluster 1	Black, No Car Households and Never worked/Long-term Unemployed Persons	Ethnic Cluster
Cluster 2	Fulltime Students and Private Renters and No Car Households	Student Cluster
Cluster 3	Managers and Professionals	Affluent Cluster
Cluster 4	No qualifications, No Car and Never worked/Long-term Unemployed	Socially underprivileged Cluster

characteristics can be found in the LSOAs in each cluster. Table 5.7 shows the name of each cluster based on the dominant variables. Cluster 1 is named the ethnic cluster because the common variables present in the cluster within in the 3 areas are persons from black ethnic minority backgrounds, never worked/long-term unemployed persons living in households with no car. Cluster 2 is named student cluster because fulltime students have the highest presence. Cluster 3 is referred to as the affluent cluster because the dominant variable in the cluster (managers and professionals) is an indication of people who are well off. Managers and professionals are individuals in occupations that are associated with above average income. Cluster 4 is categorised as socially underprivileged cluster because it is highly characterised by people who have no qualifications, are not in employment and reside in households with no car.

5.4.4 Validation of Area Classification

This section seeks to validate the clusters and ensure that the area classification conforms to existing realities. To validate the area classification, the clusters will be compared with the IMD index domain deprivation deciles. Table 5.8 shows the results of the cross tabulation of the IMD index deciles 1 – 10 and the area classification clusters. Table 5.8 also shows all the cluster memberships and IMD deprivation deciles and their LSOA distributions compared to each other. All the LSOAs in ethnic and unemployed clusters are within deciles 1 – 3, which comprises the most deprived deciles in England. Students cluster is characterised by mixed LSOAs, which cuts across deprived and least deprived LSOAs. Of the total LSOAs in the student cluster in the three areas, 67.4% of the LSOAs are in deciles 1 – 5, while the remaining are in deciles 6 – 9. For the affluent clusters, 82.03% of its LSOAs are in deciles 6 – 10, which are the least deprived deciles.

None of the LSOAs in the affluent cluster are in the most deprived decile (decile 1), and only 19.76% are in deciles 3 – 5. Finally, for the socially underprivileged clusters, 77.21% are in the 3 most deprived deciles (1 – 3), while only 1 of its LSOAs is in deciles 8 – 10, (the least deprived deciles; Table 5.8). This clearly shows that the classification performed very well and largely conforms to reality (see appendix 4a - 4c for the validation for each city).

Table 5.8 Cross tabulation of area classification clusters and indices of deprivation deciles

		Cluster Membership				
		Ethnic	**Student**	**Affluent**	**Socially Underprivileged**	**Total**
Index of Multiple Deprivation (decile 1 - 10. Where 1 is most deprived 10% of LSOAs)	**1**	102	5	0	101	**208**
	2	23	11	1	96	**131**
	3	7	18	18	64	**107**
	4	0	14	34	39	**87**
	5	0	16	46	22	**84**
	6	0	9	64	12	**85**
	7	0	11	91	3	**105**
	8	0	6	78	1	**85**
	9	0	5	70	0	**75**
	10	0	0	99	0	**99**
Total		**132**	**95**	**501**	**338**	**1066**

5.4.5 Mapping the clusters

Mapping is an essential part of area classification as it helps to visualise the results of the classification and delivers simplicity. Graphically mapping the distribution of the LSOAs in each cluster uncovers geographical patterns in the data sets and helps identify similarities and differences between areas. It also aids interpretation of the identified socio-economic patterns. Figures 5.3 – 5.5 show the area classification maps for Leeds, Nottingham and Bristol. They also show the cluster classification of the LSOAs in each area.

Figure 5.3 shows the area classification for Leeds. Visual examination reveals that the centre of Leeds is characterised by ethnic and student clusters and a few pockets of affluent LSOAs. The ethnic and student LSOAs are particularly characterised by black minority ethnic persons, never-worked/long term unemployed persons, households with no car, private renters and fulltime students. Gradual movement from the centre of Leeds towards the South sees the area landscape change to mostly LSOAs in the socially underprivileged cluster, which comprises LSOAs highly characterised by persons with no qualifications and never worked/unemployed persons. Movement towards the North West shows the same area patterns mostly characterised by people with no qualifications with some pockets of student LSOAs. Movement towards the East and South East also shows transitions into socially underprivileged clusters. Meanwhile, the suburbs to the north and east are mostly characterized by affluent LSOAs with few LSOAs belonging to the socially underprivileged.

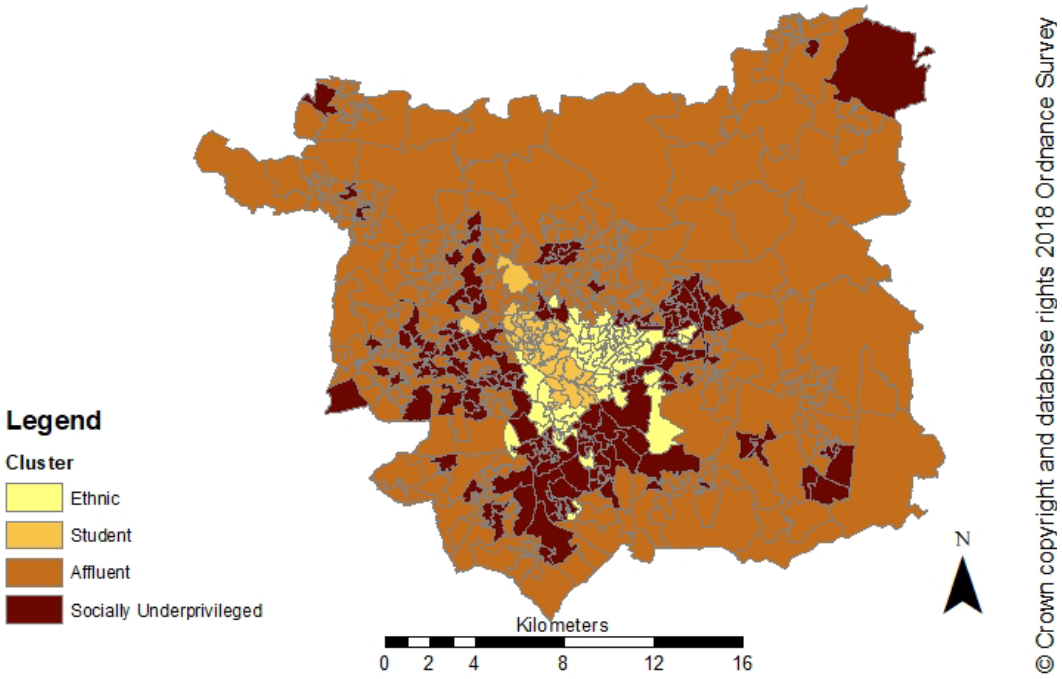

Figure 5.3 Leeds LSOA cluster classification map

Figure 5.4 shows the graphical representation of the clusters in Nottingham. Like Leeds, its centre is highly characterised by LSOAs in ethnic and student clusters. These clusters have a high presence of persons of black ethnic origin, never worked and long-term unemployed persons, no car households, private renters and students. There are also a few LSOAs within the city that are affluent LSOAs, characterised by persons in higher managerial and professional occupations. As the distance from the centre increases, the areas are characterised by LOSAs dominated by managers and professionals. Within and beyond the suburbs of Nottingham that fall in the affluent cluster, there are some LSOAs classified as socially underprivileged cluster, highly characterised by unemployed and never worked persons with no qualifications and very low car ownership LSOAs towards the North West, North East and South.

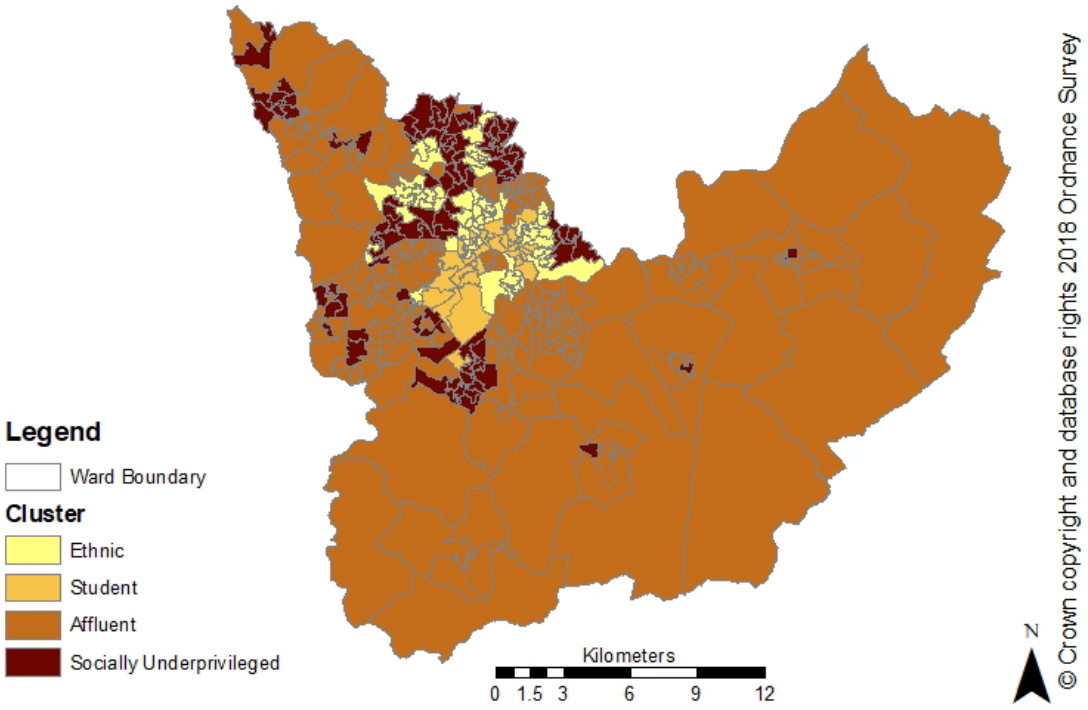

Figure 5.4 Nottingham LSOA cluster classification map

Figure 5.5 shows the area classification map for the City of Bristol. The City Centre is mostly dominated by students and ethnic and unemployed (full time students, Indian/Pakistani/Bangladeshi and British Black/Caribbean and African), with just a few affluent LSOAs. Visual examination further shows that as distance increase from the centre of the city, what is observed are pockets of affluent and student LSOAs towards the North West. The suburbs of Bristol are characterised by both affluent and deprived (never worked, long term unemployed, lone parent households and social renters), LSOAs with a few students LSOAs in the North East. Most distinct is that the borders of Bristol are mostly characterised by deprived LSOAs to the north, south and east.

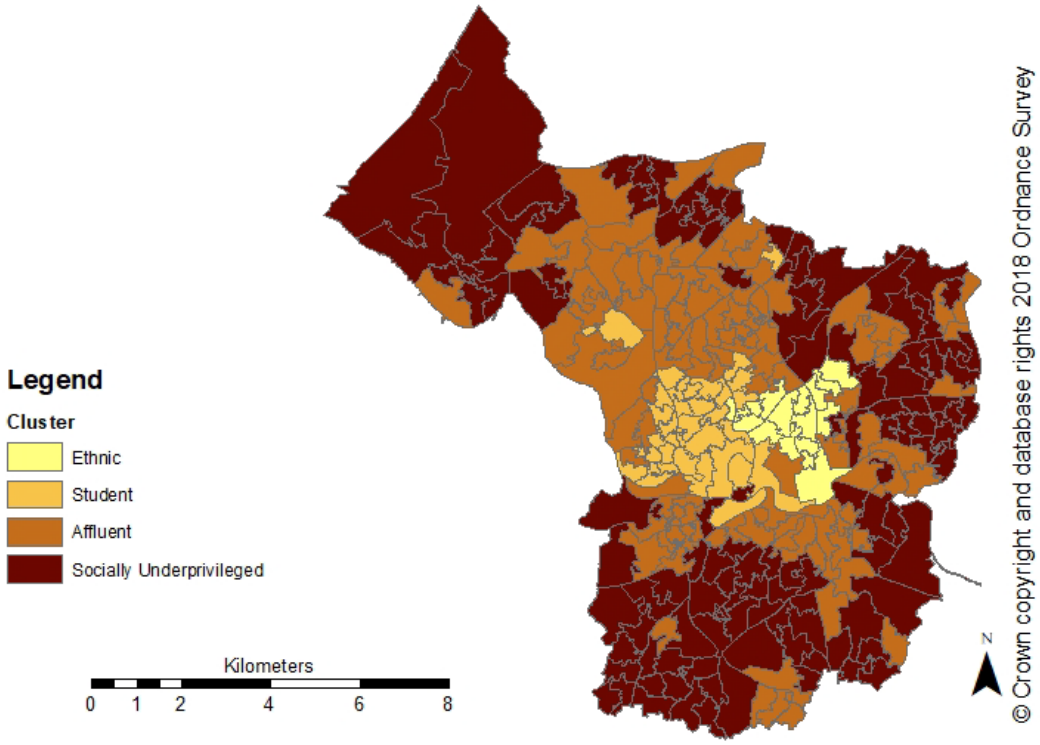

Figure 5.5 Bristol LSOA cluster classification map

5.5 Distribution of retailers outlets and area socio-economic classification.

As the area distribution of SE variables has been critically examined and mapped in the previous sections, this section seeks to examine the geographical distribution of both AASR and FGR outlets in the three areas. This section also compares the geographical distribution of these groups of retailers in the three areas and the socio-economic clusters identified in the previous section, in order to fully understand the linkages between these retailers and socio-economic deprivation. This will help achieve the research objective that seeks to 'compare the location patterns of AASR and FGR outlets and SED.

5.5.1 Geographical distributions of AASR and FGR outlets in Leeds, Nottingham and Bristol.

Figures 5.6, 5.7 and 5.8 show the geographical distribution of AASR and FGR outlets overlaid on the classification maps for the three areas. The maps are overlaid to enhance a visual comparison of the distribution of the retailers outlets in relation to their area classification via socio-economic variables. It is important to note that although the maps are displayed using ward boundaries, the data that drives the classification is at LSOA level. This is because the LSOAs are numerous, thereby displaying the data becomes an issue since

the boundaries clutter the map. Thus, providing a justification for dissolving the LSOA boundaries.

In Figure 5.6A, the distribution of the AASR outlets within the different clusters can be clearly seen. It shows that there is a concentration of AASR outlets in the centre of Leeds, which comprises LSOAs classified as ethnic and student clusters. Furthermore, as the distance from the centre of Leeds increases, what is observed is a large presence of AASRs in these LSOAs classified as ethnic, students and socially underprivileged clusters. The suburbs of Leeds are characterised by the affluent cluster made up of LSOAs with high proportions of managers and professionals. In addition, a few LSOAs characterised as socially underprivileged cluster have very sparse distributions of AASR outlets.

Visual investigation of Figure 5.6B reveals a concentration of FGR outlets in the centre of Leeds which comprises of LSOAs characterised as ethnic and student clusters. Further examination of Figure 5.6B shows that with distance from the city centre, a large presence of FGRs is observed in LSOAs classified as ethnic and socially underprivileged clusters. In addition, the suburban LSOAs mostly classified as affluent cluster have sparse presence of FGRs. A major difference in the distributions of the two groups of retailers is that the FGRs appear to be more evenly distributed, with stronger presence in many affluent areas compared to the AASRs.

Figure 5.7A shows that there is also a concentration of AASR outlets in the centre of Nottingham, which is highly characterised by LSOAs classified as students, ethnic and socially underprivileged clusters. There are also a few affluent LSOAs in the city centre. Movement from the city centre towards its periphery, most especially to the north of Nottingham City, shows a high presence of AASR outlets. mostly in LSOAs classified as ethnic and socially underprivileged clusters.

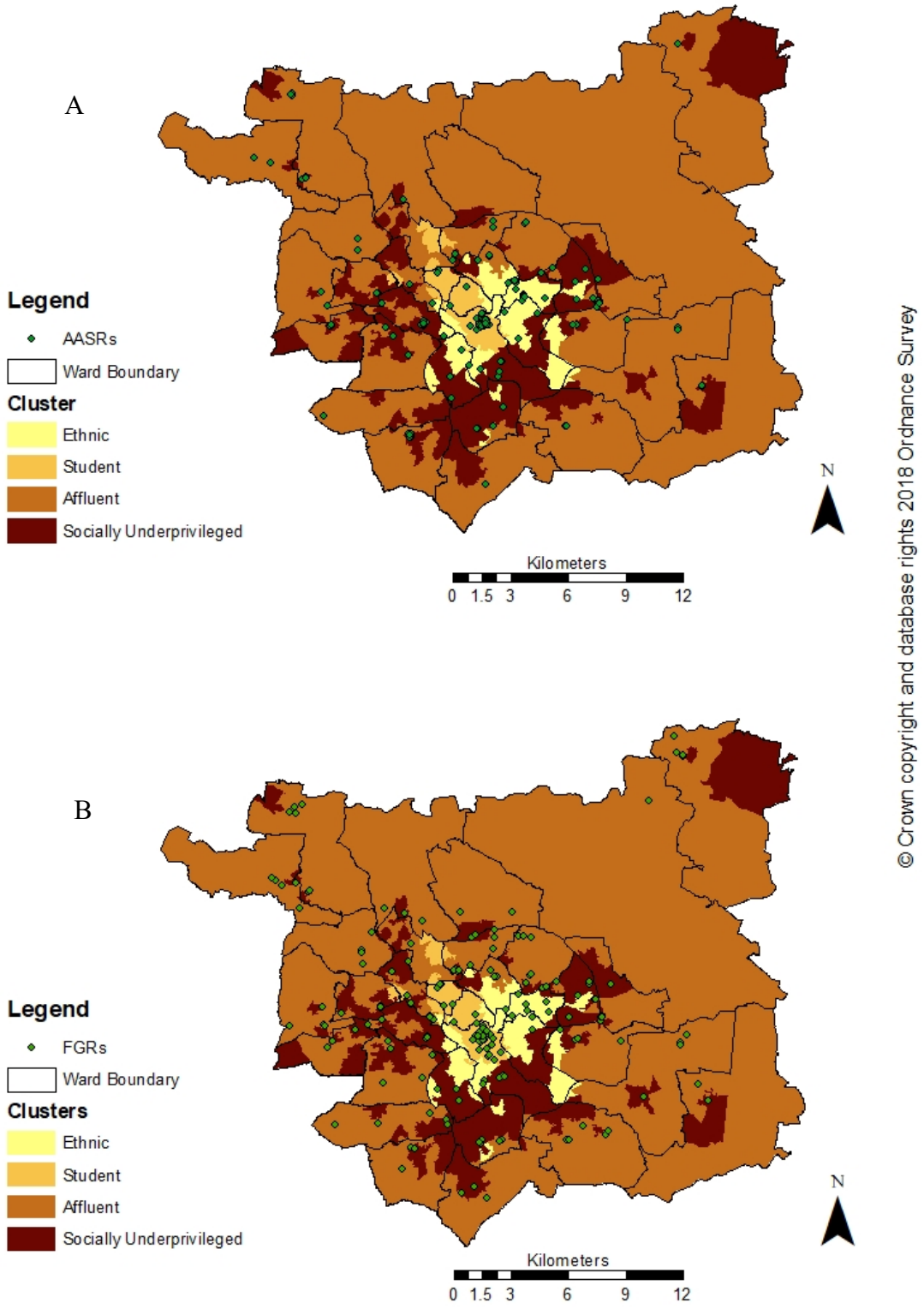

Figure 5.6 Retailer distribution and area classification in Leeds

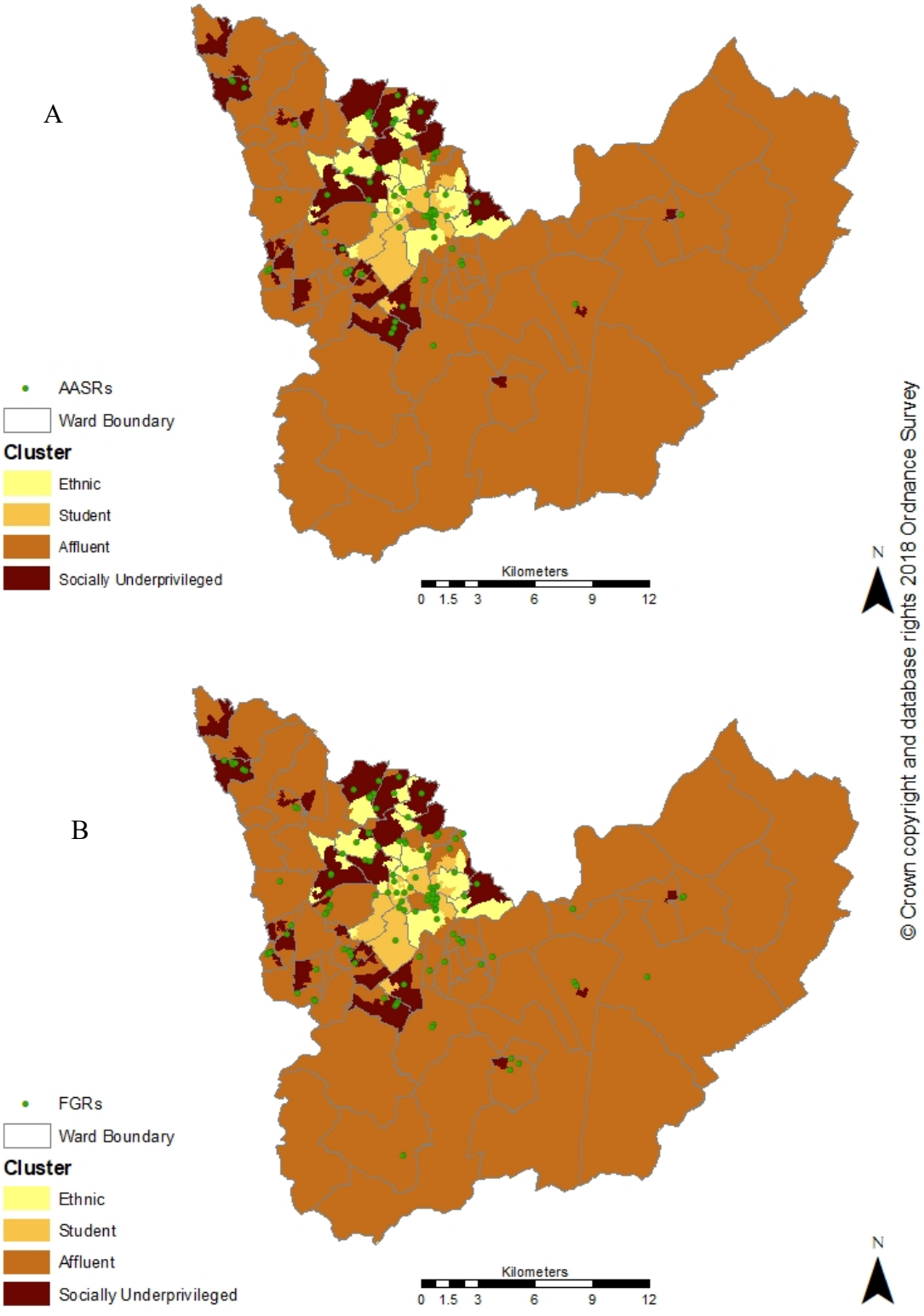

Figure 5.7 Retailer distribution and area classification in Nottingham

Furthermore, LSOAs in the suburbs of Nottingham (Broxtowe and Rushcliffe) are markedly characterised by affluent LSOAs having a very sparse distribution of AASRs, with a noticeable presence of AASRs close to the very few non-affluent LSOAs in these areas. From Figure 5.7B, the centre of Nottingham classified as mostly students, ethnic and no qualification areas has a notable presence of FGR outlets. The affluent LSOAs towards the north of Nottingham city also have a large presence of FGRs. What is more, the suburbs which are characterised by affluent LSOAs have a low presence of FGRs, but with a more distinct and evenly distributed presence compared to the AASR outlets.

Regarding Bristol, visual examination of Figure 5.8A shows a relative concentration of these AASR outlets in the centre of Bristol in LSOAs classified as student areas. In addition, the AASR outlets are fairly dispersed with no strong affinity towards the no qualification, affluent or ethnic and unemployed areas as distance increases from the city centre. The strongest concentrations are found with the student areas in the centre and north east of Bristol, as seen in Figure 5.8A. Furthermore, some clusters of AASR outlets are observed in some LSOAs classified as affluent areas. Figure 5.8B shows the distribution of FGRs vis-à-vis area socio-economic classification and reveals that there is also a high presence of these FGRs in the LSOAs classified as student clusters, showing somewhat similar patterns compared to those of the AASRs**.** Like the AASRs, movement from the centre of Bristol to the north, east and south shows a relatively even distribution of FGR outlets across the landscape, with some clusters in no qualification, affluent, ethnic and student areas. The no qualification LSOAs in the south and north of the city also have a noticeable presence of FGRs

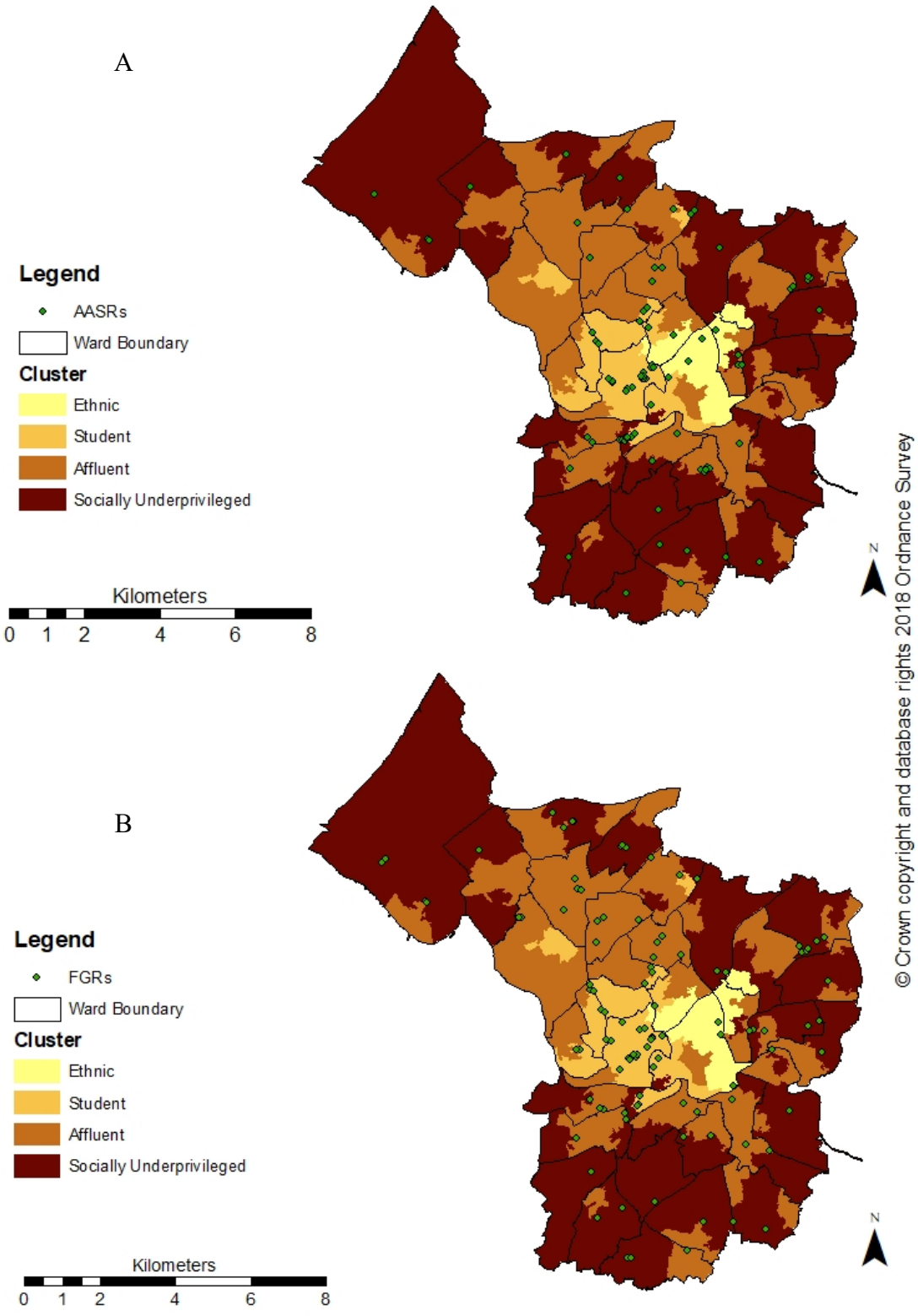

Figure 5.8 Retailer distribution and area classification in Bristol

5.5.2 KDE map for AASRs, FGRs and the 4-cluster classification in Leeds, Nottingham and Bristol

Figures 5.9 – 5.11 are hotspot maps which provide a more nuanced picture of the geographical patterns of FGRs and AASRs compared to area deprivation in Leeds, Nottingham and Bristol, respectively.

For AASRs, the hotspot map shows high incidence around the centre of Leeds and towards the periphery of the city (Figure 5.9B). High clustering can be seen in some of the areas such as Headingly, Beeston and Potternewton. In addition, just as observed in Figure 5.6a, AASRs are clustered around the city centre and with increasing distances from the city centre, the density begins to reduce, especially towards the north east, north west and south east, while south west areas have higher incidence of AASRs, but not as pronounced as the centre and its periphery.

On the other hand, for FGRs (Figure 5.9A), as the distances increases from the centre, a dense landscape of FGRs is observed, which then reduces with greater distances to the north east, north west and south east, whereas the south west and west generally have high hotspots. More importantly, the pattern of clustering depicts high incidence in the city centre and its periphery in areas such as Headingly, Chapel Allerton, Beeston Morley, including Morley in the south west and Thombury in the west. The outer suburbs are generally characterised by very low incidence of FGRs.

These areas with high incidence of both AASRs and FGRs also coincide with LSOAs classified as unemployed, students and socially underprivileged clusters (Figure 5.9C), which contain neighbourhoods with characteristics of increased deprivation. Interestingly, both retail groups have little or no presence in the suburbs of Leeds. These patterns are in tandem with the socio-economic deprivation in Leeds, showing similarities in the patterns of AASRs and FGRs. On the other hand, there are some striking differences in their patterns compared to area deprivation. AASRs, seems to be more concentrated and clustered around the city centre and in its periphery, whereas FGRs, although clustered, have a wider spread especially to the west and south west which also have higher deprivation characteristics. AASRs also seems to have more discrete clusters situated in LSOAs with deprived characteristics.

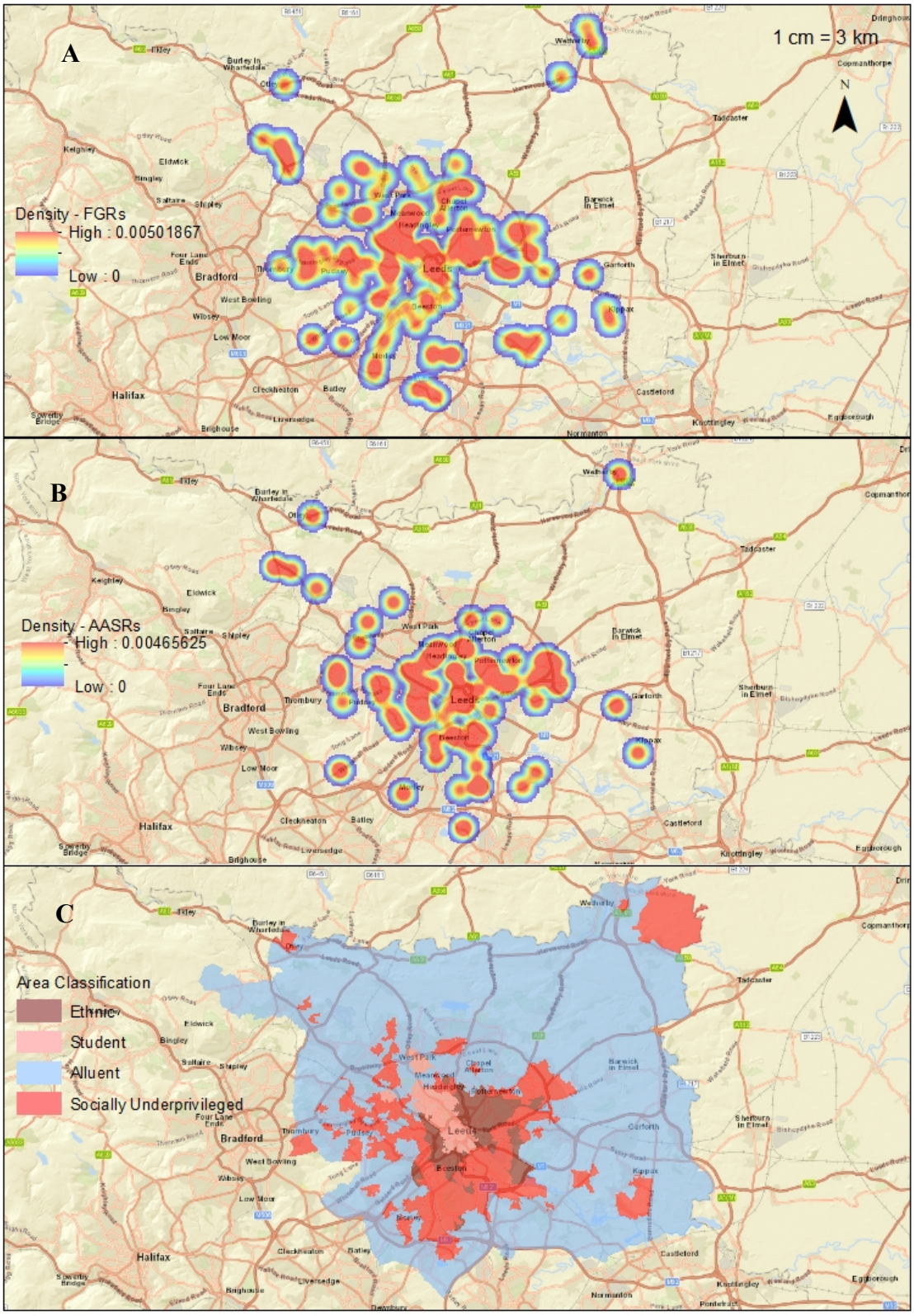

Figure 5.9 KDE maps for FGRs (A), AASRs (B) outlets and area classification (C) in Leeds.

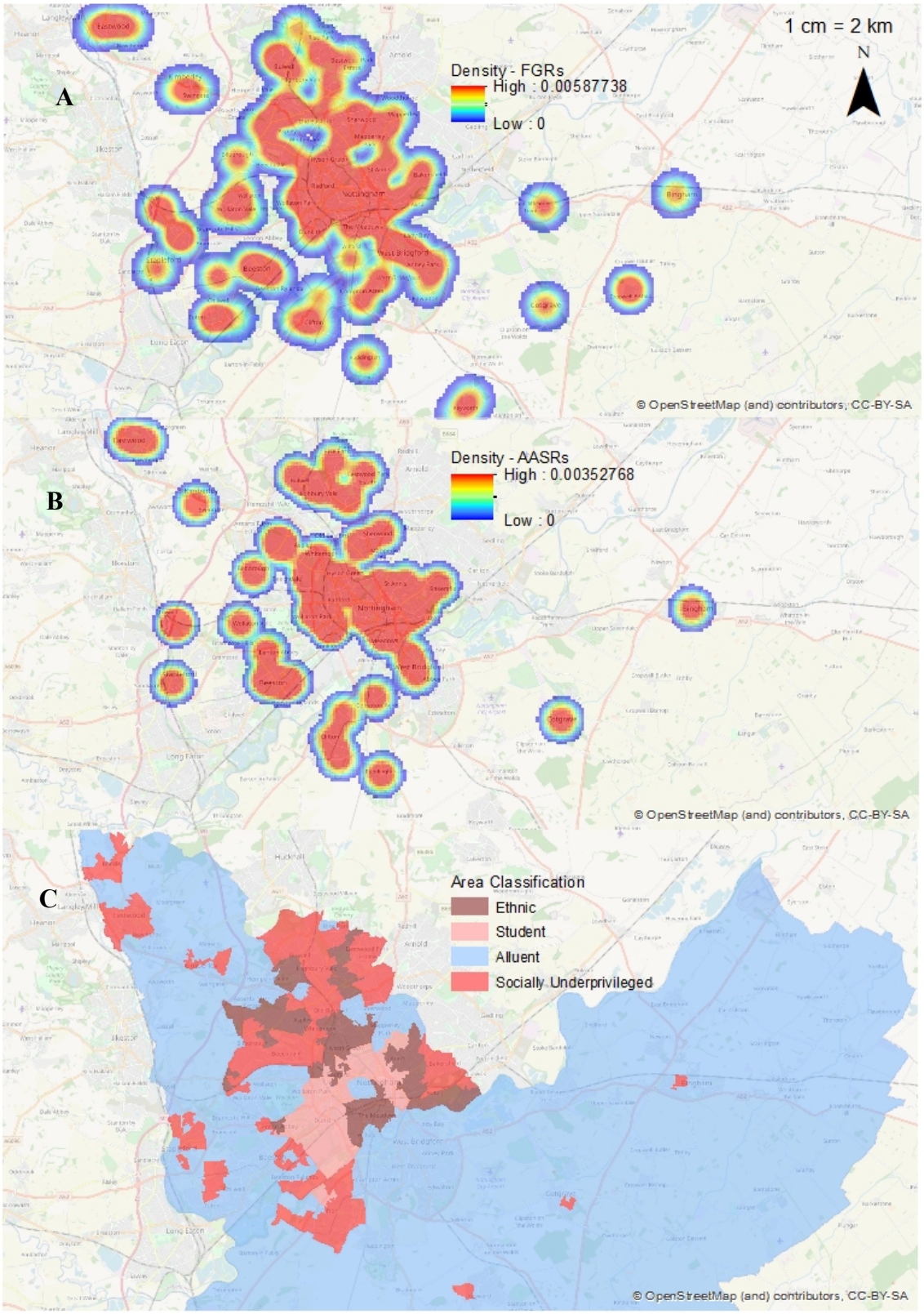

Figure 5.10 KDE Maps for FGRs (A), AASRs (B) outlets and area classification (C) in Nottingham.

Figure 5.10 shows the KDE for both FGRs and AASRs as well as the area classification in Nottingham. The patterns of clustering of FGRs (Figure 5.10A) show very interesting characteristics with very high clustering around the city centre which gradually diffuses outwards with increasing distances with the suburbs experiencing low incidence of FGRs. Areas such as St Ann's, Radford, Hyson Green and Bulwell, which also coincide with largely deprived LSOAs, are classified as deprived under the ethnic and socially underprivileged clusters (Figure 5.10C), whereas other areas such as Aspley, Beechdale and Whitemore, classified in the unemployed and ethnic clusters, have a low prevalence of FGRs. Interestingly, some areas of high clustering such as Abbey Park and Mapperley are classified as affluent LSOAs. Student areas such as Dunkirk and Wollaton Park also have high incidences of FGRs. Together this shows a distribution that cuts across all neighbourhood types for FGRs but with absence in some areas with deprived characteristics

Figure 5.10B shows the density maps for AASRs for Nottingham. A markedly clear pattern is evident with a condensed presence in the city centre which drops sharply into distinct clusters as distance from the centre increases. High incidences of AASRs are in areas such as Radford, Hyson Green, The Meadows and Bulwell (Figure 5.10B), which are mostly classified as deprived (no qualification and ethnic) neighbourhoods (Figure 5.10C). Student areas (e.g. Dunkirk) characterised by mixed socio-economic characteristics, still have some strong deprivation characteristics but have low incidence of AASRs. Notable some parts of Abbey Park and West Bridgford classified as affluent clusters (Figure 5.10C) have high density. These results show some similarities and differences in the patterns of both groups of retailers. More precisely, there are deprived and affluent areas which have both AASRs and FGRs as well as affluent areas. On the other hand, AASRs seems to have more clustered around the city centre and its periphery compared to FGRs.

Figure 5.11 shows the KDE for FGRs, AASRs and the area classification maps for Bristol. From Figure 5.11A, the west of the map has a high incidence of FGRs and with distances from the centre, reveals pockets of clustering in all directions confirming the patterns in Figure 5.8B. Areas such as Lawrence Hill, Clifton, Clifton Downs and Cotham are FGR hotspots. Interestingly, these areas are characterised by LSOAs classified as students cluster (Figure 5.11C). In addition, there are affluent areas that also have high clustering of FGRs such as Bishopston and Ashley Downs and Westbury on Tyne wards. Some ethnic areas including Frome Vale, St Georges West and Halley Road have a high incidence of FGRs.

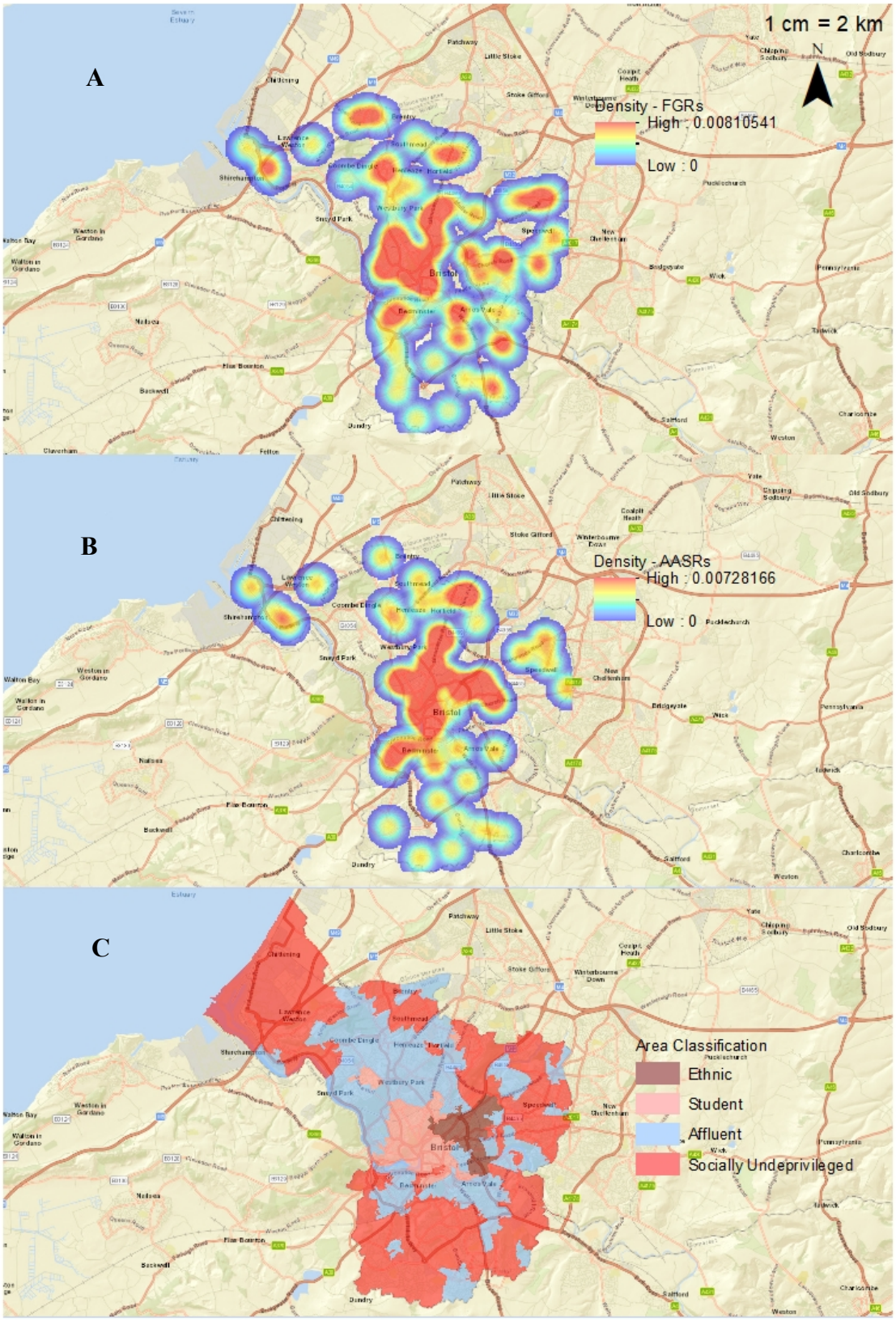

Figure 5.11 KDE Maps for FGR (A), AASR (B) outlets and area classification (C) in Bristol

Generally, the patterns show FGRs exhibit a relatively diffused pattern round Bristol but with a very pronounced presence in the student neighbourhoods. From Figure 5.11B, patterns of AASRs are clustered around the centre of the city in areas such as Lawrence Hill, Central and parts of Ashley Wards. These areas are characterised by affluent, student and ethnic neighbourhoods as shown Figure 5.11C. In addition, there are pockets of clustering towards the north west of Bristol which comprises LSOAs classified as ethnic clusters (Figure 5.11C). AASRs are not concentrated in the south of Bristol which are notably characterised by deprived characteristics. In addition, the south eastern parts of Bristol have little or no AASRs presence but are characterised by neighbourhoods with high unemployment and low education. Therefore, AASRs presence in Bristol cuts across all LSOAs types. In summary, both groups of retailers have very high presence in the student areas, with AASRs having a more clustered presence in the centre of the city compared to FGRs.

In conclusion, across the cities, there are notable similarities in the patters of clustering of AASRs and FGRs. There is a strong presence in the centres of the cities which are mostly classified as deprived LSOAs with large proportions of student, ethnic and some persons with no qualifications. Generally, AASRs have a more clustered presence in areas with deprived characteristics compared to FGRs. Also, local variations exist with subtle differences.

5.5.3 Distribution of retailers outlets in the 4 classification in the three areas

Table 5.9 shows the distribution of FGR and AASR outlets across the different clusters in Leeds, Nottingham and Bristol. There are quite a number of similarities, but also differences across the 3 cities, as well as across the different groups of retailers.

Across the 3 areas and across both retail groups cluster 2, which is typified by fulltime students, private renters and households with no car in Leeds and Nottingham and persons in managerial and professional occupations in Bristol, has the highest mean distribution of FGR and gambling and financial retailers. In addition, the consistently very high standard deviations for this cluster across the three areas and each retailer group show that the distributions are not even across all the LSOAs in the cluster. A major difference between the distributions of AASRs (gambling and financial) compared to FGRs in the LSOAs in the student clusters is that the uneven distribution of AASRs across the LSOAs in the student

cluster is more pronounced compared to FGRs, as evidenced by the very high standard deviations of AASRs (Table 5.9).

Table 5.9 further reveals that the affluent clusters have the lowest mean distribution of AASRs and its subgroups generally in all areas, and specifically in Leeds and Nottingham. Only Bristol has a somewhat different pattern, with the affluent cluster having higher mean distribution compared to the ethnic cluster. The situation is different for FGRs across Leeds, Nottingham and Bristol, with the LSOAs in ethnic clusters having the lowest distribution across the three urban areas and all areas combined. Therefore, the clusters with affluent characteristics have the lowest distribution of gambling and financial outlets, especially in Leeds and Nottingham compared to FGRs.

Table 5.9 Means and standard deviations of retailers outlets '000 households in each cluster for the three areas

		All areas			**Leeds**			**Nottingham**			**Bristol**		
	Cluster	**No. Out.**	**Mean**	**SD**	**No. Out.**	**Mean**	**SD**	**No. Out.**	**Mean**	**SD**	**No. Out.**	**Mean**	**SD**
FGRs	1	37	0.40	1.13	14	0.37	0.77	20	0.49	1.47	3	0.19	0.54
	2	79	1.20	2.54	32	1.32	3.65	18	1.02	1.38	29	1.21	1.61
	3	160	0.46	0.96	71	0.39	0.90	53	0.52	1.06	36	0.53	0.96
	4	127	0.55	1.11	56	0.61	1.19	34	0.55	1.17	37	0.47	0.96
	Total	**403**	**0.55**	**1.26**	**173**	**0.52**	**1.39**	**125**	**0.57**	**1.21**	**105**	**0.56**	**1.06**
AASRs	1	49	0.56	1.82	22	0.63	1.53	23	0.59	2.25	4	0.25	0.45
	2	98	1.44	6.15	48	1.88	9.28	20	1.16	3.47	30	1.16	2.08
	3	87	0.24	0.78	39	0.21	0.76	27	0.25	0.84	21	0.30	0.75
	4	140	0.58	1.74	68	0.67	1.88	31	0.49	1.47	41	0.54	1.77
	Total	**374**	**0.49**	**2.26**	**177**	**0.52**	**2.86**	**101**	**0.46**	**1.70**	**96**	**0.50**	**1.46**
Gambling	1	43	0.49	1.58	17	0.49	1.16	22	0.56	2.05	4	0.25	0.45
	2	82	1.20	4.91	39	1.53	7.37	17	0.98	2.93	26	1.01	1.65
	3	81	0.22	0.74	37	0.20	0.71	25	0.23	0.78	19	0.27	0.73
	4	117	0.48	1.29	55	0.55	1.41	29	0.46	1.25	33	0.43	1.19
	Total	**323**	**0.43**	**1.82**	**148**	**0.43**	**2.27**	**93**	**0.42**	**1.49**	**82**	**0.42**	**1.09**
Financial	1	6	0.07	0.34	5	0.14	0.47	1	0.03	0.22	0	0.00	0.00
	2	16	0.24	1.32	9	0.35	1.91	3	0.18	0.93	4	0.16	0.56
	3	6	0.02	0.20	2	0.01	0.20	2	0.02	0.18	2	0.03	0.20
	4	23	0.09	0.59	13	0.13	0.64	2	0.03	0.27	8	0.10	0.70
	Total	**51**	**0.07**	**0.55**	**29**	**0.09**	**0.66**	**8**	**0.04**	**0.34**	**14**	**0.07**	**0.51**

All areas = all 3 areas (Leeds, Nottingham and Bristol merged)
Cluster - 1 = ethnic, 2 = student, 3 = affluent and 4 = socially underprivileged.
Mean = mean of outlets ‰ households
No. out. = total outlets

In addition, across all clusters with highly pronounced deprivation characteristics (ethnic and socially underprivileged clusters), socially underprivileged clusters have the highest concentration of both FGRs and AASRs, especially in Leeds and Bristol.

In summary, there are consistencies across the three urban areas with the student cluster, which is relatively deprived, having the highest presence of both FGRs, gambling and financial outlets, but AASRs having the highest concentration in these areas. In addition, AASRs and its sub-groups are more pronounced in the 2 clusters, with very high deprivation characteristics compared to FGRs. Likewise, there are distinct differences in Leeds and Nottingham compared to Bristol. In Bristol, the affluent cluster has a higher mean distribution of both FGRs and gambling and financial outlets compared to one of the highly deprived clusters.

5.5.4 ANOVA Robust test of equality of means

To build on the explanation explored in the previous section, to ascertain if the mean differences between the various clusters for each group of retailers are significant, an ANOVA test was conducted to evaluate the means. To achieve this, the retailers' outlets ‰ households (FGRs, AASRs, gambling and financial retailers) were used as the dependent variables while the cluster membership (LSOA classifications) was used as the independent variables. Levene's test was significant ($p < .05$) for all retailers, indicating violation of assumption of homogeneity of variances. Thus, a Welch omnibus test was carried out (Table 5.10). In addition, the data outcome variables (retail outlets data) also violated the assumptions of homogeneity of variance. Hence a Welch one-way ANOVA test which assumes unequal variances was adopted in order to examine if there are differences between the mean of outlets across the different clusters.

Although there is criticism against the use of parametric techniques for non-normal data (Siegal, 1956; Lix et al., 1996), there is also strong evidence that suggests that the technique is robust and violation of non-normality does not bear strongly on the accuracy of the probabilities (Glass et al., 1972; Hopkins and Weeks, 1990).Table 5.10 shows the results of the Welch one-way ANOVA test which compared the mean distribution of outlets across the 4 clusters in Leeds, Nottingham and Bristol. There is a significant difference ($p < .05$) in the mean of FGRs, AASRs, gambling and financial outlets ‰ households for all areas combined across the 4 clusters. In Leeds (Table 5.10), there are significant differences ($p <.05$) in the

cluster means of AASRs, gambling and financial retailers, while FGRs across the 4 clusters show no significant difference ($p > .05$).

Table 5.10 Welch ANOVA test results for mean of all retail outlets '000 households the four classifications in Leeds, Nottingham and Bristol

Retailers	All Areas	Leeds	Nottingham	Bristol
			Sig. (p value)	
FGRs	.024*	.111	.363	.016*
AASRs	.001*	.011*	.222	.080
Gambling	.001*	.018*	.198	.078
Financial	.017*	.036*	.794	N/A

*The mean difference is significant at $p < .05$ level.

In Bristol, there is a significant difference ($p < .05$) in the cluster mean of FGRs across the 4 clusters only, whereas in Nottingham there are no significant differences in the cluster means for all retailers ($p > .05$). In Bristol, the comparison test could not be estimated for financial retail outlets as one of the clusters (ethnic cluster) has no financial outlet.

Table 5.11 Games Howell post-hoc test for comparison of mean differences between clusters for FGRs and AASRs in the three areas

			All Areas	Leeds	Nottingham	Bristol
	Independent Variable		Mean Difference	Mean Difference	Mean Difference	Mean Difference
Dependent Variable	(I) Cluster	(J) Cluster	(I-J)	(I-J)	(I-J)	(I-J)
FGRs	1	2	**-0.7940***	-0.9495	-0.5225	**-1.0216***
		3	-0.0537	-0.0227	-0.0273	-0.3415
		4	-0.1433	-0.2447	-0.0581	-0.2734
	2	1	**0.7940***	0.9495	0.5225	**1.0216***
		3	**0.7404***	0.9268	0.4951	0.6800
		4	0.6507	0.7048	0.4644	0.7481
	3	1	0.0537	0.0227	0.0273	0.3415
		2	**0-.7404***	-0.9268	-0.4951	-0.6800
		4	-0.0897	-0.2220	-0.0308	0.0681
	4	1	0.1433	0.2447	0.0581	0.2734
		2	-0.6507	-0.7048	-0.4644	-0.7481
		3	0.0897	0.2220	0.0308	-0.0681
AASRs	1	2	-0.8774	-1.2505	-0.5718	-0.9152
		3	0.3241	0.4173	0.3380	-0.0466
		4	-0.0128	-0.0438	0.1016	-0.2853
	2	1	0.8774	1.2505	0.5718	0.9152
		3	1.2015	1.6677	0.9098	0.8686
		4	0.8646	1.2066	0.6734	0.6299
	3	1	-0.3241	-0.4173	-0.3380	0.0466
		2	-1.2015	-1.6677	-0.9098	-0.8686
		4	**-0.3369****	**-0.4611***	-0.2364	-0.2387
	4	1	0.0128	0.0438	-0.1016	0.2853
		2	-0.8646	-1.2066	-0.6734	-0.6299
		3	**0.3369****	**0.4611***	0.2364	0.2387
Gambling	1	2	-0.7130	-1.0446	-0.42010	-0.7595
		3	0.2673	0.2867	0.32559	-0.0185
		4	0.0062	-0.0615	0.10271	-0.1819
	2	1	0.7130	1.0446	0.42010	0.7595
		3	0.9803	1.3313	0.74570	0.7410
		4	0.7192	0.9830	0.52282	0.5776
	3	1	-0.2673	-0.2867	-0.32559	0.0185
		2	-0.9803	-1.3313	-0.74570	-0.7410
		4	**-0.2611****	**-0.34823***	-0.22288	-0.1634
	4	1	-0.0062	0.0615	-0.10271	0.1819
		2	-0.7192	-0.9830	-0.52282	-0.5776
		3	**0.2611****	**0.34823***	0.22288	0.1634
Financial	1	2	-0.1644	-0.2059	-0.15168	-0.1557
		3	0.0568	0.1306	0.01243	-0.0282
		4	-0.0190	0.0177	-0.00107	-0.1035
	2	1	0.1644	0.2059	0.15168	0.1557
		3	0.2212	0.3365	0.16410	0.1275
		4	0.1454	0.2236	0.15060	0.0523
	3	1	-0.0568	-0.1306	-0.01243	0.0282
		2	-0.2212	-0.3365	-0.16410	-0.1275
		4	-0.0758	-0.1129	-0.01350	-0.0753
	4	1	0.0190	-0.0177	0.00107	0.1035
		2	-0.1454	-0.2236	-0.15060	-0.0523
		3	0.0758	0.1129	0.01350	0.0753

**The mean difference is significant at $p < .001$ level.
*The mean difference is significant at $p < .05$ level.
All areas = all 3 areas (Leeds, Nottingham and Bristol merged together).
Cluster - 1 = ethnic, 2 = student, 3 = affluent and 4 = socially underprivileged.
Mean difference (I – J) = difference in mean outlets per '000 households for each cluster compared to the other.

Table 5.11 shows the Games Howell comparison test between FGRs and AASRs mean outlet ‰ households in each cluster across the 3 areas. In Leeds, there is a significantly lower mean ($p < .05$) in the affluent clusters compared to the socially underprivileged cluster for AASRs and gambling retailers only. For FGRs, there are no significant differences across all clusters ($p > .05$). Hence, there is a markedly higher concentration of AASR and gambling retail outlets in clusters with high deprivation characteristics compared to relatively affluent clusters, while FGRs have statistically similar patterns across all clusters.

In Bristol (Table 5.11), there is a significant difference in the mean of FGR outlets in the ethnic cluster compared to the student cluster ($p < .05$) which are both relatively deprived clusters. Interestingly, the mean in the student cluster is higher compared to the ethnic cluster. However, there is no significant differences in the cluster means for AASRs and its sub-groups ($p > .05$), i.e. they are comparable across all clusters. Accordingly, there is a high concentration of FGRs in the student cluster compared to ethnic cluster (i.e. within deprived clusters, the distribution of FGRs is significantly different in Bristol).

For all areas (Table 5.11), there is a significantly lower mean in ethnic and affluent clusters compared to the student cluster ($p <.05$) for FGRs, showing that LSOAs in these areas have low concentration of FGRs compared to student areas. In addition, for AASR and gambling outlets, the means of outlets in the affluent clusters are significantly lower compared to the socially underprivileged cluster ($p < .001$). Therefore, there is high concentration of all AASRs and gambling retailers in highly deprived clusters compared to affluent clusters. Although the Welch test (Table 5.10) also shows a significant difference in the mean of financial outlets across the clusters, a multiple comparison test (Table 5.11) indicates no significant differences (which could be as a result of the relatively low means for financial retailers across the clusters - see Table 5.9).

5.5.5 Summary of area classification and retail locations

In summary, section 5.5 has presented an area classification in Leeds, Nottingham and Bristol, using SECs. The area classification groups all the LSOAs based on the dominant SECs in each LSOA. It further groups LSOAs with similar characteristics in the same cluster. The clusters are ethnic, student, affluent and no qualification. It has also validated the cluster classification by comparing the cluster classification to the index of multiple deprivation. The validation shows that the classification performed relatively well, especially for the

affluent, ethnic and socially underprivileged clusters. The geographic distributions of the retailers outlets across the various clusters were mapped. This revealed an interesting distribution with a more pronounced distribution of AASRs in the LSOAs with deprived characteristics compared to affluent LSOAs in the 3 areas. These patterns were also confirmed by developing a KDE which maps the retail points as a continuous surface to highlight retail hotspots in the three cities. Section 5.6 below reports the examination of the distribution using inferential statistics and discovery that there is a significant concentration of AASRs in some of the LSOAs with deprived characteristics compared to affluent LSOAs. Although FGRs show no significant difference between LSOAs with affluent and deprived characteristics, within deprived LSAOs, there are significant differences in the FGR distribution.

5.6 Bivariate relationship between retailers and socio-economic characteristics

Table 5.12 shows the results of a two-tailed bivariate binomial logistic regression analysis between the two retail groups and each socio-economic characteristic across the study areas. In Leeds (Table 5.12), generally an increase in the area distribution of private renters, persons of Chinese descent, households with no car and fulltime students 18 and above increases the likelihood of the presence of food, gambling and financial outlets ($p < .05$). However, these variables are far more likely to see an increase in AASRs compared to FGRs based on the exponential odds. An increase in the distribution of owner occupied, couple families, persons aged 45 – 64, level 2 educational qualifications and households with 2 or 3 cars, however, reduces the likelihood of AASRs and FGRs ($p < .05$), with the highest reduction in AASRs compared to FGRs. In addition, social renters, persons of IPB and black ethnic origins, persons with no qualifications and never worked/unemployed persons increase the likelihood of AASRs only ($p < .01$). In Nottingham (Table 5.12), couple family households and owner occupiers decrease the likelihood of both AASRs and FGRs ($p < .10$), with the highest reduction in the former compared to the latter, whereas only fulltime students increase the odds of the likelihood of both FGRs and AASRs, with the highest increase in FGRs ($p < .10$). Other variables which increase the odds of the presence of only AASRs include private renters and households with no car ($p < .05$), whereas households with 1 or more cars and persons in higher managerial and professional occupations reduce the odds of the likelihood of AASRs ($p <.05$).

Table 5.12 Odds ratio for the effect of socio-economic characteristics on the distribution of retailers in Leeds, Nottingham and Bristol

	All Areas				Leeds				Nottingham				Bristol			
	FGRs	**AASRS**	**Gamb.**	**Fin.**	**FGRs**	**AASRs**	**Gamb**	**Fin**	**FGRs**	**AASRs**	**Gamb**	**Fin**	**FGRs**	**AASRs**	**Gamb**	**Fin**
Housing Tenure																
Owner Occupied	.808**	.594***	.590***	.400***	.804*	.568***	.564***	.422**	.810^{+}	.658**	.658**	.253*	.826	.576***	.563***	.441*
Social renters	.968	1.182*	1.197*	1.300	1.011	1.288*	1.285*	1.269	.984	1.228	1.228	2.537*	.886	1.014	1.061	.905
Private Renters	1.368***	1.570***	1.562***	1.847***	1.308**	1.487***	1.500***	1.736**	1.381**	1.424**	1.424**	1.547	1.433**	1.866***	1.810***	2.536**
Family Composition																
Couple Family	.739***	.531***	.529***	.385***	.735**	.498***	.498***	.423**	.707**	.578**	.578**	.255*	.831	.570**	.556**	.380*
Lone parents	.810**	.926	.938	.694	.958	1.038	1.038	.906	.689*	.862	.862	.781	.735*	.837	.875	.324*
Min. Ethnic Grp.																
Black	.979	1.171*	1.179*	1.237	1.031	1.198^{+}	1.202^{+}	1.418*	.975	1.237	1.237	1.366	.878	1.082	1.103	.934
IPB	1.044	1.174*	1.184*	1.433**	1.080	1.154	1.162	1.618**	1.083	1.302*	1.302*	.934	.905	1.297^{+}	1.320*	1.262
British Chinese	1.309***	1.243**	1.247**	1.430***	1.241*	1.222*	1.228**	1.468**	1.316*	1.291*	1.291*	1.735*	1.514*	1.304*	1.309*	1.498*
Age Composition																
Age 18 - 24	1.252***	1.238**	1.238**	1.398**	1.115	1.150	1.153	1.236	1.334*	1.250^{+}	1.250^{+}	1.598	1.490**	1.459**	1.447**	1.808**
Age 25 - 44	1.125^{+}	1.445***	1.429***	1.604**	1.144	1.565***	1.566***	1.583*	1.036	1.180	1.180	1.327	1.156	1.406*	1.367*	1.586
Age 45 - 64	.775***	.657***	.655***	.537***	.813*	.671**	.662***	.553**	.766*	.693*	.693*	.548	.730*	.616**	.618**	.501*
Age 65 Above	.956	.770**	.781**	.551**	1.003	.781^{+}	.782^{+}	.640	1.037	.919	.919	.381	.812	.643**	.673**	.467^{+}
Edu. Qua.																
No Qualifications	.918	1.079	1.101	1.064	1.114	1.276^{+}	1.269^{+}	1.711*	.857	1.196	1.196	.754	.764	.857	.910	.556
Level 1	.789**	.856^{+}	.868+	.761	.894	.896	.882	1.034	.656**	.863	.863	.767	.801	.832	.877	.461*
Level 2	.742***	.694***	.701***	.586**	.785*	.729**	.722**	.635*	.678**	.675**	.675**	.585	.780^{+}	.716*	.745^{+}	.489*
Level 3	1.174*	1.080	1.079	1.142	1.022	.955	.958	.801	1.304*	1.137	1.137	1.411	1.354*	1.252^{+}	1.238	1.557*
Level 4 Above	1.096	.987	.964	.955	.959	.901	.911	.602	1.143	.846	.846	.942	1.196	1.112	1.041	1.518
Car Ownership																
No Car	1.201**	1.674***	1.700***	3.007***	1.242*	1.804***	1.821***	3.558***	1.211	1.689**	1.689**	4.395*	1.159	1.707***	1.769***	2.433**
One Car	.967	.856*	.838*	.502***	1.057	.887	.869	.502**	.923	.742	.742*	.374*	.785^{+}	.775^{+}	.749^{+}	.461**
2 Cars	.799**	.520***	.514***	.213***	.735**	.463***	.461***	.154***	.821	.570**	.570**	.141^{+}	.913	.527***	.507***	.332*
3 cars	.868^{+}	.564***	.557***	.253***	.779*	.442***	.443***	.154**	.858	.613*	.613*	.090^{+}	1.044	.651*	.627**	.502
4 or more cars	.867^{+}	.564***	.555***	.286**	.817	.352***	.324***	.183**	.838	.674*	.674*	.012^{+}	.966	.666*	.651*	.574
NS-SeC																
MP	.986	.795**	.778**	.639*	.886	.755*	.758*	.440*	.989	.679*	.679*	.567	1.140	.923	.866	1.036
Iint. Occu.	.805**	.698***	.697***	.570**	.862	.690**	.684**	.565*	.812^{+}	.723*	.723*	.494	.740*	.691*	.702*	.506^{+}
RO	.879^{+}	1.092	1.109	.959	1.063	1.259^{+}	1.248^{+}	1.450	.798^{+}	1.107	1.107	.715	.748*	.930	.980	.603
NW/LU	.964	1.244**	1.260**	1.575**	1.091	1.371**	1.374**	2.078***	.866	1.263	1.263	1.270	.856	1.088	1.137	.533
Fulltime Students	1.244**	1.206**	1.206**	1.378*	1.097	1.098	1.104	1.185	1.335**	1.262^{+}	1.262^{+}	1.641^{+}	1.441**	1.365*	1.348*	1.784**

Predictor variables are all z - scores. Odds ratio –- Dependent variable is a binary variable 0 = no retail presence, 1 = at least 1 retailer present.
*** $p < .001$ (two-tailed test), ** $p < .01$ (two-tailed test), * $p < .05$

In Bristol, full time students, private renters, ethnic minorities and persons aged 18 – 24 increase the likelihood of both FGRs and AASRs, with the highest odds of increase in AASRs compared to FGRs ($p < .05$). In contrast, aged 45 – 64, level 2 qualifications, one car households and persons in intermediate occupations reduce the likelihood of AASRs and FGRs, with the highest reduction observed with AASRs. In addition, these variables increase the odds of the likelihood of only AASRs aged 25 – 44, IPB and households with no car, whereas owner occupiers, couple family, persons aged and 65 above, households with 2 or more cars reduce the likelihood of only AASRs (Table 5.12).

In summary, across all areas, these variables have the strongest effect on the likelihood of the increase of FGRS and AASRs i.e. private renters, British Chinese, aged 18 – 24, 25 – 44, no car ownership, and full-time students, with the highest increase in prevalence in AASRs compared to FGRs. Owner occupiers, couple families, 2 cars and above, persons in intermediate occupations reduce the likelihood of ASSRs and FGRs, with the greatest reductions in AASRs. Therefore, generally, area SECs indicating forms of deprivation increase the odds of FGRs and AASRs, but the effect is stronger on AASRs, while those characteristics linked to higher socio-economic status reduce the odds of both group of retailers, with the highest probability of reduction in AASRs.

5.7 Modelling the relationship between AASRs and SE characteristics

The means tests and bivariate analyses performed in the previous section reveal salient patterns in the relationships between AASRs and SED, yet they are insufficient to confirm the targeting pattern ascribed to these AASRs. To attempt to explore this likelihood, a stepwise binomial logistic regression model in an exploratory manner was undertaken help to uncover significant characteristics of AASRs locations. Although this is neither sufficient to prove motive nor causality, Nevertheless, it should help to uncover AASRs locations preferences. A stepwise binomial logistic regression is a method which inputs each variable sequentially in a model and excludes non-significant variables at each step. Hence, the resulting model would not include non-significant variables. This process was undertaken manually guided by evidence from the literature.

5.7.1 Variable selection

Selecting the variables to be utilized for the prediction of the observed AASR location preference was a very complex process and involved consideration of many factors. Evidence from the literature guided selection of predictors due to the large number of potential variables. In addition to these, multi-collinearity was also addressed by examining correlations between the variables and checking the collinearity statistics (tolerance and variance inflation factors (VIF)). The minimum tolerance value adopted for this research is 0.2 (Menard, 1995) while a VIF greater than 3.0 is taken as evidence of multi-collinearity (Hair et al., 2014; Hair et al., 2018). Although there are various ways to handle multi-collinearity (see chapter 3), the approach this research takes are explained below.

If two variables showed multi-collinearity, they are interchanged in the model and if both were significant, the model with the highest power was selected (Wang, 1996). This method rather than using a dimension reduction technique was adopted because the research is interested in determining the influence of the original SECs on AASR locations. Using a data reduction technique makes this difficult, as these techniques usually create composites of collinear variables, rather than returning the original variables. Secondly, for the England wide analysis, the deprivation indicators used (income, employment and education deprivation domains) were constructed using principal component analysis (PCA). Therefore, using a different approach for the citywide analysis offers a different perspective and helped to identify area SECs influencing location strategies.

The drawback of this is that omission of important variables might occur. Based on the selected approach, this section develops four different models to account for that drawback in order to ensure that the effects of all the important socio-economic variables on gambling and financial retailers are considered. An important justification for this method is that extant literature suggests that all variables theoretically linked to the study should be considered in the model (Hair et al., 2014). Therefore, because of the effect of multicollinearity which exists between many of the considered variables, the excluded variables might offer very important theoretical and policy-relevant information which would be lost if excluded. More importantly, no single approach can tackle the problem; rather it is best to combine different approaches (Wang, 1996; Hair et al., 2018). Hence, the use of stepwise regression and development of four models would ensure that all variables with theoretical underpinnings are considered. In addition, adopting this method as against developing composites using a

PCA will also help to identify the role of individual socio-economic characteristics on AASRs' locations, which would otherwise be masked if a composite were adopted.

Accordingly, if a variable was significant in a model and it displayed collinearity with another variable, the other variable was adopted for another model to ensure consideration of all important variables in this analysis. Hence, collinearity diagnostics which show proportions of variance explained by each variable on the different dimensions were examined. If predictors had high VIF and low tolerance values, it showed that their regression coefficients have dependent variances (Midi et al., 2010), and therefore, those variables were not used together in a model. Also, if one of the pair of collinear variables became non-significant and excluded, the initially excluded variable was re-introduced to ensure a robust model.

5.7.2 Model 1

To run the first model, ten (10) predictor variables were initially selected, taking into consideration the multicollinearity among the variables (see appendix 2). Table 5.13 shows the variables and reasons for selection. For final selection of variables for the first model, collinearity between the variables was examined using the VIF and Tolerance values. This influenced the final modelling process. Table 5.14 shows the VIF and Tolerance values for the 10-predictor variables. A tolerance value of less than .20 and a VIF value greater than 3.0 was taken as a case of collinearity for the regression model. From Table 5.14, there is evidence of collinearity in the selected variables as fulltime students, persons aged 25 – 44, no qualifications, owner occupied, lone parents and persons aged 65 above all have VIF and tolerance values greater than 3 and less than .2 respectively. Therefore, fulltime students was removed. After excluding fulltime students, tolerance and VIF values were still below and above the threshold (see appendix 6a). Collinearity diagnostics (appendix 6b) shows collinearity between owner occupiers and private renters, lone parent family and person aged 65 above as these variables explain over 50% variance in a single dimension (appendix 6b).

Table 5.13 List of variables for model 1 and reason for selection

Variable	Reason for Selection
Owner Occupiers	Significant negative correlation with AASRs, strong correlation with no car households, couple family, social renters, 2 car households and intermediate occupations (see table 5.2).
Fulltime Students	Significant positive relationship with AASRs. Very strong correlation with intermediate occupations and person age 18 – 24 (see table 5.2).
Private Rented	Significant positive correlation with AASRs. No strong correlation with any other variable
IPB	No significant relationship with AASRs, but an important minority ethnic group in England and strong evidence that AASRs are concentrated in minority ethnic group areas.
Black	Positive significant relationship with AASRs, important minority ethnic group.
British Chinese	A very important ethnic minority in England. Shows strong correlation with AASRs.
No Qualifications	No significant correlation with AASRs, but strong evidence supports low education as a catalyst for AASRs demand. High correlation with routine/lower occupations.
Age 25 – 44	Positive significant relationship with AASRs.
Lone Parents Households	Strong evidence from the literature review that AASRs services abound in areas dominated by lone parents, although it has no significant relationship with AASRs. Also selected based on exclusion of couple family because of strong correlation with owner occupied households (see table 5.2).
Age 65 and over	Selected as it has no strong correlation with any other variable and represent an important demography. It has significant relationship with AASRs

Hence, lone parent household, persons aged 65 and above, private renters and owner occupied were interchanged in the model. Table 5.15 shows the tolerance and VIF statistics for model 1 and all VIF and tolerance values are within acceptable thresholds. Table 5.16 shows the results of the multivariate binary logistics regression for socio-economic predictors of presence or absence of AASRs, gambling and financial retailers for Leeds, Nottingham and Bristol after a systematic stepwise inclusion of variables in the model involving the interchange of collinear and removal of non-significant variables. Table 5.16 further shows the different models (1 – 4) adopted using different combinations of SECs.

Table 5.14 Collinearity statistics table showing tolerance and VIF statistics

Variables	Tolerance	VIF
Zscore: Private Renters	.154	6.499
Zscore: Lone Parent Family	.179	5.578
Zscore: Black	.536	1.866
Zscore: IPB	.730	1.369
Zscore: No Qualifications	.194	5.146
Zscore: Fulltime Students	.094	10.599
Zscore: Owner Occupiers	.153	6.537
Zscore: Age 25 - 44	.168	5.939
Zscore: Age 65 Over	.177	5.659
Zscore: British Chinese	.545	1.836

Table 5.15 Collinearity statistics table showing tolerance and VIF for variables in Model 1

Variables	**Tolerance**	**VIF**
Zscore: Private Renters	.580	1.723
Zscore: Lone Parent Family Households	.424	2.361
Zscore: No Qualifications	.375	2.670
Zscore: Age 25 - 44	.725	1.379

For model 1 (Table 5.16), overall the area distribution of private renters ($p < .001$), persons with no qualifications ($p < .05$), persons aged 25 – 44 ($p < .05$) and lone parent households ($p < .05$) are significant predictors of gambling and financial outlets across the three areas. Private renters, persons with no qualifications and persons aged 25 – 44 increase the odds of presence of all AASRs in Leeds and Bristol, but only gambling outlets in Nottingham.

Table 5.16 Stepwise binomial logistic regression between socio-economic characteristics and AASRs outlets '000 households in Leeds, Nottingham and Bristol

	All Areas			Leeds			Nottingham			Bristol		
SEC (Predictors)	**AASRs**	**Gambling**	**Financial**	**AASRs**	**Gambling**	**Financial**	**AASRs**	**Gambling**	**Financial**	**AASRs**	**Gambling**	**Financial**
Model 1												
Private Renters	1.920***	1.950***	2.759***	1.738***	1.789***	3.764***	1.898***	1.898***		3.321***	3.491***	3.644*
No Qualifications	2.207***	2.266***	4.419***	2.399***	1.764***	3.801***	2.503***	2.503***		2.204*	2.445**	5.566*
Age 25 – 44	1.218*	1.203*		1.349*	1.311*							
Lone Parents Households	.684**	.684**	.391**	.662*			.555*	.555*				
Model 2												
No Car	1.508***	1.542***	2.696***	1.637***	1.653***	3.133***	1.689**	1.689**	4.395***	1.707*	1.769***	2.433**
Age 25 – 44	1.226*	1.210*		1.362*	1.359*							
Level2 Qualifications	.826*	.836*										
British Chinese						1.367*						
Model 3												
Couple Family	.566***	.560***	.411***	.541***	.542***	.408**	.578**	.578*		.570**	.556**	.380*
Age 25 – 44	1.177*			1.288*	1.289*							
No Qualifications												
IPB			1.429**			1.678**						
Model 4												
Never worked/Unemployed	1.204*	1.223**	1.61**	1.275*	1.278*	2.070***						
Age 25 – 44	1.383***	1.364***	1.498*	1.517**	1.518**					1.406*		
Managers and Professional							.679*	.679*				
British Chinese	1.234**	1.241**	1.492***			1.507**					1.309*	1.498*

***significant at p < .001
**significant at p < .01
*significant at p < .05

Private renters and no qualifications increase the odds of likelihood by at least 1.7 times, and as high as 3.6 and 5.6 times respectively, while persons aged 25 – 44 increases the likelihood of presence of only gambling outlets by at least 1.2 times in Leeds and all areas. However, lone parent households reduce the likelihood of gambling and financial outlets by between 31.6% and 60.9% in all area analysis

5.7.3 Model 2

Table 5.17 shows the variable selection and the basis for selection. There is collinearity between some of the predictors evidenced from the tolerance values less than .2 and VIF greater than 3.0 (see appendix 6c). Further investigations (appendix 6d) show collinearity between no car households and persons in routine and lower status occupations. Therefore, routine occupation is dropped for no car, due to the importance of households with no cars as evidenced from the correlation and bivariate regression (Tables 5.2 and 5.12 respectively). The variable is also a good proxy as a signifier of income levels in urban areas. In addition, private renters was removed to include fulltime students (appendix 6e).

Table 5.16 also shows the result of the binary logistic regression between AASRs, gambling and financial retailers and selected SECs for model 2 in Leeds, Nottingham and Bristol (with all collinear variables interchanged in the model). In addition, Table 5.18 shows the collinearity statistics for variables in model 2 with VIF and tolerance values all below the thresholds. Only area distribution of households with no car ($p < .001$), people within age 25 – 44 ($p < .05$), people with level 2 qualifications ($p < .05$) and persons of minority ethnic group ($p < .0.5$) have significant effects on the likelihood of gambling and financial outlets with variations across the three areas.

No car households, age 25 – 44 and British Chinese increase the odds of presence of all AASRs. A log unit increase in the distribution of no car households increases the likelihood of presence of gambling and financial outlets by between 51% and 339% in Leeds, Nottingham and Bristol. Overall, an increase in the distribution of persons age 25 – 44 increases the likelihood of gambling outlets by at least 21%, especially in Leeds where it increases the prevalence by 36%. Likewise, presence of ethnic minorities increases the likelihood of only financial outlets in Leeds alone (1.4 times). In contrast, an increase in people with level 2 qualifications reduces the overall likelihood of presence AASRs (all areas) by 17%.

Table 5.17 List of variables for model 2 and reason for selection

Variable	Reason for Selection
No Car	Significant positive correlation with AASRs, strong correlations with owner occupied, couple family, Black British/Caribbean/African, social renters, 2 car households, managers/professionals and intermediate occupations (see Table 5.2).
Fulltime Students	Significant positive relationship with AASRs. Very strong correlation with British Chinese/Chinese and Other Asians, intermediate occupations and aged 18 – 24 (see Table 5.2).
Private Renters	Significant positive correlation with AASRs. No strong correlation with any other variables.
IPB	No significant relationship with AASRs, but an important minority ethnic group in England and strong evidence that AASRs are concentrated in minority ethnic group areas.
Routine/Lower Occupations	Although no significant correlation with AASRs, literature supports this variable as a catalyst for AASR demand. Strong positive correlation with no qualifications, lone parents and level 1 qualification.
Aged 25 – 44	Strong correlation with AASRs in the study area.
Level 2 Qualifications	Strong relationship with AASRs in the study area and a variable to indicate education qualification in the model.
Black	Positive significant relationship with AASRs, an important minority ethnic group.
British Chinese	A very important ethnic minority in England. Shows correlation with AASRs.

Table 5.18 Collinearity statistics for variables in model 2

Predictors	Tolerance	VIF
Zscore (No Car)	.868	1.153
Zscore: Aged 25 - 44	.872	1.146
Zscore: Level 2 Qualifications	.868	1.152

5.7.4 Model 3

The variables selected and justifications for selection are shown in table 5.19 (see appendix 6f for collinearity of all initial variables). A number of variables have tolerance and VIF beyond the thresholds of 0.2 and 3.0 respectively, suggesting multicollinearity issues. There is collinearity between private renters and social renters (see appendix 6g). Private renters was removed from the initial variables due to very high VIF value of over 10 (see appendix 6f). Persons aged 18 – 24 was removed because of its collinearity with couple family households. In addition, social renters was also excluded

Table 5.19 List of variables for model 3 and reason for selection

Variable	Reason for Selection
Socially Rented	No significant correlation with AASR outlets in the study area, but evidence in the literature that reliance on benefit is an indicator for the demand for AASRs. Strong correlation with owner occupiers, households with no car, never worked/unemployed persons, and managers/professionals.
British Chinese	Correlation with AASRs, also an important minority ethnic group in England and convincing evidence from the literature that AASRs are concentrated in minority ethnic group areas.
Private Renters	Significant positive correlation with AASRs. No strong correlation with any other variable.
Couple Family	Significant correlation with AASR outlets. Strong correlation with no car households, 2 car households, intermediate occupations.
Black	Positive significant correlation with AASRs, an important minority ethnic group. Strong correlations with no car and never worked/unemployed.
Age 25 – 44	Positive significant correlation with AASRs.
No Qualifications	Strong correlation with AASRs in the study area and a variable to indicate educational qualifications in the model fitting.
Indian/Pakistani/ Bangladeshi	No significant relationship with AASRs, but an important minority ethnic group in England and strong evidence that AASRs are concentrated in minority ethnic group areas.
Age 18 – 24	Significant correlation with AASRs and an important age group. Strong correlation with fulltime students.

Table 5.20 Collinearity statistics for model 3

Predictors	Tolerance	VIF
Zscore: Couple Family Households	.831	1.204
Zscore: Age 25 - 44	.822	1.217
Zscore: IPB	.972	1.029

for no qualifications because of high VIF and collinearity (see appendix 6h and 6i). Subsequently, all tolerance and VIF values were within acceptable threshold (see appendix 6j). Table 5.16 further shows the result of the multivariate binary logistic regression between the selected SECs and AASRs for model 3. Presence of persons aged 25 – 44 ($p < .05$), couple family households ($p < .05$), persons with no education ($p < .05$) and persons of Indian/Pakistani/Bangladeshi ethnic origin ($p < .05$) have a significant impact on the prevalence of AASRs. Overall, a log unit increase in the area distribution of couple family reduces the chances of presence of gambling and financial outlets in all areas, Leeds and Bristol. Increase in persons aged 25 – 44 increases the odds of presence of gambling outlets by 29% in Leeds. Likewise, a log increase in IPB increases the odds of presence of financial

retailers in Leeds by only 67%. Table 5.20 shows all VIF and tolerance values of variables in the model below and above the required threshold, respectively.

Table 5.21 Multivariate logistic regression model 4

Variable	Reason for Selection
Fulltime students	Significant correlation with AASRs, strong correlation with age 18 – 24 and age 45 – 64.
Private Renters	Significant positive correlation with AASRs. No strong correlation with any other variable.
Couple Family	Significant correlation with AASR outlets. Strong correlation with no car households, 2 car households, intermediate occupations.
Never worked/Unemployed	No significant correlation with AASRs, but important socio-economic classification with strong evidence from the literature suggesting it has a strong influence on patronage of AASR services. Strong correlations with no car and Black British/Caribbean/African.
Age 25 – 44	Positive significant correlation with AASRs.
No Qualifications	Strong correlation with AASRs in the study area and a variable to indicate education qualification in the model fitting.
Managers and Professionals	Strong relationship with AASRs. Strong correlation with social renters and no qualifications. Selected to represent affluence in the model.
British Chinese	Correlation with AASRs, also an important minority ethnic group in England and convincing evidence from the literature that AASRs are concentrated in minority ethnic group areas.
Black	Positive significant correlation with AASRs, an important minority ethnic group. Strong correlations with no car and never worked/unemployed.
IPB	No significant relationship with AASRs, but an important minority ethnic group in England and strong evidence that AASRs are concentrated in minority ethnic group areas.

5.7.5 Model 4

Table 5.21 shows the variables selected and reason for selection for model 4. No qualifications has very high VIF (see appendix 6k) and shows multicollinearity with fulltime students and managers and professionals (see appendix 6l), hence it was removed as was considered in a different model. Re-examination of the collinearity diagnostic (appendix 6k) saw the exclusion of private renters and couple families due to high VIF, as they had been considered in previous models. In addition, managers and professionals and never worked/unemployed were interchanged due to multicollinearity (appendix 6m). Further examination revealed no VIF above 3.0 and tolerance below 0.2 (see appendix 6n).

Table 5.22 Collinearity statistics for model 4

Variables	Tolerance	VIF
Zscore: British Chinese	.989	1.011
Zscore: Aged 25 - 44	.955	1.047
Zscore: Never Worked/Long term Unemployed	.962	1.040

Finally, table 5.16 shows the results of the multivariate binomial logistic regression between selected SECs and presence and absence of AASRs (gambling and financial retailers) outlets in Leeds, Nottingham and Bristol (model 4). From model 4, area characteristics of never worked/unemployed persons, persons aged 25 – 44, managers and professionals and persons of minority ethnic origin are significant predictors ($p < .05$) of location preferences of AASRs. The effects of these variables vary across the three areas. In Leeds, a log unit increase in the proportions of unemployed and persons who have never worked increases the likelihood of presence of gambling and financial outlets by 1.3 and 2.1 times respectively. Likewise, persons aged 24 – 44 increases the likelihood of presence of gambling retailers by 1.5 times. Lastly, an increase in British Chinese ethnic minorities increases the odds of presence of financial outlets only.

In Nottingham, only managers and professionals have a significant effect on AASRs. An increase in its distribution reduces the chances of having a financial outlet by 32%. In Bristol, persons aged 25 – 44 increases the likelihood of only combined AASRs by 41%, while persons of ethnic minorities ethnic origin increase the likelihood of gambling and financial retailers by 31% and 50% respectively. In addition, for all areas, never worked/unemployed, aged 25 – 44 and British Chinese increase the likelihood of presence of gambling and financial outlets by 22% and 61% respectively (see table 5.22 for collinearity statistics of variables in the model).

5.8 Summary

This chapter has explored relationships between SECs and retailers location preferences in Leeds, Nottingham and Bristol. To achieve this, it used the Spearman correlation coefficient to establish the association between groups of SECs and AASR and FGR location preferences. To carry out the analysis, the AASRs were further broken down into gambling

and financial retailers in order to make a clear distinction between the different groups of AASRs and their corresponding relationships with aspects of SECs. The test of association revealed salient SECs that have association with these groups of retailers. It also revealed similarities and differences in the relationship between each group of retailers and SECs. The relationship varied across socio-economic dimensions as well as across the three different cities. It further used the concept of geodemographics to create an area classification which grouped similar areas based on dominant SECs using k-means classification technique.

The classifications are ethnic, student, affluent and socially underprivileged clusters. The resulting classification grouped the LSOAs in the three areas along socio-economic lines with a clear distinction of the least deprived LSOAs and deprived LSOAs. The classification was validated by cross tabulating the area classification against the IMD deciles and it was found to conform to existing patterns of socio-economic deprivation in the three areas. Rigorous analysis of the outlets' means revealed a clear significant difference in the mean of AASR outlets in some of the clusters with deprived characteristics compared to the affluent cluster, whereas for FGRs, significant differences only exist with deprived clusters when compared to each other and not with the affluent cluster. This is a major signifier of the location preference of these AASRs. The study also employed simple binomial logistic regression to understand linkages between various socio-economic themes and AASRs and compare the observed linkages with those of FGRs. What was observed is that there is a higher likelihood of AASRs in areas with low SECs compared to FGRs, which is consistent with findings at the national level.

As univariate analysis and means test and regression cannot adequately address the notion of targeting and persistent spatial inequalities ascribed to the presence of AASRs, this study further carried out a multivariate binary logistic regression to model the effects of area SECs - age, car ownership, education, family composition, ethnicity and occupation - on the presence of AASRs in the 3 areas. Findings show that area SECs do indeed affect the likelihood of presence or absence of gambling and financial retailers, in ways consistent with targeting, deliberate or not, of deprived areas.

Chapter 6

Discussion of Findings

6.1 Introduction

This research has examined the relationship between retailers and socio-economic deprivation. More precisely, it has critically reviewed the relationships between alleged anti-social retailer (AASRs) locations and socio-economic deprivation (SED) and compared the observed relationships with those of food and grocery retailers (FGRs), a more ubiquitous retail group. This is in order to address the allegations of concentration and deliberate targeting ascribed to these AASRs. The research consists of two phases. The first phase of the research critically examined and compared the relationship between AASRs, FGRs and SED in England using the Indices of Multiple Deprivation domains (income, employment and education). The second phase of this research carried out a comparative analysis of AASRs and FGRs and area SECs obtained from the UK National Census for Leeds, Nottingham and Bristol. In addition, the second phase developed neighbourhood models that predict the likelihood of presence or absence of AASRs in small areas using SECs and a multivariate binomial logistic regression (BLR).

The sub-research questions for the first phase, are as follows:

- What is the relationship between SED, AASRs and FGRs in England?
- Is there a relative concentration of AASRs in deprived neighbourhoods in England in comparison with FGRs?
- Are there similarities and/or differences in the location patterns of AASRs and FGRs relative to SED in England?

Subsequent sub-research objectives for the first phase were as follows:

1. To explore the relationship between AASRs, FGR locations and SED in England.
2. To confirm/validate whether there is a concentration of AASRs e.g. gambling and fringe banking and RTO in disadvantaged neighbourhoods in England.
3. To explore whether these concentrations are also found in food and grocery retailer (FGRs) locations in England.

4. To compare any similarities and differences in the relationships observed between the two groups of retailers (AASRs and FGRs) and SED in England.

In addition, the second phase sought to address the sub-research questions, listed as follows:

- What is the relationship between the two groups of retailers' outlets (AASRs and FGRs) and area SECs at city level?
- What are the similarities and differences between the two groups of retailer locations and area SECs in small areas in Leeds, Nottingham and Bristol?
- Which socioeconomic characteristics (SECs) are most predictive of AASR locations?

For the second phase of the research, the sub-objectives 1 - 4 are as follows:

1. To explore the relationship between SECs and AASR locations in Leeds, Nottingham and Bristol.
2. To explore whether these associations are also found for FGRs in Leeds, Nottingham and Bristol.
3. To develop an area classification map for Leeds, Nottingham and Bristol using socio-economic variables.
4. To compare any similarities and differences in the relationships between the FGRs, AASRs and SECs in Leeds, Nottingham and Bristol.

And additionally, for Phase 2:

5. To develop a synoptic neighbourhood model that best fits AASR locations using socio-economic variables.

In this chapter, the results of this research across the two phases are brought together and discussed in full detail. This discussion begins by considering the research objectives and how each objective was achieved to guide the direction of this practical study. In addition, this chapter discusses the results of the various methodological considerations.

6.2 Relationship between retailers and socio-economic deprivation in England

This section discusses the results of Phase 1 of this research, namely the analysis of retailers and SED. It discusses the results of the relationship between AASRs and FGRs and SED in England. It begins by discussing associations between AASRs, FGRs and SED, and then discusses the similarities and differences between the presence of AASRs and FGRs in deprived neighbourhoods.

6.2.1 AASRs and socio-economic deprivation

This research set out to identify the relationship between gambling and financial retailers and SED in England. The results of the analysis are set out in this sub-section, which looks separately at gambling and financial retailers and their relationships with SED in England.

6.2.1.1 Gambling locations and socio-economic deprivation

Thoughtful consideration of the supply of gambling outlets is a necessary step to attempting to tackle issues of problem gambling and the other inherent risks associated with participation in gambling. It is acknowledged that the linkages between gambling and problem gambling are complex and understanding the nature of gambling availability is a critical step in the right direction. Unfortunately, there is dearth of literature on the supply of gambling in the UK compared to many parts of the world. The few studies that do exist on the supply of gambling in the UK include Wardle et al. (2014) Whysall (2014) and Astbury and Thurstain-Goodwin (2015). Interestingly, some of these studies found contrasting evidence on the supply of gambling opportunities. Therefore, there is an urgent need for a critical appraisal on the distribution of gambling outlets.

To begin, this study utilised geographical information systems (GIS) to explore the spatial patterns of gambling retailers in England by mapping the distribution of their outlets. Concentrations are observed in the urban and commercial hubs of England. This corroborates Wardle et al. (2014) who also discovered inequalities in the spatial distribution of gambling opportunities, with higher densities in new towns and the suburban and major urban centres in the UK. Then, a test of association was used to examine the relationship between income, employment and education deprivation domains. Results show that there is a significant positive relationship between income, employment and education deprivation indicators and the supply of gambling outlets in England. This finding is similar to the results of studies carried by Wardle et al. (2014) and Astbury Thurstain-Goodwin, (2015) and in

England. Therefore, the results in England follow similar patterns compared to other parts of the world (Wheeler et al., 2006; Pearce et al., 2008; Pickernell et al. 2013). Conversely, these results are different to the findings of Whysall (2014) which found no significant concentration of Ladbrokes and Coral in deprived areas compared to other retailers. One reason for the mixed results could be the different methodological considerations. Whysall (2014) examined the relationship with location preferences of different key retail brands (Ladbrokes, Coral) and socio-economic deprivation, rather than assess the overall association between all the different retail players and socio-economic deprivation. This research argues that the overall effect of socio-economic deprivation on all these retailers locations supersedes individual analysis because these retailers offer similar services. As such, they exert similar influences on the prevailing environmental landscape of deprived communities.

In this study, although correlation analysis discovered association between gambling and SED, this type of analysis cannot be used to infer concentration. Furthermore, even though the kernel density analysis revealed pockets of concentration of AASRs in deprived areas, the concentration needs to be tested through rigorous statistical analysis to address the probability of occurrence of this pattern. Accordingly, this study analysed the distribution of gambling retailers through an in-depth analysis of means between deprived areas across England to address the notion of concentration of gambling retailers in deprived communities. To achieve this, the mean and standard deviation of gambling outlets per deprivation decile for income, employment and education were explored. Results revealed significant concentrations between gambling outlets and SED with deprived SECs areas having higher concentrations of gambling retailers.

Likewise, as area deprivation reduces, the concentration reduces. Statistical analysis using Analysis of Variance (ANOVA) revealed that the mean differences between areas with different SECs are highly significant. More importantly, comparison highlights the influences of area socio-economic deprivation on gambling retailers, with the most deprived areas having far more statistically significant concentrations compared to their more affluent counterparts for all three deprivation indicators adopted in this study (i.e. income, employment and education). This reinforces the notion of the concentration in deprived communities previously ascribed to these retailers (Wheeler et al., 2006; Wardle et al., 2014;). In addition, of the three indicators, the concentration is most marked with the employment deprivation indicator.

Surprisingly, even within areas with similar SECs, there is high variation in the distribution of these retailers, as evidenced from the standard deviations of the outlets within the deprived LSOAs. This clearly shows that not all deprived areas have a high concentration of gambling outlets, introducing a twist in the location preferences of gambling retailers. This is further emphasised by the analysis of the top and 20 bottom LSOAs in terms of retail presence with some deprived LSOAs having no presence of AASRs. These reinforce the view that socio-economic deprivation alone does not adequately account for the location preferences of these retailers (Gilliland and Ross, 2005; McMillen and Doran, 2006; Young et al., 2009). Even Wardle et al. (2014) reiterated this in their discussion on England, stating that deprivation characteristics alone fail to explain the supply of fixed odd betting terminals in England. This raises the possibility that some areas offer special opportunities to these retailers. Undoubtedly, location plays a pivotal role in retail success and optimum locations are those that offer accessibility, demand, favourable regulations and, especially, vacant premises. The latter (vacant premises) is a seemingly regular edifice in deprived areas in England (Whysall, 2011), which may be an amplifying factor in these deprived communities.

To investigate the above argument, this research accounted for the influence of commercial zoning by excluding core residential areas from the analysis. To achieve this, only areas which had a sampled retail outlet (either FGR or AASR) were included in the analysis. Statistical analysis further revealed that there is a highly significant relationship between gambling outlets and deprived commercial areas. More importantly, the relationship seems to be stronger compared to the results of the previous analysis (all areas). In addition, analysis of means showed higher means in the most deprived commercial areas compared to least deprived commercial areas. What is more, the mean differences were highly significant, confirming a significant concentration in deprived commercial locations. This further strengthens the validity of the results of the hotspots maps which revealed high concentrations of gambling outlets in highly urbanised and commercial areas in England.

This pattern further confirms the evidence from the standard deviations which indicated a wide variation in the distribution of gambling outlets in deprived areas, with commercially viable deprived LSOAs having a more significant positive relationship and concentration compared to other deprived areas. Similar studies which explored the spatial distribution of gambling opportunities in Canada conjectured that supply-side factors such as historical land use zoning and alcohol licensing patterns, together with area SECs influence gambling availability (Gilland and Ross, 2005). Emphasis was also placed on policy impacts,

accessibility, marketing strategies, offerings and customer demand (demand and supply factors) in Australia (McMillen and Doran, 2006; Young et al., 2009). These highly deprived commercialised and historical urban centres in England are characterised by good accessibility, availability of shop premises and optimum location, indicating area characteristics which favour retail location. In England, concentration in these commercial locations may also be the impact of the Association of British Bookmakers (2014) code of practice which puts a restriction on the number of FOBTs per outlets. To circumvent this code of practice, according to Portas (2011), betting retailers "simply opened another unit just doors down" (p.29).

6.2.1.2 Financial retailers locations and socio-economic deprivation

The spatial distributions of high yield interest lenders and RTOs were analysed and are referred to as financial retailers because of the nature of their products and services. A test of correlation analysis further shows a significant positive association between income, employment and education deprivation indicators, and that a unit increase in these area characteristics will have a positive association with these financial retailers. Results of the means tests show a high concentration of these retailers in the most deprived deciles of the three deprivation indicators and so, as was seen with gambling retailers, there is a positive relationship between area deprivation and financial outlets. The means tests further show significant mean differences in deprived areas compared to the more affluent areas. This indicates that there is a concentration of financial outlets in income, employment and education deprived areas. These findings are similar to findings from the US, where there is strong evidence of spatial concentration of high yield interest lenders in deprived communities (Squires and O'Connor, 1998; Graves, 2003; Gallmeyer and Roberts, 2009; Cover et al., 2011; Fowler and Cover, 2014).

This research also found that these financial outlets have very high concentrations in the most deprived income, employment and education areas in the UK, which is in line with a previous study in the UK (Whysall, 2014). This is in contrast to evidence from empirical studies in the US which asserted that they are usually located in moderately poor communities as opposed to the very impoverished areas (Gallmeyer and Roberts, 2009; Cover et al., 2011; Fowler and Cover, 2014; Prager, 2014). Interestingly, Whysall (2014) treated each retailer in the industry as a discrete entity rather than looking at overall provisioning, implying that even outlets of the various retail brands are located in deprived localities. Undisputedly, the characteristics of deprived communities, as well as many of

their residents, offer attraction to these financial retailers (Stegman, 1997). On the other hand, these deprived areas are historical commercial centres in the UK that offer retailers optimum location characteristics. Subsequently, the question that begs to be answered is why these financial retailers are concentrated in the most deprived communities in England. Could it be because of the abundance of demand or could it be as a result of historic commercialisation and zoning regulations? This argument for commercialisation has also been by international studies that deprivation-related SECs, especially low income, fail to adequately account for the heavy presence of fringe banks in some deprived communities (Gallmeyer and Roberts, 2009; Cover et al., 2011; Fowler et al., 2014; Prager, 2014). In addition, government policies, laws and regulations that govern these organisations interact with SECs to inform preferential locations for these financial retailers (Prager, 2014; Fowler et al., 2014).

Effects of these regulations are clear and vivid in the US, where different states have different payday loans laws and policies (Prager, 2014), whereas in the UK, similar laws govern all areas. This research accounts for the influence of commercialisation and land use zoning regulations on the location of financial retailers by carrying out the analysis on commercial locations only. Evidence from correlation analysis reveals a stronger association between these retailers and income, employment and education deprived commercial communities, compared to the overall deprived areas. Further analysis of means shows similar patterns of concentration compared to the analysis focusing on all areas. In addition, a highly statistically significant mean is observed in the most deprived commercial areas, compared to the least deprived as well as compared to all areas. Conversely, the results of the logistic regression for financial retailers across commercial LSOAs reveals that although these retailers have highest prevalence in the most deprived commercial neighbourhoods compared to their counterparts in affluent neighbourhoods, the prevalence is lower compared to the all area analysis. Although correlation and ANOVA support the evidence from the US that rather than deprived areas, financial retailers are more prevalent in moderately poor areas with high income inequalities (Burkey and Simkins, 2004; Gallmeyer and Roberts, 2009; Fowler et al., 2014;), stronger analysis from the logistic regression shows otherwise. This provides some evidence that across England, fringe banking and RTO retailers are not only concentrated in deprived areas, but they also seem to greatly favour highly deprived localities (Hill et al., 1998; Squires and O'Connor, 1998; Graves, 2003; Whysall, 2014), further confirming the results of the all area analysis.

6.2.2 FGRs and socio-economic deprivation

This study also explored the relationship between FGRs and SED in England. A major aim of this research was to carry out a comparative analysis of the location preferences of AASRs and FGRs. To carry out a comparative analysis, the location preferences for each of the retailers must be thoroughly analysed. Consequently, this sub-section discusses the results of the relationships between FGRs and SED in England. The hotspot analysis of FGRs shows a concentration of these retailers in deprived areas and around the commercial and historical centres in England. FGRs seem to show a comparatively even distribution. Further tests of correlation show that there is indeed a significant positive association between FGRs and area deprivation indicators. These findings are consistent with studies in Canada (; Smoyer-Tomic et al., 2006; Gould et al., 2012; Low and Qui, 2015;), the US (Sharkey and Horel, 2008; Raja et al., 2008), New Zealand (Pearce et al., 2008) and UK (Cummins and Macintyre, 1999;2002; Smith et al., 2009; Black et al., 2011)

To further investigate this, the results of the mean distribution and ANOVA between income, employment and education deprivation indicators revealed that FGRs have their highest presence in moderately deprived areas for income and education deprivation rather than in most deprived areas, and the mean differences between the outlets in these areas significantly differ. FGRs, furthermore, have highest presence in employment deprived areas. In addition, the results of the logistic regression show that although the FGRs have greater presence in the most deprived neighbourhoods compared to the most affluent neighbourhoods, mid-deprived communities have the best access across income, employment and education deprivation indicators. This corroborates findings in the UK and Canada and New Zealand (Larson and Gilliland, 2008; Black et al., 2012) and confirms evidence of a nonlinear relationship between FGRs and SED. These findings contradict similar empirical studies which found best food provisioning in the most deprived areas in Canada (Apparicio et al., 2007; Black et al., 2011) and the US (Zenk et al., 2005; Bower et al., 2014;). These results are, however, in congruence with Guy et al. (2004) in the UK, namely that, over time, there has been an increase in provisioning in deprived areas, although that study did note that above average areas seem to have better provisioning. Yet, Maguire et al. (2015), however, found no relationship between area socio-economic deprivation and FGRs. Thus, from this study, it is evidenced that FGRs are prevalent in mid deprived areas contrary to Cummins and Macintyre (1999; 2002).

From previous studies it was found that, although SED is a major determinant of FGR locations, town planning and exclusionary zoning regulations are also significant drivers of FGR locations (Black et al., 2011). In addition, food accessibility also varies across the urban/rural divide and different environmental contexts, as shown in the UK and the US (Smith et al., 2009; Bower et al., 2014). Furthermore, there seems to be evidence of inequalities in outlets even within deprived areas as seen from the mean differences. These concerns were echoed in a similar study by Guy et al. (2004), which concluded that even though provisioning increased in deprived areas, within some deprived areas accessibility was more limited. This suggests that commercialisation might be exerting an influence on the linkages between FGRs and SED.

This research accounted for commercialisation by considering only sampled areas with retail presence as against all areas. Results also revealed that the linkages observed between FGR locations and SED in commercial areas across England is contrary to the situation in all areas. Correlations show negative relationships between food retailers and income, employment and education deprived commercial areas. Furthermore, affluent commercial areas in England have the highest concentration of FGRs. What is more, the mean differences between the least and most deprived commercial areas are significantly different. In addition, the logistic regression shows highest prevalence of FGR outlets in affluent commercial areas compared to deprived commercial areas for income, employment and education indicators Showing that some deprived areas have poor FGR outlet provisioning. This reinforces the findings of similar studies in the UK (Clarke et al., 2002; Guy et al., 2004). More importantly, this study re-asserts the concerns raised by Guy et al. (2004) that although food provision has improved within deprived areas, within deprived areas there are still pockets of food deserts which are neglected compared to their affluent counterparts. These areas could likely be the historical commercial areas which have been worst hit by the ‘waves of decentralisation’ (Schiller, 1988) and store wars era (Wrigley, 1994), which resulted in the closure of many small and independent grocery retailers (Department of Health, 1991) and heralded in the era of vacant premises in the commercial deprived areas. These results are contrary to similar studies in the UK which found little or no linkages in SED and food outlets/provisioning (Smith et al., 2009; Maguire et al., 2015).

6.3 Comparison of FGRs and AASRs to SED

This section compares the similarities and differences between AASRs and FGRs based on the findings of the individual group of retailers and SED which were discussed in section 6.2. The insights that emerged from section 6.2 allow for a critical comparative investigation of the socio-economic drivers of FGR and AASR locations and identification of the key contextual underpinnings driving AASR locations. It further answers the research question:

> *'is there a relative concentration of AASRs in deprived neighbourhoods in England in comparison to FGRs?'*

Numerous sources have suggested that not only are gambling and financial retailers concentrated in deprived areas but that the concentration is deliberate and targeted in UK. Unfortunately, however, none have attempted to empirically examine the evidence across all AASR groups in the UK. Therefore, this section discusses the findings of the comparative analysis of the relationships between AASRs, FGRs and SED in England, in order to provide relevant insights to the question of deliberate targeting.

Comparative analysis of the hotspot maps shows several similarities in the spatial distribution of FGRs and AASRs. The spatial distribution of AASRs and FGRs shows concentration in major historical and regional commercial centres in England. These historical and regional industrialised areas also coincide with the most deprived areas in England. In addition, there is also a positive relationship between the two groups of retailers and SED in all areas. What is more, both groups of retailers have similar patterns (lowest distribution) in the least deprived areas. The analysis of the top 20 LSOAs shows that the majority of the LSOAs are in the most deprived deciles for both AASRs and FGRs. This further shows that there are some characteristics in these deprived LSOAs that favour location of both AASRs and FGRs. Consequently, this seemingly concentrated retail presence could well reflect that notion that deprived areas offer salient characteristics which in turn represent optimum location characteristics (i.e. close proximity of potential consumers and retailers, transport network and accessibility, co-location advantages, regulations and availability of vacant premises). This further resonates the importance of location in retailing and therefore brings to question the notion of targeting ascribed to gambling and financial retailers by critics (Graves, 2003; Stegman and Faris, 2003; Dyall, 2007; Portas, 2011). Undoubtedly, these AASRs offer controversial products and services. This, coupled with their seemingly unethical practices which expose the already vulnerable

populations in deprived communities to harm, might be responsible for the notion of targeting ascribed to these retailers.

Comparison of results of the analysis of means for all the areas also shows interesting patterns between the location preferences of AASRs and FGRs in England. The comparison of mean distribution in areas with similar deprivation characteristics shows that AASRs are mostly concentrated in the most deprived neighbourhoods, with a sharp decrease as income, education and employment deprivation reduces. In addition, the differences between AASRs along socio-economic gradients are significant between the most deprived, moderate and least deprived areas. In further justification of this, even the concentrations are significantly higher in the most deprived areas compared to the second most deprived areas. This is contrary to the location preferences of FGRs, with their highest concentration in mid-deprived areas especially for income and education indicators. In comparison, the differences between the means of outlets in income and education most deprived and mid-deprived areas are significantly different. For employment deprivation, although FGR outlets have higher means in the most deprived areas, the means in deprived and mid-deprived areas do not differ significantly, indicating an overall similar pattern within employment most deprived and mid-deprived areas. The regression results further show that the odds of presence of gambling and financial retailers in deprived neighbourhoods is more than three times compared to FGRs.

The above analysis is based on the results of the comparison of AASRs and FGRs in all areas in England. Taking the analysis further and looking at the comparison from the point of view of retail locations only (i.e. areas with optimum characteristics best suited for all types of retail formation) enables the accounting for the impact of commercialisation on these retailers' location preferences (FGRs and AASRs). The results thus show a striking difference in the location preferences of both groups of retailers. They reveal negative and positive associations between FGRs and AASRs respectively, with income, employment and education in deprived commercial areas. The conspicuous differences in the patterns of AASRs and FGRs strongly support the notion of targeting ascribed to these retailers by critics (Graves, 2003; Stegman and Faris, 2003).

This is somewhat different to the findings of Whysall (2014) which questioned the notion of targeting ascribed to some gambling retailers. Mean analysis also reveals that the higher the deprivation, the higher the observed AASR retail distribution, with the most deprived

commercial areas having the highest concentrations of these retailers. In addition, the mean differences between deprived and affluent commercial areas are highly significant, whereas the opposite is the situation for FGRs, with highest presence observed in the most affluent commercial areas. Interestingly, although the least deprived areas have the most outlets, there are no significant differences in the means of most deprived and affluent areas for employment and education deprivation indicators. In fact, only the mean difference in the 10% most deprived areas is significantly lower compared to the 10% least deprived areas, signifying a relatively even distribution across employment and education deprivation classification. For income deprivation, the mean is significantly lower in the most deprived commercial decile compared to all other deciles and highest in affluent deciles. In addition, the regression further reveals FGRs are more prevalent in affluent LSOAs, while AASRs are prevalent in the most deprived areas, showing that FGRs have abundant presence in high status neighbourhoods, raising concerns for public health in deprived areas.

Therefore, there are strong indications that, aside from the seemingly favourable characteristics of these deprived areas in terms of optimum location characteristics, there are other characteristics in these areas which seems to favour the location strategies of AASRs. The literature review (Zikmund-Fisher and Parker, 1999; Dyall and Hand, 2003; Stegman, 2007; Wardle et al., 2010) suggests that inhabitants of deprived communities provide strong demand for gambling and high-interest financial services based on the desire to improve their life circumstances. Clearly put, Hill and Stephens (1997) identified three key factors namely; exchange restriction, consequences of restriction and coping strategies. AS a result, the response to these factors provides a strong drive for the demand for AASRs. This demand might be the pull factor attracting these retailers. Consequently, although the location preferences of AASRs reflect the influence of patterns of historical urban development and industrialisation patterns as identified from the various methodologies, there is strong and convincing evidence that area socio-economic deprivation is a major factor driving their location strategies. This research provides strong circumstantial evidence which lends robust justification to the proposition that gambling and financial retailers deliberately target deprived communities in England.

6.4 Area socio-economic characteristics and retailers locations - Phase 2 study

This section discusses the results of Phase 2 of this research, which further explored the relationships between area SECs and AASR and FGR locations. Analysis of the first phase

involved using the income, employment and education domains of the Indices of Multiple Deprivation (2015), which are the composite indicators created from numerous but relatively related income, employment and education variables. In the UK, there is a dearth of literature on linkages between individual area socio-demographic and economic characteristics and retail location preference, especially for AASRs. Some studies have attempted this critically (e.g. Wardle et al., 2014), but did not model their effect on gambling provisioning. Another justification for this analysis was to unravel not only the complex results at national level, but also to disentangle some of the contradictory results obtained in the Phase 1 analysis. Therefore, a salient question remains: 'how do different individual area SECs impact on retail location preferences?'

In response to this, the second phase extends the results of the first phase by examining the linkages between different categories of area SECs, including family composition, minority ethnic groups, household housing tenure, age categories, national statistics socio-economic classification (NS-SeC), educational qualifications and car ownership drawn from the UK National Census (2011) and AASRs and FGRs. These socio-economic themes are in line with evidence from international and literature which found linkages between housing tenure (Graves, 2003; Burkey and Simkins, 2004), family composition (Burkey and Simkins, 2004; Gilland and Ross, 2005;), minority ethnic composition (Burkey and Simkins, 2004; Wheeler et al., 2006; Gallmeyer and Roberts, 2009; Cover et al., 2011; Fowler et al., 2014) age composition (Wheeler et al., 2006; Gallmeyer and Roberts, 2009), education qualifications (Gilland and Ross, 2005; Robitaille and Herjean, 2008; Burkey and Simkins, 2004; Fowler et al., 2014; Barth et al., 2015), car ownership and occupation status (Gilliland and Ross, 2005; Gallmeyer and Roberts, 2009) and AASR locations.

Similarly, the first phase of this thesis critically reviewed the relationship between gambling, financial, FGR locations and patterns of SED, and carried out a comparative analysis of the observed linkages between these retailers and SED in all lower super output areas (LSOAs) using the income, employment and education domains of the Indices of Multiple Deprivation in England. This second phase further extends the study by undertaking a comparative analysis of the linkages between FGR and AASR location preferences and area SECs mentioned in the previous paragraph. This city analysis at LSOA geography is important because it will help to understand if the situation uncovered England-wide is replicated at intra-city level. In addition, it will also reveal if similar relationships exist across a sample of cities. What is more, although the England wide analysis provides an overall picture of

the supply of retail outlets (AASRs and FGRs), for stakeholders to develop adequate responses rather than a one-policy fits all situations to address retail supply, a city analysis will help unravel local variations and aid formulation of tailored policies to address the issues.

To measure area socio-economic deprivation, this study employed the concept of geo-demographics which involves classifying areas based on their socio-economic and demographic characteristics of areas. This is discussed in the subsequent sub-sections.

6.4.1 Relationship between AASRs and socio-economic characteristics in Leeds, Nottingham and Bristol

This sub-section discusses the results of the correlations between gambling and financial outlets and the identified socio-economic themes in the three areas. The relevant socio-economic themes will be discussed thereafter.

6.4.1.1 Relationship between AASRs and socio-economic characteristics in Leeds, Nottingham and Bristol

Understanding the linkages between these retailers outlets and area SECs will help to understand how they drive gambling and financial retailers' location preferences, and in so doing, aid understanding of the seemingly complex relationships between the them.

In line with previous literature, overall, couple families, persons aged 45 - 64 and 65+, with higher education especially Level 2 qualifications, higher and professional occupations are negative correlates of gambling and financial retailers across all the cities (cf. Burkey and Simkins, 2004; Gallmeyer and Roberts, 2009; Wardle et al., 2014 Barth et al., 2015). Conversely, persons aged 18 - 24 and 25 - 44, minority ethnic characteristics, especially Black and Chinese persons and private renters, are positive correlates of AASRs overall (cf. Burkey and Simkins, 2004; Wheeler et al., 2006; Barth et al., 2015;). Owner occupiers are also negative correlates of AASRs, which in contrast to previous literature which found no significant relationship (Burkey and Simkins, 2004).

Never worked and unemployed persons, fulltime students and households with no car (a proxy for low income) are also strong positive correlates of AASRs. In general, the above are in line with the overall consensus that neighbourhood characteristics which are signifiers of low income and strong indicators of low SECs have a high likelihood of being strong correlates of AASRs (Robitaille and Herjean, 2008; Gallmeyer and Roberts, 2009; Cover et al., 2011; Wardle et al., 2014). Aside from this overall general pattern, the linkages between

AASRs and the various SECs further vary across the different cities and also across the different groups of retailers. In addition, the linkages with SECs are more pronounced in Leeds, compared to the other two cities.

6.4.2 Area socio-economic classification in Leeds, Nottingham and Bristol

This research further set out to measure area socio-economic deprivation by creating a geodemographic classification using variables linked to SED drawn from the existing literature. In addition, one of the objectives of this research was to create an area socio-economic classification for Leeds, Nottingham and Bristol, which would then be used to measure area deprivation, rather than using the indices of multiple deprivation data. A key advantage of this is that the classification is driven by area characteristics that have been identified as playing intrinsic roles in the demand for AASRs. In addition, more specific analyses rather than general deprivation measures are required to break down the complexities and contradictions in the results obtained in the first phase of the analysis. Furthermore, other strong determinants of retail locations such as minority ethnic characteristics and housing tenure, are not incorporated into the IMD. Therefore, this custom-built measure adequately depicts areas based on AASR services demand characteristics and salient characteristics with strong linkages to AASRs. This method is developed from the science of geodemographic classification which clusters areas based on similar characteristics (Harris et al., 2005).

The result of the classification was further validated by comparing it to the IMD 2015. Validation revealed that the classification performed relatively well and conformed to existing general area deprivation realities. The validation further supports the applicability and accuracy of the science of geodemography (Harris et al., 2005; Vickers, 2006). The most important contribution of geodemographics is that since it is solely rooted in consumer and lifestyle behaviour, a custom-built classification can help to uncover location preferences (Harris et al., 2005) as well as provide a valuable summary of area characteristics (Openshaw and Wymer, 1995). Hence, it would help to differentiate localities and unearth underlying peculiar consumer lifestyles driving retail location preference. Although, the method has been described as highly subjective (Openshaw and Gillard, 1978) and lacking strong statistical and theoretical background (Harris et al., 2005), its applicability and usefulness in detecting underlying phenomenal characteristics is not in question.

The geodemographic classification revealed salient area characteristics in the 3 areas. It grouped all the LSOAs in the three areas into four different clusters, namely ethnic cluster, student cluster, affluent cluster and socially underprivileged cluster. As their names apply, these characteristics typify these clusters. Generally, the suburbs of Leeds and Nottingham are mostly characterised by affluent LSOAs, while Bristol has a somewhat different distribution with its periphery and northern edge (coastal and docks area), typified by persons with no qualification. Interestingly, these clusters show clear socio-economic divides. The student cluster, which is typified by mostly students and private renters, is characterised by LSOAs around or near the centre of the three areas. In Bristol, this cluster also contains LSOAs with high proportions of persons in managerial and professional occupations. These LSOAs cut across the most deprived to least deprived deciles for the IMD, showing a combination of both affluent and deprived characteristics. In Leeds and Nottingham, these LSOAs are typically most deprived and mid-deprived deciles, while for Bristol almost half of the LSOAs are in the 50% least deprived deciles. The ethnic and socially underprivileged clusters, which are typified by a large presence of households with no car, persons with no qualifications, never worked and unemployed persons, Black ethnic minorities, are characterised by LSOAs classified as deprived based on the IMD 2015. Accordingly, these clusters contain the most deprived LSOAs in Leeds, Nottingham and Bristol. In contrast, the affluent cluster typified by persons in professional and higher managerial occupations are mostly characterised by LSOAs in the least deprived deciles.

6.4.3 Retailers (AASRs and FGRs) and area socio-economic classification in Leeds, Nottingham and Bristol

This subsection discusses the results of the distribution of retailers and the area socio-economic classification. It also discusses the linkages between gambling, financial and FGR outlets, and each of the clusters in the three cities. Understanding the linkages between these retailers outlets and area SECs will help to ascertain how they relate to each group of retailers location preferences.

The geographical distribution of AASRs and FGRs shows some somewhat similar patterns with high concentrations in the student clusters in Leeds, Nottingham and Bristol. This is also confirmed from the results of the KDE analysis in the three areas. In Leeds and Nottingham, these LSOAs are mostly deprived and mid-deprived LSOAs, while in Bristol, these LSOAs have mixed characteristics with some more affluent LSOAs included. These

areas are characterised by students, persons with no car and private renters in Leeds and Nottingham and a small proportion of managers and professionals in Bristol. This is also confirmed from the results of the KDE analysis in the 3 areas. These LSOAs have the highest concentration of both groups of retailers in the three areas, which is also evident in the mean distribution. Therefore, the mixed characteristics of these LSOAs and their strategic locations (city central or in close proximity to city centres) with good accessibility, might be the driving force that makes them viable locations for these groups of retailers. Despite these similarities, there are also striking differences in the distribution of these groups of retailers in this cluster. AASRs have more presence in these LSOAs in Leeds and Nottingham compared to FGRs, showing that there seems to be salient attractors which favour AASRs in these localities. This supports the arguments of apparent concentration and targeting of deprived communities by AASRs (Graves, 2003; Stegman and Farris, 2003; Dyall, 2007; Portas, 2011). In addition, the strategic locations of these LSOAs around inner city locations, which are characterised by abundant commercial properties and vacant premises, further offer attractions to these AASRs, especially financial retailers, showing that their location preference lies in the interplay of availability of premises and rules and regulations as well as neighbourhood SECs. This further confirms the findings of Cover et al. (2011) that the presence of commercial activities is a strong determinant of alternative financial service industries. These areas are also characterised by high income inequalities, which suggests that, rather than very poor areas, preference is given by these retailers to moderately poor areas with high income inequalities (Burkey and Simkins, 2004; Gallmeyer and Roberts, 2009; Fowler et al., 2014). Therefore, it is logically, to assume that these lenders seeking customers with some prospects to meet the loan obligations.

Affluent clusters, strongly characterised by least deprived LSOAs typified by high proportions of persons in managerial and higher professional occupations, have the lowest geographical distributions of gambling and financial retailers in Leeds, Nottingham and Bristol. The majority of these LSOAs are found in the suburbs, most especially for Leeds and Nottingham, which could account for their limited presence because most of the LSOAs would have very low population densities and are also classified as residential areas. Interestingly, the few LSOAs around the city centre and its periphery also have a sparse distribution of AASRs. Therefore, aside from the geographical location of these LSOAs, their affluent SECs might also be a major contributor to the seemingly few AASRs present, reinforcing similar studies which found low distribution of betting machines (Gilliland and

Ross, 2005; Wardle et al., 2014) and financial outlets (Graves, 2003) in affluent and low populated areas. However, in contrast, FGR patterns show a very different distribution in LSOAs within these clusters compared to AASRs, with FGRs having higher mean distribution in all affluent LSOAs across all three areas. Even in Bristol the cluster has the highest means compared to other clusters except for student cluster. This shows a preference of FGRs for relatively affluent areas, contrary to similar previous studies in the UK which found relatively better FGR provisioning in deprived areas or similar patterns of food retailers across different socio-economic classes (Cummins and Macintyre, 1999, 2002; Maguire et al., 2015).

Findings further reveal that the neighbourhoods in socially under privileged clusters in Leeds, Nottingham and Bristol are highly characterised by LSOAs with very deprived characteristics. The geographical distribution of these LSOAs also shows that they are situated around the periphery of the city centre in Leeds and Nottingham, while in Bristol, these areas are towards the outer areas and docks. These LSOAs are typified by very low car ownership, unemployed and people who have never worked as well as have a high supply of AASRs compared to the affluent and ethnic cluster. The deprived characteristics of these areas make them fertile ground for AASRs (Robitaille and Herjean, 2008; Cover et al., 2011; Wardle et al., 2014;). These deprived LSOAs also have relatively high distributions of FGRs and the affluent cluster has the highest mean of FGRs compared to all other clusters, except for the student clusters in Leeds and Nottingham. This finding on the geographical distribution of FGRs is similar to findings from similar studies which found evidence of good provisioning of supermarket in deprived areas (Clark et al., 2002; Pearce et al., 2007; Smoyer-Tomic et al., 2008), but contrary to others (Gould et al., 2012). Comparison of AASRs and FGRs distributions shows a greater presence of AASRs in these LSOAs. In addition, AASRs are not evenly distributed across these LSOAs, based on the relatively high standard deviations compared to FGRs.

Ethnic clusters are typified by a large presence of persons of African descent, households with no car who have never worked and are in long-term unemployment. These characteristics are signifiers of strong socio-economic deprivation. These LSOAs are also classified as the most deprived 30% based on the IMD classification, further underlining the extreme levels of area deprivation. These LSOAs have a large presence geographically within the inner cities in Leeds and Bristol and around the periphery of inner Nottingham (Nottingham City). The strong indicators of poverty, an intrinsic part of the area

configuration and the strategic location of these LSOAs, make them likely locations for AASRs due to an abundance of their demand drivers (McKernan et al., 2003; Collard and Hayes, 2010; Wardle et al., 2010). The mean distribution of AASRs further confirms this, with higher concentrations in Nottingham compared to the affluent and socially underprivileged clusters. It also has a higher supply compared to affluent LSOAs in Leeds. Findings further reveal that FGRs have the lowest presence in the LSOAs in these clusters across the three areas. Even LSOAs in the affluent cluster have a higher presence of food retailers. This suggests that the characteristics of these clusters offer less attractions, most particularly for FGRs. In addition, comparison of FGRs and AASRs shows a more pronounced presence of AASRs in these neighbourhoods.

To ascertain if the above patterns are statistically significant, the means of both FGRs and AASRs were analysed. The findings further show that there is a statistically significant difference in the mean of AASRs, gambling and financial outlets between different clusters. Post-hoc analysis further revealed that the LSOAs in the socially underprivileged cluster have a statistically significant higher mean for AASRs and gambling outlets in all areas, compared to only the affluent cluster and specifically in Leeds. The clusters in Leeds, Nottingham and Bristol are strongly characterised by LSOAs with very high deprivation characteristics. The affluent LSOAs, on the other hand, are characterised by least deprived LSOAs based on the IMD classification. This reinforces the findings of similar studies which discovered that gambling opportunities have significant concentrations in deprived areas as opposed to affluent areas in New Zealand (Wheeler et al., 2006; Dyall, 2007), Australia (Marshall and Baker, 2002), Canada (Wilson et al., 2006; Robitaille and Herjean 2008) and the UK (Wardle et al., 2014).

The socially underprivileged LSOAs are also typified by very low car ownership and more unemployed people who have never worked in the 3 areas, supporting the findings of studies which found prevalence of gambling opportunities in communities with high proportions of persons with low education (Gilland and Ross, 2005; Robitaille and Herjean, 2008). This thesis used households with no car as a proxy for low income revealing comparable results for similar studies in Canada and the UK (Robitaille and Herjean, 2008; Wardle et al., 2014) which discovered high availability of gambling machines in low income areas.

The findings are also in line with the literature highlighting that gambling retailers tend to be more prevalent in areas with higher proportions of unemployed persons (Pickernell et al.,

2013). Interestingly, these area SECs are also strong drivers of gambling demand (Coups et al., 1998; Wardle et al., 2010). These findings are contrary to the results of McMillen and Doran (2006), which found no significant concentrations of gaming machines in deprived areas in Australia. The affluent cluster on the other hand is typified by LSOAs highly characterised by persons in higher socio-economic classifications who are in professional and higher managerial occupations. This further supports the findings which highlighted that areas with lower proportions of people in managerial positions are high machine density zones (Wardle et al., 2014).

The analysis of means shows that there is a statistically significant difference in the mean of financial outlets across the four clusters for the 'all area' analysis, showing that the concentrations are significantly higher in one or more of the clusters. These clusters are patterned along a socio-economic gradient, with no qualification and ethnic clusters (representing high deprivation characteristics), student clusters (representing mixed characteristics, but relatively deprived) and affluent clusters. This supports evidence from international literature that area SECs influence the location preference of financial retailers (Li et al., 2009; Prager, 2009; Barth et al., 2015). Further post-hoc tests failed to show any significant difference in the means of financial outlets in various clusters, which is quite surprising. A cursory look at the post-hoc results revealed that the variances are relatively small, and a Games Howell post-hoc test usually requires relatively large variances to reveal significance because it controls for type 1 error (Keselman et al., 1978). Therefore, these non-significant results could be because of the relatively low density of financial retailers.

Findings of the post-hoc test show that, overall, there are statistically significant differences in the mean of FGR outlets for the combined analysis, with higher means in the student cluster compared to the ethnic cluster. This situation is also similar in Bristol. As noted, previous LSOAs in the student cluster have the highest mean across all clusters and, furthermore, have relatively deprived characteristics. These findings buttress evidence from the literature which confirms a high presence of FGRs in deprived areas internationally (Smoyer-Tomic et al., 2006; Smoyer-Tomic et al., 2008; Pearce et al., 2008; Raja et al. 2008; Gould et al., 2012) and in the UK (Cummins and Macintyre, 1999; 2002Smith et al., 2009; McDonald et al., 2009). In addition, these FGR concentrations do not significantly differ between the affluent neighbourhoods and the most deprived neighbourhoods (socially underprivileged and ethnic neighbourhoods) in Leeds, Nottingham or Bristol. This clearly supports comparable studies which found no linkages between socio-economic deprivation

and FGRs (Maguire et al., 2015). However, these findings do contrast evidence from some studies in the US (Boone-Heinonen et al., 2011; Bower at al., 2014) and the UK (Guy et al., 2004), which found best access in affluent areas.

In addition, even though LSOAs in the student and ethnic clusters are strategically located (city centre or in close proximity to city centres) with good accessibility, especially in Leeds and Nottingham, the ethnic cluster has low presence of FGRs. This further confirms the results of comparable studies which found that, although deprived areas seem to have good food provisioning, there are some pockets of deprived areas with limited food provisioning, confirming the notion of food deserts in some inner-city neighbourhoods (Larsen and Gilliland, 2008; Liu and Qiu, 2015). More importantly, this current study re-asserts the concerns raised by Guy et al. (2004) that, although food provision has improved within deprived areas, within deprived areas there are still pockets of food deserts which are neglected. This strong evidence further suggests that ethnic areas, especially areas with large proportions of Black ethnic minority communities, have poor FGR outlets provisioning, similar to findings in the US (Zenk et al., 2005). This study further identified that areas with high proportions of private renters have significantly higher FGRs, contrary to findings in the US (Somyer-Tomic et al.,2008).

6.4.4 Comparison of the similarities and differences in the location preferences of AASRS and FGRs from the area classification

Emerging empirical research has linked negative consequences to exposure and participating in gambling and high yield interest lenders and RTO. More importantly, the presence of AASRs are said to be contributors to damaging the already fragile environmental landscape in deprived areas. To address the notion of targeting, this research has compared the results of the linkages between AASRs and FGRs and area SECs in Leeds, Nottingham and Bristol. This comparison shows some similarities but also striking differences between the two groups of retailers location preferences.

From the results of the correlation analysis, the two groups of retailers have relatively similar relationships in terms of area distribution of private renters, owner occupiers, Chinese ethnic minority, age composition, Level 2 qualifications, no car households and persons in higher occupations (managers and professional and intermediate/small account owners). In addition, the mean distributions show very high distribution of these two groups of retailers in LSOAs

in the student clusters in Leeds, Nottingham and Bristol. This student cluster is mostly characterised by relatively deprived LSOAs in Leeds and Nottingham, although it is possible that geographical location (good accessibility and proximity to the city centre) is the major factor driving location preference for both groups of retailers. According to Ghosh and McLafferty (1982) and Current et al. (1990), location plays a central role in the success of any retailer. Therefore, retailers select optimal locations based on factors such as accessibility, parking spaces and footfall, among others. Consequently, it is very possible that these locations, which are within the city centres or in close proximity, offer strong attractions, rather than the area SECs. These questions the validity of the notion of targeting ascribed to gambling and financial retailers.

Comparison further shows that there seems to be a more pronounced linkage between AASRs, and SECs compared to FGRs. Correlation analysis shows that there are stronger positive and negative associations with AASRs with deprived and affluent characteristics respectively, compared to FGRs. AASRs also have far higher presence in the ethnic, student and socially underprivileged clusters compared to FGRs in these areas. These areas are characterised by a large presence of full-time students, households with no car, persons from the Black ethnic minority group, private renters, persons with no qualification, never worked/ long term unemployed persons and a low presence of persons in professional and higher managerial occupations. Furthermore, the concentrations are significant in socially underprivileged cluster (one of the most deprived clusters) compared to the affluent cluster. Contrastingly, FGRs have higher means in the affluent clusters strongly characterised by LSOAs with a large presence of persons in higher managerial and professional occupations compared to AASRs. In addition, FGRs only have a significantly higher mean in the deprived student clusters compared to ethnic clusters (both deprived clusters and no significant differences between the distribution of FGRs in the affluent and the most deprived clusters (no qualification and ethnic clusters).

This supports the notion that gambling and financial retailers are not only concentrated in deprived areas but that they might also be deliberately targeting these disadvantaged communities (Stegman and Faris, 2003; Graves, 2003) because of the seemingly high hard pressed characteristics of individuals in these neighbourhoods. This suggests that the same characteristics that underpin these AASR locations at the national level also seem to be the driving force behind their distribution when looking at the intra-urban level, although there

are differences within cities which underpin the importance of place in the distribution of AASRs.

6.4.5 Predictors of AASR and FGR location preferences

The results of the binary logistic regression between AASRs and FGRs and SECs show very interesting trends, with some salient similarities and differences between the predictors of the retailer presence. This section discusses the results of the bivariate logistic regression between AASRs, FGRs and area characteristics.

The findings suggest that area SECs play a significant role in the likelihood of the presence or absence of AASRs and FGRs. On one side, SECs with linkages with deprived SECs increase the odds of the likelihood of gambling, financial and food retailers. An increase in the distribution of private renters, persons of Chinese ethnic origin and households with no car, increases the odds of presence of these retailers in the three cities. Likewise, higher proportions of persons aged 45 – 64 and car ownership reduce the odds of the presence of these retailers. These findings re-enforce the results of similar studies which concluded that area SECs influence FGR and AASR location patterns, and areas which have high proportions of characteristics with strong linkages with high deprivation are fertile grounds for FGRs and AASRs, with the opposite for areas with low deprivation (Cummins and Macintyre, 1999, 2002; Gilliland and Ross, 2005; Gallmeyer and Roberts; 2009; Cover et al., 2011; Whysall, 2014; Wardle et al., 2014).

AASRs and FGRs also show salient differences in their location preferences. For AASRs, the effects of these SECs, even though similar for both sub-groups, are more pronounced with financial retailers, showing that the predictive power of socio-economic factors on location preferences of AASRs is far greater for financial retailers. Overall, AASRs show a more consistent and higher prevalence with low SECs compared to FGRs. For instance, area distribution of never worked/unemployed persons and socially renters which are very strong drivers of high socio-economic deprivation (Herbet, 1975; Bradshaw et al., 2004), have no significant effect on the likelihood of presence or absence of FGRs in the three areas. Contrastingly, these aforementioned characteristics strongly increase the odds of presence of AASRs. Likewise, high proportions of lone parent households, which is also a strong driver of deprivation (Bradshaw et al., 2004), reduce the odds of the likelihood of presence of FGRs. Additionally, the odds of absence of AASRs in areas with affluent characteristics

are far greater compared to FGRs, showing that FGRs do not systematically neglect deprived areas in UK (Cummins and Macintyre 1999, 2002).

Further comparison of the linkages between area SECs of FGRs to gambling retailers shows FGRs having stronger linkages with some low deprivation characteristics such as high proportions of Chinese ethnic minorities and young people (fulltime students), increasing the likelihood of FGRs compared to gambling retailers. From the area classification, ethnic minority areas and student areas are geographically located within the city centres and their peripheries, and, as explained earlier, these areas, although relatively deprived, have very attractive retail location characteristics which might be the driving force of FGRs in these locations.

6.4.6 Modelling the location preference of AASRs

The interpretation of the results of modelling the location preferences of gambling and financial retailers using a binomial logistic regression are discussed in this section. This study extends prior research by assessing the effects of socio-economic variables on the distribution of gambling payday lenders, pawn shops, high yield interest lenders and RTO outlets in three different cities in England. In addition, it developed four models to explain the salient predictors of AASRs. The adopted method allowed this research to identify the effects of all-important socio-economic characteristics as well as identify the effects of individual area characteristics on AASRs, rather than creating composites which would mask the effect of individual characteristics on the location preferences of these retailers. More importantly, these 4 final models were selected after rigorous statistical testing and combinations and are therefore all encompassing. Hence, any combination of the selected variables in whatsoever order will **only** yield one of proposed models. More importantly, the different models also help to show the subtle differences within the 3 cities.

Model 1 shows that area distribution of private renters, persons with no qualifications, and persons aged 25 – 44 are positive predictors of AASRs, while lone parent households are negative predictors, even though aged 25 – 44 is not a negative predictor of financial retailers. Suggesting that areas hosting these socio-economic segments of the populations are better suited for these retailers is consistent with other international research which found low education (Brukey and Simkins, 2004; Gilliland and Ross, 2005; Prager, 2009; Fowler et al., 2014) and renters (Graves, 2003) to be salient predictors of gambling and financial retailers'

location preferences, as well as being a catalyst fuelling demand (Collard and Hayes, 2010). The results regarding young adults is contrary to previous evidence which showed a prevalence of financial retailers in such areas (Prager, 2008) and this could be as a result of the different classification whereas Prager (2009) used aged 40 or less as against aged 25 – 44 used in this thesis. Interestingly, lone parent family and no qualification have become highly significant predictors of presence or absence of all AASRs respectively, which was not evident from the bivariate logistic regression. This highlights the value of multivariate analysis in uncovering the seemingly complex relationships in retail location preferences. In addition, the negative effect of distribution of lone parent households is contrary to findings of similar research (Gilliland and Ross, 2005), even after inclusion of education and housing tenure which is interesting, especially considering that single parenthood is a major driver of low socio-economic status (Bradshaw et al., 2004) and demand for financial retailers (Collard and Hayes, 2010). One reason for this could be that high proportions of single parents reside in core residential areas where planning policies limit commercial uses in England.

The results of model 2 show that from all the variables, only the distribution of households with no car, aged 25 – 44 and persons with Level 2 qualifications are significant predictors of AASRs, but their effects differ when looking at each retail group (gambling and financial). More importantly, no car households, which is a proxy for low income and poverty levels (two major driver of socio-economic inequality) increases the prevalence of these retailers. This echoes the results of international studies which employed multivariate regression analysis and revealed that financial retailers preferred low and moderately deprived income locations (Gallmeyer and Roberts, 2009; Fowler et al., 2014; Barth et al., 2015). The model results further indicate that even after adjusting for income, prevalence of young adults in neighbourhoods provides fertile ground for gambling retailers (combined analysis and Leeds), corroborating the results of model 1 and highlighting the influence of active populations on gambling locations. In contrast, high proportions of Level 2 qualifications is a strong predictor of an absence of gambling retailers. Considering that there is strong evidence of lower prevalence for gambling with higher education (Tan et al., 2010; Wardle et al., 2010) this result is not unexpected and in addition, this result regarding higher qualification further supports international results (Burkey and Simkins, 2004; Li et al., 2009; Barth et al., 2015).

Model 3 further evidences the influence of couple families as a negative predictor of both gambling and financial retailers, as well as AASRs overall. Similar to single parents, the geographical distribution of couple families might be the mitigating factor, as there is a high possibility that these demographic groups reside in residential locations with limited commercial spaces. Interestingly, with financial retailers, evidence from the literature (Pyper, 2007) suggested that couple families (especially those with dependents) were significantly more likely to patronise payday services, this research did not account for dependents. In addition, high proportions of persons aged 25 – 44 increases the likelihood of all AASRs, for all areas and in Leeds in particular, but after controlling for couple families, the effect becomes non-significant for each group of AASRs. Interestingly, the Indian/Pakistani/Bangladeshi ethnic group is a significant predictor of financial retailers and not gambling retailers. Evidence from the literature suggests that localities with high proportions of minority ethnic groups are favourable locations for financial retailers especially (Li et al., 2009; Barth et al., 2015). More precisely, Prager (2009) found a positive significant effect of Asian ethnic minority populations on locations of cheque cashers in US. This study did not find evidence of gambling retailers in areas with high distribution of IPBs. Emerging from this detailed analysis is that there might be a cultural/religious influence on demand for gambling among different ethnic groups.

Model 4 highlights the influences of areas with large populations of Ethnic minorities, never worked and long term unemployed and young adults play on the location preferences of AASRs. Each of these SECs positively influence the prevalence of both gambling and financial retailers in the three cities. This re-enforces evidence from similar studies which emphasised the importance of labour factors in the location preferences of these retailers (Fowler et al., 2014). The influences of minority ethnic groups and unemployment on socio-economic deprivation cannot be over emphasised. In the UK, ethnic minority is a major feature of socio-economic deprivation and more importantly, there is a large presence of ethnic minority residents (persons of Chinese ethnic origin) in the city centres within the 3 cities. Minority ethnic and unemployed groups have been identified as major drivers of patronage of AASRs (McKernan et al., 2003; Wardle et al., 2010). Therefore, this prevalence of AASRs in these locations could be the underlying SECs, emphasising the influences of socio-economic and ethnic minority indicators in spatial organisation of AASRs.

From the results, strong deprivation indicators and variables positively correlated with SED are strong predictors of AASRs compared to FGRs. This lends some very important elements

to the notion of targeting ascribed by critics of AASRs. Careful examination of the results indicates that there are areas which have high prevalence of deprivation characteristics that favour both AASRs and FGRs. Likewise, there are areas with high deprivation characteristics which favour neither AASRs nor FGRs. This pattern is particularly vivid in Bristol where a particular deprived cluster had no presence of financial retailers. This indicates that not only deprived characteristics attract these AASRs. Therefore, this results in no way ascribe that these deprived characteristics are the major drivers of location patterns of AASRs. Rather, they influence the location preferences of these AASRs.

6.5 Summary

This chapter has discussed the results of this thesis which has critically reviewed the relationships between alleged anti-social retailer (AASRs) locations and socio-economic deprivation (SED), and compared the observed relationships with those of food and grocery retailers (FGRs). This thesis has carried out a comparative analysis both at National level, as well as examining the relationships within three different cities with different deprivation characteristics. This chapter has not only discussed the linkages between FGRs and AASRs across different measures of deprivation but has also discussed the linkages across different SECs known to be strong signifiers of socio-economic status at neighbourhood level.

In addition, this chapter has not only discussed the results of this thesis, it has also interpreted and described the results in relation to previous literature. In addition, it has identified and explained new findings and developed understanding of the nature of the relationship between AASRs and SED. Income, employment and education deprivation are strong factors influencing the location patterns of AASRs in England. The prevalence of AASRs in these deprived income, education and employment neighbourhoods reduces as deprivation reduces. This shows a linear relationship between AASRs and the 3 deprivation indicators across England. Even after accounting for the effect of commercial tracts, the effect of these indicators remains unchanged. Examining each AASR group has shown that their prevalence across the deprivation classification for the three indicators are different, with financial retailers having very high prevalence compared to gambling retailers for all areas in England. After stratifying the retailers across commercial tracts only, the prevalence of financial retailers, although showing similar patterns (i.e. the higher the deprivation, the higher their prevalence), their occurrence reduced across the three deprivations indicators, while the prevalence of gambling retailers increased.

Comparison shows a different pattern to FGRs, with highest prevalence in moderately deprived neighbourhoods, followed by deprived areas. In addition, some relatively affluent areas have higher prevalence compared to the most deprived neighbourhoods across the three deprivation indicators. Furthermore, after examining the influence of available commercial tracts, a noticeable reversal was observed with the affluent commercial neighbourhoods having the highest prevalence of food retailers across two indicators (income and employment) and, as deprivation increases, the odds of presence reduces across commercial tracts. For education deprivation, the prevalence of FGRs is statistically similar across all classifications in England. This study further adds to the body of knowledge by attempting to account for the effect of commercialisation on the distribution of these AASRs, which has not previously been attempted in the UK.

Across all the cities, results of the analysis show very complex linkages between retail presence and SECs. In particular, the results show that there are deprived neighbourhoods, which have good accessibility and have strong presence of both AASRs and FGRs. In addition, there are some clusters with high proportions of ethnic minorities and unemployed persons that are very deprived that and have very low presence of both FGRs and AASRs, but AASRs are still more prevalent compared to FGRs. Furthermore, affluent LSOAs have the highest concentration of FGRs. The regression analysis also reveals that no car ownership, no education, Indian/Pakistani/Bangladeshi and Chinese minority ethnic groups, persons aged 25 -44, private renters, never-worked and unemployed are predictors of AASRs, whereas lone parent households, couple families, managers and professionals are significant predictors of absence of AASRs.

Finally, in the first phase evidence found financial retailers in the most deprived localities, but more localised analysis discovered that these retailers are not concentrated in some very deprived areas. Therefore, it can be concluded that although initial all-England analysis revealed important relationships, it did not conclusively address the questions of this research. The Phase 2 analysis, which focused on microscale analysis, unearthed and laid bare the complex and contradictory findings of the Phase 1 study, showing that detailed rigorous analysis is necessary to carefully disentangle the complex relationships between AASRs and SED.

Chapter 7

Summary, Overall Conclusions and Suggestions for Further Studies

7.1 Introduction

This thesis has investigated the location preferences of AASRs (gambling, pawn shops, payday loans and RTO retailers) in relation to socio-economic deprivation (SED) in England. The study adopted a very practical stance in order to understand retail location preferences by carrying out a detailed comparative analysis of the location preferences of AASRs and food and grocery retailers (FGRs) in relation to SED to investigate the allegations of targeting ascribed to gambling and financial retailers in England. To achieve this, the research adopted GIS and statistical techniques to explain the relationships between SED and the retail locations.

It also investigated the location preferences of both AASRs and FGRs vis-à-vis SED to determine how area deprivation impacts their location strategies. Then the research compared the location preferences of AASRs and FGRs to unravel similarities and differences between the aforementioned retail location preferences. The study also deconstructed SED by carrying out a systematic analysis of the relationship between identified socio-economic drivers of deprivation and these retail locations to understand how different SECs influence FGR and AASR location in England.

This study adopted the above strategies because of the on-going debates by critics and policy makers on the location strategies of AASRs. In the UK, critics opine that the location strategies of AASRs favour deprived communities and, in addition, contend that their prevalence in these impoverished communities is a deliberate effort aimed at exploiting the inhabitants. Unfortunately, this standpoint is informed by studies from other parts of the world and most studies in the UK studies are based on one sided analysis which mostly investigated gambling locations and deprivation. As yet, no study in the UK has carried out a detailed spatial analysis of the fringe banking and RTO sector in the UK. These gaps informed the research.

The broad aim of this research was to investigate the allegation of deliberate targeting of poor and vulnerable communities ascribed to AASRs by carrying out a comparative analysis of the location preferences of AASRs and FGRs using quantitative and geospatial techniques

in England and, at a more localised level, three selected cities in England, Leeds, Nottingham and Bristol.

To achieve this broad aim, this research adopts a two-phase analysis. The first phase objectives involved carrying out a critical comparative analysis of the location preferences of AASRs and FGRs and their linkages with SED in England. The second phase involved investigating similarities and differences between the AASR and FGR locations and salient SECs, which are not only strong drivers of SED but also drivers of demand for AASR services.

Each of these phases addressed a series of research questions, formulated into different sets of objectives. Therefore, this chapter summarises the research findings based on the research objectives and demonstrate how the objectives were achieved within the context of this thesis.

The chapter is divided into 4 sections. Section 7.2 reviews the research objectives, section 7.3 discusses the contribution to knowledge of this thesis and 7.4 outlines the implications for policy of each of the findings discussed in the discussion chapter (chapter 6). Section 7.4 also highlights the contribution of this research to knowledge and section 7.5 highlights the limitations of the study by critiquing of the research design and methods adopted. Section 7.6 offers an agenda for future research based on the limitations of this study. Finally, section 7.7 provides the concluding statement for this research.

7.2. Summary of research findings and implications

As highlighted in section 7.1, this study was carried out in two phases. Phases one and two undertook both a national and city-wide analysis, respectively, with each phase having clear and specific objectives. Discussion of the research findings also follows this pattern, with sub-section 7.2.1 summarising the research findings from chapter 4 while section 7.2.2 summarising the research findings from chapter 5. Section 7.3 summarising the implications of the results based on the discussion in chapter 6.

7.2.1 Summary of research findings and implications form the Phase 1 Study

This sub-section summarises the results of the first phase of the study, which was concerned with the location preferences of AASRs and FGRs in England and summarises its findings, based on the objectives for the Phase 1 study.

Objective 1: To explore the relationship between AASR locations and SED in England.

This objective was actualised in Chapter 4. The analysis in chapter 4 illustrates the relationship between AASRs and area SED in England. To achieve this, a Spearman correlation analysis was used to test if there is a significant relationship between AASRs and SED. This research excluded amusement and family entertainment centres because these locations are not primary gambling locations. Rather, gambling activities are offered as side attractions. Based on the definition of the Ministry of Housing, Communities and Local Government (MHCLG, 2012) in the NNPF, casinos are classified as city centre attractions. Another argument here is that these are essentially facilities for visitors/tourists, rather than local residents, and thus are unlikely to reflect local population characteristics. Therefore, casinos were also excluded from the analysis. To represent SED, rather than adopting the generic IMD2015, this study selected the income, employment and education deprivation domains which are contended to be strong factors impacting the location preferences of gambling, financial and FGR locations (Graves, 2003; Wheeler et al., 2006; Wardle et al., 2014). This research found positive linkages between AASRs and the 3 deprivation indicators in all LSOAs in England. More precisely, income, employment and education deprivation are strong correlates of gambling and financial retailers locations. After accounting for the influence of commercial tracts (land use zoning) by excluding all areas which have no retail presence (either FGRs, gambling or financial retailers), the results of this study still confirm a positive association, with income having the strongest positive association with AASR retail presence. This influence is strongest with financial retailers in England.

Objective 2: To confirm/validate whether there is a concentration of AASRs (i.e. gambling and fringe banking and rent-to-own) in disadvantaged neighbourhoods in England

Although this investigation revealed a broadly linear relationship between AASRs and SED, this is not a measure of concentration. Thus, to examine concentrations, this study carried out a hotspot analysis using the kernel density estimation (KDE) technique, which represents point features as a surface. This method clearly depicted the areas of high and low concentration. The hotspot map revealed clear concentration of AASRs (gambling and financial locations) in South East England, most especially London. Concentrations of gambling and financial outlets were also evident in areas around the West Midlands, as well

as in the North West, North East, West Yorkshire and various coastal locations in the South. Essentially, these concentrations appear to be in the more urbanised and traditional urban centres of England. Interestingly, these areas coincide with areas of high deprivation.

In addition, to understand if these concentrations are significant, a Welch one-way ANOVA was used to analyse the means of AASR outlets across income, employment and education deprivation. The results reveal that there is a significant concentration of financial and gambling outlets in both deprived commercial areas and all other deprived areas in England. Generally, as deprivation reduces, the concentration also reduces. This shows a clear pattern in the distribution of gambling and financial retailers locations in England. Across the three sets of deprivation deciles, this analysis revealed concentration in employment deprived areas (including commercial areas) to be the highest. To further understand the prevalence of gambling and financial businesses across different area deprivation characteristics, the study also carried out a binomial regression analysis between the effect of income, employment and education deprivation on the presence or absence of gambling and financial retailers (AASRs). The regression results further confirmed the prevalence of gambling and financial retailers in the most deprived neighbourhoods as well as in the most deprived commercial locations in England. Furthermore, as deprivation reduces, prevalence also reduces. As the odds ratio showed, the most deprived LSOAs have the highest likelihood of presence of AASRs. In particular, the odds of prevalence are highest for financial retailers compared to gambling retailers, showing that it is more likely for payday loan, pawn shops, RTOs and high yield interest lenders to locate in deprived localities.

Objective 3: To explore whether these concentrations are also found in food and grocery retailers (FGRs) locations in England.

The analysis of FGR location revealed very interesting patterns with the three deprivation indicators. The results of the correlations between their locations show positive linkages (i.e. the higher the deprivation, the more the FGR outlets across income, employment and education deprived communities in England). The hotspot maps further suggest that areas of high deprivation have the highest FGR presence in England. These high clusters are across different areas in England: London, West Yorkshire, the North West, the North East and some coastal locations. These areas are also historical industrial centres in England, and majorly affected by the economic recession.

To ascertain if there is a concentration of FGRs in these income, education and employment deprived areas, a one-way ANOVA was used to examine if there are significant differences in means across the different deciles. The analysis reveals that the most deprived communities in terms of income and education do not have the highest concentrations of FGRs. In contrast for employment deprivation there are no significant differences in the distribution of FGRs between the most and mid-deprived areas. Irrespective of this, however, the affluent localities have the lowest presence of FGRs. Regression analysis further confirms that FGRs are more prevalent in the mid-deprived deciles compared to the most deprived deciles, as shown in the regression analysis (i.e. the odds of presence of FGRs in most deprived deciles are lower compared to mid deprived deciles, but higher compared to the most affluent communities).

After accounting for the influence of commercial tracts by removing localities with neither presence of AASRs nor FGRs, the results reveal a very distinct pattern compared to the initial findings. Correlation analysis shows negative relationships between food retail outlets and income, employment and education deprivation in commercial zones. Furthermore, the means test (one-way ANOVA) further revealed significant differences in means of outlets across income, employment and education deprivation, with the least deprived income, employment and education commercial neighbourhoods having the highest presence of FGRs (i.e. best outlet presence in the most affluent commercial neighbourhoods). This pattern was further confirmed by the results of the regression analysis which indicated that the highest likelihood of presence of FGRs is in the least deprived commercial locations, and the higher the area deprivation of a commercial tract, the lower the prevalence of FGRs. Again, these results appear to differ significantly compared to AASRs.

Objective 4: To compare any similarities and differences in the relationships observed between the two groups of retailers (AASRs and FGRs) and SED in England

In summary, findings on similarities and differences between AASRs and FGRs location in England emerged from the insights gained from the individual analysis of the two retail groups, which showed the similarities and differences across all areas. One major similarity that emerged from the correlation and hotspot analysis of both retail groups across all localities in England is that FGRs and AASRs have presence in deprived localities in England. These areas have high proportions of unemployed and low-income persons with little or no education. Therefore, these deprived areas could be localities that offer greater

attractions in terms of demand, transportation networks and land values for food, gambling and financial retailers, as most of these areas are the traditional and historical commercial centres in England identified from the hotspot analysis.

As stated above, there are numerous differences in the location preferences of these two groups of retailers in England. The results of the analysis of means and regression show that financial and gambling retailers have higher concentrations and prevalence in deprived areas compared to FGRs. The odds of prevalence of gambling and financial outlets in income most deprived LSOAs is over 4 and 8 times, respectively, compared to FGRs. In employment most deprived areas, the likelihood of financial and gambling retailers is over 7 times and almost 3 times respectively, compared to FGRs. Furthermore, for education deprived neighbourhoods, the odds ratio of prevalence of gambling and financial retailers is more than double and 6 times compared to FGRs. Likewise, in moderately deprived areas where FGRs have the highest prevalence, comparison to the likelihood of AASRs (gambling and financial services) shows a higher odds ratio for the latter compared to the former. Therefore, although there are similarities, deeper analysis begins to show very strong and distinct differences, illustrating a very strong by AASRs for deprived areas.

Further comparison of the results shows that across highly deprived commercial income, employment and education localities, the location preferences of FGRs and AASRs have strong and striking differences. FGRs have their lowest prevalence in the most deprived commercial areas and, as the three socio-economic indicators improve across England, food outlets in commercial areas further improves. The situation is the opposite for financial and gambling retailers. Therefore, as AASRs are concentrated and prevalent in the most deprived areas, as well as commercial localities, while FGRs have better outlets provisioning in the least deprived commercial neighbourhoods, there is strong evidence that there might be an element of targeting as regards their location preferences. This is consistent with other ethically questionable aspects of their wider practices such as flouting regulations and failing to adhere to safer and ethical practices. On one hand, the targeting may simply mean that they are seeking their core customers and meeting consumer demands. On the other hand, it could be exploitative and arguably unethical if it is seen as targeting weak and vulnerable consumers, which is unacceptable. The findings, together with the above, clearly indicate a disparity between the spatial provisioning of retail outlets in deprived areas compared to their affluent communities, with the later having better access to favourable retail services. This supports the deprivation amplification theory which implies that deprived areas are

littered with unfavourable and unhealthy retail outlets. Another possible explanation for the dearth of these gambling and financial retailers in affluent areas is the 'not in my backyard' (NIMBY) syndrome. NIMBY implies that people often develop resistance to facilities which are believed to have negative consequences on their immediate environment (O'Hare, 1977; Dear, 1992). Hence, it is possible that these uses may be perceived as anti-social and excluded from more affluent areas through stronger resistance by more socially powerful residents.

7.2.2 Summary of research findings and implications for the Phase 2 Study

In order to achieve the objectives of Phase 2, the study adopted a different approach by examining the effect of individual area SECs (age, housing tenure, family composition, ethnicity, educational qualification, occupation type (NS-SEC)) identified as strong drivers of the location preferences of AASRs and FGRs. This phase progressed beyond reliance on the IMD 2015. For objectives 1 and 2 of the Phase 2 study, individual neighbourhood characteristics which were strong correlates of AASRs were identified and then used to build an area classification to measure deprivation. In addition to this, to further understand regional differences, the study selected 3 cities based on input from the England-wide study. From the England wide-study, concentrations in deprived areas cut across north, central and south regions. Therefore, selection of the areas for more detailed research was informed by this divide. Logically, any area selected needed to be a major city in England and this was accomplished by ensuring that all the cities selected belonged to the Core Cities group. The cities were also selected along a socio-economic spectrum. Finally, the selected cities were Leeds (North), Nottingham (Midlands) and Bristol (South).

Objective 1: To explore the relationship between socio-economic characteristics and AASR locations in Leeds, Nottingham and Bristol

Results show that area SECs have strong linkages with gambling and financial retailers. Generally, area characteristics which have strong linkages with low socio-economic status have positive relationships with AASRs together with its sub-groups (gambling and financial outlets) in all 3 cities, while SECs associated with high socio-economic status display negative correlates. Looking at all 3 areas, the positive interplay between these area characteristics - private renters, young adults (aged 18 – 24 and 25 - 44), households with no car, ethnic minorities (IPB, Black and Chinese) and full-time students - are similar. Likewise, the negative relationships between homeowners, couple families, adults (45 and above),

Level 2 qualifications, multiple car owners, persons in intermediate occupations are also similar across the three areas.

In Leeds, variables that show strongest positive association with gambling and financial locations are private renters, Black ethnic minority, persons aged 18 – 24, persons with no qualifications, households with no car and fulltime students. In contrast, owner occupiers, couple family households, persons aged 45 – 64, persons with level 2 qualifications, households with more than one car, persons in managerial, professional and intermediate occupations have negative associations with locations of AASRs and its subgroups.

In Nottingham, ethnic minorities, households with no car, young adults (18 – 24) and fulltime students show positive association, whereas homeowners, couple families and multiple car owners have negative association with AASRs. Finally, in Bristol, young adults (18 – 24) and private renters are in areas with high proportions of gambling and financial locations, while couple families and multiple car owners show negative associations. This shows very complex relationships emerging from this level of analysis and highlights that the influences of SECs are subtle across localities.

Objective 2: To explore whether these associations are also found for FGRs in Leeds, Nottingham and Bristol

Likewise, the association between FGR outlet provisioning and area SECs was also examined. Results shows that although negative and positive associations can be observed across area characteristics which are signifiers of high socio-economic and low socio-economic status, respectively, no single area characteristics has the same effect across all 3 areas. Looking at each city, in Leeds, positive associations are found in areas with high proportions of households with no car, ethnic minorities, young adults (18 – 24) and private renters, while negative associations are observed in areas characterised by high proportions of home owners, couple families, persons with Level 2 qualifications and multiple car ownership.

In Nottingham, positive association is only observed in areas with high proportions of private renters while negative relationships are found with high proportions of lone parents, couple families and Level 1 and Level 2 qualifications only. For Bristol, none of the area characteristics reveal any positive interplay with FGR locations, while areas with high proportions of area deprivation characteristics like lone parent families, uneducated persons

and low car ownership have either negative or no relationships with FGRs. This shows that food outlets in localities with these deprived characteristics is limited.

Objective 3: To develop an area classification map for Leeds, Nottingham and Bristol using socio-economic variables

To measure area deprivation across the 3 areas, this study used the concept of geodemographics, which involves the classification of areas based on similarities and differences. This technique was used to reduce the initial 33 SECs into 7 variables through a rigorous and systematic process driven by evidence from the literature review on drivers of deprivation and AASRs (McKernan et al., 2003; Minister's Strategic Unit, 2005; Wardle et al., 2010; Collard and Hayes, 2010). These salient area SECs are Black ethnic group, persons with no qualifications, full time students, private renters, households with no car, managers and professionals and never worked and long-term unemployed persons. These 7 characteristics were used thereafter to group all the LSOAs in Leeds, Nottingham and Bristol into 4 distinct clusters.

- **Ethnic Cluster:** This cluster is typified by British Black/Caribbean/African groups, households with no car, and never worked and long-term unemployed persons.
- **Student Cluster:** This cluster is characterised by fulltime students and private renters and no car households.
- **Affluent Cluster:** This cluster is categorised as the affluent due to high proportions professionals and persons in higher managerial occupations.
- **Socially underprivileged Cluster:** This cluster is typified by persons with no qualifications, households with no car and never worked and long-term unemployed persons typify these LSOAs.

These clusters were also validated against their respective IMD 2015 classification, which indicated that the cluster classification relatively matched the patterns of area deprivation in the 3 cities. From the classification it is evident that areas were differentiated along the lines of socio-economic classification and clearly identifies those LSOAs with clear high socio-economic status (affluent cluster). The validation further revealed that 95% of areas characterised by the ethnic cluster consists of LSOAs in deciles 1 and 2, the two most deprived deciles, showing that the cluster is the most deprived cluster. Interestingly, Bristol has only about 6%, Leeds 11.6% and Nottingham approximately 19% of their LSOAs in this cluster, clearly showing that Bristol is a relatively affluent city compared to the other two.

Objective 4: To compare the similarities and differences in the relationships between the locations of the 2 retail groups and socio-economic characteristics in Leeds, Nottingham and Bristol

To achieve this objective, the area classification maps created under the previous objective for each of the areas were used to indicate the level of socio-economic disadvantage in each of the LSOAs, and compared to the locations of grocers, gambling and financial retailers. Comparison showed a complex pattern, but with similarities and distinct differences across the different clusters in Leeds, Nottingham and Bristol.

Geographical analysis indicates high concentration of AASRs in student areas across the 3 cities. The affluent clusters have the least concentration of AASRs in Leeds and Nottingham, while in Bristol these areas have higher concentrations compared to the ethnic and socially underprivileged clusters, which are relatively deprived. Across Leeds and Bristol, the ethnic cluster, which comprises the most deprived LSOAs, contains the lowest concentrations of AASRs, while in Nottingham the socially underprivileged cluster, which also consist of relatively deprived LSOAs, have the lowest concentrations. Examining Leeds, Nottingham and Bristol as a single entity, across AASRs, LSOAs in the affluent and student cluster have the lowest and highest concentrations of AASRs as well as gambling and financial retailers.

ANOVA analysis further reveals that for all areas, there are significant differences in the means of all AASRs and gambling and financial locations across the 4 different clusters. In addition, in Leeds there are significant differences in the means across the 4 different clusters, whereas in Nottingham and Bristol, there are no significant differences in the means across the different socio-economic clusters. Overall, there is a socio-economic impact in the location of AASRs, and Leeds. Further post-hoc analysis shows that for all areas, AASRs and gambling retailers have significantly higher means in areas within socially underprivileged clusters compared to the affluent clusters (i.e. there is a concentration of AASRs in areas with low SECs compared to their counterparts in relatively affluent neighbourhoods). This pattern is also consistent with Leeds.

For FGRs, choropleth maps reveal that there is a concentration of outlets in the centre of Leeds, classified as ethnic and student clusters, and as distance from the city centre increases, a stronger presence of FGRs is observed within ethnic and socially underprivileged clusters. Likewise, the centre of Nottingham, classified mostly as students, ethnic and socially underprivileged clusters, again has a high presence of food retailers. The affluent LSOAs towards the north of Nottingham city also have a large presence of FGRs. In Bristol,

compared to the other 2 areas, there is a relatively even distribution across the different area socio-economic clusters. Analysis of means further reveals no statistical differences between the distribution of FGRs in Leeds and Nottingham across the 4 clusters. However, the distribution in Bristol shows that areas classified as student clusters have a statistically higher concentration of FGRs compared to those areas classified as ethnic and unemployed clusters, the most deprived areas in Bristol. For all areas, the areas classified as student clusters have a significantly high concentration of FGRs compared to the affluent and ethnic clusters only.

In addition, simple binomial logistic regression highlights similar patterns to those obtained from the test of association between area SECs and the distribution of FGRs and AASRs: SECs with strong linkages with high deprivation (i.e. private renters, British Chinese, households with no car) increase the likelihood of food, gambling and financial retailers across Leeds, Nottingham and Bristol. On the other hand, those characteristics with linkages to affluent socio-economic status (i.e. homeowners, couple families, persons aged 45 – 64 and persons in intermediate occupations) reduce the likelihood of FGRs and AASRs. Comparison further shows that the effects of the above-mentioned SECs are more pronounced and consistent predictors of the location preferences of AASRs compared to FGRs across all the cities.

Objective 5: To develop a synoptic neighbourhood model that best fits AASR locations using socio-economic variables in Leeds, Nottingham and Bristol.

This research also used a binomial logistic regression model to develop synoptic neighbourhood models that explain gambling and financial retail location preferences using salient SECs driven by evidence from the review of the literature (McKernan et al., 2003; Wardle et al., 2010, Collard and Hayes, 2010). In modelling the salient predictors of the spatial distribution of AASRs across the three cities, four different neighbourhood models were developed to counter the effect of multi-collinearity and omission of important area SECs. Model 1 indicated that area distribution of private renters, persons with no qualifications and young adults (person aged 25 – 44) and lone parent households are salient predictors of AASR location preferences. Area distribution of lone parent households reduces the odds of presence of AASRs, while private renters, persons with no qualifications and persons aged 25 – 44 increase the likelihood of the presence of AASRs, especially gambling retailers.

Model 2 indicated that a large proportion of households with no car is a strong positive predictor of AASRs, gambling and financial retailers in Leeds, Nottingham and Bristol, even

after controlling for persons with Level 2 Qualifications, British Chinese and persons aged 25 – 44. In addition, presence of ethnic minorities and persons aged 25 – 44 also increases the likelihood of the presence of AASRs, but their effects differ across the 3 areas, whereas presence of persons who possess high educational qualifications (Level 2 Qualifications) increases the odds of absence of AASRs, when looking at all the areas combined together.

Model 3 evidenced that couple families impact negatively on the location preferences of AASRs in Leeds, Nottingham and Bristol. Neighbourhoods with high representation of persons aged 25 – 44 and persons with no qualifications increase the likelihood of AASRs, even after controlling for couple families. Additionally, IPB groups and no qualifications increase the odds of presence of payday loans, pawn shops and RTOs. Model 4 further highlights that the presence of ethnic minority group, never worked/long term unemployed and young adults positively influences AASR locations.

7.3 Contributions to knowledge

This research contributes to the body of knowledge in several ways. Firstly, this study adopted a very practical stance to understand retail location preferences by carrying out a detailed comparative analysis of the location preferences of AASRs and FGRs in relation to SED, in order to investigate the notion of targeting ascribed to gambling and financial retailers in England. In addition, the study used GIS and statistical analysis to clearly understand retail location preferences and also adopted a robust comparative analysis. Unfortunately, previous research in the UK which supported the notion of deliberated concentration of AASRs in deprived neighbourhoods failed to carry out a comparative analysis of the observed patterns of location between AASRs and a more conventional group of retailers with ubiquitous demand across socio-economic variations. In addition, previous studies in the UK which attempted to address the notion of deliberate targeting by carrying out a comparative analysis also failed to examine the location of AASRs as a group. Rather, it examined the location patterns of different players, e.g. Ladbrokes or Corals, as single entities.

In the UK, critics have ascribed the spatial patterns of high yield interest lenders and fringe banks not only as being concentrated in deprived communities in England, but also deliberately targeting deprived communities, without carrying out any empirical research in the UK to arrive at this salient conclusion. Rather, evidence from studies in the US have

formed the basis for these notions. Accordingly, this study is the first to carry a detailed analysis of the relationship between the location of financial retailers (pawnshops, payday loans, high yield interest lenders and RTOs) and SED in England using rigorous geo-statistical analysis. This study provides concrete evidence to suggest that the location preferences of these financial retailers varies along socio-economic lines, with evidence of concentration in the deprived neighbourhoods in England.

In addition, to examine socio-economic deprivation, previous studies either adopted the IMD or only income deprivation when explaining the location patterns of AASRs in England. This study has extended previous research by not only examining the influences of income deprivation on retail location patterns, but also examining the role of education and employment deprivation in retail location preferences. From the results, there is clear evidence that income, education and employment derivation are also important correlates of retail location preferences. Furthermore, income and employment deprivation exert the greatest influences on AASR location.

Furthermore, no research in England has examined the spatial distribution of gambling and financial retailers within cities. The city-wide analysis in this study further extends previous studies by investigating the influences of individual area SECs on alleged anti-social and food and grocery retail locations. SECs are key indicators of their retail location preferences. In particular, deprived city centres such as those in Nottingham and Leeds with excellent accessibility, private renters and large proportions of students, are attractors of both FGRs and AASRs. In addition, there are some combinations of deprived area characteristics which offer powerful attractions to AASRs, while there are other deprived area characteristics which offer little or no attraction for retailers, most especially gambling and financial retailers. Hence, deprived area SECs alone do not adequately explain the location preferences of AASRs in England. This research study further contributes to knowledge by a) identifying that area characteristics such as private renters, households with car ownership, Chinese ethnic minority, never worked/unemployed persons, persons aged 25 – 44, lone parents, no qualifications and couple families are salient predictors of gambling and financial establishments and b) by modelling the effect of these characteristics on these retailers' location preferences.

There are also other contributions to knowledge here that are important in several key aspects. Firstly, a far more detailed and nuanced understanding of the location preferences of these

specific anti-social businesses has emerged. Secondly, it has become clear that subtle and yet complex differences in location preferences exist within and between the retail uses focused on here, signposting that generalised statements and policies regarding controversial retail uses may be overly simplistic. Thirdly, a body of statistical and geodemographic techniques and tools have been used which clearly indicate how, in future, more rigorous analysis of controversial location patterns may be evaluated.

7.4 Theoretical Contributions

From the results of this research, there are some theoretical implications that have been brought to the fore. An important finding which this research has brought to the fore is that the pattern of area socio-economic characteristics is a major spatial process resulting in the development of the existing retail structures i.e. the location patterns of both retail types either AASRs or FGRs are not only entrenched in, but also reflective of and sensitive to the characteristics of neighbourhoods. A major flaw in most retail location theories is that they do not account for this theme; indeed, some of the more prominent, such as central place theory, start from an assumption that consumers are all identical. This emphasises the need to continually seek for ways to incorporate area characteristics into retail models and theories as well as refining and expanding the parameters of the spatial interaction model types to incorporate more area parameters. In addition, a clear finding is that conceptualisations of retail location theories that fail to incorporate the effects of planning policies are of limited applicability. This is because this research has also unearthed the underlying realities that human decisions, on both demand and supply sides, are impacted by the wider social and political processes (Brown, 1992).

Retail location is a complex process and characteristics such as accessibility, proximity to other retail types, attractiveness of destinations, and intervening opportunities such as constraints on mobility, competition and travel distances continue to impact supply and demand side characteristics. In addition, this research brings to fore the notion of agglomeration in retail trade. It is very clear that both similar and different retail establishments benefit from clustering together, as has been long recognised (Nelson, 1958; Brown, 1992). Thereby, the notion that agglomeration of a particular retail group is a ploy to deliberately target segments of the population might be inaccurate. Indeed, alternative explanations for clustering clearly exist, such as the business benefits that may result from it (e.g. easing consumer comparisons) or as a consequence of planning policies. So

clustering does not necessarily indicate targeting. Therefore, this study further contributes to extant literatures by emphasising the importance of agglomeration in any study on retail location preferences, while also highlighting the shortcomings of conventional retail location theories when addressing issues with a clear socio-economic dimension.

7.5 Implications for policy

The results of the two phases in this research have numerous implications. The results of the Phase 1 (England wide study) show very important implications for policy. Firstly, the location of gambling, financial and food retailers show some similar patterns, with concentrations in the historical and traditional hubs of England, clearly depicting that their location preferences reflect the patterns of retail opportunities in England. These historical and traditional hubs in the UK have exceptional accessibility and good population mix, as well as the availability of commercial premises (especially given the current problems of UK high street retailing), all of which are very strong considerations in optimal retail location selection. In addition, for AASRs, the bottom 20 LSOAs are also characterised by mostly deprived characteristics, especially for financial retailers, further supporting the notion that not all deprived areas have large presence of AASRs. In general, policy formulation without adequate consideration for the overall existing patterns of retail provisioning might lead to inappropriate planning solutions. Therefore, careful consideration needs to be given before attributing the notion of deliberate targeting to the prevailing patterns of AASR establishments.

Further evidence reveals that FGRs are typically most prevalent in the mid-deprived areas compared to the most deprived and least deprived areas. This situation suggests that deprived commercial areas which cater for the underprivileged neighbourhoods are underserved by FGRs, introducing very serious health and dietary challenges and increasing health inequality in areas which have also been at the receiving end of budget cuts and austerity measures. Even after accounting for the influence of commercialisation, this study found that deprived commercial tracts have the least food outlets (supermarkets and multiples) while their counterparts in less deprived and affluent areas have better provision.

The systematic absence of FGRs in deprived commercial locations in England might be due to the effect of the different waves of decentralisation which have encouraged the move by retailers, especially FGRs, to exit the historical and traditional town centres and build out-

of-town centres. In addition, the 1996 Planning Policy Guidance (PPG6, 1996), which further discouraged out of store facilities, had an unintended result by leading to the closure of shops in the already unattractive, deprived commercial centres as against attractive localities. In addition, the failure of the PPG6 amendments to attract these retailers to unattractive centres left the deprived town centres in a worse position. Hence, if the underprivileged are underserved by supermarkets and multiples, these communities will have no other choice but to patronise small local grocery shops which are not only more expensive but also offer limited and less healthy options. Hence, there is the need for the adoption of a pro-active measure to tackle food inequality in deprived Urban England to prevent dietary challenges.

The idea adopted in the past of introducing a superstore with large floor spaces might not adequately address these issues. Rather, strategically encouraging medium-sized stores from different retailers would not only pose a minimal displacement effect on the existing food infrastructure (Clarke et al., 2002; Raja et al., 2008), but also ensure wider food choices (a very important concept in food provisioning) in these deprived localities (Clarke et al., 2004). Although critics might question the method of measurement for food provisioning in this thesis, retail outlets were used in preference to floor spaces for measuring because this study is a comparative analysis and comparing different measures would introduce bias. In addition, deprived communities might have greater provision of FGR floor space because of a large presence of superstores. These stores can cause the closure of pre-existing stores, which only further worsens food provisioning especially food options in general (Clarke et al., 2002).

Comparison of AASRs and FGRs in Phase 1 shows that irrespective of the similarities between their location preferences as explained in section 7.2, AASRs (gambling and financial establishments) are not only concentrated in deprived communities, but their prevalence is highest in deprived commercial areas. This suggests that their location varies in line with socio-economic deprivation. Thus, these patterns of gambling and financial retailers need to be given serious attention because of the inherent risks these retail services pose to individuals, especially vulnerable populations who are more strongly represented in deprived localities. These patterns can exacerbate pathological gambling, chronic indebtedness and unsustainable lending from unethical practices. Consequently, responsible gambling and lending policies should be enacted, and regulatory bodies should ensure adequate enforcement and strict adherence. Aside from the recently enacted price cap on

play on gaming machines in gambling establishments, local authorities and regulatory agencies need to evaluate the present distribution of gambling establishments and ensure that future requests for gambling permissions are rigorously scrutinised in order to protect vulnerable populations.

The Phase 2 study also generated numerous implications for policy. The results, based on the city scale analysis, reveal that although the regional analysis showed that AASRs are concentrated in deprived areas, not all deprived areas are preferential locations for gambling and financial retailers. For instance, the ethnic cluster, which is the most deprived cluster, has the lowest alleged anti-social and food retail presence across Nottingham and Leeds, while it has no financial outlets in Bristol. Therefore, although AASRs have more presence in these clusters compared to FGRs, it can still be said that neighbourhoods in these clusters offer only limited attractions to AASRs. Hence, since some of the most deprived communities have the lowest AASR presence, this clearly illustrates that deprivation alone does not adequately explain the location preferences of gambling and financial retailers. This clearly indicates that developing policies to tackle the scourge of gambling and financial services by considering deprivation in isolation would not adequately address the root causes. Thus, policy formation to address the location patterns of AASRs should be developed at local level and different strategies should be developed for different areas after careful consideration of local patterns, as against developing a 'one policy fits all' approach. While recent policy shifts have undoubtedly addressed some of the more troubling aspects of gambling (e.g. limiting FOBT stakes) and high yield interest loans (e.g. interest and rollover of loan caps), the evidence provided by this thesis supporting targeting suggests a need for continued vigilance.

The Phase 2 results also echo some of the results of the Phase 1 study. For example, student areas have the highest presence of FGRs, gambling and financial retailers. These areas are typified by students, private renters and households with no car. Interestingly, these neighbourhoods are geographically located around the centre of the cities, especially areas with good transportation facilities, interconnectivity and excellent footfall and draw catchment from other neighbourhoods due to the mixed land use in these areas. This clearly reiterates that AASR locations are driven by salient characteristics that also drive conventional retail location preferences. Policy on high street decline arguably emphasises the need for occupancy to reduce vacant business premises without much thought for local impact by the occupiers. Hence, if proposed uses are linked to anti-social or controversial

businesses, it is necessary to strengthen planning controls (e.g. make it difficult for property renters to switch class). Presently, betting shops and high yield interest lenders are in a class which also includes theatres, petrol stations and taxi business (Planning Portal, 2019). Therefore, changing from general shops etc to betting shops and high yield interest lenders needs to be treated more cautiously by planning authorities. Notwithstanding, however, perhaps the most important lesson for policy makers from this study is that future policy should be based on sound, detailed and statistically validated evidence using rigorous methodology such as the methodology that has been employed for this thesis.

7.6 Limitations of the research and direction for future studies

This study used the physical addresses of outlets expressed as a function of their neighbourhood population to estimate AASR and FGR provisioning in the study area. Therefore, it assumed that each retail location (gambling, financial and FGRs) had the same trade area, which introduces bias because the trade area of a convenience store is different compared to a superstore and/or compared to a betting shop. In addition, the catchment area of a retail store refers to the surrounding areas in which the store draws its trade. This concept has attracted numerous research studies (Huff, 1964; Berry 1967; Fotheringham, 1983; Singleton et al., 2016; Waddington et al., 2018), and in attempting to delineate catchment areas, simple methods such as creating buffers with distances and complex methods developed into retail prediction models. Extant literature in gambling, financial and FGRs have used different buffer distances (Brennan et al., 2011; Pearce et al., 2008; Lamichhane et al., 2013; Wardle et al., 2014;). This study would have attempted to carry out a further catchment area analysis, but based on the comparative analysis, adopting different/similar catchment areas for the different kinds of retailer might have introduced bias into the analysis. This is because, ultimately, each outlet is unique, in size, accessibility, attractions, local competition, management and so forth. Hence, any generalised catchment area size creates intrinsic problems.

Another issue is the timing of this thesis. The timing coincides with a period of high street decline in the UK. A recent publication by the ONS[9] identified that, although the high street has grown over the past 7 years, the growth rate is lower compared to previous rates.

[9] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/highstreetsingreatbritain/2019-06-06#businesses-and-employment-on-the-high-street

Therefore, future studies could examine how the decline of the high street has impacted on controversial uses such as gambling and financial businesses. The various data set employed for the study also introduced some limitations. Firstly, the gambling data adopted for the research was sourced from the GC and dated 2015. The FGR location was sourced from Geolytix April 2016 and the financial data set (pawnshops, high yield interest lenders, and RTO) were obtained from retailers' websites up until October 2016. Likewise, the Phase 2 study employed SECs from the 2011 census. These mismatches of data from different time points, especially between the census and retail location data, even though unavoidable, are a limitation of the study. In addition, although the regression model for both Phase 1 and Phase 2 modelled the effect of area deprivation and different area SECs in an explanatory fashion, it did not incorporate a multi-level approach. Thus, a multi-level approach may further uncover salient characteristics for this kind of research (Hox, 1998; Hox et al., 2017). Unfortunately, the time limit for this research did not permit this level of analysis. Irrespective, the city level approach adopted by this research further helped to tackle this limitation.

Another limitation is the issue of generalisation, often referred to as the modifiable area unit problem (Openshaw, 1984; Fotheringham, et al., 1991; Nelson and Brewer, 2017). Modifiable area unit problem (MAUP) has been shown to affect the reliability of analysis drawn from aggregation of area data to different geographies, such as census data. MAUP asserts that the geographical extent (i.e. spatial scales) introduces dissimilar effects on reliability and validity of conclusion because area characteristics lack the capability to provide accurate information about actual individual characteristics (Openshaw, 1984). The only workable solution to MAUP is using data at the lowest geography in analysis (Tuson et al., 2019). Hence this study utilised the lowest geography (LSOA) appropriate for this research theme to reduce the effect of MAUP.

7.7 Further Research

There are several different possibilities for future research which would further augment the findings of this thesis. As identified in the limitations section, future research could develop a method to incorporate catchment area analysis suitable for a robust comparative analysis, taking into cognisance that different retail groups have different catchment areas. This might be better achieved by comparing gambling and financial retailers with more comparable retailers such as credit unions and mainstream financial retailers to further aid understanding

of the seemingly complex relationships with area characteristics. These alternative datasets were not available at the time of this research and efforts to collect this dataset proved very difficult given the time frame of this research. Furthermore, this research also identified that the location patterns of all retail types either AASRs or FGRs are not only entrenched in, but also reflective of and sensitive to the characteristics of neighbourhoods. However, from a locational perspective there still remains the problem of causality i.e. does the social structure of deprived areas attract these uses (especially AASRs) or are they being excluded from other areas as a result of the NIMBY effects? Also, the fact that both groups of retailers show these characteristics does not automatically mean the causes are the same. Similar outcomes can result from different causes. Methodologically, this research did not address causality. Therefore, the longitudinal study suggested above might help to address these important aspects.

Future research could also improve the results of this research by examining the impact of commercialisation and accessibility on the location preferences of these retailers. AASR retail location preferences can be linked with data on residential planning policies, land use classification, transport links, accessibility measures and different location attractiveness combined with neighbourhood statistics to further understand the interaction between them. In addition, a longitudinal approach could be used to examine the changes in AASRs and socio-economic deprivation to identify and understand the trends in the provision of AASRs over a period, using the databases constructed for this thesis. This would further help to unravel the concept of deliberate targeting ascribed to gambling and financial retailers and the issue of causality, which this research could not appropriately justify due to lack of a longitudinal dataset. In addition, the timing of this research also coincides with a period of policy shifts which have reduced the amount of bet per stake on FOBTs in the gambling industry. It would be especially interesting to track the impact of these recent policy changes vis-a-vis AASRs by repeating some of these analyses at a future date, even though isolating policy impacts from other contextual dynamics may be difficult.

In addition, future research could move the results of this thesis forward by going further to examine the effects of these concentrations of AASRs in deprived communities, especially with regards to crime in the UK as the review of the literature found linkages between crime locations and fringe banking locations in North America (Kubrin et al., 2011). Likewise, linkages between gambling and pathological gambling has also been explored (Wheeler et al., 2006) in Australia. Therefore, further research could attempt to quantify the spatial effect

of gambling and financial retailers on different crime types in England, as there is a dearth of literature in this research area. Finally, as indicated in previous chapters, this study focused on mostly big multiple and some independent grocers, and it did not include ethnic grocery supermarket provisioning such as Chinese supermarkets, Indian/Pakistani groceries, Indian delicatessens, African supermarkets, etc. Therefore, it will be interesting for future studies to examine how the inclusion of these forms of food retailing might affect the patterns observed in this study, as well as wider features of these outlets.

7.8 Concluding statement

This research sets out to critically analyse the spatial characteristics of gambling and high yield interest financial lenders to ascertain if their patterns of location reflect concentration in deprived areas, and if this concentration reflects a systematic attempt to target impoverished and deprived communities in England. Prior to this research, the notion of deliberate targeting of deprived communities had not been critically examined in the UK. Hence, this research adopted different rigorous geo-statistical analysis to achieve that and carried out a further comparative analysis by comparing their location preferences to that of another conventional retail group (FRGs) with more ubiquitous demand across the socio-economic spectrum. This research identified very complex and interwoven relationship between SED, FGRs and AASRs with some similarities but very striking differences.

Similarities reveal that the location preferences of these 2 group of retailers reflects the prevailing historical urban formation, with concentration in traditional urban centres in England. Unfortunately, these traditional centres were badly hit by the economic recession and hence their communities are highly deprived. The complex and more advanced analyses also reveal salient differences in their location patterns. In particular, AASRs are prevalent in deprived areas, even after examining the effect of commercialisation, whereas FGRs are more prevalent in moderately deprived neighbourhoods and in the most affluent commercial tracts. This reveals a very important issue, namely that, other than supply factors, there are other factors that are influencing the concentration of AASRs in deprived areas. This is because, irrespective of the fact that deprived commercial tracts have abundant vacant premises, FGRs are not prevalent in these localities. Hence, the seemingly deprived characteristics abundant in these locations which drive demand for AASRs might be a major pull factor in the location preferences of AASRs.

The abundant presence of AASRs in deprived areas might also be a result of the identity place attachment and sense of community. According to Manzo and Perkins (2006), higher levels of community bond, attachment and sense of belonging increase social cohesion and bring about active participation in community development and planning. However, deprived areas also have high levels of migrant populations, individuals and households encountering multiple forms of deprivation. Not only that, a high proportion of households are usually renters with high turnover rates. Consequently, there is likely to be very low sense of belonging and emotional attachment in these neighbourhoods which would hinder positive community activities trying to influence the spatial structures in their immediate environment. Hence, proliferation of gambling and financial retailers may result.

Other salient findings from complex analysis from this thesis indicate that low educational standard is a very strong predictor of AASR locations. More importantly, neighbourhoods with high proportions of persons with no educational qualifications increase the prevalence of AASRs, especially financial outlets in Leeds, Bristol and Nottingham from the multivariate logistic regression. Interestingly, initial bivariate associations show no significant relationship between AASRs and no educational qualifications. In addition, the England-wide study found that the education deprivation domain had the least effect on AASRs and gambling retailers. This further emphasise that, sometimes, composite measures can mask the effect of individual variables, further re-enforcing the stance of this research to adopt individual area characteristics (census data) alongside composite measures.

Furthermore, different neighbourhood characteristics exert dynamic influences on retail location preferences, as can be seen from the city-scale analyses. Irrespective of the similarities in the overall effect of low SECs, the effect of individual characteristics varies across Leeds, Nottingham and Bristol, emphasising the importance of place in the factors that influence retail location strategies. Other relevant points relating to this thesis are that no research on gambling and financial provisioning in the UK has transcended the research from national level to look at different cities in order to further confirm the major factors impacting location preference. In addition, no study in the UK has carried out a holistic comparison of gambling, financial retail locations to include a more ubiquitous retail group to further unravel the complexities of their location strategies. Furthermore, no study has carried out a detailed spatial exploration of the geography of fringe banking, payday loans and rent-to-own in the UK. The influence of minority ethnic groups on retail location preference, especially gambling and financial retailers, are not similar. A large presence of

Chinese minority ethic area characteristics is a strong positive predictor of financial and gambling retailers, while Indian/Pakistani/Bangladeshi is only a positive predictor of FGRs and financial retailers. This might be an indicator of the influence of religious and cultural differences on gambling and financial retail locations.

Overall, this thesis has demonstrated the complexity and subtlety of micro-location retail decisions and a clear need for detailed and rigorous analysis to fully understand the challenging controversial issues that surround uses like gambling and high yield interest lending. Inevitably, it has not been able to answer all the questions raised by all such usage, but it has surely increased understanding of these socially important issues and illustrated how such understanding requires objective and rigorous research to underpin it.

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Appendix

Appendix 1 – Correlations and ANOVA

a) Spearman correlation co-efficient for AASRs and FGRs and income, employment and education deprivation for only LSOAs with respective retailer's presence.

Spearman's rho		RFGRs	RAASRs	RGamb	RFin
IncomeR	Correlation Coefficient	.054**	.076**	.056**	.173**
	N	**7736**	**5572**	**5502**	**662**
EmploymentR	Correlation Coefficient	.089**	.108**	.097**	.219**
	N	**7736**	**5572**	**5502**	**662**
EducationR	Correlation Coefficient	.052**	.058**	.053**	.178**
	N	**7736**	**5572**	**5502**	**662**

**. Correlation is significant at p < 0.001 level (2-tailed).
N = number of LSOAs
R = Rank of all outlets per '000 persons

b) Welch ANOVA for all retailers' outlets per '000 and income, employment and education domain deciles for only LSOAs with respective retailer's presence.

Deprivation Domain	Retailer	Statistica	df1	df2	Sig.
Income	FGRs	8.873	9	3025.942	.000
	AASRs	10.160	9	1641.239	.000
	Gambling	7.395	9	1611.609	.000
	Financial	4.922	9	111.899	.000
Employment	FGRs	10.094	9	3083.602	.000
	AASRs	9.956	9	1835.442	.000
	Gambling	8.565	9	1814.622	.000
	Financial	4.445	9	139.654	.000
Education	FGRs	3.912	9	3099.734	.000
	AASRs	5.908	9	2074.363	.000
	Gambling	4.785	9	2041.953	.000
	Financial	5.600	9	190.038	.000

c) Mean of outlets per ‘000 persons and income deprivation domain for only LSOAs with respective retailer’s presence.

Retailers	Decile	LSOAs	Mean	Std. dev.
	1	696	0.9444	0.62956
	2	854	0.9278	0.58681
	3	899	0.8916	0.53657
	4	942	0.9045	0.54051
	5	937	0.8664	0.52256
FGRs	6	831	0.837	0.48178
	7	730	0.819	0.42265
	8	680	0.8292	0.51182
	9	611	0.7661	0.38783
	10	556	0.8539	1.05477
	Total	**7736**	**0.868**	**0.57833**
	1	885	1.6090	2.12538
	2	866	1.4161	1.86555
	3	809	1.3637	1.52680
	4	743	1.2917	1.53153
	5	650	1.1786	1.14340
AASR	6	479	1.0717	1.37996
	7	419	1.0384	1.03729
	8	308	1.0887	1.75227
	9	220	.9540	.84093
	10	193	1.4297	2.99429
	Total	**5572**	**1.3010**	**1.68733**
	1	876	1.3704	1.65483
	2	855	1.2517	1.46379
	3	795	1.2326	1.23642
	4	733	1.1754	1.24953
	5	644	1.0938	.94590
Gambling	6	473	1.0127	1.06765
	7	414	.9812	.88054
	8	305	1.0267	1.33070
	9	216	.9313	.75483
	10	191	1.3329	2.66649
	Total	**5502**	**1.1760**	**1.35672**
	1	156	1.4330	1.00585
	2	127	1.2297	.92478
	3	123	1.0030	.71986
	4	88	1.1162	.72743
	5	65	.9488	.55691
Financial	6	26	1.3217	1.15557
	7	30	.9623	.58434
	8	18	1.2326	1.62334
	9	12	.7277	.30547
	10	17	1.2552	1.37048
	Total	**662**	**1.1759**	**.89996**

d) Mean of outlets per ‘000 persons and employment deprivation domain for only LSOAs with respective retailer’s presence.

Retailers	Decile	LSOAs	Mean	Std. dev.
FGRs	1	779	1.0108	.67152
	2	815	.9010	.53343
	3	861	.9048	.55310
	4	880	.8662	.48874
	5	858	.8569	.51439
	6	816	.8448	.50577
	7	785	.8134	.42736
	8	671	.7852	.37738
	9	623	.8045	.57503
	10	648	.8657	.98217
	Total	**7736**	**.8680**	**.57833**
AASR	1	937	1.7851	2.39098
	2	782	1.2929	1.46728
	3	742	1.3165	1.49727
	4	736	1.2291	1.36579
	5	577	1.1355	1.14090
	6	498	1.1449	1.48745
	7	410	1.0862	1.17621
	8	339	.9616	1.01889
	9	269	1.1444	1.84505
	10	282	1.3453	2.53193
	Total	**5572**	**1.3010**	**1.68733**
Gambling	1	928	1.5157	1.85058
	2	769	1.1609	1.17131
	3	731	1.1992	1.24283
	4	727	1.1138	1.09573
	5	567	1.0584	.95903
	6	495	1.0617	1.14741
	7	404	1.0309	1.00785
	8	336	.9111	.79774
	9	266	1.0661	1.42486
	10	279	1.2655	2.24751
	Total	**5502**	**1.1760**	**1.35672**
Financial	1	177	1.5034	1.07291
	2	105	1.1268	.73101
	3	102	.9830	.67526
	4	87	1.0902	.75673
	5	61	.9022	.57141
	6	35	1.2748	1.00548
	7	32	.9019	.56199
	8	21	.9455	.74267
	9	20	1.2135	1.49209
	10	22	1.1945	1.24711
	Total	**662**	**1.1759**	**.89996**

e) Mean of outlets per ‘000 persons and education deprivation domain for only LSOAs with respective retailer’s presence.

Retailers	Decile	LSOAs	Mean	Std. dev.
FGRs	1	754	.9396	.59779
	2	819	.9205	.59324
	3	899	.8956	.55458
	4	860	.8589	.47975
	5	785	.8472	.53428
	6	839	.8443	.54630
	7	719	.8229	.43576
	8	707	.8317	.52225
	9	717	.8388	.49591
	10	637	.8704	.94392
	Total	**7736**	**.8680**	**.57833**
AASR	1	778	1.5419	2.01125
	2	781	1.4756	2.00410
	3	710	1.4651	1.95980
	4	644	1.1740	1.29745
	5	562	1.2440	1.58899
	6	527	1.2101	1.30129
	7	452	1.0968	1.13668
	8	397	1.1675	1.81885
	9	380	1.1430	1.07949
	10	341	1.0858	1.69972
	Total	**5572**	**1.3010**	**1.68733**
Gambling	1	771	1.3198	1.52224
	2	774	1.3130	1.64577
	3	698	1.3045	1.53150
	4	640	1.0843	1.07449
	5	556	1.1426	1.26981
	6	516	1.1075	1.03964
	7	441	1.0085	.90634
	8	394	1.0829	1.37037
	9	374	1.0609	.90477
	10	338	1.0572	1.67265
	Total	**5502**	**1.1760**	**1.35672**
Financial	1	128	1.4226	1.07358
	2	109	1.2489	.87363
	3	103	1.2589	.87557
	4	56	1.1093	.82714
	5	61	1.0473	.81461
	6	66	1.0037	.69469
	7	52	.9811	.59980
	8	30	1.2276	1.51603
	9	39	.9633	.58841
	10	18	.7176	.29752
	Total	**662**	**1.1759**	**.89996**

f) Games Howell post-hoc multiple comparison test showing significant mean differences for income deprivation deciles and AASRs and FGRs outlets ‘000 persons for all LSOA considerations

		ALL LSOAs	COM. LSOAs	LSOA with Presence	ALL LSOAs	COM. LSOAs	LSOA with Presence	ALL LSOAs	COM. LSOAs	LSOA with Presence	ALL LSOAs	COM. LSOAs	LSOA with Presence
		FGR Outlets			AASR Outlets			Gambling Outlets			Financial Outlets		
(I) Inc Dec	(J) Inc Dec	mean diff	mean diff	mean diff	mean diff	mean diff	mean diff	mean diff	mean diff	mean diff	mean diff	mean diff	
1	2	-.04112*	-.07592	.01660	.06018	.22364	.19292	.03967	.15975	.11870	.02052	.06389	.20330
	3	-.04384*	-.08825*	.05284	.09776*	.31411*	.24527	.06724	.22503*	.13778	.03052*	.08908*	.43000*
	4	-.05928*	-.13124*	.03998	.14136*	.42557*	.31728*	.10320*	.31674*	.19500	.03816*	.10883*	.31680
	5	-.04696*	-.13592*	.07807	.20041*	.54594*	.43043*	.15111*	.41063*	.27656*	.04930*	.13531*	.48416*
	6	-.01164	-.13586*	.10743*	.27729*	.68734*	.53729*	.21968*	.53377*	.35769*	.05761*	.15358*	.11128
	7	.01811	-.12179*	.12548*	.30112*	.70463*	.57059*	.24184*	.54961*	.38913*	.05928*	.15502*	.47064*
	8	.02851	-.16052*	.11520*	.33154*	.77123*	.52033*	.27022*	.61171*	.34370*	.06132*	.15952*	.20040
	9	.05762*	-.11631*	.17832*	.36970*	.89521*	.65500*	.30429*	.72013*	.43911*	.06541*	.17508*	.70523*
	10	.05564*	-.21303*	.09058	.34961*	.75028*	.17934	.28804*	.59711*	.03743	.06157*	.15317*	.17778
2	1	.04112*	.07592	-.01660	-.06018	-.22364	-.19292	-.03967	-.15975	-.11870	-.02052	-.06389	-.20330
	3	-.00272	-.01233	.03624	.03758	.09047	.05235	.02758	.06528	.01908	.01000	.02519	.22670
	4	-.01816	-.05532	.02338	.08118*	.20194*	.12436	.06353	.15699*	.07631	.01764	.04494	.11350
	5	-.00584	-.06000	.06147	.14022*	.32230*	.23751	.11144*	.25088*	.15786	.02878*	.07143*	.28086
	6	.02948	-.05993	.09083*	.21711*	.46370*	.34437*	.18002*	.37401*	.23900*	.03709*	.08969*	-.09202
	7	.05924*	-.04587	.10888*	.24094*	.48099*	.37767*	.20217*	.38986*	.27043*	.03876*	.09114*	.26734
	8	.06963*	-.08460	.09859*	.27135*	.54759*	.32741	.23055*	.45196*	.22501	.04080*	.09563*	-.00290
	9	.09874*	-.04038	.16172*	.30952*	.67157*	.46208*	.26462*	.56038*	.32041*	.04489*	.11119*	.50193*
	10	.09676*	-.13711	.07398	.28943*	.52665*	-.01358	.24837*	.43736*	-.08127	.04106*	.08929*	-.02552
3	1	.04384*	.08825*	-.05284	-.09776*	-.31411*	-.24527	-.06724	-.22503*	-.13778	-.03052*	-.08908*	-.43000*

	2	.00272	.01233	-.03624	-.03758	-.09047	-.05235	-.02758	-.06528	-.01908	-.01000	-.02519	-.22670
	4	-.01544	-.04299	-.01286	.04360	.11146	.07201	.03595	.09171	.05723	.00764	.01975	-.11319
	5	-.00312	-.04767	.02523	.10265*	.23183*	.18516	.08387*	.18560*	.13878	.01878*	.04624*	.05417
	6	.03220	-.04761	.05459	.17953*	.37323*	.29202*	.15244*	.30873*	.21992*	.02709*	.06450*	-.31872
	7	.06196*	-.03354	.07264	.20336*	.39052*	.32532*	.17460*	.32458*	.25135*	.02876*	.06594*	.04065
	8	.07235*	-.07227	.06235	.23378*	.45712*	.27505	.20298*	.38668*	.20593	.03080*	.07044*	-.22960
	9	.10146*	-.02806	.12548*	.27194*	.58110*	.40973*	.23704*	.49510*	.30133*	.03489*	.08600*	.27524
	10	.09948*	-.12478	.03774	.25185*	.43617*	-.06593	.22080*	.37208*	-.10034	.03106*	.06409*	-.25221
4	1	.05928*	.13124*	-.03998	-.14136*	-.42557*	-.31728*	-.10320*	-.31674*	-.19500	-.03816*	-.10883*	-.31680
	2	.01816	.05532	-.02338	-.08118*	-.20194*	-.12436	-.06353	-.15699*	-.07631	-.01764	-.04494	-.11350
	3	.01544	.04299	.01286	-.04360	-.11146	-.07201	-.03595	-.09171	-.05723	-.00764	-.01975	.11319
	5	.01232	-.00468	.03809	.05905	.12037	.11315	.04791	.09388	.08156	.01114	.02648	.16736
	6	.04764*	-.00461	.06745	.13593*	.26177*	.22001	.11649*	.21702*	.16269	.01945*	.04475*	-.20552
	7	.07739*	.00945	.08550*	.15976*	.27906*	.25331*	.13864*	.23287*	.19412	.02112*	.04619*	.15384
	8	.08779*	-.02928	.07522	.19018*	.34566*	.20305	.16702*	.29497*	.14870	.02316*	.05069*	-.11640
	9	.11690*	.01494	.13834*	.22834*	.46963*	.33772*	.20109*	.40339*	.24410*	.02725*	.06625*	.38843
	10	.11492*	-.08179	.05060	.20826*	.32471*	-.13794	.18484*	.28037*	-.15757	.02341*	.04434	-.13902
5	1	.04696*	.13592*	-.07807	-.20041*	-.54594*	-.43043*	-.15111*	-.41063*	-.27656*	-.04930*	-.13531*	-.48416*
	2	.00584	.06000	-.06147	-.14022*	-.32230*	-.23751	-.11144*	-.25088*	-.15786	-.02878*	-.07143*	-.28086
	3	.00312	.04767	-.02523	-.10265*	-.23183*	-.18516	-.08387*	-.18560*	-.13878	-.01878*	-.04624*	-.05417
	4	-.01232	.00468	-.03809	-.05905	-.12037	-.11315	-.04791	-.09388	-.08156	-.01114	-.02648	-.16736
	6	.03532	.00006	.02936	.07688*	.14140	.10686	.06858*	.12314*	.08113	.00831	.01826	-.37288
	7	.06507*	.01413	.04741	.10071*	.15869*	.14016	.09073*	.13898*	.11256	.00998	.01971	-.01352
	8	.07546*	-.02461	.03712	.13113*	.22529*	.08989	.11911*	.20108*	.06714	.01202*	.02421	-.28376
	9	.10458*	.01961	.10025*	.16929*	.34926*	.22457	.15318*	.30950*	.16255	.01611*	.03976*	.22107
	10	.10260*	-.07711	.01251	.14921*	.20434	-.25109	.13693*	.18648	-.23913	.01228*	.01786	-.30638
6	1	.01164	.13586*	-.10743*	-.27729*	-.68734*	-.53729*	-.21968*	-.53377*	-.35769*	-.05761*	-.15358*	-.11128

	2	-.02948	.05993	-.09083*	-.21711*	-.46370*	-.34437*	-.18002*	-.37401*	-.23900*	-.03709*	-.08969*	.09202
	3	-.03220	.04761	-.05459	-.17953*	-.37323*	-.29202*	-.15244*	-.30873*	-.21992*	-.02709*	-.06450*	.31872
	4	-.04764*	.00461	-.06745	-.13593*	-.26177*	-.22001	-.11649*	-.21702*	-.16269	-.01945*	-.04475*	.20552
	5	-.03532	-.00006	-.02936	-.07688*	-.14140	-.10686	-.06858*	-.12314*	-.08113	-.00831	-.01826	.37288
	7	.02975	.01406	.01805	.02383	.01729	.03330	.02216	.01584	.03143	.00167	.00145	.35936
	8	.04015*	-.02467	.00777	.05425*	.08389	-.01697	.05053*	.07795	-.01399	.00371	.00594	.08912
	9	.06926*	.01955	.07089	.09241*	.20786*	.11771	.08460*	.18636*	.08141	.00780	.02150	.59395
	10	.06728*	-.07718	-.01685	.07232*	.06294	-.35795	.06836*	.06335	-.32026	.00397	-.00040	.06650
7	1	-.01811	.12179*	-.12548*	-.30112*	-.70463*	-.57059*	-.24184*	-.54961*	-.38913*	-.05928*	-.15502*	-.47064*
	2	-.05924*	.04587	-.10888*	-.24094*	-.48099*	-.37767*	-.20217*	-.38986*	-.27043*	-.03876*	-.09114*	-.26734
	3	-.06196*	.03354	-.07264	-.20336*	-.39052*	-.32532*	-.17460*	-.32458*	-.25135*	-.02876*	-.06594*	-.04065
	4	-.07739*	-.00945	-.08550*	-.15976*	-.27906*	-.25331*	-.13864*	-.23287*	-.19412	-.02112*	-.04619*	-.15384
	5	-.06507*	-.01413	-.04741	-.10071*	-.15869*	-.14016	-.09073*	-.13898*	-.11256	-.00998	-.01971	.01352
	6	-.02975	-.01406	-.01805	-.02383	-.01729	-.03330	-.02216	-.01584	-.03143	-.00167	-.00145	-.35936
	8	.01039	-.03873	-.01028	.03042	.06660	-.05026	.02838	.06210	-.04542	.00204	.00450	-.27024
	9	.03951*	.00549	.05284	.06858*	.19057*	.08441	.06245*	.17052*	.04998	.00613	.02005	.23459
	10	.03753*	-.09124	-.03490	.04849	.04565	-.39125	.04620	.04750	-.35169	.00230	-.00185	-.29286
8	1	-.02851	.16052*	-.11520*	-.33154*	-.77123*	-.52033*	-.27022*	-.61171*	-.34370*	-.06132*	-.15952*	-.20040
	2	-.06963*	.08460	-.09859*	-.27135*	-.54759*	-.32741	-.23055*	-.45196*	-.22501	-.04080*	-.09563*	.00290
	3	-.07235*	.07227	-.06235	-.23378*	-.45712*	-.27505	-.20298*	-.38668*	-.20593	-.03080*	-.07044*	.22960
	4	-.08779*	.02928	-.07522	-.19018*	-.34566*	-.20305	-.16702*	-.29497*	-.14870	-.02316*	-.05069*	.11640
	5	-.07546*	.02461	-.03712	-.13113*	-.22529*	-.08989	-.11911*	-.20108*	-.06714	-.01202*	-.02421	.28376
	6	-.04015*	.02467	-.00777	-.05425*	-.08389	.01697	-.05053*	-.07795	.01399	-.00371	-.00594	-.08912
	7	-.01039	.03873	.01028	-.03042	-.06660	.05026	-.02838	-.06210	.04542	-.00204	-.00450	.27024
	9	.02912	.04422	.06313	.03816	.12397	.13467	.03407*	.10842	.09540	.00409	.01556	.50483
	10	.02714	-.05251	-.02461	.01808	-.02095	-.34099	.01782	-.01460	-.30627	.00026	-.00635	-.02261
9	1	-.05762*	.11631*	-.17832*	-.36970*	-.89521*	-.65500*	-.30429*	-.72013*	-.43911*	-.06541*	-.17508*	-.70523*

	2	-.09874*	.04038	-.16172*	-.30952*	-.67157*	-.46208*	-.26462*	-.56038*	-.32041*	-.04489*	-.11119*	-.50193*
	3	-.10146*	.02806	-.12548*	-.27194*	-.58110*	-.40973*	-.23704*	-.49510*	-.30133*	-.03489*	-.08600*	-.27524
	4	-.11690*	-.01494	-.13834*	-.22834*	-.46963*	-.33772*	-.20109*	-.40339*	-.24410*	-.02725*	-.06625*	-.38843
	5	-.10458*	-.01961	-.10025*	-.16929*	-.34926*	-.22457	-.15318*	-.30950*	-.16255	-.01611*	-.03976*	-.22107
	6	-.06926*	-.01955	-.07089	-.09241*	-.20786*	-.11771	-.08460*	-.18636*	-.08141	-.00780	-.02150	-.59395
	7	-.03951*	-.00549	-.05284	-.06858*	-.19057*	-.08441	-.06245*	-.17052*	-.04998	-.00613	-.02005	-.23459
	8	-.02912	-.04422	-.06313	-.03816	-.12397	-.13467	-.03407*	-.10842	-.09540	-.00409	-.01556	-.50483
	10	-.00198	-.09673	-.08774	-.02009	-.14492	-.47566	-.01625	-.12302	-.40168	-.00384	-.02190	-.52745
10	1	-.05564*	.21303*	-.09058	-.34961*	-.75028*	-.17934	-.28804*	-.59711*	-.03743	-.06157*	-.15317*	-.17778
	2	-.09676*	.13711	-.07398	-.28943*	-.52665*	.01358	-.24837*	-.43736*	.08127	-.04106*	-.08929*	.02552
	3	-.09948*	.12478	-.03774	-.25185*	-.43617*	.06593	-.22080*	-.37208*	.10034	-.03106*	-.06409*	.25221
	4	-.11492*	.08179	-.05060	-.20826*	-.32471*	.13794	-.18484*	-.28037*	.15757	-.02341*	-.04434	.13902
	5	-.10260*	.07711	-.01251	-.14921*	-.20434	.25109	-.13693*	-.18648	.23913	-.01228*	-.01786	.30638
	6	-.06728*	.07718	.01685	-.07232*	-.06294	.35795	-.06836*	-.06335	.32026	-.00397	.00040	-.06650
	7	-.03753*	.09124	.03490	-.04849	-.04565	.39125	-.04620	-.04750	.35169	-.00230	.00185	.29286
	8	-.02714	.05251	.02461	-.01808	.02095	.34099	-.01782	.01460	.30627	-.00026	.00635	.02261
	9	.00198	.09673	.08774	.02009	.14492	.47566	.01625	.12302	.40168	.00384	.02190	.52745

*mean difference significant at $p < .05$

g) Games Howell post-hoc multiple comparison test showing significant mean differences for employment deprivation deciles and AASRs and FGRs outlets ‘000 persons for all LSOA considerations

		ALL LSOA	COM. LSOAs	LSOA with Presence	ALL LSOAs	COM. LSOAs	LSOAs with Presence	ALL LSOAs	COM. LSOAs	LSOA with Presence	ALL LSOA	COM. LSOAs	LSOA with Presence
		FGR Outlets			AASR Outlets			Gambling Outlets			FGR Outlets		
(I) Emp Dec	(J) Emp Dec	Mean Differences			Mean Differences			Mean Differences			Mean Differences		
1	2	.01617	.00178	.10982*	.20148*	.46732*	.49226*	.15647*	.35705*	.35482*	.04500*	.11027*	.37662*
	3	.00265	-.03207	.10609*	.21197*	.50103*	.46862*	.16146*	.37503*	.31654*	.05051*	.12601*	.52040*
	4	.00768	-.01213	.14468*	.23389*	.56867*	.55609*	.18174*	.43738*	.40190*	.05215*	.13129*	.41324*
	5	.01598	-.05623	.15397*	.30990*	.71683*	.64966*	.24562*	.55740*	.45726*	.06428*	.15942*	.60121*
	6	.02986	-.05587	.16601*	.33573*	.76062*	.64028*	.26829*	.59430*	.45404*	.06744*	.16632*	.22863
	7	.04536*	-.05724	.19749*	.37373*	.84747*	.69896*	.30149*	.66798*	.48483*	.07224*	.17949*	.60151*
	8	.07939*	-.02928	.22562*	.41011*	.91829*	.82355*	.33512*	.73264*	.60461*	.07499*	.18565*	.55796
	9	.08716*	-.07804	.20630*	.41560*	.89129*	.64075*	.34196*	.71499*	.44965*	.07364*	.17630*	.28990
	10	.06902*	-.13402*	.14516*	.39386*	.80996*	.43989	.32083*	.63519*	.25017	.07303*	.17478*	.30896
2	**1**	**-.01617**	**-.00178**	**-.10982***	**-.20148***	**-.46732***	**-.49226***	**-.15647***	**-.35705***	**-.35482***	-.04500*	-.11027*	-.37662*
	3	-.01353	-.03385	-.00373	.01050	.03371	-.02364	.00499	.01798	-.03828	.00550	.01574	.14379
	4	-.00849	-.01391	.03486	.03242	.10135	.06383	.02527	.08033	.04708	.00715	.02102	.03663
	5	-.00019	-.05801	.04415	.10842*	.24951*	.15740	.08915*	.20035*	.10244	.01927*	.04916*	.22459
	6	.01369	-.05765	.05619	.13425*	.29330*	.14802	.11181*	.23725*	.09922	.02244*	.05606*	-.14799
	7	.02919	-.05903	.08766*	.17226*	.38015*	.20670	.14502*	.31093*	.13001	.02724*	.06922*	.22490
	8	.06322*	-.03106	.11580*	.20863*	.45097*	.33129*	.17865*	.37559*	.24979*	.02998*	.07539*	.18134
	9	.07098*	-.07983	.09648*	.21413*	.42397*	.14849	.18549*	.35794*	.09483	.02864*	.06603*	-.08672
	10	.05284*	-.13580*	.03533	.19238*	.34265*	-.05237	.16436*	.27813*	-.10464	.02803*	.06451*	-.06765

	1	-.00265	.03207	-.10609*	-.21197*	-.50103*	-.46862*	-.16146*	-.37503*	-.31654*	-.05051*	-.12601*	-.52040*
	2	.01353	.03385	.00373	-.01050	-.03371	.02364	-.00499	-.01798	.03828	-.00550	-.01574	-.14379
	4	.00504	.01994	.03859	.02192	.06763	.08747	.02028	.06235	.08536	.00164	.00528	-.10716
3	5	.01333	-.02416	.04788	.09793*	.21580*	.18104	.08416*	.18238*	.14072	.01377	.03342	.08080
	6	.02721	-.02380	.05992	.12376*	.25959*	.17166	.10682*	.21927*	.13750	.01694*	.04032	-.29177
	7	.04271*	-.02517	.09140*	.16176*	.34644*	.23034	.14003*	.29295*	.16829	.02173*	.05349*	.08111
	8	.07675*	.00279	.11954*	.19814*	.41726*	.35492*	.17366*	.35761*	.28807*	.02448*	.05965*	.03755
	9	.08451*	-.04597	.10022*	.20363*	.39025*	.17213	.18050*	.33996*	.13311	.02313*	.05029*	-.23050
	10	.06637*	-.10195	.03907	.18189*	.30893*	-.02873	.15936*	.26016*	-.06636	.02252*	.04877*	-.21144
	1	-.00768	.01213	-.14468*	-.23389*	-.56867*	-.55609*	-.18174*	-.43738*	-.40190*	-.05215*	-.13129*	-.41324*
	2	.00849	.01391	-.03486	-.03242	-.10135	-.06383	-.02527	-.08033	-.04708	-.00715	-.02102	-.03663
	3	-.00504	-.01994	-.03859	-.02192	-.06763	-.08747	-.02028	-.06235	-.08536	-.00164	-.00528	.10716
4	5	.00830	-.04410	.00929	.07601*	.14816*	.09357	.06388*	.12003	.05536	.01213	.02814	.18796
	6	.02218	-.04373	.02133	.10184*	.19195*	.08419	.08655*	.15692*	.05214	.01529*	.03503	-.18462
	7	.03768*	-.04511	.05280	.13984*	.27881*	.14287	.11975*	.23060*	.08293	.02009*	.04820*	.18827
	8	.07171*	-.01715	.08094*	.17622*	.34962*	.26746*	.15338*	.29526*	.20272*	.02284*	.05436*	.14471
	9	.07947*	-.06591	.06162	.18171*	.32262*	.08466	.16022*	.27761*	.04775	.02149*	.04501	-.12335
	10	.06134*	-.12189	.00047	.15997*	.24130*	-.11620	.13909*	.19781	-.15172	.02088*	.04349	-.10428
	1	-.01598	.05623	-.15397*	-.30990*	-.71683*	-.64966*	-.24562*	-.55740*	-.45726*	-.06428*	-.15942*	-.60121*
	2	.00019	.05801	-.04415	-.10842*	-.24951*	-.15740	-.08915*	-.20035*	-.10244	-.01927*	-.04916*	-.22459
	3	-.01333	.02416	-.04788	-.09793*	-.21580*	-.18104	-.08416*	-.18238*	-.14072	-.01377	-.03342	-.08080
5	4	-.00830	.04410	-.00929	-.07601*	-.14816*	-.09357	-.06388*	-.12003	-.05536	-.01213	-.02814	-.18796
	6	.01388	.00036	.01203	.02583	.04379	-.00938	.02266	.03689	-.00322	.00317	.00690	-.37258
	7	.02938	-.00102	.04351	.06384*	.13064	.04930	.05587*	.11058	.02757	.00797	.02007	.00031
	8	.06341*	.02695	.07165	.10021*	.20146*	.17389	.08950*	.17523*	.14736	.01071*	.02623	-.04325
	9	.07118*	-.02181	.05233	.10570*	.17446	-.00891	.09634*	.15759*	-.00761	.00936	.01687	-.31131
	10	.05304*	-.07779	-.00882	.08396*	.09314	-.20977	.07521*	.07778	-.20708	.00875	.01536	-.29224

6	1	-.02986	.05587	-.16601*	-.33573*	-.76062*	-.64028*	-.26829*	-.59430*	-.45404*	-.06744*	-.16632*	-.22863
	2	-.01369	.05765	-.05619	-.13425*	-.29330*	-.14802	-.11181*	-.23725*	-.09922	-.02244*	-.05606*	.14799
	3	-.02721	.02380	-.05992	-.12376*	-.25959*	-.17166	-.10682*	-.21927*	-.13750	-.01694*	-.04032	.29177
	4	-.02218	.04373	-.02133	-.10184*	-.19195*	-.08419	-.08655*	-.15692*	-.05214	-.01529*	-.03503	.18462
	5	-.01388	-.00036	-.01203	-.02583	-.04379	.00938	-.02266	-.03689	.00322	-.00317	-.00690	.37258
	7	.01550	-.00138	.03148	.03800	.08685	.05868	.03321	.07368	.03079	.00480	.01317	.37288
	8	.04953*	.02659	.05962	.07438*	.15767*	.18327	.06684*	.13834*	.15058	.00754	.01933	.32933
	9	.05730*	-.02218	.04030	.07987*	.13067	.00047	.07368*	.12069	-.00439	.00620	.00997	.06127
	10	.03916	-.07816	-.02085	.05813	.04934	-.20039	.05254*	.04089	-.20386	.00559	.00846	.08034
7	1	-.04536*	.05724	-.19749*	-.37373*	-.84747*	-.69896*	-.30149*	-.66798*	-.48483*	-.07224*	-.17949*	-.60151*
	2	-.02919	.05903	-.08766*	-.17226*	-.38015*	-.20670	-.14502*	-.31093*	-.13001	-.02724*	-.06922*	-.22490
	3	-.04271*	.02517	-.09140*	-.16176*	-.34644*	-.23034	-.14003*	-.29295*	-.16829	-.02173*	-.05349*	-.08111
	4	-.03768*	.04511	-.05280	-.13984*	-.27881*	-.14287	-.11975*	-.23060*	-.08293	-.02009*	-.04820*	-.18827
	5	-.02938	.00102	-.04351	-.06384*	-.13064	-.04930	-.05587*	-.11058	-.02757	-.00797	-.02007	-.00031
	6	-.01550	.00138	-.03148	-.03800	-.08685	-.05868	-.03321	-.07368	-.03079	-.00480	-.01317	-.37288
	8	.03403*	.02796	.02814	.03637	.07082	.12459	.03363	.06466	.11978	.00274	.00616	-.04356
	9	.04180*	-.02080	.00882	.04187	.04381	-.05821	.04047*	.04701	-.03518	.00140	-.00319	-.31161
	10	.02366	-.07678	-.05233	.02012	-.03751	-.25907	.01934	-.03279	-.23465	.00079	-.00471	-.29255
8	1	-.07939*	.02928	-.22562*	-.41011*	-.91829*	-.82355*	-.33512*	-.73264*	-.60461*	-.07499*	-.18565*	-.55796
	2	-.06322*	.03106	-.11580*	-.20863*	-.45097*	-.33129*	-.17865*	-.37559*	-.24979*	-.02998*	-.07539*	-.18134
	3	-.07675*	-.00279	-.11954*	-.19814*	-.41726*	-.35492*	-.17366*	-.35761*	-.28807*	-.02448*	-.05965*	-.03755
	4	-.07171*	.01715	-.08094*	-.17622*	-.34962*	-.26746*	-.15338*	-.29526*	-.20272*	-.02284*	-.05436*	-.14471
	5	-.06341*	-.02695	-.07165	-.10021*	-.20146*	-.17389	-.08950*	-.17523*	-.14736	-.01071*	-.02623	.04325
	6	-.04953*	-.02659	-.05962	-.07438*	-.15767*	-.18327	-.06684*	-.13834*	-.15058	-.00754	-.01933	-.32933
	7	-.03403*	-.02796	-.02814	-.03637	-.07082	-.12459	-.03363	-.06466	-.11978	-.00274	-.00616	.04356
	9	.00776	-.04876	-.01932	.00549	-.02700	-.18279	.00684	-.01765	-.15496	-.00135	-.00935	-.26806
	10	-.01038	-.10474	-.08047	-.01625	-.10832	-.38365	-.01429	-.09745	-.35444	-.00196	-.01087	-.24899

9	1	-.08716*	.07804	-.20630*	-.41560*	-.89129*	-.64075*	-.34196*	-.71499*	-.44965*	-.07364*	-.17630*	-.28990
	2	-.07098*	.07983	-.09648*	-.21413*	-.42397*	-.14849	-.18549*	-.35794*	-.09483	-.02864*	-.06603*	.08672
	3	-.08451*	.04597	-.10022*	-.20363*	-.39025*	-.17213	-.18050*	-.33996*	-.13311	-.02313*	-.05029*	.23050
	4	-.07947*	.06591	-.06162	-.18171*	-.32262*	-.08466	-.16022*	-.27761*	-.04775	-.02149*	-.04501	.12335
	5	-.07118*	.02181	-.05233	-.10570*	-.17446	.00891	-.09634*	-.15759*	.00761	-.00936	-.01687	.31131
	6	-.05730*	.02218	-.04030	-.07987*	-.13067	-.00047	-.07368*	-.12069	.00439	-.00620	-.00997	-.06127
	7	-.04180*	.02080	-.00882	-.04187	-.04381	.05821	-.04047*	-.04701	.03518	-.00140	.00319	.31161
	8	-.00776	.04876	.01932	-.00549	.02700	.18279	-.00684	.01765	.15496	.00135	.00935	.26806
	10	-.01814	-.05598	-.06115	-.02174	-.08132	-.20086	-.02113	-.07980	-.19947	-.00061	-.00152	.01906
10	1	-.06902*	.13402*	-.14516*	-.39386*	-.80996*	-.43989	-.32083*	-.63519*	-.25017	-.07303*	-.17478*	-.30896
	2	-.05284*	.13580*	-.03533	-.19238*	-.34265*	.05237	-.16436*	-.27813*	.10464	-.02803*	-.06451*	.06765
	3	-.06637*	.10195	-.03907	-.18189*	-.30893*	.02873	-.15936*	-.26016*	.06636	-.02252*	-.04877*	.21144
	4	-.06134*	.12189	-.00047	-.15997*	-.24130*	.11620	-.13909*	-.19781	.15172	-.02088*	-.04349	.10428
	5	-.05304*	.07779	.00882	-.08396*	-.09314	.20977	-.07521*	-.07778	.20708	-.00875	-.01536	.29224
	6	-.03916	.07816	.02085	-.05813	-.04934	.20039	-.05254*	-.04089	.20386	-.00559	-.00846	-.08034
	7	-.02366	.07678	.05233	-.02012	.03751	.25907	-.01934	.03279	.23465	-.00079	.00471	.29255
	8	.01038	.10474	.08047	.01625	.10832	.38365	.01429	.09745	.35444	.00196	.01087	.24899
	9	.01814	.05598	.06115	.02174	.08132	.20086	.02113	.07980	.19947	.00061	.00152	-.01906

*mean difference significant at $p < .05$

h) Games Howell post-hoc multiple comparison test showing significant mean differences for education deprivation deciles and AASRs and FGRs outlets ‘000 persons for all LSOA considerations

		ALL LSOA	COM. LSOAs	LSOA with Presence	ALL LSOA	COM. LSOAs	LSOA with presence	ALL LSOA	COM. LSOAs	LSOA with Presence	ALL LSOA	COM. LSOAs	LSOA with presence
		FGR Outlets			AASR Outlet			Gambling Outlet			Financial Outlets		
(I) Edu Dec	(J) Edu Dec												
1	2	-.01384	-.01482	.01905	.01438	.07919	.06637	.00038	.03460	.00673	.01400	.04459	.17369
	3	-.02939	-.04399	.04391	.04864	.19135	.07684	.03266	.13909	.01525	.01598	.05226	.16370
	4	-.00920	-.02861	.08069	.13507*	.38474*	.36792*	.09854*	.28024*	.23547*	.03653*	.10449*	.31326
	5	.01326	-.03006	.09231*	.15246*	.36535*	.29788	.11646*	.26873*	.17718	.03600*	.09662*	.37529
	6	.00002	-.06162	.09528*	.17111*	.43479*	.33187*	.13583*	.33948*	.21229	.03527*	.09531*	.41884*
	7	.03555*	-.03202	.11664*	.21433*	.50201*	.44513*	.17442*	.39918*	.31129*	.03991*	.10282*	.44141*
	8	.03672*	-.06006	.10783*	.22420*	.51220*	.37444*	.17996*	.39578*	.23685	.04424*	.11641*	.19496
	9	.03259	-.08357	.10079*	.23303*	.53996*	.39890*	.18902*	.42491*	.25884*	.04401*	.11505*	.45928*
	10	.04693*	-.11720	.06911	.25258*	.55572*	.45611*	.20106*	.41396*	.26251	.05151*	.14176*	.70496*
2	1	.01384	.01482	-.01905	-.01438	-.07919	-.06637	-.00038	-.03460	-.00673	-.01400	-.04459	-.17369
	3	-.01555	-.02917	.02485	.03426	.11216	.01047	.03228	.10449	.00851	.00198	.00767	-.00999
	4	.00465	-.01379	.06163	.12069*	.30555*	.30154*	.09815*	.24565*	.22874	.02254*	.05990*	.13957
	5	.02710	-.01525	.07325	.13808*	.28616*	.23150	.11608*	.23413*	.17045	.02200*	.05203*	.20160
	6	.01387	-.04681	.07623	.15673*	.35560*	.26550	.13545*	.30488*	.20556	.02128*	.05072*	.24516
	7	.04940*	-.01720	.09759*	.19996*	.42281*	.37876*	.17404*	.36458*	.30456*	.02592*	.05823*	.26773
	8	.05056*	-.04524	.08878	.20982*	.43300*	.30807	.17958*	.36118*	.23012	.03024*	.07182*	.02127
	9	.04644*	-.06875	.08174	.21865*	.46077*	.33252*	.18864*	.39031*	.25210*	.03001*	.07046*	.28560
	10	.06078*	-.10238	.05006	.23820*	.47653*	.38973*	.20068*	.37936*	.25578	.03752*	.09717*	.53127*
3	1	.02939	.04399	-.04391	-.04864	-.19135	-.07684	-.03266	-.13909	-.01525	-.01598	-.05226	-.16370

	2	.01555	.02917	-.02485	-.03426	-.11216	-.01047	-.03228	-.10449	-.00851	-.00198	-.00767	.00999
	4	.02019	.01538	.03678	.08643*	.19339*	.29108*	.06587*	.14115	.22023	.02055*	.05223*	.14956
	5	.04265*	.01392	.04840	.10382*	.17400	.22104	.08380*	.12963	.16194	.02002*	.04437	.21158
	6	.02941	-.01764	.05137	.12247*	.24344*	.25503	.10317*	.20039*	.19704	.01930*	.04305	.25514
	7	.06494*	.01197	.07274	.16569*	.31065*	.36829*	.14176*	.26009*	.29605*	.02394*	.05056*	.27771
	8	.06611*	-.01607	.06392	.17556*	.32084*	.29760	.14730*	.25669*	.22161	.02826*	.06415*	.03126
	9	.06198*	-.03958	.05688	.18439*	.34861*	.32205*	.15636*	.28581*	.24359*	.02803*	.06279*	.29558
	10	.07632*	-.07321	.02521	.20394*	.36437*	.37926*	.16840*	.27487*	.24727	.03554*	.08950*	.54126*
	1	.00920	.02861	-.08069	-.13507*	-.38474*	-.36792*	-.09854*	-.28024*	-.23547*	-.03653*	-.10449*	-.31326
	2	-.00465	.01379	-.06163	-.12069*	-.30555*	-.30154*	-.09815*	-.24565*	-.22874	-.02254*	-.05990*	-.13957
	3	-.02019	-.01538	-.03678	-.08643*	-.19339*	-.29108*	-.06587*	-.14115	-.22023	-.02055*	-.05223*	-.14956
4	5	.02245	-.00145	.01162	.01739	-.01939	-.07004	.01792	-.01152	-.05829	-.00053	-.00787	.06202
	6	.00922	-.03301	.01459	.03604	.05006	-.03604	.03730	.05924	-.02318	-.00126	-.00918	.10558
	7	.04475*	-.00341	.03596	.07927*	.11727	.07722	.07589*	.11894	.07582	.00338	-.00167	.12815
	8	.04591*	-.03145	.02714	.08913*	.12746	.00652	.08143*	.11554	.00138	.00771	.01192	-.11830
	9	.04179*	-.05496	.02010	.09796*	.15522*	.03098	.09049*	.14466*	.02336	.00748	.01056	.14602
	10	.05613*	-.08859	-.01157	.11751*	.17098	.08819	.10253*	.13372	.02704	.01498*	.03727*	.39170
	1	-.01326	.03006	-.09231*	-.15246*	-.36535*	-.29788	-.11646*	-.26873*	-.17718	-.03600*	-.09662*	-.37529
	2	-.02710	.01525	-.07325	-.13808*	-.28616*	-.23150	-.11608*	-.23413*	-.17045	-.02200*	-.05203*	-.20160
	3	-.04265*	-.01392	-.04840	-.10382*	-.17400	-.22104	-.08380*	-.12963	-.16194	-.02002*	-.04437	-.21158
5	4	-.02245	.00145	-.01162	-.01739	.01939	.07004	-.01792	.01152	.05829	.00053	.00787	-.06202
	6	-.01323	-.03156	.00297	.01865	.06944	.03399	.01937	.07075	.03511	-.00073	-.00131	.04356
	7	.02229	-.00195	.02434	.06187*	.13666	.14725	.05796*	.13046	.13411	.00391	.00620	.06613
	8	.02346	-.03000	.01552	.07174*	.14685	.07656	.06350*	.12706	.05967	.00824	.01979	-.18033
	9	.01933	-.05351	.00848	.08057*	.17461*	.10102	.07256*	.15618*	.08166	.00801	.01843	.08400
	10	.03367	-.08714	-.02319	.10012*	.19037	.15823	.08460*	.14524	.08533	.01551*	.04513*	.32968
6	1	-.00002	.06162	-.09528*	-.17111*	-.43479*	-.33187*	-.13583*	-.33948*	-.21229	-.03527*	-.09531*	-.41884*

	2	-.01387	.04681	-.07623	-.15673*	-.35560*	-.26550	-.13545*	-.30488*	-.20556	-.02128*	-.05072*	-.24516
	3	-.02941	.01764	-.05137	-.12247*	-.24344*	-.25503	-.10317*	-.20039*	-.19704	-.01930*	-.04305	-.25514
	4	-.00922	.03301	-.01459	-.03604	-.05006	.03604	-.03730	-.05924	.02318	.00126	.00918	-.10558
	5	.01323	.03156	-.00297	-.01865	-.06944	-.03399	-.01937	-.07075	-.03511	.00073	.00131	-.04356
	7	.03553*	.02961	.02136	.04322	.06721	.11326	.03859	.05970	.09901	.00464	.00751	.02257
	8	.03669*	.00156	.01255	.05309	.07740	.04257	.04413	.05630	.02456	.00896	.02110	-.22389
	9	.03257	-.02195	.00551	.06192*	.10517	.06702	.05319*	.08543	.04655	.00873	.01974	.04044
	10	.04691*	-.05558	-.02617	.08147*	.12093	.12423	.06523*	.07448	.05022	.01624*	.04644*	.28612
	1	-.03555*	.03202	-.11664*	-.21433*	-.50201*	-.44513*	-.17442*	-.39918*	-.31129*	-.03991*	-.10282*	-.44141*
	2	-.04940*	.01720	-.09759*	-.19996*	-.42281*	-.37876*	-.17404*	-.36458*	-.30456*	-.02592*	-.05823*	-.26773
	3	-.06494*	-.01197	-.07274	-.16569*	-.31065*	-.36829*	-.14176*	-.26009*	-.29605*	-.02394*	-.05056*	-.27771
7	4	-.04475*	.00341	-.03596	-.07927*	-.11727	-.07722	-.07589*	-.11894	-.07582	-.00338	.00167	-.12815
	5	-.02229	.00195	-.02434	-.06187*	-.13666	-.14725	-.05796*	-.13046	-.13411	-.00391	-.00620	-.06613
	6	-.03553*	-.02961	-.02136	-.04322	-.06721	-.11326	-.03859	-.05970	-.09901	-.00464	-.00751	-.02257
	8	.00116	-.02804	-.00881	.00987	.01019	-.07069	.00554	-.00340	-.07444	.00432	.01359	-.24646
	9	-.00296	-.05155	-.01585	.01870	.03795	-.04624	.01460	.02572	-.05246	.00410	.01223	.01787
	10	.01138	-.08518	-.04753	.03825	.05371	.01097	.02664	.01478	-.04878	.01160*	.03893*	.26355
	1	-.03672*	.06006	-.10783*	-.22420*	-.51220*	-.37444*	-.17996*	-.39578*	-.23685	-.04424*	-.11641*	-.19496
	2	-.05056*	.04524	-.08878	-.20982*	-.43300*	-.30807	-.17958*	-.36118*	-.23012	-.03024*	-.07182*	-.02127
	3	-.06611*	.01607	-.06392	-.17556*	-.32084*	-.29760	-.14730*	-.25669*	-.22161	-.02826*	-.06415*	-.03126
8	4	-.04591*	.03145	-.02714	-.08913*	-.12746	-.00652	-.08143*	-.11554	-.00138	-.00771	-.01192	.11830
	5	-.02346	.03000	-.01552	-.07174*	-.14685	-.07656	-.06350*	-.12706	-.05967	-.00824	-.01979	.18033
	6	-.03669*	-.00156	-.01255	-.05309	-.07740	-.04257	-.04413	-.05630	-.02456	-.00896	-.02110	.22389
	7	-.00116	.02804	.00881	-.00987	-.01019	.07069	-.00554	.00340	.07444	-.00432	-.01359	.24646
	9	-.00412	-.02351	-.00704	.00883	.02776	.02445	.00906	.02912	.02198	-.00023	-.00136	.26433
	10	.01022	-.05714	-.03872	.02838	.04352	.08166	.02110	.01818	.02566	.00728	.02535	.51000
9	1	-.03259	.08357	-.10079*	-.23303*	-.53996*	-.39890*	-.18902*	-.42491*	-.25884*	-.04401*	-.11505*	-.45928*

	2	-.04644*	.06875	-.08174	-.21865*	-.46077*	-.33252*	-.18864*	-.39031*	-.25210*	-.03001*	-.07046*	-.28560
	3	-.06198*	.03958	-.05688	-.18439*	-.34861*	-.32205*	-.15636*	-.28581*	-.24359*	-.02803*	-.06279*	-.29558
	4	-.04179*	.05496	-.02010	-.09796*	-.15522*	-.03098	-.09049*	-.14466*	-.02336	-.00748	-.01056	-.14602
	5	-.01933	.05351	-.00848	-.08057*	-.17461*	-.10102	-.07256*	-.15618*	-.08166	-.00801	-.01843	-.08400
	6	-.03257	.02195	-.00551	-.06192*	-.10517	-.06702	-.05319*	-.08543	-.04655	-.00873	-.01974	-.04044
	7	.00296	.05155	.01585	-.01870	-.03795	.04624	-.01460	-.02572	.05246	-.00410	-.01223	-.01787
	8	.00412	.02351	.00704	-.00883	-.02776	-.02445	-.00906	-.02912	-.02198	.00023	.00136	-.26433
	10	.01434	-.03363	-.03168	.01955	.01576	.05721	.01204	-.01094	.00368	.00751*	.02671	.24568
10	1	-.04693*	.11720	-.06911	-.25258*	-.55572*	-.45611*	-.20106*	-.41396*	-.26251	-.05151*	-.14176*	-.70496*
	2	-.06078*	.10238	-.05006	-.23820*	-.47653*	-.38973*	-.20068*	-.37936*	-.25578	-.03752*	-.09717*	-.53127*
	3	-.07632*	.07321	-.02521	-.20394*	-.36437*	-.37926*	-.16840*	-.27487*	-.24727	-.03554*	-.08950*	-.54126*
	4	-.05613*	.08859	.01157	-.11751*	-.17098	-.08819	-.10253*	-.13372	-.02704	-.01498*	-.03727*	-.39170
	5	-.03367	.08714	.02319	-.10012*	-.19037	-.15823	-.08460*	-.14524	-.08533	-.01551*	-.04513*	-.32968
	6	-.04691*	.05558	.02617	-.08147*	-.12093	-.12423	-.06523*	-.07448	-.05022	-.01624*	-.04644*	-.28612
	7	-.01138	.08518	.04753	-.03825	-.05371	-.01097	-.02664	-.01478	.04878	-.01160*	-.03893*	-.26355
	8	-.01022	.05714	.03872	-.02838	-.04352	-.08166	-.02110	-.01818	-.02566	-.00728	-.02535	-.51000
	9	-.01434	.03363	.03168	-.01955	-.01576	-.05721	-.01204	.01094	-.00368	-.00751*	-.02671	-.24568

*mean difference significant at $p < .05$

Appendix 2 - Correlations

a) Initial correlation between AASRs and FGRs and socio-economic characteristics in Nottingham

Socio-economic variables	Nottingham			
	FGRs	**AASRs**	**Gamb.**	**Fin.**
Housing Tenure				
Owner Occupied	.031	-.062	.062	.151*
Social Renters	.099	.003	-.002	-.121
Private Renters	-.111	.059	-.059	-.068
Family Composition				
Couple Family	.061	.079	.078	.155*
Lone Parent Family	.282**	.140	.140	.020
Ethnic Composition				
Black	.118	.012	.012	-.034
IPB	-.072	-.054	-.053	.021
Chinese	-.157*	-.121	-.121	-.171*
Age Composition				
18 - 24	-.028	.020	-.020	-.104
25 - 44	.060	-.047	.047	.016
45 - 64	.049	-.031	.029	.060
65+	.010	.040	-.040	.102
Educational Qualifications				
No Qualifications	.194**	-.021	-.021	.045
Level 1	.260**	.109	.109	.009
Level 2	.196**	.102	.102	-.011
Level 3	-.164*	-.068	-.068	-.123
Level 4 and above	-.188*	-.011	-.011	.016
Car Ownership				
No Car	.006	.087	-.086	-.161*
One Car	.052	-.089	.088	.150*
Two Cars	-.018	-.062	.062	.162*
Three Cars	-.111	-.027	.026	.183*
Four Cars Above	-.135	-.009	.009	.176*
Ns-Sec Classification				
Managers and Professionals	-.073	-.054	.053	.069
Intermediate occupations	.033	-.040	.039	.055
Lower and Routine Occupations	.205**	-.005	.004	.048
Never-worked/Long-term Unemp.	.210**	.005	-.005	.010
Fulltime students	-.037	.067	-.066	-.080

****Correlation is significant at the p < .001 level**
***Correlation is significant at the p < .05 level**

b) Within correlations between selected socio-economic characteristics in all areas

All Areas

	Social Renters	Private Renters	Couple Family Households	Lone Parent Family Households	Black	IPB	British Chinese	Aged 18 - 24	Aged 25 - 44	Aged 45 - 64	Aged 65 Above	No Qualifications	Level 1 Qualifications	Level 2 Qualifications	Fulltime Students	No Car	Managers and Professionals	Intermediate Occupations	Routine/Lower Occupations	Never Worked/Long term Unemployed
Owner Occ.	-.787**	-.606**	.919**	-.357**	-.707**	-.231**	-.455**	-.616**	-.390**	.837**	.667**	-.199**	-.001	.410**	-.580**	-.939**	.685**	.845**	-.174**	-.654**
SR		-.011	-.693**	.658**	.690**	-.013	.105	.235**	.138*	-.465**	-.371**	.593**	.409**	.009	.183**	.822**	-.743**	-.598**	.550**	.749**
PR			-.594**	-.265**	.264**	.392**	.609**	.702**	.453**	-.757**	-.616**	-.449**	-.528**	-.678**	.712**	.462**	-.152**	-.606**	-.433**	.098
Couple				-.318**	-.643**	-.174**	-.430**	-.590**	-.377**	.803**	.522**	-.245**	-.009	.391**	-.541**	-.919**	.685**	.775**	-.219**	-.583**
LR					.513**	-.106	-.255**	-.191**	.167**	-.186**	-.286**	.692**	.704**	.413**	-.249**	.441**	-.579**	-.227**	.726**	.714**
Black						.315**	.153**	.249**	.383**	-.539**	-.541**	.318**	.189**	-.118*	.234**	.746**	-.595**	-.545**	.307**	.783**
IPB							.197**	.229**	.250**	-.385**	-.322**	-.142*	-.253**	-.401**	.273**	.236**	-.143*	-.190**	-.211**	.340**
BC								.745**	.068	-.592**	-.420**	-.405**	-.444**	-.524**	.771**	.388**	-.187**	-.566**	-.428**	-.094
Age 18 - 24									-.072	-.765**	-.559**	-.381**	-.470**	-.591**	.986**	.499**	-.411**	-.771**	-.399**	.016
Age 25 - 44										-.400**	-.575**	-.041	.045	-.159**	-.086	.356**	-.006	-.215**	.091	.375**
Age 45 - 64											.714**	.094	.247**	.557**	-.747**	-.760**	.533**	.851**	.106	-.431**
Age 65+												.206**	.062	.283**	-.528**	-.549**	.375**	.680**	.078	-.425**
No Qua													.769**	.404**	-.434**	.387**	-.627**	-.002	.933**	.636**
Level 1														.709**	-.547**	.139*	-.473**	.201**	.888**	.456**
Level 2															-.650**	-.320**	-.027	.545**	.544**	.032
Students																.462**	-.353**	-.754**	-.471**	-.021
No Car																	-.773**	-.781**	.346**	.738**
Man and Prof.																		.578**	-.632**	-.692**
Inter. Occ.																			.017	-.446**
R/LO																				.583**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

c) Within correlations between selected socio-economic characteristics in Leeds

Leeds

	Social Renters	Private Renters	Couple Family Households	Lone Parent Family Households	Black	IPB	British Chinese	Aged 18 - 24	Aged 25 - 44	Aged 45 - 64	Aged 65 Above	No Qualifications	Level 1 Qualifications	Level 2 Qualifications	Fulltime Students	No Car	Managers and Professionals	Intermediate Occupations	Routine/Lower Occupations	Never Worked/Long term Unemployed
Owner Occ.	-.737**	-.562**	.914**	-.423**	-.524**	-.178**	-.365**	-.540**	-.320**	.798**	.594**	-.316**	.039	.525**	-.492**	-.931**	.659**	.846**	-.277**	-.623**
SR		-.143**	-.569**	.768**	.501**	-.035	.065	.020	.078	-.303**	-.219**	.717**	.429**	-.044	.006	.760**	-.697**	-.501**	.665**	.676**
PR			-.643**	-.317**	.155**	.299**	.451**	.772**	.370**	-.800**	-.609**	-.419**	-.582**	-.715**	.720**	.434**	-.113*	-.631**	-.410**	.083
Couple				-.277**	-.404**	-.102*	-.324**	-.579**	-.346**	.807**	.485**	-.224**	.130**	.583**	-.517**	-.866**	.574**	.777**	-.207**	-.461**
LP					.443**	.061	-.093*	-.238**	.070	-.096*	-.227**	.770**	.674**	.270**	-.255**	.537**	-.647**	-.228**	.763**	.699**
Black						.410**	.322**	.075	.260**	-.372**	-.378**	.292**	.130**	-.239**	.103*	.601**	-.401**	-.456**	.204**	.710**
IPB							.248**	.090*	.187**	-.327**	-.301**	.015	-.084	-.270**	.114*	.234**	-.143**	-.207**	-.133**	.555**
BC								.440**	.190**	-.474**	-.387**	-.241**	-.325**	-.451**	.483**	.333**	-.094*	-.459**	-.288**	.129**
Age 18 - 24									-.101*	-.763**	-.555**	-.405**	-.576**	-.633**	.985**	.373**	-.325**	-.737**	-.402**	-.028
Age 25 - 44										-.385**	-.517**	-.026	.028	-.215**	-.177**	.312**	.107*	-.150**	.080	.243**
Age 45 - 64											.709**	.090*	.339**	.664**	-.722**	-.690**	.450**	.817**	.113*	-.390**
Age 65+												.155**	.106*	.357**	-.507**	-.496**	.352**	.656**	.049	-.381**
No Qua													.753**	.324**	-.431**	.504**	-.669**	-.029	.931**	.641**
Level 1														.680**	-.599**	.154**	-.460**	.318**	.842**	.410**
Level 2															-.626**	-.387**	-.009	.671**	.447**	-.110*
Students																.330**	-.303**	-.718**	-.450**	-.043
No Car																	-.751**	-.740**	.459**	.737**
Man and Prof																		.500**	-.676**	-.653**
ISE																			.023	-.469**
R/LO																				.518**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

d) Within correlations between selected socio-economic characteristics in Nottingham

Nottingham

	Social Renters	Private Renters	Couple Family Households	Lone Parent Family Households	Black	IPB	British Chinese	Aged 18 - 24	Aged 25 - 44	Aged 45 - 64	Aged 65 Above	No Qualifications	Level 1 Qualifications	Level 2 Qualifications	Fulltime Students	No Car	Managers and Professionals	Intermediate Occupations	Routine/Lower Occupations	Never Worked/Long term Unemployed
Owner Occ.	-.787**	-.606**	.919**	-.357**	-.707**	-.231**	-.455**	-.616**	-.390**	.837**	.667**	-.199**	-.001	.410**	-.580**	-.939**	.685**	.845**	-.174**	-.654**
SR		-.011	-.693**	.658**	.690**	-.013	.105	.235**	.138*	-.465**	-.371**	.593**	.409**	.009	.183**	.822**	-.743**	-.598**	.550**	.749**
PR			-.594**	-.265**	.264**	.392**	.609**	.702**	.453**	-.757**	-.616**	-.449**	-.528**	-.678**	.712**	.462**	-.152**	-.606**	-.433**	.098
Couple				-.318**	-.643**	-.174**	-.430**	-.590**	-.377**	.803**	.522**	-.245**	-.009	.391**	-.541**	-.919**	.685**	.775**	-.219**	-.583**
LP					.513**	-.106	-.255**	-.191**	.167**	-.186**	-.286**	.692**	.704**	.413**	-.249**	.441**	-.579**	-.227**	.726**	.714**
Black						.315**	.153**	.249**	.383**	-.539**	-.541**	.318**	.189**	-.118*	.234**	.746**	-.595**	-.545**	.307**	.783**
IPB							.197**	.229**	.250**	-.385**	-.322**	-.142*	-.253**	-.401**	.273**	.236**	-.143*	-.190**	-.211**	.340**
BC								.745**	.068	-.592**	-.420**	-.405**	-.444**	-.524**	.771**	.388**	-.187**	-.566**	-.428**	-.094
Age 18 - 24									-.072	-.765**	-.559**	-.381**	-.470**	-.591**	.986**	.499**	-.411**	-.771**	-.399**	.016
Age 25 - 44										-.400**	-.575**	-.041	.045	-.159**	-.086	.356**	-.006	-.215**	.091	.375**
Age 45 - 64											.714**	.094	.247**	.557**	-.747**	-.760**	.533**	.851**	.106	-.431**
Age 65+												.206**	.062	.283**	-.528**	-.549**	.375**	.680**	.078	-.425**
No Qua													.769**	.404**	-.434**	.387**	-.627**	-.002	.933**	.636**
Level 1														.709**	-.547**	.139*	-.473**	.201**	.888**	.456**
Level 2															-.650**	-.320**	-.027	.545**	.544**	.032
Students																.462**	-.353**	-.754**	-.471**	-.021
No Car																	.252**	.480**	.192**	-.286**
Man and Prof																		.578**	-.632**	-.692**
Inter. Occ.																			.017	-.446**
R/LO																				.583**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

e) Within correlations between selected socio-economic characteristics in Bristol

Bristol

	Social Renters	Private Renters	Couple Family Households	Lone Parent Family Households	Black	IPB	British Chinese	Age 18 - 24	Age 25 - 44	Age 45 - 64	Age 65 Above	No Qualification	Level 1 Qualification	Level 2 Qualification	Full Time Students	No Car	Managers and Professionals	Intermediate Occupations	Routine/Lower Occupations	Never Worked/Long term Unemployed
Owner Occ.	-.678**	-.453**	.894**	-.347**	-.488**	-.210**	-.304**	-.450**	-.387**	.724**	.571**	-.131*	.049	.348**	-.388**	-.911**	.330**	.654**	-.103	-.580**
SR		-.345**	-.439**	.802**	.429**	.052	-.102	-.112	-.175**	-.166**	-.050	.704**	.525**	.219**	-.170**	.726**	-.676**	-.251**	.635**	.825**
PR			-.607**	-.530**	.092	.198**	.495**	.713**	.704**	-.721**	-.674**	-.687**	-.701**	-.717**	.704**	.280**	.399**	-.538**	-.639**	-.260**
Couple				-.150*	-.412**	-.232**	-.332**	-.485**	-.553**	.761**	.541**	.015	.156*	.428**	-.419**	-.823**	.202**	.549**	.015	-.385**
LP					.443**	.186**	-.357**	-.373**	-.257**	.019	-.007	.803**	.745**	.486**	-.421**	.437**	-.758**	.055	.787**	.847**
Black						.558**	-.003	.002	.198**	-.382**	-.331**	.115	.083	-.035	.043	.572**	-.262**	-.193**	.101	.680**
IPB							.111	.029	.144*	-.222**	-.233**	-.025	-.030	-.049	.079	.282**	-.120	-.087	-.028	.394**
BC								.657**	.130*	-.491**	-.292**	-.407**	-.423**	-.389**	.678**	.279**	.119	-.463**	-.427**	-.200**
Age 18 - 24									.191**	-.702**	-.543**	-.503**	-.553**	-.615**	.977**	.301**	.072	-.694**	-.510**	-.212**
Age 25 - 44										-.577**	-.683**	-.431**	-.393**	-.455**	.153*	.290**	.354**	-.229**	-.320**	-.050
Age 45 - 64											.712**	.290**	.390**	.542**	-.668**	-.628**	.036	.693**	.283**	-.211**
Age 65+												.377**	.347**	.487**	-.513**	-.419**	-.070	.592**	.282**	-.170**
No Qua													.886**	.647**	-.579**	.293**	-.836**	.312**	.951**	.658**
Level 1														.828**	-.638**	.111	-.813**	.534**	.943**	.511**
Level 2															-.662**	-.186**	-.581**	.709**	.742**	.226**
Students																.248**	.165**	-.714**	-.608**	-.242**
No Car																	-.460**	-.481**	.250**	.680**
MP																		-.130*	-.861**	-.649**
Inter. Occ.																			.384**	-.172**
R/LO																				.588**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Appendix 3 – Cluster Solutions

a) 3 and 4 cluster solutions for ALL Areas

3 Cluster			
	Cluster		
	1	2	3
Zscore: Private Renters	-.16717	-.26111	2.19165
Zscore: Black	.66764	-.39168	.05483
Zscore: No Qualifications	1.00584	-.34462	-1.42460
Zscore: Full Time Students	-.21932	-.30628	2.65258
Zscore: No Car	.92336	-.68942	.98282
Zscore: Managers and Professionals	-.90719	.57292	-.32441
Zscore: Never Worked/Long Term Unemployed	1.12013	-.56882	-.45032

4 Clusters				
	Cluster			
	1	2	3	4
Zscore: Private Renters	.37632	2.22176	-.22995	-.42495
Zscore: Black	1.88813	-.01756	-.40995	-.11683
Zscore: No Qualifications	.78274	-1.46154	-.55040	.88042
Zscore: Full Time Students	.03572	2.70280	-.29509	-.34040
Zscore: No Car	1.48242	.95080	-.80345	.31676
Zscore: Managers and Professionals	-.96907	-.30978	.80686	-.68551
Zscore: Never Worked/Long Term Unemployed	1.93969	-.49881	-.66260	.34855

b) 3 and 4 cluster solutions for Bristol

3 Clusters			
	Cluster		
	1	2	3
Zscore: Private Renters	-.58616	.37415	**.71417**
Zscore: Black	-.17335	3.20874	-.28565
Zscore: No Qualifications	.71370	.29046	-.98921
Zscore: Full Time Students	-.42822	.11422	**.54726**
Zscore: No Car	-.03932	1.93565	-.25850
Zscore: Managers and Professionals	-.65340	-.67439	**.97114**
Zscore: Never Worked/Long Term Unemployed	.21788	2.22663	-.64487

4 Clusters				
	Cluster			
	1	2	3	4
Zscore: Private Renters	-.58572	.36328	1.84742	.03014
Zscore: Black	-.13705	3.36519	-.21824	-.30671
Zscore: No Qualifications	.89419	.25738	-1.36020	-.61161
Zscore: Full Time Students	-.43840	.14698	2.20260	-.20479
Zscore: No Car	.17386	1.89749	.58366	-.66116
Zscore: Managers and Professionals	-.79232	-.70706	.48669	**.**83260
Zscore: Never Worked/Long Term Unemployed	.41069	2.30519	-.75221	-.58226

Appendix 4 - Validation

a) Cross tabulation of IMD deciles and the cluster 4 cluster solution in Leeds

		Cluster Classification				
		1	**2**	**3**	**4**	Total
IMD Decile	**1**	51	0	0	54	105
	2	5	4	0	34	43
	3	0	8	10	27	45
	4	0	7	15	12	34
	5	0	9	26	3	38
	6	0	4	32	4	40
	7	0	2	47	1	50
	8	0	2	44	0	46
	9	0	1	39	0	40
	10	0	0	41	0	41
Total		**56**	**37**	**254**	**135**	482

b) Cross tabulation of IMD deciles and the 4-cluster solution in Nottingham

		Cluster Classification				
		1	2	3	4	**Total**
IMD Decile	**1**	39	4	0	18	**61**
	2	16	5	0	32	**53**
	3	5	7	3	11	**26**
	4	0	5	5	11	**21**
	5	0	2	11	13	**26**
	6	0	1	16	5	**22**
	7	0	3	22	0	**25**
	8	0	0	17	0	**17**
	9	0	0	23	0	**23**
	10	0	0	47	0	**47**
Total		**60**	**27**	**144**	**90**	**321**

c) Cross tabulation of IMD deciles and the 4-cluster solution in Bristol

		Cluster Classification				
		1	**2**	**3**	**4**	**Total**
IMD decile	**1**	12	1	0	29	**42**
	2	2	2	1	30	**35**
	3	2	3	5	26	**36**
	4	0	2	14	16	**32**
	5	0	5	9	6	**20**
	6	0	4	16	3	**23**
	7	0	6	22	2	**30**
	8	0	4	17	1	**22**
	9	0	4	8	0	**12**
	10	0	0	11	0	**11**
Total		16	31	103	113	**263**

Appendix 6 - Collinearity Statistics

Model 1

a) Collinearity statistics after removal of fulltime students

Variables	Tolerance	VIF
Private Renters	.185	5.411
Lone Parent Family households	.198	5.043
No Qualifications	.206	4.844
Aged 25 - 44	.583	1.714
Owner Occupiers	.198	5.046
British Chinese	.644	1.552
Aged 65 Above	.252	3.975
IPB	.739	1.353
Black	.536	1.865

b) Collinearity diagnostics showing variance proportions

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions									
				(Constant)	Private Renters	Lone Parent Family households	No Qualifications	Age 25 - 44	Owner Occupiers	British Chinese	Aged 65 Above	IPB	Black
1	1	6.811	1.000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	2	1.199	2.384	.00	.01	.00	.00	.00	.00	.14	.00	.06	.03
	3	.799	2.919	.00	.01	.00	.00	.00	.00	.15	.00	.05	.19
	4	.516	3.634	.00	.00	.01	.00	.00	.00	.10	.00	.65	.09
	5	.329	4.549	.00	.11	.00	.00	.01	.00	.43	.01	.10	.00
	6	.204	5.784	.00	.01	.05	.03	.00	.02	.00	.03	.03	.53
	7	.086	8.897	.00	.08	.05	.07	.05	.07	.02	.17	.00	.01
	8	.035	13.930	.00	.19	.30	.11	.54	.04	.02	.01	.00	.00
	9	.016	20.425	.00	.06	.34	.72	.26	.34	.00	.63	.10	.12
	10	.005	38.153	1.00	.54	.25	.06	.14	.53	.14	.15	.02	.02

Model 2

c) Initial collinearity statistics for initial 9 variables for model 2

Variables	Tolerance	VIF
Zscore No Car	.213	4.697
Zscore: Private Renters	.176	5.688
Zscore: IPB	.791	1.264
Zscore: British Chinese	.531	1.885
Zscore: Black	.584	1.712
Zscore: Aged 25 - 44	.347	2.878
Zscore: Routine Occupations	.218	4.586
Zscore: Full Time Students	.172	5.816
Zscore: Level 2 Qualifications	.356	2.810

d) Collinearity diagnostics for all initial selected variables

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions									
				(Constant)	Zscore: (No Car)	Zscore: Private Renters	Zscore: IPB	Zscore: British Chinese	Zscore: Black	Zscore: Aged 25 - 44	Zscore: Routine Occupations	Zscore: Fulltime Students	Zscore: Level 2 Qualifications
1	1	3.580	1.000	.00	.00	.01	.01	.02	.01	.00	.00	.01	.02
	2	1.898	1.373	.00	.03	.00	.02	.00	.08	.01	.03	.00	.00
	3	1.087	1.815	.00	.02	.01	.01	.06	.00	.16	.01	.02	.01
	4	1.000	1.892	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	5	.893	2.002	.00	.01	.01	.63	.00	.03	.04	.01	.00	.00
	6	.547	2.559	.00	.00	.00	.09	.48	.17	.05	.01	.01	.10
	7	.507	2.657	.00	.03	.02	.16	.16	.50	.01	.05	.01	.01
	8	.300	3.456	.00	.01	.13	.00	.09	.04	.00	.00	.08	.63
	9	.103	5.905	.00	.82	.16	.00	.11	.15	.02	.83	.00	.22
	10	.086	6.447	.00	.07	**.66**	.07	.08	.02	**.70**	.05	**.86**	.01

e) Collinearity statistics for variables

Variables	Tolerance	VIF
Zscore: (No Car)	.556	1.799
Zscore: IPB	.846	1.181
Zscore: British Chinese	.575	1.740
Zscore: Black	.622	1.609
Zscore: Aged 25 - 44	.695	1.439
Zscore: Fulltime Students	.353	2.829
Zscore: Level 2 Qualifications	.485	2.063

Model 3

f) Collinearity statistics for the initially selected 9 variables for model 3

Variables	Tolerance	VIF
Zscore: Social Renters	.169	5.900
Zscore: British Chinese	.620	1.613
Zscore: Couple Family	.124	8.033
Zscore: IPB	.702	1.425
Zscore: Aged 25 - 44	.319	3.131
Zscore: No Qualifications	.237	4.214
Zscore: Private Renters	.097	10.362
Zscore: Black	.569	1.758
Zscore: Aged 18 - 24	.146	6.838

g) Collinearity diagnostics for initial sets of variables

				Variance Proportions								
Model	**Dimension**	**Eigenvalue**	**Condition Index**	**(Constant)**	**Zscore: Social Renters**	**Zscore: British Chinese**	**Zscore: Private Renters**	**Zscore: Couple Family Households**	**Zscore: Black**	**Zscore: Aged 25 - 44**	**Zscore: Aged 18 - 24**	**Zscore: No Qualifications**
1	1	3.072	1.000	.00	.00	.03	.01	.01	.01	.01	.01	.00
	2	2.280	1.161	.00	.03	.00	.00	.01	.05	.00	.00	.03
	3	1.151	1.634	.00	.01	.06	.00	.00	.02	.17	.02	.00
	4	1.000	1.753	1.00	.00	.00	.00	.00	.00	.00	.00	.00
	5	.632	2.204	.00	.00	.17	.01	.03	.58	.00	.01	.02
	6	.512	2.449	.00	.00	.65	.01	.00	.23	.08	.02	.02
	7	.210	3.824	.00	.28	.06	.08	.00	.06	.06	.02	.48
	8	.089	5.875	.00	.02	.02	.01	.68	.01	.39	.48	.38
	9	.054	7.548	.00	**.66**	.00	**.89**	.28	.06	.30	.44	.06

h) Collinearity statistics showing VIF and tolerance values after exclusion of persons age 18 – 24 and private renters

Predictors	Tolerance	VIF
Zscore: Social Renters	.263	3.800
Zscore: British Chinese	.675	1.482
Zscore: Aged 25 - 44	.711	1.407
Zscore: No Qualifications	.378	2.644
Zscore: Couple Family Households	.423	2.363
Zscore: Black	.585	1.711
Zscore: IPB	.803	1.245

i) Collinearity diagnostics showing variance proportions after removal of persons aged 18 – 24 and private renters

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions							
				(Constant)	Zscore: Social Renters	Zscore: British Chinese	Zscore: Couple Family Households	Zscore: Black	Zscore: Aged 25 - 44	Zscore: No Qualifications	Zscore: IPB
1	1	2.436	1.000	.00	.03	.01	.05	.06	.02	.01	.01
	2	1.695	1.199	.00	.02	.10	.01	.00	.07	.08	.05
	3	1.000	1.561	1.00	.00	.00	.00	.00	.00	.00	.00
	4	.983	1.574	.00	.01	.09	.05	.05	.00	.01	.50
	5	.912	1.634	.00	.00	.26	.00	.00	.44	.00	.05
	6	.502	2.203	.00	.00	.01	.04	.72	.06	.09	.25
	7	.314	2.786	.00	.00	.48	.58	.02	.38	.18	.05
	8	.157	3.936	.00	**.94**	.05	.28	.15	.03	**.63**	.09

j) Collinearity Statistics After removal of aged 18 – 24 and private renters and social renters

Predictors	Tolerance	VIF
Zscore: British Chinese	.688	1.453
Zscore: Couple Family Households	.562	1.781
Zscore: Black	.685	1.460
Zscore: Aged 25 - 44	.729	1.372
Zscore: No Qualifications	.710	1.409
Zscore: IPB	.852	1.174

Model 4

k) Collinearity statistics after removal of persons aged 18 – 24 and private renters and social renters

Variables	Tolerance	VIF
Zscore: British Chinese	.550	1.819
Zscore: Aged 25 - 44	.273	3.659
Zscore: Never Worked/Long Term Unemployed	.167	5.978
Zscore: Fulltime Students	.078	12.890
Zscore: No Qualification	.062	16.013
Zscore: Private Renters	.154	6.494
Zscore: Couple Family Households	.171	5.861
Zscore: IPB	.473	2.115
Zscore: Managers and Professionals	.116	8.613
Zscore: Black	.441	2.269

l) Collinearity diagnostics showing variance proportions

Dimension	Eigen-value	Condition Index	Variance Proportions										
			(Constant)	Zscore: British Chinese	Zscore: Aged 25 - 44	Zscore: Never Worked/Long term Unemployed	Zscore: Fulltime Students	Zscore: No Qualifications	Zscore: Private Renters	Zscore: Couple Family Households	Zscore: IPB	Zscore: Managers and Professionals	Zscore: Black
1	3.363	1.000	.00	.01	.00	.01	.00	.00	.01	.01	.01	.00	.02
2	2.810	1.094	.00	.02	.00	.01	.00	.01	.01	.00	.00	.01	.01
3	1.362	1.572	.00	.03	.09	.00	.01	.00	.00	.00	.02	.01	.01
4	1.000	1.834	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.995	1.839	.00	.01	.03	.00	.00	.00	.00	.03	.28	.00	.01
6	.570	2.429	.00	.14	.00	.00	.00	.00	.03	.00	.12	.01	.42
7	.497	2.603	.00	.64	.05	.00	.01	.01	.01	.00	.00	.00	.12
8	.162	4.552	.00	.02	.30	.06	.02	.00	.00	.33	.00	.28	.03
9	.118	5.328	.00	.00	.00	.85	.03	.02	.01	.17	.47	.01	.20
10	.093	6.013	.00	.07	.19	.00	.10	.05	.94	.20	.09	.00	.10
11	.029	10.725	.00	.07	.33	.06	**.82**	**.90**	.00	.26	.01	**.68**	.08

m) Collinearity statistics

Variables	Tolerance	VIF
Zscore: British Chinese	.574	1.741
Zscore: Aged 25 – 44	.781	1.280
Zscore: Never Worked/Long term Unemployed	.215	4.655
Zscore: Black	.508	1.967
Zscore: Fulltime Students	.477	2.098
Zscore: IPB	.625	1.599
Zscore: Managers and Professionals	.355	2.820

n) Collinearity statistics after excluding managers and professionals

Predictors	Tolerance	VIF
Zscore: British Chinese	.575	1.741
Zscore: Aged 25 - 44	.884	1.132
Zscore: Never Worked/Long term Unemployed	.463	2.161
Zscore: Fulltime Students	.561	1.783
Zscore: IPB	.723	1.383
Zscore: Black	.520	1.922