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Economic and Socio-Psychological Analyses of Social Housing Policies in the U.K.

LOIS YIXI LIAO

A thesis submitted in partial fulfilment of the requirement of University College London for the degree of Doctor of Philosophy

Declaration

I, Lois Yixi Liao, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Acknowledgement

Just started PhD

Just before upgrade

Rest of the time

Write-up period

[1]

Now?

I would like to thank all the support and encouragement that I received from my family,[2] friends,[3] and secondary supervisor[4] Dr Aniket Kumar. I am particularly grateful to my principal supervisor Prof. Michelle Baddeley for guiding and supporting me with academic rigour and care. She kindly allowed me to explore my free but sometimes non-linear thinking during our meetings and through writing, which enabled me to spark new research insights.

The PhD journey has not been easy, but I have truly enjoyed the process. Besides completing the doctorate, the best outcome for the past few years is figuring out my research interest and passion. I am excited to embark on a new chapter in my research career.

> *"Now this is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning."*
>
> \- *Winston Churchill*

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Abstract

Whilst access to housing is a fundamental part of the United Nation's *Universal Declaration of Human Rights,* it remains an unfulfilled objective in the U.K. On the contrary, the U.K. housing crisis has continued to worsen, with housing affordability deteriorating significantly since the 1980s due to the increased financialisation of housing. The crisis is particularly reflected in the social housing sector, where contemporary discussions on potential drivers have focused on structural 'supply' and other issues that can be easily materialised or quantified. However, issues beyond supply have often been overlooked in quantitative housing studies. Therefore, I aim to bridge the research gap by discussing social housing issues beyond 'bricks and mortar'. This paper contributes to two further research gaps. First, there remains limited attempts in bringing Bourdieusian social theories into social housing studies and policy making. Second, incorporating computational modelling into social housing studies remains an under-explored area. The analysis is predominantly based on a case study of London, utilising Zoopla rental listings and granular neighbourhood data. The main research methods involve a range of econometric techniques including hedonic modelling, spatial analysis and panel data regression. Furthermore, I apply computational simulation methods including agent-based modelling and Monte-Carlo simulations. The findings draw the following key insights. First, residents and relocators make housing choices to maximise both material and objective benefits, as well as immaterial and subjective benefits. Second, distinct habitus exists between family and non-family households, between different socio-economic statuses, and between suburban and Central London locations. In addition, migrants carry their habitus into their newly migrated country, which may be conveyed in their benefit claiming behaviour. The research findings suggest that a multi-agency partnership is required to establish a sustainable social housing policy framework. Moreover, there is a need to critically reassess the fundamental philosophy of the current social housing policies.

Impact Statement

Large metropolitan cities, such as London, invite focus for such studies as the city's current housing shortage and deteriorating housing affordability have resulted in increased social housing demand in the past few years. The 'supply issue' has conventionally been a highly discussed topic amongst policymakers, partly driven by the visible materiality of the issue. However, such a focus omits the wider issues confronted by social tenants, which extend beyond supply issues. Therefore, this thesis aims to study the various 'beyond supply' issues in social housing in the U.K. through a case study of London. In addition, there will be a focus on social and psychological issues as potential drivers. From an academia perspective, the originality of my thesis is both theoretical and methodological. For theoretical contributions, I provided a complex framework for the decision-making of renting and relocation choices, which combines rational action theory with Bourdieu's social theories. The application of Bourdieusian social theories into the discussion of social housing paves the way for future studies, an area and combination currently under-researched. For my methodological contribution, I utilised new methods such as agent-based modelling. This is coupled with the paper's attempt to explore the possibility of interpreting Bourdieu's class and psychosocial theories using revealed preference data.

Besides direct application for housing study research, the beneficiaries of the research include social housing policymakers and housing industry practitioners. My approach to achieve impact outside academia includes the following three aspects. First, this thesis attempts to conduct social housing research on a multi-disciplinary basis. These disciplines include, but are not limited to, economics, sociology, psychology, urban planning, architecture, philosophy and politics. The research points to a possibility for resolving social housing issues through a multi-agency partnership. Second, the research draws social housing policy insights from evidence-based research, based on granular rental listing and neighbourhood data. This is achieved by first developing the profiles of rental preferences in London, which provided insights on differing housing preferences between family and non-family households, between different socio-economic statuses, and between different sub-regions in London. Furthermore, the empirical research investigated the drivers of local authorities waiting list lengths in London, concluding that the key driver relates to the number of benefit claimants. Moreover, the empirical evidence suggested that both first- and non-first-generation immigrants are less likely to claim benefits compared to the native population, predominantly consisting of the White ethnic population group. The above results call for an attempt to reduce the gap between social tenants' housing needs and ones currently provided to them, and a further change in political narrative around the discussion on migrants. Finally, this thesis also proposed computational approaches to evaluate the effectiveness of social housing policies. The impact draws from, but is not limited to, the examination of the potential effectiveness of housing mobility schemes, as well as a comparison between effectiveness and welfare implications between direct-offering scheme, choice-based letting and Gale-Shapley matching-searching as an alternative allocation scheme.

List of Key Abbreviations

ABM	Agent-based Modelling
ANOVA	Analysis of Variance
AWS	Amazon Web Services
CBD	Central Business District
CBL	Choice-based Letting
DO	Direct-offering Scheme
FE	Fixed Effect
GBCS	The Great Britain Class Survey
GMM	Gaussian Mixture Model
GSMS	Gale-Shapley Matching-Searching
HIR	Housing Income Ratio
IV	Instrumental Variable
LLC	Levin-Lin-Chu
LM	Lagrangian Multiplier
LSOA	Lower Super Output Areas
MAPE	Mean Absolute Percent Error
MSOA	Middle Layer Super Output Areas
OA	Output Area
OLS	Ordinary Least Square
PSM	Propensity Score Matching
RAT	Rational Action Theory
RE	Random Effect
RTB	Right-to-Buy
RPV	Relative Property Value
SAR	Spatial Autoregressive Model
SD	Standard Deviation
SDM	Spatial Durbin Model
SEM	Spatial Error Model
SES	Socio-Economic Status
SMP	Stable Marriage Problem
SOA	Super Output Area
USMP	Unequal Stable Marriage Problem
VIF	Variance Inflation Factor

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1 Introduction

The United Nation's *Universal Declaration of Human Rights* recognises the right to housing as part of the fundamental economic, social, and cultural rights of human beings. This is alongside other rights including access to education, adequate standard of living, access to health care, entitlement to victims' rights, and access to science and culture (The United Nations, 1948),

> "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control."

Moreover, the *United Nations Committee on Economic, Social and Cultural Rights General Comments No. 4* specifically concerns the right to adequate housing (The United Nations, 1991). On the other hand, *General Comments No. 7* discusses forced evictions (The United Nations, 1997) and further clarifies the 'right to adequate housing' (The United Nations, 2009):

> "The right to housing contains freedoms […] entitlements (which) include security of tenure, housing, land and property restitution, equal and non-discriminatory access to adequate housing, participation in housing-related decision-making at the national and community levels […] Adequate housing must provide more than four walls and a roof,…(which should consider): security of tenure […] availability of service […] affordability […] habitability […] accessibility […] location and cultural adequacy […] Protection against forced evictions is a key element of the right to adequate housing and is closely linked to security of tenure" (p. 3).

Despite these universal rights, a housing crisis in London has emerged in recent decades, where problems include shortages of housing supply in sale, private rental, and social housing markets (Holman *et al.*, 2015). Simultaneously, housing inequality has become a key issue faced by the capital, with tenants becoming less protected and asset wealth inequality widening (Butler and Hamnett, 2009; McKenzie and Atkinson, 2020).

In August 2018, the Ministry of Housing, Communities & Local Government published, *A New Deal for Social Housing* (Ministry of Housing, 2018), which emphasised the five principles of social housing: 'ensuring homes are safe and descent', 'effective resolution of complaints', 'empowering residents and strengthening the regulator', 'tackling stigma and celebrating thriving communities' and 'expanding supply and supporting home ownership'. However, the recent development of social housing has seen upheavals, featuring shortages in supply, long waiting lists, mismatched choices and relocation, and other social issues including the stigmatisation of social tenants. The issues affecting the current social housing provision system can be divided into technological/material and social categories. The former includes supply issues, physical and quality standards, and the allocation of existing units. These issues are ones that are easily observable and quantifiable. Simultaneously, there are additional social issues that are not captured by these technological factors. These issues include the everyday subjective experience of residing in social housing, how social tenants relate to their social positions in a society that champions homeownership, how they convey their preferences and choices, how migrants experience the welfare system and how social housing allocation systems can be optimised. Nevertheless, most of the issues are not distinctively technological or social, but are often a hybrid where they influence each other dialectically (Baxter and Lees, 2012). Technological issues can both be amplified, and be a result of, interactions with social issues, and vice versa. For example, the four factors of physical building condition, building design and security, existence of anti-social behaviour and residents' neighbourhood perception, all interact to form the living experience of residents in tower blocks in London (Baxter and Lees, 2012).

Understanding the issues 'beyond supply' and 'beyond shelter' are as important as understanding the technological issues related to social housing. This is because the experience of social renters is not limited to their experience in dwellings and tenure choice, but also relate to issues of stigmatisation from the rest of society. As representations of a social group that are dependent on the State for rentals, social renters do not readily fit into the homeownership norm. Similarly, from policymaking perspective, "beyond mere shelter, housing assistance has other social, economic, and well-being outcomes" (Baker, Lester and Beer, 2013, p. 1). Despite existing social housing studies looking at dialectical technological and social issues (e.g. Hills *et al.*, 1990; Baker, Lester and Beer, 2013; Power, 2019), current quantitative studies on social housing mostly focus on physical issues. In particular, studies are highly apolitical, and mainly seek solutions to increase housing supply with a focus on technicality, practicality, and efficiency.

1.1 Research gap: The missing political and social lenses in social housing studies

> "[The housing related issues] have bearing on the economic and physical dimensions of housing units. But they cannot be reduced to them. They relate, instead, to the social antagonisms at the heart of capitalist societies. They require an analysis of the housing system in the broader contexts of class power, racism, patriarchy, and other forms of structural violence" (Madden and Marcuse, 2016, p. 72).

The study of housing should go beyond a discussion of supply and treatment of social housing as mere shelters. Whilst the imbalance between demand and supply are critical issues, social housing issues also encapsulate both political and social dynamics. The issues within the social housing system lie beyond the issue of supply. These issues include, but are not limited to, the co-existence of vacant dwellings with long waiting lists, and the innate contradiction between housing supplier financially motivated objectives and social housing welfare policies. Therefore, the aim of this thesis is to apply quantitative methods to the analysis of social housing issues through a political and social lens.

There are three reasons that there is a need to fill in the missing political and social perspectives in quantitative housing studies. First, housing crises are the products of housing systems. The financialisation and commodification of properties have created scarcity in the housing market. This in turn, has resulted in parts of the population having an inability to afford properties. Although the most recent 2008 Global Financial Crisis was caused by a complex multitude of factors, including regulatory failure and unstable macroeconomic environments, the aspiration of homeownership and the ability to trade real estate as assets also played significant roles (Davies, 2010). As Madden and Marcuse (2016) argued:

> “Housing crisis is a predictable, consistent outcome of a basic characteristic of capitalist spatial development: housing is not produced and distributed for the purposes of dwelling for all; it is produced and distributed as a commodity to enrich the few. Housing crisis is not a result of the system breaking down but of the system working as it is intended” (p. 15).

> And:

> “The problem with making housing a commodity is that as such, living space will be distributed based on the ability to pay and provided to the extent that it produces a profit. But ability to pay is unequal while the need for a place to live is universal. There is thus an unavoidable contradiction” (p. 46).

Based on the theory of demand and supply, increasing the stock of housing supply given the same demand levels will reduce the scarcity of housing. It also reduces the exchange value of housing and negatively impacts the interests of existing homeowners. The above issue is caused by inevitable conflicts between the use and exchange value of housing (Harvey, 2014).

Second, the type of welfare model that a country adopts may be linked to its cultural norms and values, as well as its political background. In the case of the U.K., housing is viewed as a highly commodified asset. Furthermore, social housing in the U.K. also follows a residual welfare model, which means that it also focuses assistance upon those most in need. Such a welfare model inevitably creates a divide between the citizens who are, and who are not, welfare recipients. Subsequently, this also causes stigmatisation and marginalisation of the former from the latter. If there is social stigmatisation because of welfare and social constructs, the existence of stigma goes against the original objective of social housing provision.

Third, through the implementation of a ‘property-owning democracy’, homeownership has become an ideology and a political tool. The promotion of a ‘property-owning democracy’ attaches, not only material meaning, but also symbolic meaning to homeownership. The symbolic meaning of homeownership therefore distinguishes the dominant and the dominated in the housing market, where the former are individuals with high property wealth and the latter are ones that are not able to afford renting their own properties. The symbolic interacts with the embodied power relationship in culture to form symbolic power (Swartz, 1998). Instead of physical violence, non-physical forms of symbolic violence and dominations are directed toward the dominated subordinate group in advanced societies (Bourdieu and Passeron, 1990). The stigmatisation towards this group can also be internalised, resulting in social consequences which are in contradiction of the original objectives of social housing provision. Though much of the current discussion on resolving the UK's housing crisis is apolitical, much of the problem lies within the U.K.'s welfare provision model, where politics has always maintained a strong influence.

Therefore, there is the need to progress from addressing the social housing issue from a pure focus on supply to a more complex framework. Such need is also aligned to Maslow's Hierarchy of Needs. Maslow's Hierarchy of Needs suggests that individuals move towards higher needs which are more psychological and social once their more basic needs are fulfilled (Maslow, 1943). The theory can be applied to the U.K.'s post Second World War development. Towards the mid 1970s, industrialised countries which were affected by the war mostly finished their post-war reconstruction. The U.K. was one of these countries (Crafts and Toniolo, 1996). Since the physical function of dwellings have been slowly fulfilled, residents have begun to demand more than just the utility use of dwellings. Lang (1987) noticed that the progression of these needs aligns with Maslow's Hierarchy of Needs, which have advanced from accessibility, security and safety, social connections, privacy, aesthetic, to the need to show individuality. However, this progression of needs has been neglected in the process of social housing provision. Whitehead (2017) critically argues that:

> "Many commentators in the past assumed that once minimum physical standards were achieved the task would have been complete. The reality has proved to be very different as aspirations, standards and social objectives have expanded and both the cost and the capacity to implement different forms of intervention have opened up other opportunities" (p. 12).

Consequently, a social welfare system based on universal values may result in the misallocation of social welfare.

1.2 Originality and Contribution

In this thesis, I aim to bridge the research gap through the following research strategies. The first strategy is to understand the politics of social housing and its welfare model, as well as homeownership as an ideology. The second strategy is to study the issues beyond supply including how social renters experience stigmatisation, other factors that lie beyond the provision of space that can influence the living experiences of social renters, and the potential improvements which could be made to the current matching and allocation mechanisms. It should be noted that the first and second plans are inherently connected as they both consider the 'social' aspect of social housing issues. This is because politics determines the 'norm' of the society, and consequently how society treats marginalised social renters, whereas the 'norm' of a society reinforces politics in social housing. In other words, agency and structure form a dialectic relationship, influencing and reinforcing each other. The originality of my thesis is through this focus on the social aspect of the social housing issue, and through the connection of it with technological considerations (such as housing designs and supplies). The originality is also reflected in the perspectives applied in the research, theoretical frameworks adopted, methodological approach, and policy insights.

My thesis outlines a multi-disciplinary approach in resolving social housing issues, and the important role that economic sociology plays in understanding the topic. Potential audiences for the thesis include policymakers and academics in housing studies. Besides theoretical and methodological contributions, this thesis also provides tools to improve the efficiency of the allocation system as well as showing how individual behaviour and choice should be considered in the development of social policies. In the application of policy making, this thesis is original as it applies agent-based modelling (ABM), Monte-Carlo simulation and the gravity model to policy making.

1.2.1 Theoretical originality: Bourdieu's theories in social housing

My first original contribution relates to the angle I take in studying social housing. The thesis studies the social housing issue beyond the commonly studied supply issue. The theoretical framework of my thesis incorporates economic sociology into the study of housing decision-making from a demand-side perspective. Economic sociology provides the perspectives on how social structures influence and shape renters' preferences. These influences include culture, institutions, social networks, political structures, and sanctions on deviating behaviour. As such, the key theoretical frameworks of my thesis are based on Pierre Bourdieu's social theories.

Part of Bourdieu's theory describes how individuals' 'habitus' coupled with their capital can translate into a set of practices specific to a given 'field'. Here, 'habitus' is defined as the ingrained disposition and skills of an individual; 'capital' includes economic, social, and cultural capital; and 'field' is where social games are played. There are unlimited types of fields with each having its own rules and norms. For example, modern society is based on an economic field as a social space, where social positions are arranged based on the volume of economic capital, and rules are formed based on the logic of capitalism. In *The Social Structures of the Economy*, Bourdieu (2005) wrote about the post-war French housing market using a historically oriented multi-method approach. In particular, he argued against rational action theory, suggesting that actors within the social structure are not able to make utility maximising decisions (Swartz, 1998):

> "Bourdieu's actors pursue strategies, but not as conscious maximizers of limited means to achieve desired ends. Their choices are more tacit, practical, and dispositional, reflecting the encounter between the accumulated capital and corresponding dispositions from past experience and the present opportunities and constraints of fields where they act" (p. 78).

Bourdieu showed the power that neoclassical theory has in determining government policies, and the influence of the State in socially constructing housing markets. In addition, avenues including advertising create demand by connecting the symbolic value of home with the physical attributes of houses and homeownership. In Bourdieu's *Reproduction in Education, Society and Culture,* which he co-authored with Jean Passeron, he highlighted the influence of mainstream media and education in legitimising symbolic value and violence.

Even though Bourdieu's research on habitus derive from his observations on 1960s French society, his findings and conclusions remain applicable to contemporary British society. In the context of British society, Bennett *et al.* (2008) replicated Bourdieu's work, and their results showed that social classes primarily arise from cultural divides. Other causes include gender, ethnic and age divisions. Politics also plays a role. For example, the legacy of Thatcherism, which is an ideology functioning under neoliberalism, resulted in significant social changes in the U.K. from the 1990s. The changes subsequently led to increases in inequality and polarisation across society (Bennett *et al.*, 2008). Through surveying British households, Deeming (2014) found the contemporary relevance of Bourdieu’s findings. The survey specifically asked respondents to identify items that adults could not live without, and found the working-class to show a more practical and functional taste towards their dwellings compared to other social groups. Furthermore, they tended to show stronger orientation towards consumer products within their homes, such as furniture and lifestyle goods, with strong desires to upgrade material goods to reflect their improving living standards. Deeming's (2014) findings are consistent with those of Townsend (1979), whose research suggest that the working-class show stronger disposition towards consumer goods, especially towards electrical appliances which offer them entertainment. However, one of the caveats of Deeming's (2014) study is that the survey respondents were only able to provide answers to products that they have previously consumed. Compared to the middle-class, the working-class’s relatively more constrained budgets means that they may have no knowledge of the products which represent ‘high-brow’ taste. The implication of the caveat is that answers from different social classes are not comparable.

Savage (2011) proposed the need to reincorporate Bourdieu’s social theories, especially the study of ‘field’, into urban studies. Bourdieu’s theories on field, habitus, and capital offer relevant theoretical frameworks to study the urban system. They consider population flows and social mobility whilst embedding these processes into social stratification. However, Savage (2011) pointed out that such work has been limited in the arena of urban studies. Even though I do not include a housing field analysis in this thesis, it nevertheless fills some of this research gap.

To uncover habitus, instead of using primary survey data results similar to Bourdieu’s application in *Distinction*, this research is based on secondary empirical data. Although *Distinction* is based on primary research, in some of his other studies, Bourdieu himself substituted primary research with secondary data. He argued that habitus is unconsciously embedded and can be difficult to be captured through primary research (Griller, 1996). In addition, the study focuses on differences in disposition between groups of different socio-economic statuses

(SES) in the housing rental market, rather than specifically constructing the field of the housing market.

Finally, the multi-disciplinary approach of this thesis employs different theories that complement each other. For example, Chapter 4 draws from both Bourdieu's and Maslow's theories. The former provides insights on behavioural and decision motivations from a sociological perspective, whilst the latter studies individual motivations from a psychological perspective. The combination of the theories provides a more robust and holistic theoretical perspective. Moreover, I adapted Bourdieu's theories when applying them to ensure that they matched both the research setting and its cultural context. For example, the analysis of ethnic minorities' benefit claiming behaviours incorporates discussion of both specific cultural and symbolic capital.

1.2.2 Methodological originality

My second originality is methodological and is reflected in the methodology and data used. Even though I do not incorporate any qualitative research into this thesis, it nevertheless provides insights and originality to the research topic. Comparing to qualitative research, quantitative research can provide generalisable patterns. The quantitative studies using secondary data not only aim to utilise existing data, but also provides a gateway to future research which can involve the use of qualitative research.

I incorporate Bourdieusian theories into this thesis not only theoretically but also methodologically. First, this study focuses on Bourdieu's idea of forming a subjective-objective methodology. In other words, the perspectives of this thesis are not only structural but also phenomenological. Second, this thesis mostly concerns the differing habitus between individuals, not only between different SES but also households with different needs. I explore the first point using hedonic modelling in Chapter 3 to 5. Based on the theoretical foundation developed in Chapter 2 to 6, I further explore bottom-up computational methods in Chapter 7 and 8. The methods used in Chapter 7 and 8 start with constructing individual agents' behaviour, followed by a study of the aggregate outcome of the overall system. The Agent-based Modelling (ABM) in Chapter 7 has the underlying assumption that residents aim to maximise both material and symbolic utility, based on Bourdieu's concept, when they relocate between neighbourhoods. I also use computational simulations in Chapter 8 to explore alternative ways of allocating social housing. For the study of habitus, I combine phenomenology, sociology and econometrics. My approach differs from Bourdieu's method of habitus study as his methodology is primarily based on primary research and statistics of secondary data, whereas this paper is mostly based on econometrics.

Another original contribution of this paper is the use of rental listing data. There are currently no publicly available databases on individual rental properties in the U.K. Therefore, studies based on rental markets in London are currently very limited as there is an inherent difficulty in obtaining large rental datasets. This thesis overcomes the restriction of data by utilising the Application Programming Interface (API) provided by Zoopla.[5] As a result, my thesis can conduct empirical research based on micro-data, which involves the characteristics of individual dwellings. The application of micro-data not only includes housing characteristics, but also extends to neighbourhood characteristics where output area data is used. The use of micro-data for measuring neighbourhood characteristics allows a capturing of the heterogeneity between different neighbouring streets in London. The micro-data base constructed for this study can also be used for further studies of London's rental market. Finally, I also use simulated data based on census information to construct potential profiles of properties and tenants for computational simulations.

1.3 Research Scope

1.3.1 Scope of subject

In the U.K., there are private and social housing markets. The former is determined by market demand and supply, whereas the latter involves government interventions. The scope of my thesis focuses on the social housing sector. The objective of social housing provision is "to ensure that everyone is adequately housed, and that housing does not limit their capacity to obtain the other necessities of life, or to take advantage of life's opportunities" (Whitehead, 2017, p. 12). In my thesis, the discussion of historical and regulatory contexts focuses on social housing provided by both councils and housing associations.

[5] Zoopla is a British property listing website, which provides listing and past information on rental and sale properties. Zoopla's API can be accessed from: https://developer.zoopla.co.uk/

Housing consists of both use value and exchange value. The use value is derived from the physical properties of housing, whilst the exchange value is the value that the housing can be traded for in a market (Marx, 2010). Based on these definitions, the sale market price mostly reflects the exchange value of housing, whereas the rental prices mostly reflect its use value. Since this thesis concerns social tenants and social housing, the empirical studies mostly draw insights from the private rental market with the use of listed rental prices to uncover revealed preference.

1.3.2 Scope of geographic area

In this thesis, I use two geographic classifications of regions in the U.K., namely administrative geography and census geography. The former aims to set the target area of the study, whilst the latter is used for methodological and empirical reasons.

The administrative geography in the U.K. follows a hierarchical structure. The country consists of England, Scotland, Wales, and Northern Ireland. The smaller units that make up England, Scotland, Wales, and Northern Ireland are regions, council areas, unitary authorities, and district council areas. England contains nine regions: South East, London, North West, East of England, West Midlands, South West, Yorkshire and the Humbler, East Midlands and North East (Office for National Statistics, 2016d). The makeup of the second and third levels of units for Scotland, Wales, and Northern Ireland are similar, where the third level contains electoral wards and communities (Figure 1.1). However, the hierarchical structure is more complex for England. England consists of regions, which include Greater London, Counties and Metropolitan Counties. Greater London consists of London Boroughs, which in turn consist of electoral wards. Counties consist of non-metropolitan districts, which in turn comprise electoral wards. Unitary authorities are single-tier local authorities that act as units of local government. Their lower level of unit is also an electoral wards/division. Finally, metropolitan counties consist of metropolitan districts, where the smallest unit is also an electoral ward. Population size within an electoral ward varies across the country, with an average value of 7,065 as of mid-2017 (Office for National Statistics, 2018b).

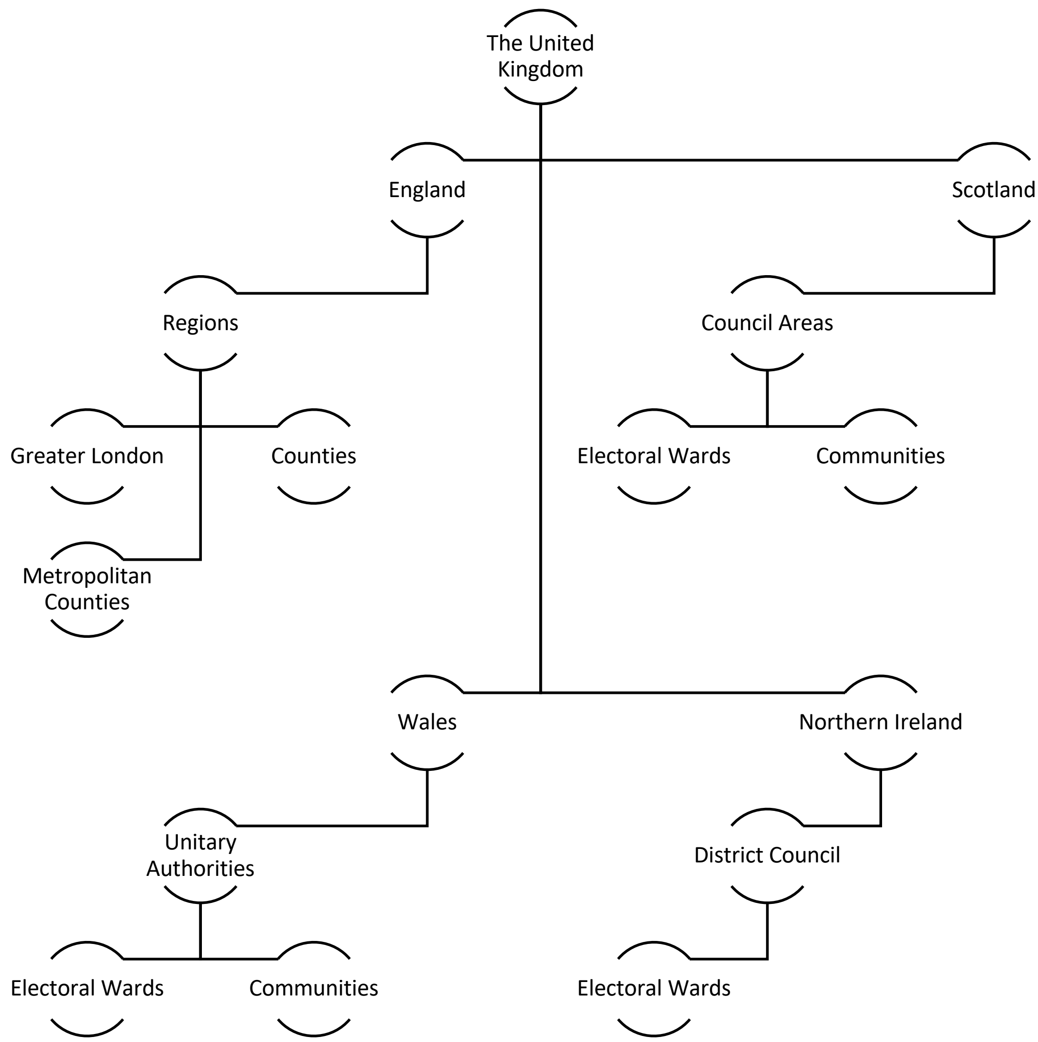
Different parts of the discussion in my thesis are applicable to different levels of the administrative geography. Whilst the discussion on the welfare state and models are applicable to the entire U.K., the discussion on the historical and regulatory development is mostly solely applicable to England. This is because Wales, Scotland and Northern Ireland have slightly different social housing provision systems. In particular, there has been a divergence in affordable and social housing policies between England and Wales, as well as between England and Scotland, after the 2010 advent of fiscal austerity (Gibb, 2020). Finally, the empirical studies mostly focus on London as housing and demographic situations in this city differ from the rest of the country. This therefore forms a distinctive case with varying implications. First, average income level is much higher in London than other parts of the country. In 2017, the average gross disposable household income was £27,825 in London, compared to a national average of £19,514 (Office for National Statistics, 2019d). In addition, there have been a net gain of managerial and professional jobs in London, whereas many of the other cities in the U.K. have experienced job losses (Butler and Hamnett, 2009). Second, despite the higher than national average income in London, properties are less affordable both in terms of renting and sale (Scanlon, 2017). As a result, the proportion of the population in social renting is higher in London, accounting for 22% of the population compared to the national average of 17%, based on 2017 data (Barton, 2017). Therefore, the social housing issue in London is of a much larger scale than the rest of the country. The stronger demand for social housing consequently places higher pressure on the housing stock and waiting lists. Third, London is much more demographically diverse than the rest of the country. For example, the outflow of the domestic population is balanced by inflows of foreign migrants (Butler and Hamnett, 2009). The demographic and ethnic diversity is also reflected in the population makeup of social renters: 27% of non-White ethnicity households live in rented social housing, which is significantly higher than any other regions in England (GOV.UK, 2020a). Overall, the capital's distinctive environment coupled with its role in the national economy make it a unique and important case study. However, it should also be noted that there exist differing circumstances between boroughs within London, in terms of administrative approaches. The regional devolution in London means that the Greater London Authority sets visions and plans which act as guidelines, whilst implementation power lies with the individual London local authorities (Mayor of London, 2016).

In this thesis, I used London as a case due to both its uniqueness and the ability to generalise it to other cities. However, whilst this city shares numerous characteristics with other cities in terms of housing models, it is not the case the London model should be directly copied.

Discussion of development economics and urban policies in the past few decades often distinguishes between ‘modern global cities’ and other ‘non-modern’ ‘ordinary cities’. These city categorisations have resulted in the perception of the existence of a hierarchy of cities , and ultimately development. ‘Modern global cities’ are perceived, typically, as commercial hubs that hold high levels of global economic activity. Furthermore, they are used as success stories of urban development. On the other hand, ‘non-modern’ cities are viewed simply as laggardly, and in need of catching up to ‘modern global cities’ (Robinson, 2013). One of the exemplars of ‘global cities’ is London, where a mixture of commercial and financial capital has given this city top status globally. However, Robinson (2013) argues that cities should be studied as ‘ordinary’, a status giving equal importance to all types of cities, rather than being labelled in a simplistic hierarchical classification as ‘developing’ or ‘developed’. Based on Robinson's (2013) argument, London is equally unique when compared to other ‘ordinary cities’. However, there remains a gap between Robinson's (2013) framework and current approaches in social policy design. For example, policies developed as a legacy of colonialism have made social housing policies in London (or the U.K.) a model answer for other cities. As a result, policymakers elsewhere can relate to the approaches of London’s contemporary social housing policies. For example, financialisation is a common trait shared by housing policies in London and many other countries, where the market focuses more on the exchange value of housing instead of its use value. Furthermore, many other countries have also experienced increasing use of social policies which emphasise ‘individual responsibility’ and the private sector as providers of welfare services. This ‘British-like’ phenomenon is seen in China, where housing was financialised in the 1980s, and the private sector is playing an increasing role in social housing provision.

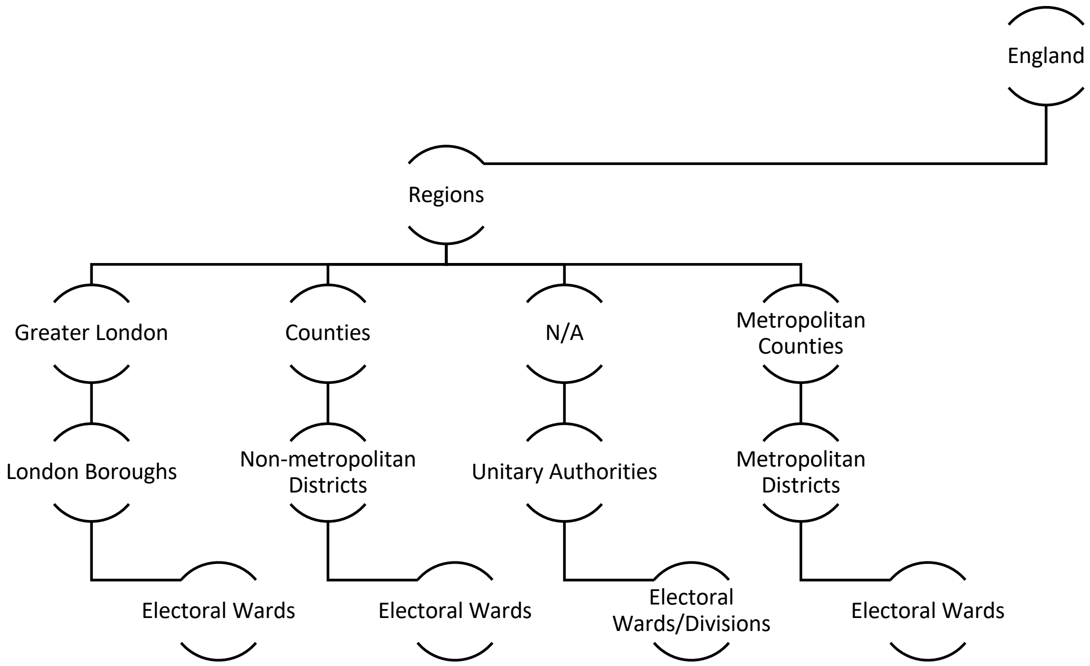
As discussed in the later parts of the thesis, there are challenges and limitations to social housing policies in London. Whilst these challenges are unique to London’s specificities, many of them also arise from the structural issues that result from the shifting of responsibility from the state to the individuals, and the involvement of the private market. The purpose of using London as a case study is not to further prescribe a 'model' city benchmark for other cities. Instead, it provides discussions to cities which have adopted similar social housing models. Their adoption of the 'London model' partly results from the dichotomy between cities which are 'modern' and 'not modern'. Therefore, and despite the model's popularity, we need move forward to an 'ordinary city' approach in constructing and designing welfare policies and cities in post-colonial discussions.

Figure 1.1 Administrative hierarchy in the U.K.



Source: Adapted from Office for National Statistics (2016b)

Figure 1.2 Administrative hierarchy in England

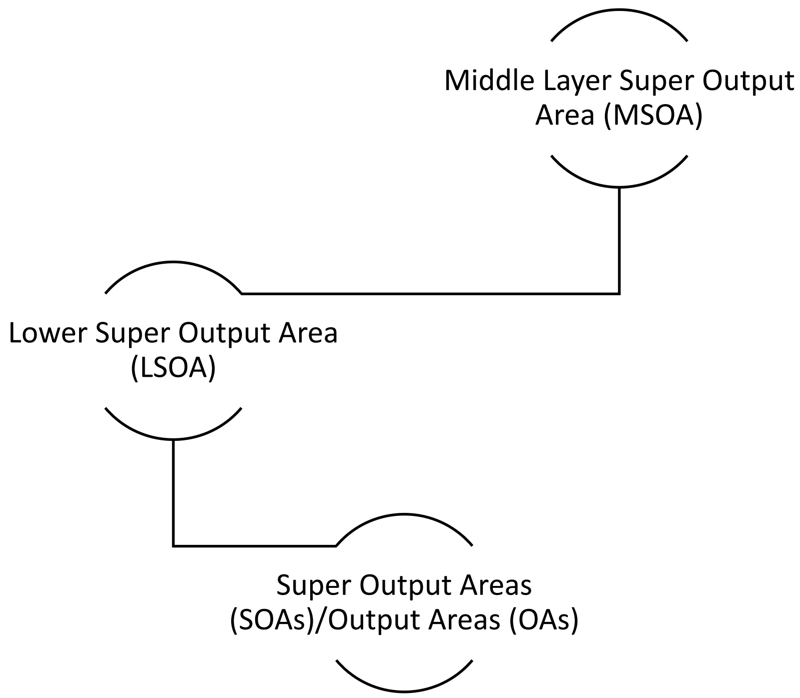


Source: Adapted from Office for National Statistics (2016b)

The data collection involves the use of census geography. The Office for National Statistics (ONS) in the U.K. takes population census data every 10 years. The most recent census was conducted in 2011. The geography which relates to census includes Output Area (OA) and Super Output Area (SOA)/Output Area (OA), where the former is the base unit for census data released (Office for National Statistics, 2016c). The ONS produces statistical hierarchy for the analysis of the census (Tower Hamlets, 2013), which consists of Middle Layer Super Output Areas (MSOAs), Lower Super Output Areas (LSOAs) and Output Areas (OAs) (Figure 1.3 and Figure 1.4).

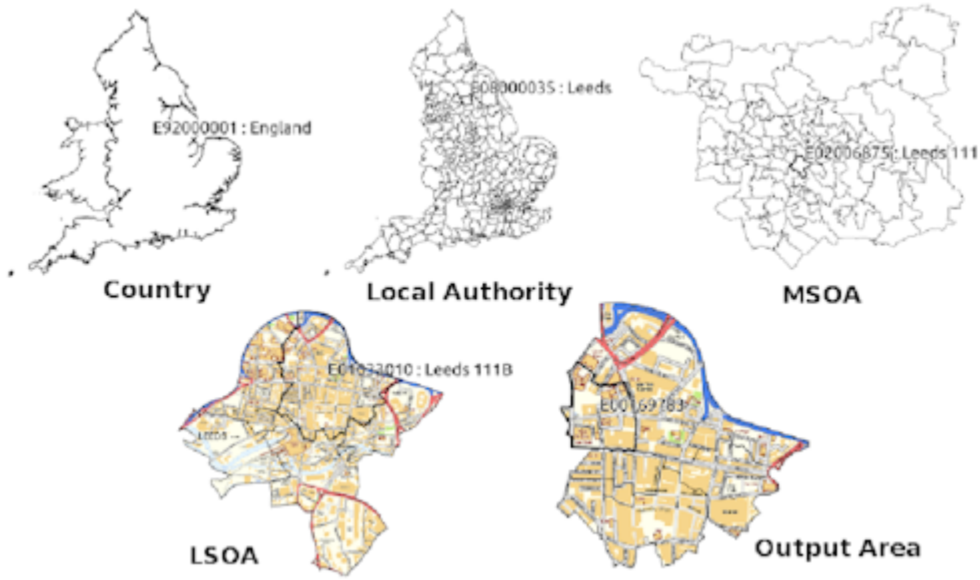
Based on the 2011 census results, there were 171,372 OAs in England. The most recent data suggests that there are now 181,408 OAs (Office for National Statistics, 2016c). Each OA contains a minimum number of 40 households and 100 persons, and the target size is 125 households. Each LSOA contains 1,000 to 3,000 residents, and between 400 and 1,200 households. Each MSOA contains a resident population of between 5,000 and 15,000, and between 2,000 and 6,000 households (Table 1.1).

Figure 1.3 Hierarchical structure between Middle Layer Super Output Area (MSOA), Lower Super Output Area (LSOA) and Super Output Area (SOA)/Output Area (OA)



Source: Adapted from Office for National Statistics (2016c)

Figure 1.4 Census geography based on 2011 Census: County, Local Authority, MSOA, LSOA and OA



Source: UK Data Service (2012)

Table 1.1 Population details of statistical hierarchical level

Statistical Hierarchy Level	Residents Population	Household Number	Comments
Super Output Areas (OAs)	Min. 100	Min. 40 Target of 125	Attempted to be socially homogenous in terms of housing and dwelling type, which is based on 2001 census data
Lower Super Output Areas (LSOAs)	1,000 – 3,000	400 – 1,200	OAs and LSOAs add up to either wards or MSOAs
Middle Layer Super Output Areas (MSOAs)	5,000 – 15,000	2,000 – 6,000	

Source: Adapted from Tower Hamlets (2013)

1.4 Research Question and Objectives

Based on the discussions above, the research question of my thesis is:

How can social housing policies in London be improved beyond a discussion of supply issues?

The issues 'beyond supply' and 'beyond shelter' open the possibility of identifying the preferences of social renters. Based on Bourdieusian theory, it is not only the social structure but also the agents within the structure that create social inequality. To Bourdieu, symbolic violence is one of the central concepts by which to understand the reproduction of social class inequality (Connolly and Healy, 2004). It is therefore important to understand the symbolic meaning and power of homeownership. It is also important to understand the symbolic meaning of dwellings in the context of the U.K. social rental market. Dwellings are not only physical spaces but also carriers of non-physical values reflected through symbols. The symbolic meaning of a dwelling may differ depending on whether it is regarded as a shelter, a home, or a family space. In the decision-making process, human actions aim to maximise both material and symbolic profit (Bourdieu, 1990), which is also applicable in the decision-making process for habitation. As compared to single households, family households may need additional mesospace space to accommodate the boundary between family members. One of the examples of such mesospace is garden. In addition, since family households are more likely to have children, their differing needs as compared to single households are also reflect in demand for education services and outdoor space. In particular, education has a function of cultural, symbolic and social capital reproduction. Hence, comparing to non-family households, education plays a more important role in the decision-making process for family households in maximising symbolic profit. Therefore, the research objective (RO) to address this discussion is:

RO1 (see Chapter 3): To examine the different rental preferences between family and non-family households in London based on the differing phenomenological experiences and specific needs that the two groups have with dwellings, specifically:

- Do family households have stronger preferences for open areas and green space in the neighbourhood than non-family households?
- Do family households have stronger preferences for mesospace (e.g. gardens) than non-family households?
- Do family households have stronger preferences for shorter distances to local schools and higher local educational quality than non-family households?

Bourdieu (1984) discussed the distinction between social classes in tastes and lifestyles. The relationship between class position and class condition varies for different classes. Class position is one’s position in the social space (Riley, 2017), whilst class condition refers to the specific sets of life conditions of a given social class (Weininger, 2005). According to Bourdieu, for individuals belonging to lowest social class, their positional characteristics are reflective of their lack of material resources. In such cases, class situation is equivalent to class position. The corresponding relationship does not hold for the middle-class, since their class position derives from their dynamic differences to, and relationships with, the other classes. In addition, symbolic distinctions increases as individuals become more distant from necessities (Bourdieu, 1966). For those at the bottom of the social hierarchy, the material constraints imposed by economic capital are the most important driver of taste, and are characterised by the taste of necessity (Bourdieu, 1984). The pressures on economic resource lead to restricted choices with regard to items of consumption (Trigg, 2001). In particular, when the budget constraint is not a concern, the working-class shows consumption preferences for products that "are both cheap and nutritious" (Bourdieu, 1984, p. 190) or "filling" (Bourdieu, 1984, p. 177). The difference in dispositions between different social groups is also reflected in their choices of homes. Individuals belonging to lower social classes are more dependent on necessities such as existing furnishing and public services, where their preferences may correspond to different levels on the Maslow's Hierarchy of Needs. Based on surveys conducted in 1960s France, Bourdieu (1984) noted that:

> "[For] the working-classes, [the preferences] reduced to 'essential' goods and virtues, demand cleanness and practicality, the middle-classes, relatively freer from necessity, look for a warm, 'cosy', comfortable or neat interior, or a fashionable and original garment. These are values which the privileged classes relegate to second rank because they have long been theirs and seem to go without saying; having attained intentions socially recognized as aesthetic, such as the pursuit of harmony and composition, they cannot identify their distinction with properties, practices or 'virtues' which no longer have to be claimed or which, because they have become commonplace and lost their distinctive value, no longer can be claimed" (p. 244).

The RO to address this discussion is:

RO2 (see Chapter 4): To examine the role of 'habitus' in renting among groups of different socio-economic statuses (SESs) – in other words, whether or not there exists different rental preferences between different socio-economic groups in London, specifically:

- What is the spatial distribution for SES in London?
- Do renters belonging to different SES show preferences matching Bourdieu's class theories and Maslow's Hierarchy of Needs? In other words, do renters of lower SES show stronger preferences to the needs of

necessities, whilst renters of higher SES show stronger preferences to the needs of luxuries?

- Are there differing preferences for local public goods (defined as open space and green area, and public transport access) across different SESs?

The financialisaton of housing may have exacerbated, rather than reduced, social-divides and inequalities. The commodification of housing, with later assistance from the privatisation of the social housing sector and the promotion of a property-owning democracy, resulted in housing units being created as a new set of capital. Though it is mostly a form of economic and financial capital, it can also be a form of social and cultural capital, especially with regards to neighbourhood choices. Another form of capital is spatial capital The concept of 'spatial capital' is derived from Bourdieu's theories and is closely related to the research question. Centner (2008, p. 197) argued that, "spatial capital, then, is a form of symbolic capital in a field where material space is at stake". Housing and neighbourhood choices are decisions driven by social, economic, cultural, and spatial capital. How these forms of capital are deployed follow the 'natural' rules of the given field, which result in spatial consequences. Space as a field is a manifestation of capital, and creates a 'metropolitan habitus' which reflect the consumption behaviour of neighbourhood choices and housing. 'Metropolitan habitus' distinguishes how habitus differs between spaces. In London, such distinctions are a combined result of historical and institutional development, which also showcase dialectic relationships between agency and structure, and between subjectivity and objectivity. The sorting of the residents in Central and suburban areas means that 'metropolitan habitus' may be reflected in the choice of living in a house as compared to flats, as well as the demand for gardens, open and green space. The RO to address this discussion is:

RO3 (see Chapter 5): To examine the different rental preferences between Central and suburban London, specifically:

- Do renters in Central and suburban London have different preferences for property types (e.g. houses versus flats)?
- Do renters in Central and suburban London have different preferences for gardens?

- Do renters in Central and suburban London have different preferences for neighbourhood open area and green space?

Given the embeddedness of habitus, the existence of habitus implies that immigrants and ethnic minorities are more likely to gravitate towards forms of welfare similar to those with which they are familiar. Esping-Andersen's (1990) categorisation of different types of welfare states are used to approximate the different ways of welfare reception.[6] Most immigrants in the U.K., (a country with a liberal approach to welfare provision), tend to migrate from low- and middle-income countries[7] where welfare provision tends to be part of the responsibilities of families and communities. Therefore, immigrants, especially ones who belong to the ethnic minority population, may rely more heavily on family and informal social networks for welfare support.

The RO to address this discussion is:

RO4 (see Chapter 6): To determine the role of 'habitus' in welfare use - In other words, whether or not migrants compete with the locals for benefits, specifically:

- What are the factors determining waiting list lengths in London?
- Are economically inactive or unemployed migrants less likely to claim benefits than native residents?
- Are economically inactive or unemployed ethnic minorities born in the U.K. less likely to claim benefits than the White population born in the U.K.?

Other usages of spatial capital relate to mobility (Mace, 2017). Bourdieu, Accardo and Emanuel (1999) discussed the relationship between social capital and mobility, arguing that "the lack of capital intensifies the experience of finitude: it chains one to a place" (p. 127). In the context of social housing, the relationship between the two also translates into how easily tenants can move to their desirable areas. Although 'objective factors' such as specific neighbourhood and

[6] Esping-Andersen (1990) categorised welfare states into: social democratic, conservative and liberal.
[7] Based on The World Bank's (2020) definitions, countries in the world are categorised into low-income, middle-income and high-income economies based on GNI per capita. According to Office for National Statistic' s (2020) dataset on *Population of the UK by country of birth and nationality*, 58.4% of immigrants in London come from low- and middle-income economies.

housing traits are important in determining migrating behaviour, 'subjective factors', such as social networks and connections to a place, also contribute to the decision-making process. The RO to address this discussion is:

RO5 (see Chapter 7): To understand the drivers of inter-borough relocation in London and their implications to housing mobility schemes, specifically:

- What are the factors determining inter-borough relocation in London?
- Based on ABM, what is the role of social networks when individuals make decisions to move home?
- Based on ABM, what are the weightings of objectivity and subjectivity in the decision-making process?

Economic, cultural and social capital form potential SESs. However, this potential is only able to actualise if there exists a symbolic capital that provides meaning to the three forms of capital (Siisiäinen, 2000). In this case, homeownership is an example of symbolic capital. The objectification of the symbolic is also consistent with a change in public policy approach, which emphasises individual responsibility. One such change includes the shift from using DO to CBL. The former is more need-based but the latter is more choice-based. The study of the allocation schemes can help redistribute the capital differences that the symbolic translation of 'property-owning democracy' creates.

The RO to address this discussion is:

RO6 (see Chapter 8): To study the efficiency and welfare implications of different types of allocation schemes (direct-offering scheme (DO), choice-based letting (CBL) and Gale-Shapley searching-matching (GSSM)), specifically:

- How can GSSM be applied to social housing allocation?
- How do the three allocations differ in terms of matching rates, which is defined as the number of properties being successfully allocated to tenants?
- How do the three allocations differ in terms of welfare for both the tenants and the landlords?

1.5 Structure of Thesis

The remaining chapters of my thesis are structured as follows. Chapter 2 and 3 discuss the symbolic meaning of homeownership and dwellings. Chapter 4 to 6 focuses on ‘habitus’. Chapter 7 and 8 incorporate Bourdieusian theories into policy evaluations.

The issues within the social housing system lie beyond the issue of supply. The details are discussed in Chapter 2. Chapter 2 also discusses the symbolic meaning and power of homeownership. In Chapter 3, I apply econometrics on rental listing data to understand how dwellings carry different symbolic meanings to families and non-families. Chapter 4 examines the distinctions in habitus between different SESs. Chapter 5 argues that ‘metropolitan habitus’ is not only reflected in urban-suburb relationships, but also within sub-areas of suburban London. For example, South London is more polycentric than North London, whilst the recent regeneration hotspot of East London is reflective of the urban features seen in Central London. I use spatial hedonic models to study the differences and commonalities between revealed preferences of rental properties amongst renters between sub-regions in London. In Chapter 6, I use panel data regressions to examine factors determining the differing sizes of waiting list lengths across London boroughs, as well as to examine whether first- and non-first-generation immigrants are more, or less, likely to claim benefits in London. Chapter 7 examines factors driving inter-borough relocation in London using the gravity model. This model is based on Newton’s Law of Gravity, which argues that location pairs that are close to each other produce greater inter-regional relocation flows. The empirical case of inter-borough relocation in London is consistent with the gravity model. The results are then fed into an ABM to understand and predict the inter-borough relocation behaviour of social renters who are subject to a combination of objective and subjective choices, and the presence of social networks. In Chapter 8, I conduct a comparative welfare state analysis for social housing allocation, using the Monte-Carlo simulation. Using simulated data based on empirical population and statistical distribution, I compare different social housing allocation mechanisms, including the previously implemented DO, the currently implemented CBL and a hypothesised mechanism based on GSMS. Finally, Chapter 9 concludes the entire thesis and outlines its limitations. It also suggests direction for future research. Given that social housing is a complex topic, future studies may continue to benefit from the use of an inter-disciplinary approach, combining insights from theorists and empiricists of philosophy, politics, economics, sociology, psychology, social policies, planning, and architecture.

2 The Welfare Model in the U.K. and Social Housing in London

2.1 Introduction

To understand the areas requiring improvement within existent social housing policies, an overview will be provided on the history, mechanisms, and limitations of current policies in the U.K., particularly in London. In this chapter, I examine the historical development of social housing policies and council housing quality in the U.K., and how the two are connected to the British welfare model. I then specifically examine the social housing policies and situation in London, discussing the systems and the shortcomings of the current supply, application, allocation and matching mechanisms.

2.2 The Development of Social Housing in the U.K.

2.2.1 Welfare model and its social consequences

Different nations address housing crises with different welfare models. Harloe (1995) categorised social housing welfare models into two general models: the residual model and the mass model. These depend on the degree of state intervention and the population of recipients. The residual model refers to cases where social housing is only applied to a small group of citizens, which tend to be the poorest in society. On the other hand, the mass model aims to provide a large-scale social housing program to not only the poor but also the middle-class. Harloe (1995) linked the degree of state intervention in the housing market to the profitability of housing to private capital. He concluded that low profitability is typically associated with high state intervention, and vice versa. Another way of categorising the welfare state is based on their 'decommodification' level (Table 2.1). Decommodification is the process which aims to treat utilities, such as health care, education and housing, as basic entitlement of citizens rather than commodities (Esping-Andersen, 1989). Based on the degree of decommodification, Esping-Andersen (1989) categorised Western welfare states into three types: conservative, liberal, and social democratic models. Developing upon Esping-Andersen's (1990) work, Ferrera (1996) proposed a fourth type of welfare state – 'Mediterranean welfare state'. This welfare state is highly fragmented and inconsistent across different areas (Ferrera, 1996). Jones (1990) also proposed a fifth type of welfare state, namely the ‘East Asian welfare state model’, which has a strong reliance on family and market elements in welfare provision (Aspalter, 2006).

Table 2.1 Types of welfare states and corresponding examples

Welfare Type	**Example Countries**
Social democratic	Norway, Sweden
Conservative	Austria, France, Germany, Italy
Liberal	U.S., Canada, Australia, U.K.
Mediterranean	Spain, Portugal, Italy
East Asian	China, Japan, Korea

Source: Adapted from Esping-Andersen (1989), Ferrera (1996) and Jones (1990)

The welfare systems in both Europe and the U.K. widely accept a right to housing as a basic human right. In *the Beveridge Report*, which formed the foundation of U.K.’s welfare state, Beveridge (1942) identified ‘the five giants’: 1) ‘want’, implying the need of an adequate income for all; 2) ‘disease’, implying the need to have accessible health care system; 3) ‘ignorance’, implying the need to have accessible education opportunities; 4) ‘squalor’, implying the need to provide sufficient housing to all; and 5) ‘idleness’, implying the need to create gainful employment opportunities. Despite these foundations, the right to housing in the welfare system is a ‘wobbly pillar of the welfare state’ (Torgersen, 1987) due to the common view that the private sector should provide housing (Stephens and Fitzpatrick, 2007). In addition, since housing is also a tradable asset, the decommodification of housing conflicts with the interests of the capital markets (Harloe, 1995).

Based on Harloe's (1995) categorisation, the U.K.’s liberal social housing system adopts the residual model. Simultaneously, based on Esping-Andersen's (1989) definitions, the U.K.’s liberal social housing system also follows a liberal welfare model, which focuses on using the market to resolve welfare issues through private market provision (Stephens and Fitzpatrick, 2007). Under such an approach, the State only provides basic needs universally in order to eliminate absolute poverty, whilst any demand for superior welfare is subject to market provision (Esping-Andersen, 1989). The British approach to social welfare has its roots in several early economists. For example, Nassau Senior stressed the importance of Adam Smith's 'laissez-faire' element, whereas John Stuart Mill believed that equality and prosperity can only be achieved through the free market rather than state inference (Esping-Andersen, 1989).

The U.K.'s welfare approach partly paves the foundation of the recent development of a 'property-owning democracy'. The U.K. is a homeownership country where the government introduces policies to encourage property ownership (Smith, Searle and Cook, 2009). When Margaret Thatcher, former prime minister of the U.K., spoke about a property-owning democracy at the Conservative Party Conference in October 1975, her speech was under the headline 'The Free Society and The Economy'. In the speech, she said, "A man's right to work as he will to spend what he earns to own property to have the State as servant and not as master these are the British inheritance. They are the essence of a free economy. And on that freedom, all our other freedoms depend" (Thatcher, 1975). The benefits of adopting a notion of a 'property-owning democracy' with a residual welfare model in a liberal welfare state has three key benefits. First, it aims to encourage the poorest of the population to participate in the labour market, and hence stimulate job growth. Second, as Rossi (1955) and Forrest and Hirayama (2015) pointed out, the promotion of a property-owning democracy enables social stability, social responsibility, and political conservatism as well as territorial attachment. In addition, homeowners with mortgages may also find it difficult to leave their current jobs. Such an argument is particularly applicable to the U.K., which is a country with large population of homeowners with mortgages. In 2016, the percentage of the population in the U.K. who were homeowners with mortgages or loans exceeded outright owners. Although the homeownership ratio in the U.K. is similar to the EU average, the country has a larger percentage of mortgage homeowners than the European average (Eurostat, 2020b). Finally, from an electoral perspective, amongst all the types of welfare state, the liberal welfare state costs the least to the government since the responsibility primarily falls to individuals. It therefore incurs the lowest tax, and consequently makes the government more attractive to median voters.

However, the residual model has its shortcomings. The consequences of the model are reflected mostly in an increased stratification, which is defined as the differences between different SESs. Stratification in this case are formed based on self-worth and value, which are reflected through two forms: financial and non-financial. For the former, factors contributing to stratification can include the unequal distribution of resources and differences between personal skills or 'in-born' factors, as a result of social reproduction. Housing affordability deteriorated between 1998 and 2008's financial crisis, and thereafter continued to decline following recovery from the crisis (Office for National Statistics, 2019c). This was accompanied by increasing inequality in property wealth coupled with rising concentration of wealth (Office for National Statistics, 2019e). Without progressive property taxes or inheritance taxes, financial stratifications can be passed down to future generations.

The latter type of stratification requires greater attention since it goes against the original objective of welfare policies; to improve the welfare of the policy recipients. The stratification of non-financial self-worth arises from the creation of a norm in society through the combination of the welfare model and a property-owning democracy. The stratification subsequently creates a group that is marginalised. In Bourdieu's terms, the housing field is dominated by the rule of property ownership, creating symbolic meaning and power of homeownership. The symbolic power of 'homeownership' means that individuals who live in undesirable circumstances have less symbolic power (Wacquant, 2009); the power divide reflected between the dominant and dominated groups is gradually normalised, and becomes the social norm and value system. In a society where homeownership is a pursuit in life, or an established social norm, social renting is regarded as a behaviour that is anti-norm. Extending Bauman's (2005) idea of 'flawed consumers', renters are now the 'flawed consumers' in the housing field as they have failed in "aesthetical conduct, ethical values and community commitment" (Cheshire, Walters and Rosenblatt, 2010, p. 2598). In addition, social renters are, amongst all renters, the ones with more 'flaws'. The anti-norm behaviour of not pursuing to own a home may be punished and stigmatised through 'symbolic violence'. 'Symbolic violence' is defined as the non-physical violence applied towards certain social groups, where the party that inflicts the violence tends to be the social group that has more symbolic power. Such violence is not only reinforced through policies, but also through the language used by politicians and some mainstream media (Žižek, 2008). Various right-wing media outlets often associate and stereotype social renters with unemployment and hedonism (Gilligan, 2012). In addition, terms such as ‘sink estates’, which describe a council estates location in economically or socially deprived areas, are often used as a way to insert symbolic power by the ruling class or party (Slater, 2018). The term has also been publicly used by politicians and government reports (e.g. David Cameron and GOV.UK (2016)), whilst survey results have also suggested that social stigma exists towards social tenants in the U.K. (Hancock and Mooney, 2013; Power and Provan, 2018). According to the *2018 British Social Attitudes Survey* (Ministry of Housing Communities & Local Government, 2019e), 24% of survey respondents reported that they would feel uncomfortable living next to social housing. However, the survey suggested that there were mixed attitudes towards social housing between different groups of people. For example, social renters (73%), residents aged between 18-25 (53%), and people with long-term illness or disability (47%) were more likely to feel comfortable living next to social housing.

The use of symbolic violence is not a deliberate act. Instead, it is an unconscious act of the dominant group to reinforce and legitimise the status quo. Nevertheless, it is difficult to conclude whether a shift in public opinion is a result of public policy changes, or vice versa. According to Bourdieu, such a process is dialectic, and involves structure and agency continuously influencing one another (King, 2000). As Tyler and Slater (2018) pointed out, “stigmatisation is never a static nor a natural phenomenon, but rather a consequential and injurious form of action through collective representation fastened on people and on places” (p. 74). Social housing is increasingly used less by the affluent and skilled working class, and more by the lower income groups. It consequently has served more for lower income groups rather than the middle-class, or even the working-class (Farrall *et al.*, 2016). Furthermore, with the common belief that a free and liberal market entitles everyone an equal opportunity to accumulate wealth, society is more likely to blame the economically disadvantaged individuals for causing their individual personal circumstances without providing sympathy (Wacquant, 2009). This further legitimises the arguments relating to the reductions in welfare expenditure. Social stigma can also alter how council tenants view themselves by negatively affecting their self-esteem. In Power's (2018) survey, over 50% of the survey respondents attributed ‘negative opinions of others’ as the worst thing associated with living in social housing. Tenants may internalise negative external criticisms, resulting in self-devaluation, shame, secrecy and withdrawal

(Corrigan, 1998). Such internalisation may stop them from actively participating in the workforce or social activities (Brattbakk and Hansen, 2004; Jacobs *et al.*, 2011), or from achieving their 'esteem needs' as per Maslow's Hierarchy of Needs.

Finally, the call for a property-owning democracy results in several policy changes in social housing and rental sectors, which further reinforces the new social norm. First, the most notable change in the social housing sector is the introduction of Right-to-Buy (RTB), which enables most council tenants to purchase their council homes with discounted rates (GOV.UK, no date c). From a homeownership perspective, the scheme enables social renters, who were previously not part of the homeowner group, to become homeowners. However, damages may also arise to the overall welfare of the society, especially to social renters. First, the scheme has resulted in 300,000 homes in London being sold since its introduction. Table 2.2 shows that the percentages of sublet properties sold under the RTB scheme is around 30% for most boroughs. However, the Government's promise to rebuild one-for-one replacement in 2012 has been broken (Greater London Authority, 2018b); the number of newly built council properties does not match those sold in a 'like-for-like' manner, and those that have been replaced tend to be built in different geographical locations (House of Commons Public Accounts Committee, 2016). Only 62,000 have been replaced by new housing stock; a loss of 20% (Greater London Authority, 2018b). The sell-off has resulted in the emergence of the 'Right-to-Buy-to-Let' phenomenon, where councils have to rent back the properties that they sold under RTB schemes as a means to let them to council tenants (Copley, 2014). Copley (2019) reported that London councils spent on average £22.3 million a year renting back the properties that were sold under RTB scheme. Second, RTB policies may also contribute to the rising number of deteriorating and socially excluded estates. In the early years of the RTB's introduction, better dwellings which were in better neighbourhoods became privately owned. In contrast, inner city neighbourhoods became more 'ghetto-like' (Stewart and Burridge, 1989). According to the ACORN classification of neighbourhoods, which segments neighbourhoods in the U.K. based on social factors and population behaviour (Acorn, 2018), half of social renters live in neighbourhoods that are classified as in 'urban adversity', whilst the figure is 23% for private renters, and 8% for owner occupiers. Furthermore, with a reduced stock of social housing, 'residualisation' occurs, where “public housing [and other social housing] moves towards a position in which it provides only a ‘safety net’ for those who for reasons of poverty, age or infirmity cannot obtain suitable accommodation in the private sector” (Malpass and Murie, 1982, p. 174, cited in Pearce and Vine, 2014). Third, there is also suppression of the private rental sector as a result of the country’s pursuit of a ‘property-owning democracy’, resulting in fewer protections for tenants. Under the social norm of homeownership, most renters see renting as a temporary state before purchasing their properties. Compared to other European countries such as Germany and the Netherlands, tenants in the U.K. are less protected by laws and regulations (Shelter, 2016). Nevertheless, it is difficult to deduce if low long-term rental demand is the cause, or effect, of a lack of regulatory attention towards the sector. However, in the case of Europe, the smaller rental market correlates to less tenant protection. The exceptions are Switzerland and Luxembourg, where there are larger private rental markets with similarly poor systems of tenancy protection. The *English Housing Survey 2015-16* suggests that housing quality is the lowest amongst private rented homes (Department for Communities and Local Government, 2017b). Above all, the idea of a ‘property-owning democracy’ may have also contributed to the creation of a new kind of relative poverty. Whilst absolute poverty focuses on basic human needs (such as food, shelter, health, water and sanitation), the idea of relative poverty, defined as individuals’ economic state relative to the average society (Foster, 1998), is a more relevant concept in the discussion of welfare. Bauman (2005) argued that poverty should not only be defined as a state where material substance is lacking or the presence of physical pain, but should also be assessed as a relative state compared to the overall society. According to Bauman (2005), poverty means not being able to meet standards, where such standards are set by the current society. Therefore, not being able to afford property is not inherently ‘good’ or ‘bad’. Instead, it becomes a state of relative poverty in a homeownership society.

Table 2.2 Sublet RTB homes of selected boroughs (subject to availability of data)

Borough	Leaseholds sold under RTB	Registered with away address	% of homes sub-let
Barking and Dagenham	3495	1488	42.58
Camden	8378	3530	42.13
Ealing	4716	169	44.51
Greenwich	4736	1602	33.83
Hammersmith and Fulham	4710	1883	39.98
Haringey	4969	1925	38.74
Havering	2503	963	38.47
Hillingdon	3266	1355	41.49
Hounslow	3026	1038	34.30
Islington	8059	3378	41.92
Kingston-upon-Thames	1515	711	46.93
Lambeth	9479	3235	34.13
Lewisham	557	188	34.13
Newham	7125	3324	46.65
Redbridge	2474	1086	43.90
Southwark	12539	4857	38.74
Sutton	1502	400	26.63
Tower Hamlets	9538	2541	26.64
Waltham Forest	2123	802	37.78
Westminster	8988	3363	37.42

Source: Responses of Freedom of Information Act Request (from Inside Housing, 2015)

2.2.2 The historical development of social housing policies

Since the 18th Century, the U.K. has experienced rapid urbanisation and migration from rural areas to cities. Within this historical context, the social housing system has undergone the following seven phases (University of the West of England, 2008): 1) Pre-council housing period dominated by private and informal rentals; 2) Post-World War I housing provision for war heroes; 3) Inter-war slum clearance; 4) Resolving the post-World War II housing shortage; 5) New urbanisation vision; 6) The expansion of cities and 7) Pushing for homeownership through RTB.

Housing crises in large cities in the U.K. such as London started to emerge in the 18th Century, when the nation began to experience rapid urbanisation resulting in mass internal migration from rural areas into the cities (White, 2009). In response, *The Housing and Town Planning Act of 1919* gave local authorities the power and responsibilities to build council houses. However, since the 1970s, the social housing provision model of the U.K. has gone through a process of 'modernisation', which sought to transform the model from one focused on 'public' (welfare state) to one focused on 'social' (post-welfare state). The transformation also involved the privatisation of the public sector, and resulted in private rental in the council housing market (Malpass and Victory, 2010).

Following policy changes in the 1980s, the underlying philosophy of the social housing policy model in the U.K. has shifted from a hierarchical philosophy to one of individualism (Lane, 2000). Before this period, the U.K. government subsidised the development of social housing in London, with local authorities directly commissioning properties built on their own land (Forrest and Murie, 2014). However, since the 1980s, a more market-oriented approach has been adopted. The government now provides much less help to councils, and the latter now need to purchase land or buildings on sale in the open market (Malpass and Victory, 2010). Private developers are currently the main supplier of social housing, who build social housing under planning agreements (Holman *et al.*, 2015), whilst council-built council houses only account for 2% of new housing stocks in 2017 (Greater London Authority, 2018a). As Figure 2.10 illustrates, housing associations are also responsible for building social housing alongside the private sector and the local councils. In addition, the social housing policy reforms in the 1980s, including the change from DO to the CBL. Since then, the

U.K.'s liberalism approach to social welfare policy has preferred a market solution over government interference, emphasising individual responsibility and choice (Esping-Andersen, 1990). However, the movement towards a more consumption-based public policy started before the shift from DO to CBL. Since the 1950s, public policy has also been centred on rational action theory, with an emphasis on consumer choice and sovereignty (McClennen, 1983); CBL within social housing is an example of such policy.

Currently, *the Housing Act* is the main regulatory guideline in the U.K. for issues related to housing. Most of the current approaches in council housing are based on more recent housing acts including *the Housing Act 1980*, *the Housing Act 1985, the Housing Act 1988*, *the Housing Act 1996* and *the Housing Act 2004.* Many of the recent regulatory changes follow from Thatcher's proposition of a 'property-owning democracy', which differs from John Rawls' original concept of 'property-owning democracy' (O'Neill and Williamson, 2012). Her government's *Housing Act 1980* first introduced the RTB as part of legislation, even though RTB existed before then. *The Housing Act 1985* aimed to transfer the power of housing supply and management from the public sector to the private sector through facilitating a shift from housing stock ownership by councils to not-for-profit housing associations. Since then, the percentage of social housing rented from local councils has drastically decreased. In 2015-16, 59% of social housing tenants rent from housing associations, whereas the remainder rent from local councils (Ministry of Housing, Communities & Local Government, 2017b). *The Housing Act 1988* aimed to provide greater levels of freedom to council tenants in deciding where to live by allowing council tenants to transfer to another landlord. In addition, *the Housing Act 1988* made changes to allow the enhanced provision of incentives for RTB. The schemes encourage the participation in the residential home sales market, and subsequently increases the demand for housing.

2.2.3 The historical development of council housing quality

Council estates constructed in different eras are of different quality due to different contemporary building techniques and trends, as well as the target recipients of the homes. Overall, the ones built before 1960s are much more physically attractive and structurally sound than ones developed between 1960s and 1970s. Notables examples include West London's Grenfell Tower built in 1967 and subsequently devastated by a fire on 14th June 2007 (Ministry of

Housing, Communities & Local Government, 2017a). Another example is Ronan Point in London, which was built in 1968. Power and Provan (2018) argued that the collapse of Ronan Point in 1968, which happened two months after its completion, also signalled the beginning of stigma towards social renters. The collapse resulted in the general public questioning high-rise council estates built using Large Panel System techniques. This also led to difficulties in renting such estates out. Vulnerable people, including the homeless and the disabled, became the main tenants of these council houses. Since then, council estates have been associated with marginalised people. This increased council estate management problems and further magnified stigmatisation (Power and Provan, 2018).

There are several possible explanations for the poor quality of council houses built after 1960s. First, during the time, local authorities developed a large number of high-rise tower blocks to reduce housing shortage whilst preventing urban sprawl. The council houses built during that time mostly consisted of prefabricated roof trusses, concrete tiles with felt, and plastic guttering. Insulation tended to be lacking and single glazed windows were common. Noise later became an issue for these high-rise tower blocks. In addition, they also received criticism for their lack of communal facilities, communities, or space for interactions between the residents (NHBC Foundation, 2015). Second, more social housing was built by housing associations instead of local authorities, and the former are relatively more cost sensitive. As a result, new social housing units developed by housing associations after the late 1980s had poor structural qualities (Stone, 2007). Third, there are also issues relating to building management. Properties owned by local authorities tend to be physically obsolescent or deteriorating due to lack of management oversight and funding resources (Stone, 2007).

However, based on the *English Housing Survey* and *English House Condition Survey,* the interior quality of social housing is overall satisfactory compared to the private rental or owner occupier sectors (Department for Communities and Local Government, 2017b). According to the survey, between 2006 and 2015, the percentage of socially rented homes in the U.K. that were qualified as 'non-decent homes' were consistently lower than the numbers recorded of both private rented and owner-occupied homes. In addition, the same survey showed that social rented properties tend to be more energy efficient compared to private rented properties and owner-occupied properties. The explanation of this difference is the higher proportion of flats in the social rental sector, since flats have less exposed surface areas than houses (Department for Communities and Local Government, 2017b). Furthermore, the survey results show that the percentage of dwellings that experienced damp issues in the social rental sector in 2015 was lower than the private rental sector (Figure 2.6). Amongst all measures of housing quality in the *English Housing Survey*, overcrowding was the only factor that was more prevalent in social rental sector than the private rental and the owner occupier sectors, where the figures were 7%, 5 % and 1% respectively in 2016 – 2017. Whilst the social rental sector show an overall decent housing quality compared to the private rental sector, the 'mean life satisfaction score', which measures personal well-being through surveys, is still the lowest amongst social renters (Figure 2.7). This is potentially explained by other factors such as long-term disabilities and unemployment, where both measures are higher amongst social renters than (Department for Communities and Local Government, 2017b). At the same time, these factors form part of the selection criteria for social tenants in the current allocation process. Nevertheless, the *Decent Homes Framework* faced criticisms pertaining to reliability and credibility as outlined by the Communities and Local Government Select Committee (2010) in the House of Commons of the U.K. Parliament. First, the standard outlined in *Decent Homes Framework* is low. In addition, the standard does not distinguish between housing that is non-decent and those that are of an exceptionally poor quality. Second, the judgements of the assessors are not monitored, and can be subjective and inconsistent.

Resolving housing quality issues can create substantial improvements to a resident's quality of life. Non-decent homes come with higher repair costs than those that have met the decent home standard, and residents' satisfaction level reduces by 0.03 points when the cost of repairs rises from £0 to £41 per square metre (Department for Communities and Local Government, 2014a).

Figure 2.1 Inter-war Housing: Ossulston Street Estate in King's Cross, London, built in 1927 -31

Source: Image © London Metropolitan Archives (City of London)[8] (1930)

Figure 2.2 Post Second World War Housing (1950 -1960): Hallfield Estate in Paddington, London, built 1947 - 58

Source: Photo © [Stephen Richards](#) ([cc-by-sa/2.0](#))[9] (2011)

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[8] Source: https://www.londonpicturearchive.org.uk/view-item?i=269002&WINID=1613907435421
[9] Source: https://www.geograph.org.uk/photo/2774749

Figure 2.3 1960-1975 Housing: King Square Estate in Finsbury, London, built in 1959 - 65

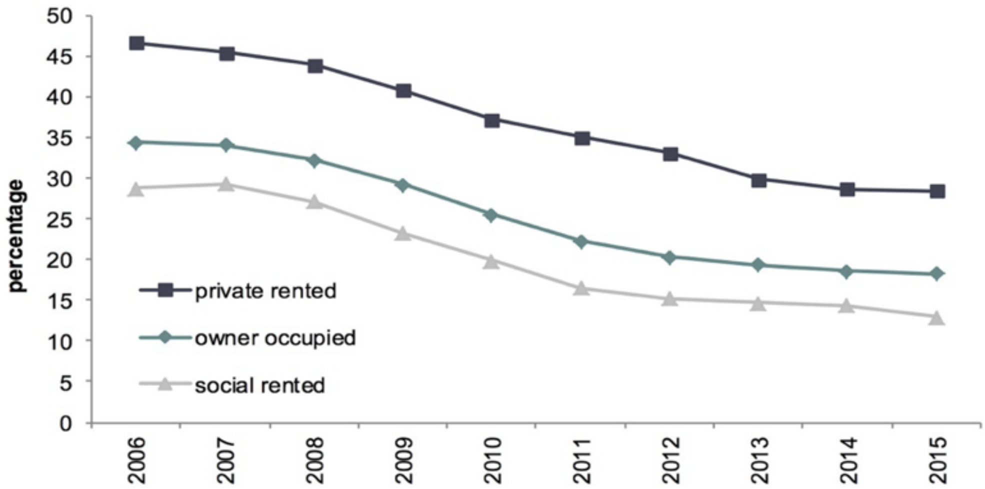
Source: Photo © Stephen Richards (cc-by-sa/2.0)[10] (2011)

[10]Source: https://www.geograph.org.uk/photo/2648906

Figure 2.4 1990 - 2010 Housing: Lithos Road Estate in West Hampstead, built in 1991

Source: The House Shop[11] (no date)

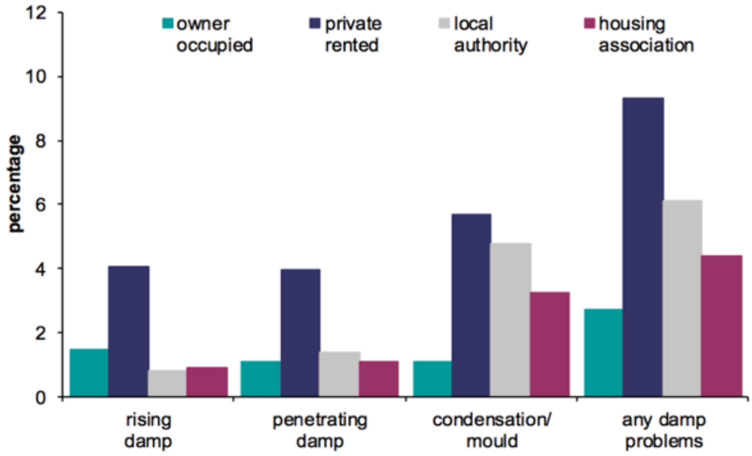
Figure 2.5 Percentage of non-decent homes for private rented, owner occupied and social rented homes (2006 – 2015)



Source: Department for Communities and Local Government (2017)

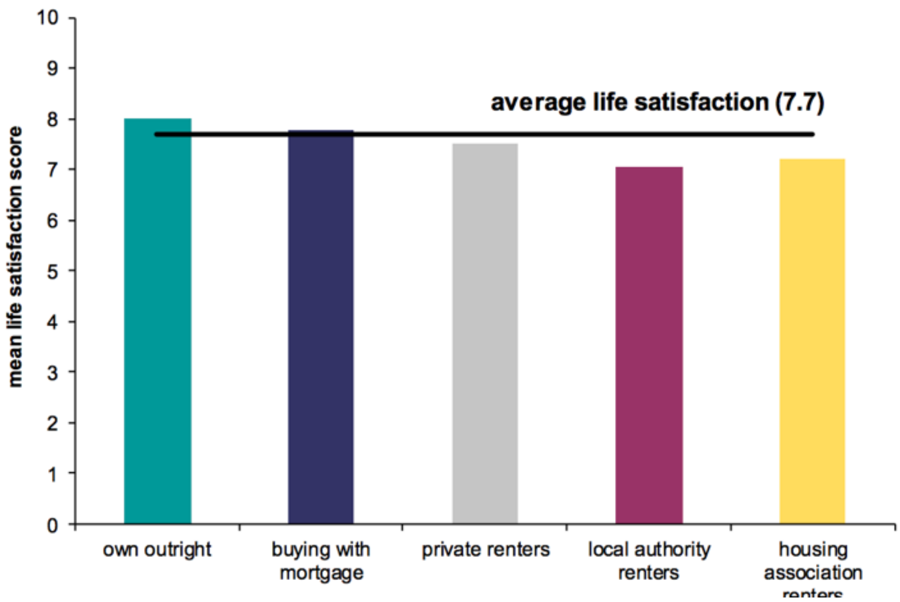
[11] Source: https://www.thehouseshop.com/property-to-rent/lithos-road-west-hampstead-nw3-6er/3391903

Figure 2.6 Percentage of dwellings experiencing damp problems for owner occupied, private rented, local authority and housing association homes of the year 2015



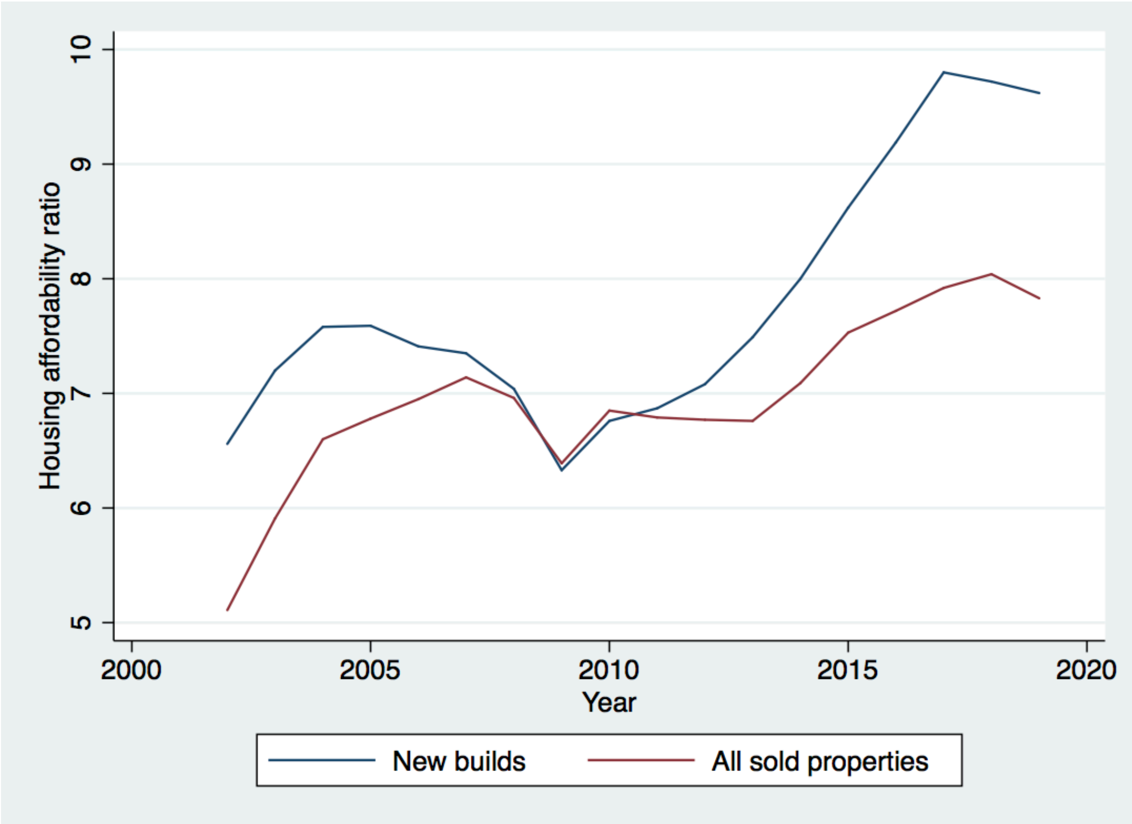
Source: Department for Communities and Local Government (2017)

Figure 2.7 Mean life satisfaction score for different tenure of homes (2015-2016)



Source: Department for Communities and Local Government (2017)

Figure 2.8 Housing affordability ratio: new builds and all sold properties in England between 2002 and 2019



Source: Office for National Statistics (2020a)

2.3 Social Housing in London

2.3.1 Supply mechanism

The quarterly average housing price in London has followed an overall upward trend since the late 1990s, with dips in price that occurred during the 2008 Global Financial Crisis. Prior to this Crisis, the quarterly average housing price of new dwellings in London was at a premium compared to the quarterly average price of former owner-occupied prices. However, the new builds also experienced a greater fall in price during the Crisis, yet their average price is still above the latter (Figure 2.9). The increasing housing prices since 1996 were accompanied with a much slower increase in labour income, which resulted in deteriorating housing affordability during the same time period (Office for National Statistics, 2019c). However, the increase in property values has been insufficient to stimulate the supply of housing, and is yet unable to close the gap between demand and supply. Housing shortage persists. The Mayor of London set the target of 50,000 new homes per year for the time period between 2012 and 2037, whilst the projected annual growth of London households is 56,600 during the time. Holman *et al.*

(2015) identified the key barriers that hinder housing supply in London, including institutional challenges, procedural challenges, and fundamental resource challenges. Regarding fundamental resource challenges, it is difficult to resolve issues such as lack of financing, lack of available land, and the lack of infrastructural support in the short or medium term.

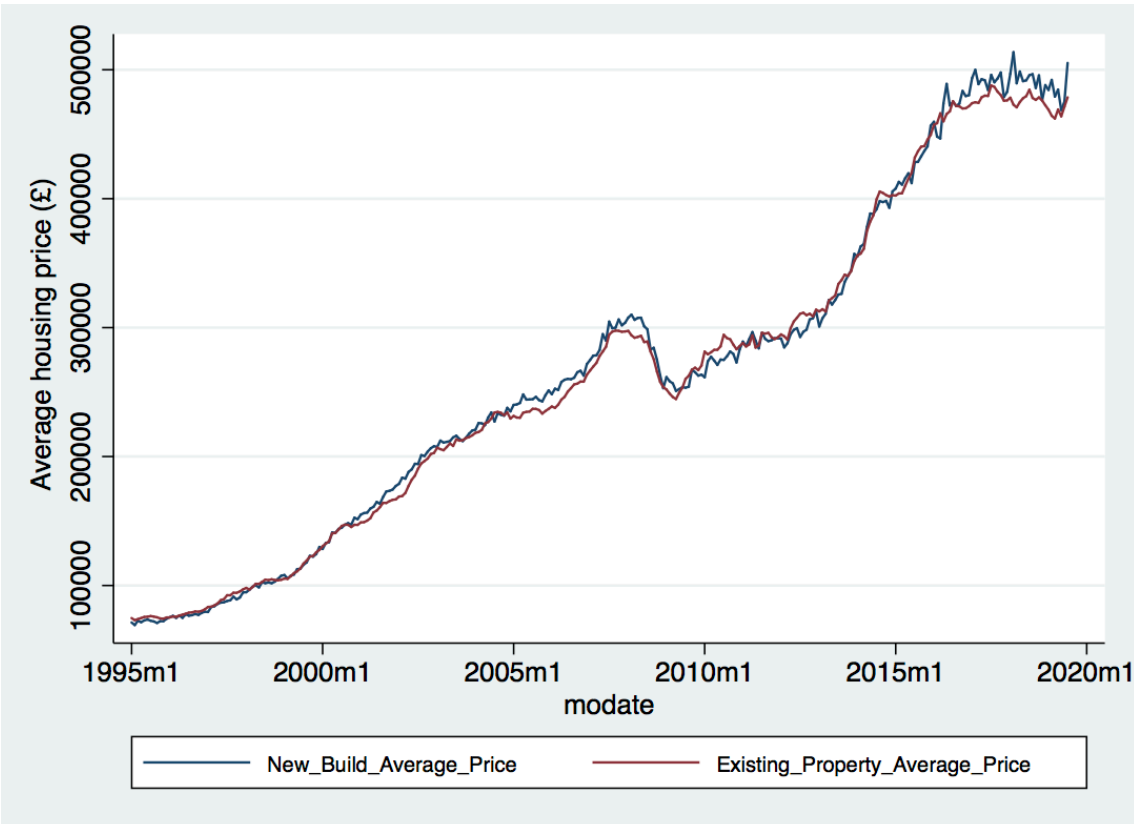
In the private housing sector, shortages of housing supply have two consequences which are reflected in the competition of demand in both the sales and rental markets. People who hope to own their own properties, cannot afford to buy their own properties, whereas people who wish to rent find that the supply of properties in the rental market is insufficient. The competition for rental properties from the consumption end also affects rental affordability. Since 2008, rental affordability in the private renting sector, which is measured as the ratio between rent and income, increased by 30% (Trust for London, 2020). As a result, the people who are unable to afford to rent privately often turn to social housing.

To further exacerbate the issue, there is also a shortage in the supply of social housing which ensures competition also exists amongst potential social tenants. This is reflected in long waiting lists across local authorities in London. Currently, the main suppliers of social housing in London are private developers, housing associations, and local authorities (Wilson and Barton, 2020). As Figure 2.10 indicates, the increasing role that housing associations play in contributing to new housing stock has been accompanied by the decreasing role that local authorities play. Some of the supply constraints in the overall housing market pointed out by Holman *et al.* (2015) still apply, though they are different for the different types of social housing suppliers. First, the main constraint faced by private developers is incentive. Most social housing is developed through mixed-use properties which contains both private and public residential properties. Private developers need to ensure that the overall developments meet their financial targets. As a result, it is likely that the final development is often more beneficial to private developers relative to the local authorities they chose to partner with. For example, The Elephant Park project in London replaced the Heygate council estate in 2012 following the latter's demolition. The new development only replaced 74 of the social-rented homes, whereas the original estate contained 1194 social-rented flats (Lend Lease, 2014). This is considerately less than the council's requirement for developments of such a size to provide 432 social-rented homes, which should have accounted for 25% of total units (Southwark Council, 2017). Second, despite local authorities' intentions to build more council houses, they face financial barriers to build more. For example, there are restrictions on the use of RTB receipts and grants for councils. The government restricts local councils from using receipts from RTB sales for a minimum of three years, and then only allow those funds to fund 30% of development costs when used. Furthermore, there are restrictions on how these receipts can be combined with the use of other public funds. These restrictions have been coupled with a decreasing availability of government subsidies supporting developments. Subsidies have mostly been diverted into funding for shared ownership homes and Affordable Rent tenures instead of social rent. There are also borrowing caps on councils through the introduction of Housing Revenue Account (HRA). Nevertheless, there have been some recent changes with regards to the financing of social housing. A recent letter from the Ministry of Housing, Communities & Local Government recognised the impact that the HRA borrowing cap has had on local authorities' plans in constructing more council houses (Ministry of Housing, Communities & Local Government, 2018b). As a result, on 29th October 2018, the government abolished the HRA borrowing cap (Ministry of Housing, Communities & Local Government, 2018a). In addition, the set-up of housing associations has led to less profit driven objectives compared to private developers. They are also less constrained financially, whilst their mandate to pursue a market-oriented approach for social housing has simultaneously given them priority to access subsidies. This is supported by the London Housing Strategy (Greater London Authority, 2018b). However, the main barrier faced by housing associations is the lack of available land (Wilson and Barton, 2020).

The shortage in social housing supply available for rent is supplemented by properties leased from private landlords and private landlords who accept Housing Benefits or Universal Credit. For example, in Barnet, private landlords can lease their properties to Barnet Council through the scheme Let2Barnet or to a housing association through Housing Association Leasing Direct (HALD). In return, the landlords get a sustained supply of tenants and management services (Barnet Council, no date). Whilst the partnership with private landlord fulfils some of the social housing supply, its effectiveness may not align with policy intentions. Evidence suggests that one-third of the advertised properties reject Housing Benefit or Local Housing Allowance claimants, whilst a 2016 survey for Crisis, a homelessness-focused NGO, suggests that 55% of landlords are not willing to rent to Housing Benefit claimants (Wilson, 2019).

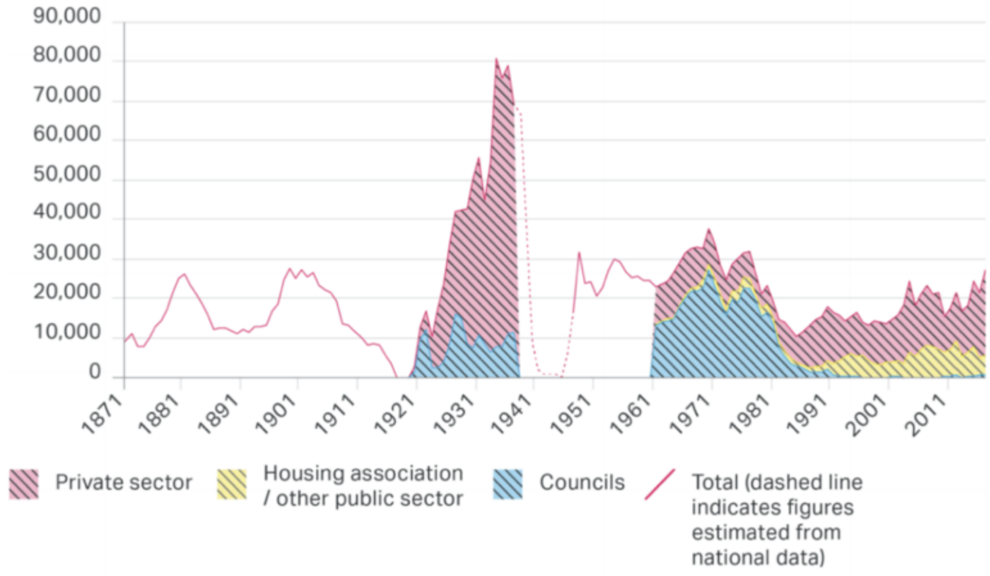
There has also been a shift in addressing the social housing shortage using private renting. An increasing number of housing associations are entering the private renting sector with the help of several government schemes (Power *et al.*, 2018). Power *et al.* (2018) argued that private renting provided by social landlords, such as housing associations, are often able to improve the rental conditions for tenants. The improvements include better regulation for the private renting sector and provision of better housing quality to those who cannot afford to buy or access the conventional social housing system. However, without increasing the overall supply of both private and public housing supply, housing associations entering the private renting sector may push out some existing private renters, which further contributes to the rent affordability issue.

Figure 2.9 Simple average house prices in London (monthly)



Source: Adapted from HM Land Registry (2019) data

Figure 2.10 New build homes in Greater London, 1871 – 2017



Source: Greater London Authority (2018a)

2.3.2 Pricing mechanism

The base weekly social rental price is based on the rental formula (Department for Communities and Local Government, 2014b):

$$R = (30\% \times RPV \times +70\% \times RLE \times) \times NAR$$

Where *R* is the formula rent, *RPV* is the relative property value, *NAR* is the national average rent, *RLE* is the relative local earning and W_b is a set bedroom weighting factor (Table 2.3). Relative property value is defined as the individual property's value over the average property value in England as at the January 1999 price. Relative local earning is defined as the average manual earning[12] of the county of the property, divided by the national average manual earning. The National average rent is equivalent to England's average rent in April 2000 (Department for Communities and Local Government, 2014b).

The above base formula provides the rental price for 2001/2002. Between 2001/2002 to 2014/2015, rental prices rose by the Retail Price index (RPI) for each year, in additional to a fixed amount which was 1% in 2001/2002 and 0.5% for the other years. Between 2015/2016 and 2024/2025, the rental price rises by

[12] Average manual earning is defined as the average weekly gross earning of full-time manual workers (Department for Communities and Local Government, 2014b).

the Consumer Price Index (CPI) each year along with an additional fixed amount of 1%.

Table 2.3 Bedroom weighting factor

Number of bedrooms	Bedroom weight
0	0.8
1	0.9
2	1
3	1.1
4	1.2
5	1.3
6 and 6+	1.4

Source: Department for Communities and Local Government (2014)

Even though housing policymakers aim to introduce a market mechanism to resolve housing issues, there are currently disparities in the price mechanism between social and private rental markets. Table 0.1 in Appendix-Chapter 2 lists the average social rent for all London boroughs between 2009/2010 and 2018/2019. There exist differences in rental prices between different London boroughs. Even though the set-up of the social rent considers differences in resale prices between different London boroughs, current weekly social rent does not reflect the price differences in the way that the private rental market does. For example, in 2018/2019, the lowest and the highest weekly rents were £89.9 and £127.09, in the boroughs of Greenwich and Westminster respectively. The highest rent was 41.4% more than the lowest rent. During the same period in the private rental market, the average weekly rents in Westminster and Greenwich were £706.0 and £345.3 respectively.[13] As such, the above calculations suggest that weekly rents in Westminster are 104% more than Greenwich. The failure to match the private and social rental markets could be because certain areas in London have gained significantly more value than others since 1999. In addition,

[13] The calculations of weekly rent are based on data from Office for National Statistics (2020): https://www.ons.gov.uk/peoplepopulationandcommunity/housing/adhocs/11660privaterentalmarketinlondonapril2019tomarch2020

there is also a mismatch in the price differential of properties, with different number of bedrooms between social and private rental markets. Table 0.2 in Appendix-Chapter 2 shows that the common rental ratios are 0.6, 0.8, 1.0, 1.3 and 1.8 for studios flats, one-bedroom flats, two-bedroom flats, three-bedroom flats and ones that have more than four bedrooms respectively in the private market. The price differential is significantly higher than the bedroom weighting factor in Table 2.3. The mismatch implies that flats with more bedrooms are relatively more under-priced. Another limitation of using the pricing system is that the pricing mechanism may have overlooked the differences between private renters and social renters, in terms of their stage of life, socio-economic status, and personal values.

2.3.3 Application process

The *English Housing Survey 2015-16* reported that 17% of households in England were in the social rented sector; a total of 3.9 million households. Nevertheless, social housing is not without demand, as reflected in the long waiting lists across London's local councils. As of April 2017, a number of boroughs in London, including Islington, Tower Hamlets, Newham, and Lambeth, had waiting list lengths exceeding 10,000 applicants (Figure 2.11). At the same time, data suggests that nearly all the local authorities have vacant housing stocks (Figure 2.12 and Figure 2.13).

The 1998 devolution settlement set the trend of decentralisation and devolution in the U.K. (Pike *et al.*, 2012). Although devolution does not fully extend to England, Greater London has a decentralised system of local authorities (Raco and Henderson, 2009). Within London, local authorities govern most areas, with the exception of the City of London which operates under a self-governing municipal democracy (sui generis authority) (see *Town and Country Planning (Use Classes) Order 1987*) (Legislation.gov.uk, 2019). Potential council tenants apply for a council house through their local council, which decides applicants' eligibility to join the corresponding waiting list (GOV.UK, no date a). Before the *Localism Act 2011,* the assessment of eligibility was based on the potential council tenants' nationality, immigration status and recent overseas residence experiences; all British citizens who had not recently lived abroad were entitled to apply. However, the introduction of the *Localism Act 2011* placed a strong emphasis on 'local connections' to the local area as a condition for potential social housing applicants. In addition, this is also based on their past experiences of living and working in the local area. These assessment rules also differ between boroughs. The councils further assess against the potential tenants' other characteristics, such as economic and social status (GOV.UK, no date a). The more stringent requirements that the *Localism Act 2011* places on potential applicants make access to social housing more difficult for those without, or with limited, local connections. The change partially caused the recent decline in the number of households on waiting lists (Ministry of Housing Communities & Local Government, 2019c).

The *English Housing Survey 2015-16*, published by the Department for Communities and Local Government (2017), describes the profile of social renters in London. There are four key observations drawn from the census data. First, most social renters are British or Irish nationals, accounting for 92% of total renters. Second, 42% of social tenant households are single households. The percentage of lone parents with children is 14%, which is higher than the figure amongst private renters (11%) and owner occupiers (3%). Third, the average age of social renters is older than those in the private tenants: the former is 52 and the latter is 40. Amongst the tenants, 16% are above 65 while 51% are between 25 and 54. Fourth, the social rental sector contains a higher proportion of residents from vulnerable groups than both the private rented sector and the owner occupier sector. In 2015-2016, 49% of the households in the social rented sector had at least one family member who had a long-term illness or disability, whereas the figure was 29% and 23% for the owner occupier sector and the private rented sector, respectively.

2.3.4 Allocation and matching process

The Housing Act 1996 requires the local authorities in the U.K. to publish their council housing allocation schemes. The current approaches to assigning social housing in the U.K. include CBL and DO (Shelter, no date), where most London boroughs adopt a choice-based system. Such a policy shift aligns with the overall shift of introducing a greater degree of 'choice' into public policies (Barnes and Prior, 1995). For DO schemes, the council directly offers an available property based on an applicant's priority and requirements. At this point, the applicant can accept, turn down or challenge the offer. The council can also suspend the applicant if s/he turns down the offer. Currently, there are only three boroughs offering DO schemes namely, Hammersmith and Fulham, Richmond-upon-Thames, and Barnet. Amongst these boroughs, Richmond-upon-Thames has transferred its housing stock to relevant housing associations, and no longer manages its own housing stock.

Most of the local authorities in London use CBL, mediating through the Choice Homes Schemes. Local authorities receive applications from applicants and place the eligible applicants in waiting lists based on priority, which determined by a points system. Leaflets and newsletters provide information on vacant properties to those on the waiting list, with such information including the restrictions and criterion for potential tenants. Waiting list applicants then bid for the vacant properties with bids ranked based on the priority measurement system. The bidder with the highest priority in the waiting list gets first refusal on an advertised property. If that bidder declines the property, the second person in the list will get the offer. In most cases, each applicant can only apply for a capped number of properties, with viewings only offered to bidders of top priority.

Local authorities are primarily responsible for implementing an allocation mechanism, where they need to determine the priorities of applicants and the allocation process. Local authorities need to ensure that their allocation mechanism only allocates their housing stock to ‘eligible persons’, where its definition is outlined by Section 160ZA of the *Housing Act 1996.* As long as this process satisfies the eligibility criteria, the local authorities have the freedom to decide whether the applicants are qualified for the purpose of their own allocation schemes (Wilson, Barton and Smith, 2018). However, the current allocation policy has its limitations. First, CBL can result in self-segregation; this phenomenon is more prevalent amongst ethnic minority groups (Van Ham and Manley, 2009). Schelling's (1971) dynamic models of segregation also show a similar conclusion in the U.S. Second, whilst CBL aims to empower tenants, applicants may not have ultimate control of the properties that they are able to apply to. Landlords are still free to set the rules and requirements of their ideal potential tenants, and applicants are able to apply for properties that they are deemed eligible (Brown and King, 2005). The asymmetric power in the transaction has implications on the overall social welfare. Third, the emphasis on ‘local connections’ within social housing allocation schemes can result in allocation processes favouring applicants of certain socio-economic backgrounds.

For example, some local authorities prioritise applicants who have had family members living in the area for above a certain number of years. Such a policy means that migrants are in a disadvantaged position in the application process. Some local authorities give priority to applicants who are agricultural workers, which can also be a disadvantage for ethnic minorities, given their underrepresentation in that sector (Rutter and Latorre, 2009).

Under the current system, transferring to alternative accommodation within the same landlord's housing stock is possible, where the purpose of the process is to improve mobility for existing tenants (Wilson, Barton and Smith, 2018). The process is governed by legislation including the *Homelessness Act 2002,* Part 6 of the *Housing Act 1996* and the *Localism Act 2011.*

Ministry of Housing, Communities & Local Government[14] data shows the level of demand for council houses surpassing supply, with all local authorities in London having lengthy waiting lists. As of 2017, Newham had the longest waiting list at 25,729 households, followed by Lambeth and Newham (Shelter, 2018). In 2015-2016, 9% of all adults on waiting lists for social housing in the U.K. had been waiting for more than 10 years, whilst 27% had been waiting for more than 5 years (Department for Communities and Local Government, 2017a).

At the same time, more than 7,500 council properties were vacant in 2017.[15] There are several possible explanations for this paradox. First, some of these empty dwellings may be subject to maintenance or renovation, which means that they are not available to rent. However, it is difficult to conclude due to lack of relevant data. Second, the empty dwellings may arise from them being available dwellings which were offered and declined by potential tenants.

Another observation based on secondary data is an asymmetric distribution of demand across London, with more severe demand-supply imbalances in certain boroughs. Examples include Barking and Dagenham, which reported a 50-year waiting list (Walker, 2016).

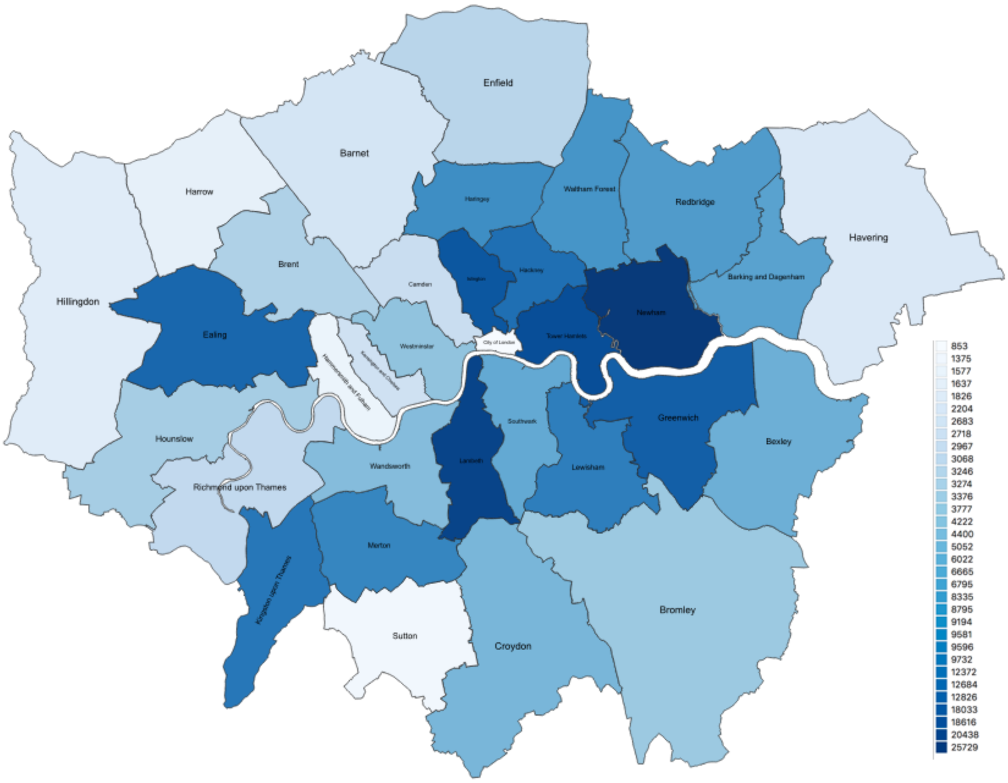
Finally, potential issues exist regarding basing housing allocation policies on rational action theory. Rational action theory states that individuals are always

[14] Data source: https://www.gov.uk/government/collections/local-authority-housing-data#2016-to-2017

[15] Source: https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants

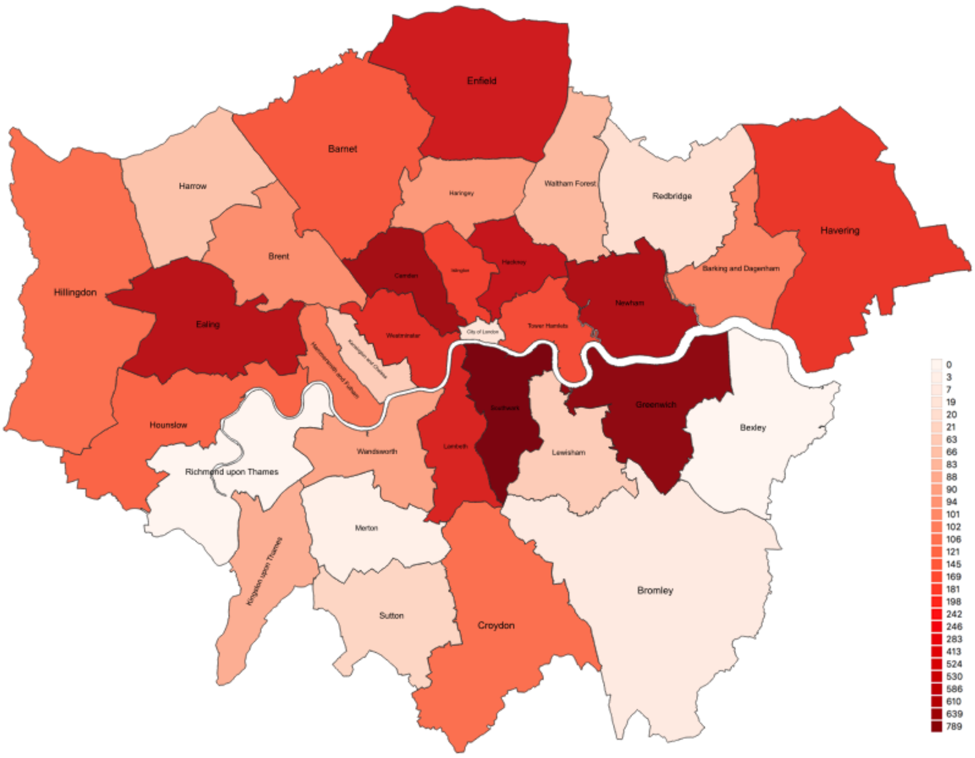
able to make rational and logical decisions, maximising their utility and self-interest. The theory is based on three assumptions: the rationality of individuals, that the preferences of individuals are identifiable through utility functions, and the independence of individual actions. Rational agents are able to decide upon all available information, the likelihood of activities, and have the ability to conduct cost-benefit analysis on all available options (Wooldridge, 2000). Nevertheless, rational action theory faces several criticisms including the notion that market participants follow 'market rationality'. The solution of the constrained utility maximisation process using the Lagrange Multiplier Method assumes agents act in accordance to market logic. However, 'individual rationality' differs from 'market rationality'. When making decisions, agents do not only face constraints relating to income and affordability, but also in relation to cognition, information availability, and the social environment that they belong to. For cognition, the time horizon of an individual's utility maximisation process affects 'utility maximisation'. For instance, individuals may be myopic and '*carpe diem'*, or may have a longer-term view with an aim to maximise lifetime utility. This results in two distinctive utility maximisation objectives. The utility function also changes when short-term emotion comes into play. Simon (1955) argues that individuals can exhibit behaviour which deviates from strict rationality in their decision-making processes. Based on his idea of bounded rationality, individuals make rational decisions within a restricted framework, where the framework is restricted by factors such as information, time limits, and cognitive limitations. These constraint factors include available knowledge, ability to implement, capability to make comparisons between alternative options, ability in understanding their own needs (Simon, 1991), inertia (Fehr and Tyran, 2008), social norms (Muthoo, 1996; Opp, 2013) and moral and ethics (Etzioni, 1990). The limitations result in decisions that are 'satisfactory' rather than 'optimal' (Simon, 1955). 'Bounded rationality' implies that the classical rationality model should incorporate additional dimensions through considerations of potential costs associated to gathering, processing, and evaluating information. Above all, rational action theory constructs an individualist homo-economicus in the decision-making process, where the agent makes decision and goes about his/her life without the influence of the social constructs that he/she is situated within.

Figure 2.11 Households on waiting list (As of April 2017), excluding applicants for transfer



Source: Adapted from Ministry of Housing Communities & Local Government (2019c) data

Figure 2.12 Local authority owned vacant dwelling



Source: Adapted from Ministry of Housing Communities & Local Government (2018c) data

Figure 2.13 Vacant dwellings available for letting, 2016-2017

Source: Adapted from Ministry of Housing Communities & Local Government (2018c) data

2.4 Conclusion

Housing is regarded as a tradable commodity in most countries, and an additional tool to deliver one of the fundamental human rights defined by the United Nations in 1948. Based on the level of 'decommodification', Esping-Andersen (1990) divided welfare states into three types, with the U.K. defined as a liberal welfare state where the housing crisis is expected to be resolved through market mechanisms. Following the previous Prime Minister Margaret Thatcher's proposal to establish a 'property-owning democracy', social housing provision has followed seven development phases, including an introduction of Right-to-Buy (RTB) in 1980.

London's housing crisis has its roots in the 18th Century, during which rapid urbanisation led to mass migration from rural areas. Since then, the supply of the U.K. council houses has fallen short of increasing demand; the issue is especially prevalent in London (Wilson, Barton and Smith, 2018). Though the problem has been prevalent throughout the history of social housing provision, it has worsened in the past few decades alongside increasing stigmatisation of council estates and social housing tenants. Whilst existing studies have addressed such issues by providing policy insights, there remains limited focus on tackling the issues beyond supply.

There are four key reasons why there is a need to understand social housing issues beyond tackling the supply issue. First, vacant dwellings co-exist with long waiting lists, implying a possible need to improve the current allocation and matching mechanism. Second, the U.K. government's attempts to use the private sector to resolve welfare supply issues may result in a conflict of interest between local governments and the private sector, where the latter's objective is profit-maximisation. Therefore, having the private sector filling the gap between demand and supply requires ensuring the objectives align with developers' incentives. Even though local governments have attempted to mitigate the issue using regulations and assessment frameworks, including the current requirements on affordable housing, misalignment of the objectives can still cause problems. In the example of Section 106, there is room for negotiation between the local authorities and the developers (Monk *et al.*, 2006). Whilst private developers are required to meet certain criteria for social housing provision before new development projects are accepted, this condition of approval is based on varying local authority assessment approaches, which are conducted on a case-by-case basis. There is currently an imbalance of available resources between councils and private developers. For example, private developers have more expertise in planning and development than local councils. A recent report stated, "few councils have the resources and in-house development expertise that they did during the 1960s and 1970s" (Greater London Authority, 2018a, p. 7). Third, current discussions and policies focus on the supply units and physical space. The Law of Diminishing Marginal Utility suggests that providing more of the same goods will not increase an individual's overall utility once basic physiological needs are satisfied. Purely focusing on the 'quantity supply' without considering other factors crucial to social tenants' welfare can lead to undesirable consequences. These have included building many residential tower blocks between 1960 and 1979 to resolve the housing crisis. In addition, as suggested by Bourdieu, the decision-making process comprises the maximisation of economic or material profit, and the maximisation of symbolic profit. Finally, the liberal welfare state and residual social housing welfare model in the U.K. has created additional social problems, related to the economy's and social policies' shifting emphasis on 'individual responsibility' and private market involvement in delivering welfare services. Homeownership has become a symbolic power that distinguishes between 'high culture' and 'low culture', and results in a divide between the winners and losers. In Bourdieu's *Distinction*, symbolic power divides society into different social classes. As discussed in Section 2.2, a society that segments its citizens based on their purchasing power of properties can lead to stigmatisation in the context of homeownership. The situation worsens when the society becomes 'one-dimensional' in judging an individual's success. Therefore, the existence of stigmatisation arising from welfare policies fundamentally goes against the original objective of the social housing provision, which is to 'empower' individuals who cannot afford homeownership.

My thesis, therefore, provides three plans to examine social housing beyond the supply issue: 1) understanding where social stigmatisation towards social tenants arises from; 2) understanding the needs of social renters beyond 'space' to improve their overall welfare; 3) improving on the current matching and allocation mechanisms. Whilst this chapter examines the first point, later chapters focus on the second and third points.

3 Household Structure and Preference: The symbolic value of 'family'

3.1 Introduction

Revealed preference theory argues that the best way to determine individuals' preferences are by observing their purchasing behaviour (Lockwood, 1999). The current CBL allows potential social housing applicants to rank their housing choices based on their own preferences. As a result, applicants can convey their preferences through their revealed preferences on social housing applications. However, demand-side preferences are rarely transmitted to the supply-side, and the supply-side of social housing remains heavily focused on increasing housing units. Under the current market, where social housing demand far exceeds supply, housing units are assigned regardless of the efficiency of matching characteristics between housing units with potential tenants' demands. The mismatched or unfulfilled demand-side preferences may therefore remain undetected.

Understanding the preferences of social tenants is one of the key steps in constructing effective social housing policies and maximising overall social welfare. London boroughs have heterogeneous features, and consequently may appeal to different renters who have very different demands. For example, full-time professional workers working in central London tend to rent either close to work, or along commuter lines. This type of renter may value accessibility more than other neighbourhood factors. On the other hand, families that have children of school-age may value education quality and distance to schools more. Section 3.2.1 argues that single residents may experience dwellings differently to family residents, and that the latter have stronger inclinations to separate private and public space within dwellings. Based on this argument, family households may place more emphasis on communal spaces, such as gardens, than single households. However, existing studies focus on capitalisation on education and garden do not consider how capitalisation effect may differ between family and non-family households. Studies which draw insights from the rental market whilst distinguishing how family and non-family households experience these factors differently are limited. In this chapter, the focus on the rental market is crucial as a means to draw meaningful policy implications for social housing. In addition, by distinguishing the differential needs of family and non-family households through an empirical and phenomenological perspective, policymakers can design more specific housing policies to maximise overall social welfare.

This chapter aims to improve on existing studies and draw policy implications by uncovering the differences in dwelling preferences between family and non-family households. I empirically test whether differences in revealed preferences exist between family and non-family households towards distances to school, quality of local education and gardens within the dwelling. The main method involved is hedonic modelling, which is a pricing model which estimates how housing related factors can contribute to pricing, based on revealed preferences (Rosen, 1974).

3.2 Theoretical Framework

3.2.1 The symbolic meanings of dwellings

I construct the research hypothesis of this chapter through studying the symbolic meanings of dwellings, and how such symbolic meanings differ between family and non-family members. Furthermore, I examine these differences through reviewing existing literature that focus on the phenomenological experiences of dwellings.

‘Lifeworld’ is an immediate surrounding environment of individuals, which they give little reflection to and take for granted (Husserl, 1970). Part of Husserl's (1970) definition on the constitution of lifeworld is reflected in spatiality, which involves individuals’ participation in the physical environment. Individuals who exist in the world require constant interpretation and adaption of the external environment they are situated within to make sense of the relationship between the subjective ‘I’ and the objective externality. In this context, dwellings are one of the key components in the spatiality aspect of the lifeworld, and serves many different purposes - One can view a dwelling as a shelter, a home or a space for family (Figure 3.1).

Figure 3.1 Component of the symbolic meaning of dwelling

Source: own construction

A shelter is more concerned with the physical attributes of a dwelling, protecting the residents from the adversity of the local environment. The latter two attributes of dwellings (as a home or a space for family) carry psychological and symbolic significances. According to the Oxford Dictionary, 'home' is defined as "the place where one lives permanently, especially as a member of family or household" (Lexico, no date), where 'permanence' is defined as "the state or quality of lasting or remaining unchanged indefinitely" (Lexico, no date). The definitions imply two key qualities of a 'home': timelessness and familiarity. Following from the definition, a 'home' is a place where human beings can be at ease with themselves. And 'being at home' is a state whereby a human can retreat to the core of his/her own existence whilst being distant from worldly disturbances (Zaborowski, 2005). Contrary to homeowners who may see themselves living in a property permanently, renters experience a greater sense of temporality in their rented space. Therefore, renters may attach a weaker sense of 'being at home' towards their dwellings. Nevertheless, intangible concepts and ideals such as 'home' often need to be materialised for people to be able to grasp. One way of materialising the concept of 'home' within the dwelling is through creative activities such as furnishing, turning a home into 'a mirror of self' (Marcus, 2006). This links to Flannery's (1972) research that suggests that architecture can reveal socioeconomic structures and relationships, such as marriage and kinship patterns.

Whilst single occupants use houses both for their value as a shelter and as a home, family occupants further see their value as a family space. Different from a dwelling for a single person, a family home is not only a carrier of individuals but also the relations between them (Steadman, 2016). In other words, it is not only a home at a personal level, but also a manifestation of the concept of 'family'. In the context of family, the physical structure of a dwelling is much less important than the symbolic one (Lévi-Strauss, 1987). Family households can feel differently towards dwellings phenomenologically compared to single person households. The reason arises from the existence of a boundary between the household and the outside world, as well as the additional family household boundary between family members. There are three types of personal territoriality (Porteous, 1977):

- Microspace: a person's most private zone that no one should violate
- Mesospace: a space which associates to living space
- Macrospace: where the person obtains daily necessities

In the context of a family home, examples of microspace include bedrooms and bathrooms, examples of mesospace include family rooms such as kitchens, dining rooms and gardens, and examples of macrospace include the immediate neighbourhood of the dwelling. Family households not only protect individual family members from external threats, but also cultivate the symbolic idea of 'family'. Therefore, compared to a single person household, family households may place greater significance on neighbourhood safety and security. Family households also need to consider additional boundaries that exist between family members, such as mesospaces of living rooms, kitchens, dining rooms, balconies, and gardens. The distinction between microspace and mesospace can be even greater in households within individualistic societies such as the U.K, since such societies emphasise more on individual privacy compared to collectivist societies.

Arguing from Bourdieusian theories, individuals aim to maximise their material and symbolic utility. Unlike 'shelter', which can have a standardised measurement within a given environment, both 'home' and 'family' are intangible concepts that do not have universally defined measurements. As a result, they pose a challenge to policymakers. However, there is increasing evidence that suggest social renters see dwellings beyond shelters, and therefore have the need to interpret them as homes and family spaces. Power's (2018) survey found that when asked the question "what are the things that make you feel proud about your life and where you live" (p. 3), 55% answered 'being involved, community spirit, neighbourliness' and 'bringing up family'. All these responses correspond to the 'love and belonging' of Maslow's Hierarchy of Needs. Meanwhile, 40% answered 'quality of estate, environment, home, service' and 'feeling safe, good values, independence, working', which corresponds to the 'safety and security' of

Maslow's Hierarchy of Needs. The survey also found none of the answers focused on 'physiological needs'. Although there are increasing policies emphasising a dwellings' role as a home and family space (e.g. *Design and Quality Standards*), most social housing policies and building regulations (e.g. *The Decent Homes* Standard) have so-far focused purely on how individuals relate to dwellings as shelters.

However, the challenge is to quantitatively measure preferences, which requires a discussion of how true preferences can be translated and reflected in housing transactions. Individuals' value expressions are typically examined through revealed preferences and stated preferences (Lockwood, 1999), which can be useful in determining the assigned values of individuals. Stated preference is obtained through what individuals claim as their preferences. Revealed preference is expressed through actual behaviour via institutions such as marketplaces. By assuming that intentions are directly transited into actions, Samuelson (1937) argued that individuals revealed their preferences through market transactions. The basis of revealed preference theory assumes that consumers are utility maximisers that are subjected to diminishing marginal rates of substitution, which states that the marginal rates of substitution decrease when a consumer declines along the indifference curve (Samuelson, 1937). Transactions and exchanges can reflect individuals' revealed preferences, which convey information as to their assigned values – in the context of housing market they include housing transactions and listings. Revealed preferences of housing can be used with hedonic modelling (Bajari and Benkard, 2005). In a standard hedonic model, the factors that can influence an individual's rental decisions include:

- **Structural factors:** e.g. 'number of bedrooms', 'house effect' and 'garden effect'
- **Neighbourhood effect:** e.g. 'transportation access', 'education and schooling', 'economic performance' and 'safety and security'
- **Environmental factors:** e.g. 'environment quality and green space'

The modelling is based on the following assumptions:

- The validity of revealed preference in the context of the rental housing market

- The existence of an efficient market where the market adjusts itself over the long-term and fully reflects available information
- The existence of a liquid market, where renters and landlords can rent or let without causing drastic changes in rental prices

3.2.2 Earlier empirical evidence

a. Structural factors

For structural factors, the key factors that have been identified in earlier studies include the number of bedrooms and bathrooms (e.g. Quigley, 1985), furnishing status (e.g. Allen, Springer and Waller, 1995), interior renovation (e.g. Vandell and Lane, 1989), type of dwelling (e.g. Hill, 2013), and whether or not the dwelling contains a domestic garden (e.g. Sirmans, Macpherson and Zietz, 2005).

First, the space and size of a property tend to be reflected in the number of bathrooms or bedrooms (Quigley, 1985). By studying households in the Pittsburgh (USA) metropolitan housing market, Quigley (1985) found that households preferred larger properties. Meanwhile, Allen, Springer and Waller (1995) found that the number of bathrooms within flats and single families had a statistically significant relationship with rental prices in Clemson (USA). However, such a relationship did not hold for condominiums.

Second, existing studies on the impact of furnishing on rental premium are mixed. For example, Allen, Springer and Waller (1995) found that furnishing did not result in a rental premium for single-family houses or flats in Clemson (USA). However, rental premiums from furnishing existed for condominiums. Meanwhile, based on studies on Lulea (Sweden) and Gothenburg (Sweden), Björklund and Klingborg (2005) found that the shift from function quality-based rents to aesthetic quality-based rents in the rental market were an ongoing process. However, the number of studies which have used quantitative approaches to explore the relationship between interior design and residential market rental premium have so-far been limited. Most of the existing studies use a qualitative approach, whereas quantitative studies tend to focus on commercial properties. Vandell and Lane (1989) examined class A office buildings in Boston (USA) and Cambridge (USA) and found that high quality architectural design had a positive effect on rent. Nase, Berry and Adair's (2013a) study on high street retail properties in Belfast between 1994 and 2009 found that certain aspects of interior designs, such as material quality, connectivity, frontage continuity and variety had positive impacts on rental values. In Nase, Berry and Adair (2013b), they also found that the same conclusion held for commercial office properties.

Third, dwelling type is one of the key determinants in housing prices, where empirical results have suggested preference for houses. Quigley (1985) argued that households prefer less dense dwellings by showing that single-detached properties were preferred to duplexes, whereas flats were the least preferred. However, compared to flats, houses on average are worse in terms of insulation (e.g. energy and noise) (Ministry of Housing, Communities & Local Government, 2017). Therefore, in terms of the consumption aspect of dwellings, the ‘house effect’ may be a need derived from the symbolic meaning of a house as opposed to its functional uses. The strong preferences towards houses are greater in the U.K. compared to newly developed cities in developing countries, where flats are associated with ‘modernity’, ‘development’ and ‘high-end living’ (Rowe, 2005).

b. Neighbourhood characteristics

There is a difference between a ‘submarket’ of a housing market and a ‘neighbourhood’ (Furtado, 2011). The definition of ‘submarket’ is currently not unified amongst researchers; definitions can focus on either grouping dwellings within a specific location or ones that have similar characteristics (Watkins, 2001). On the other hand, a neighbourhood: (a) is homogeneous; (b) has an identity or social cohesion; (c) has residences which are close substitutes for each other; or (d) is a small area that does not fall into the above three categories (Megbolugbe, Hoek-Smit and Linneman, 1996).

Neighbourhood characteristics can affect housing decisions since they reflect the quality of public services therein (Oates, 1969). Most existing studies examining the relationship between neighbourhood characteristics and housing prices focus on transportation access (e.g. Quigley, 1985), education accessibility (e.g. Wen, Zhang and Zhang, 2014; Zheng, Hu and Wang, 2016), local economic security, job opportunities (e.g. Agnew and Lyons, 2018), as well as neighbourhood safety and security (e.g. Ihlanfeldt and Mayock, 2010). The first three variables relate to public services consciously provided by local public service providers, and the variable ‘neighbourhood safety and security’ relates to individuals’ living experiences.

Transportation access also affects choice of living through facilitating social ties, enabling participation in city life, and providing commuting means for employment

(Lund and Mokhtarian, 1994; Ong and Blumenberg, 1998; Coulton, Korbin and Su, 1999; Kenyon, Lyons and Rafferty, 2002). Empirical research has also found a statistically significant relationship between transportation access and housing prices. Using multilevel and quantile hedonic analysis to study residential properties in Cardiff (UK), Wang *et al.* (2015) found that the number of bus stations within walking distance (300 – 1500 metres) of a given property was positively associated to their observed sale prices. In the context of London, Song *et al.* (2019) applied hedonic modelling to study areas within the vicinity of the Docklands Light Railway.[16] They found that the railway produced price premiums for properties within station catchment areas. In other countries, Brandt and Maennig (2012) and Tse (2002) found a statistically significant relationship between the two in Hamburg (Germany) and Hong Kong (China). Munoz-Raskin (2010) found similar results, suggesting that there was a sales premium on properties located within walking distance of main transportation links in Bogotá (Colombia). For rental properties, Wang *et al.* (2016) adopted a spatial quantile hedonic model studying two-bedroom-one-bathroom properties in the rental market in Shanghai (China) and found that the proximity to the closest metro stations was positively related to the average asking price.

Second, security in a neighbourhood area also play a role in determining housing prices. For example, Lynch and Rasmussen (2001) found that the impact of crime on housing prices were largely trivial, but had significant impacts in high crime areas in Jacksonville (USA). Using hedonic analysis, Troy and Grove (2008) suggested that there was also an interplaying relationship between crime and urban parks in Baltimore (USA). More specifically, in areas with low crime rates (406% and 484% of the national average), parks exhibited positive impacts on housing prices, and negatively influenced housing prices when crime rates were above the national average threshold.

Third, in addition to functional amenity provision from neighbourhoods, symbolic values of social identity can also be provided to residents (Furtado, 2011). The perceived prestige of a neighbourhood and residents' experience can also influence individuals' preferences. Applying hedonic modelling to Columbus in Ohio (USA), Tita, Petras and Greenbaum (2006) found that the impact of crime

[16] Docklands Light Railway is an automated light railway system in London.

rates reduced housing prices for middle-class and wealthy neighbourhoods. This was not evident in poor neighbourhoods.

c. Nature and gardens

Urban green space and parks have two main purposes: improving the urban environment and offering a space for social interaction (Hoshino and Kuriyama, 2010). Other purposes include creating positive health benefits (de Vries *et al.*, 2003), psychological restoration (Young *et al.*, 2020), and delivering aesthetic needs (Chen, Adimo and Bao, 2009). Wilson's (1984) biophilia hypothesis states that humans have the "innate tendency to focus on life and lifelike process", whereas "our existence depends on this propensity, our spirit is woven from it, hope rises on its current" (p. 1). Consequently, Wilson (1984) argued that green space and nature are fundamentals needs for human well-being. Studies, such as by Lou (2008), suggest that limited access to nature can result in 'Nature Deficit Disorder', which is defined as a behavioural problem arising from insufficient time spent outdoors or in nature.

Earlier studies using hedonic modelling to model the relationship between housing preference and open green space mostly suggest a positive relationship. Through applying a microsimulation model, which is a simulation process based on micro census and area data, Chin and Foong (2006) found that properties that are adjacent to parks exhibited a sales premium in Hong Kong (China). However, the significance of such a relationship varies depending on the types of green spaces (e.g. Cheshire and Sheppard, 1996; Cho, Bowker and Park, 2006). Similarly, Gibbons, Mourato and Resende (2014) used a hedonic property price approach to evaluate housing price capitalisation in England (UK) based on the level of accessibility to different types of nature. They found that freshwater and flood plain locations, broadleaved woodland, coniferous woodland and enclosed farmland resulted in strong housing price capitalisation. On the other hand, Panduro and Veie (2013) categorised green space using a classification and valuation method based on their functionality, location, maintenance and perception by the public. The eight categories were park, lake, nature, churchyard, sports field, common area, agriculture field and green buffer. Their results show that price premium and proximity to green space exhibit a positively correlated relationship based on quadratic specification. Though the magnitudes of such relationships differ between different categories of green space, the overall marginal effect is similar.

Based on the discussion in Section 3.2.1, gardens not only serve the function of access to nature, but also a space for privacy. It is a space that is outside the dwelling yet private. Earlier studies using hedonic models on housing prices have also included ‘garden’ as an independent variable. For example, Bhatti and Church (2004) argued that the role of a garden in a dwelling provided privacy, sociability, as well as sensual connections to nature. In addition, the popularity of gardens are closely related to the popularity of gardening as a leisure activity (Bhatti and Church, 2004).

Despite these positive attributes, urban green space remains unequally distributed amongst city residents. Residents with lower educational attainment levels tend to belong to vulnerable low income households groups, and are more likely to have less access to these spaces (Cole *et al.*, 2019). A similar observation is found amongst children and elderly age groups (Sikorska *et al.*, 2020). The above implies that social renters may also have less access to urban green space as compared to residents of other housing tenures. This arises from the social rental sector having a much larger proportion of socially and economically disadvantaged residents, families with children and elderly population compared to the other housing tenures. Given the health benefits associated to green space usage, living in social housing may result in adverse consequences on social renters’ health. This was also observed by Baker *et al.* (2014) who found that a bi-directional relationship existed between poor health and living in unaffordable housing in Australia.

d. Education

Earlier studies found that schooling facilities, both in terms of proximity and quality, were significant in determining property values. Through studying residential properties in Quebec (Canada) between 1990 and 1991, Rosiers, Lagana and Theriault (2001) found that parents show statistically strong preferences towards residential properties that have schools at a distance of between 300 to 500 metres. On the other hand, Metz (2015) found that amongst schools of the same education quality, the sale price of properties and their distance to local schools exhibited an inverse relationship.

In terms of education quality, Rosen and Fullerton (1977) and Jud and Watts (1981) found a positive statistical significance of school quality being capitalised into home values. How they measured 'school quality' was through proxies such as educational spending and/or test results amongst students. Many of these earlier studies, such as Rosen and Fullerton (1977) and Jud and Watts (1981), used hedonic modelling. However, they suffered from endogeneity problems. Endogeneity results in biased estimations and can arise from different sources. For example, the issue occurs when there exists a correlation between the variables in the model and the error term. In other words, unobserved variables exist in relation to both the dependent and independent variables, whilst not being included in the model. Endogeneity can also arise from simultaneity. This occurs when there is a two-way causal relationship between the dependent and independent variables (Sørensen, 2012). The nature of the problem means that it is not possible to address the issue by including more control variables. In the context of studies such as Rosen and Fullerton (1977) and Jud and Watts (1981), endogeneity arises from ignoring the unobserved variables that contribute to both home values and education quality.

Nevertheless, there have been attempts to address endogeneity in recent literature. For example, Gibbons, Machin and Silva (2013) used boundary discontinuity design to match identical properties that were at two sides of admission authority boundaries in England. The benefit of using boundary discontinuity design is to resolve the endogeneity issue by matching properties with same characteristics. Their results suggest that housing price increased by 3% when there is an improvement of the school quality of one standard deviation. All of the studies above focus on the resale market, where studies on rental properties are limited due to data restrictions. Amongst the limited studies on the rental market , Zheng, Hu and Wang (2016), partially examined the extent to which school quality is capitalised in rent through paired data regression. Their method matches similar rental and resale properties, followed by an examination of how price premiums differ between these two groups, subject to differences between education quality. Whilst their study utilises 'renter discrimination school entrance policies' to examine school quality capitalisation in the sale market, it also provides insights to school quality capitalisation in the rental market. Their results do not suggest the existence of a significant relationship between rental price and school quality. Another relevant study was by Beracha and Hardin

(2018), whose study shows the existence of rental premium for dwellings located areas of higher education quality in Broward and Miami-Dade (USA) housing markets. However, the capitalisation effect in the rental market is less significant than those recorded in the resale market.

Despite the positive impacts, there are also negative externalities, such as noise, for those living close to a school. A high population density of children and parents inevitably generate a lot of noise. This is supported by Shield and Dockrell (2004), who highlighted that the noise levels at London primary schools ranged between 49 to 75dB(A), which is significantly higher than the noise conditions set by the issued by Department for Environment, Food & Rural Affairs.[17]

3.2.3 Research hypotheses

The earlier discussions on how families with and without children may see space differently concludes the need of understanding the role of mesospace such as gardens. On the other hand, based on earlier studies, education related factors are clear distinction in housing considerations between the two types of households. Based on the above, the empirical test focuses on the garden effect and education effect, which are part of the structural factors and neighbourhood factors respectively. The three research hypotheses developed for the study conducted in this chapter are:

H_1*: Households with children place greater value on distance to the nearest school than households without children*

H_2 *: Households with children place greater value on school quality than households without children*

H_3*: Households with children place greater value on gardens than households without children*

[17] The Guideline sets the permitted noise level as: “34 dBA (decibels adjusted) if the underlying level of noise is no more than 24 dBA” or “10 dBA above the underlying level of noise if this is more than 24 dBA” (GOV.UK, 2017).

3.3 Methodology and Data

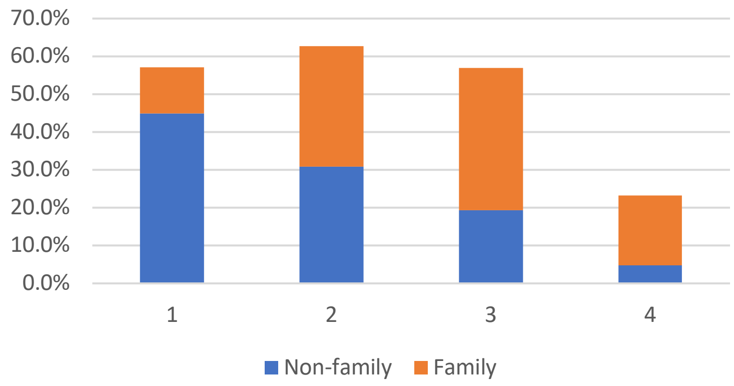
3.3.1 Model specification

a. Identification issue

The objective of the econometrics test is to examine whether families are willing to pay more for rental properties that: 1) are located close to local schools; 2) in neighbourhoods with higher education qualities; and 3) have gardens. However, there are two major difficulties in capturing such effects. First, the secondary data only shows the number of bedrooms in the dwellings, and does not convey information pertaining to whether these dwellings are rented to family or non-family households. One way of addressing the limitation of the data is to assume one-bedroom flats are rented to single persons or couples, whilst the ones that have two bedrooms are rented to families with children. The assumption is developed based on the 'room standard' within *Homes (Fitness for Human Habitation) Act 2008,* which is applicable to rental properties in the U.K. (Ministry of Housing Communities & Local Government, 2019b). Based on the Act, the maximum number of tenants that can stay in a flat with one room and two rooms are two and three respectively. The rules imposed by the Act also coincides with the 2011 Census results, which found that most tenants renting one-bedroom properties were single households, whereas most family households[18] rented two-bedroom and three-bedroom properties. According to the census data, 45% of single households resided in one-bedroom properties, whereas the proportion was 12.1% for families. On the other hand, 69.3% of the families resided in two- or three-bedroom properties (Figure 3.2). It therefore shows that most of the renters for one-bedroom flats are single households, whereas most renters of two-bedroom and three-bedroom flats were families. The empirical analysis therefore aims to distinguish the revealed preferences between family and non-family households based on the assumption, and to test whether the two datasets show different revealed preferences.

[18] Family households include: 1) Married, same-sex civil partnership or cohabiting couple; 2) Lone parent; 3) All aged 65 and over; and 4) Other household types (Office for National Statistics, 2014).

Figure 3.2 Distribution of number of bedrooms based on household types: non-family vs. family



Source: based on 2011 Census Data (Office for National Statistics, 2011)

However, the identification method outlined above has its limitations. There is an endogeneity issue that rental premiums may not only arise from education or garden capitalisation but may also arise from an 'additional bedroom'. To address this issue, the empirical test compared rental properties that had two bedrooms and three bedrooms, and hence captured the rental capitalisation for an additional bedroom. Second, there are omitted neighbourhood factors which may result in the endogeneity issue of the model. To resolve this problem, the model considered ward-level neighbourhood-fixed effect (neighbourhood-FE).

b. Empirical model

To examine the research hypotheses, the test model includes interaction terms between the treatment variable 'family' and independent variables 'distance to the nearest school', 'education quality' and 'whether or not there is a garden in the dwelling'. The model includes a dummy variable H_i, which indicates whether property i belonged to the treatment group. For model (2) and (3), $H_i = 1$ if the property had two bedrooms, and 0 if they had one bedroom (including studios). For model (3) and (4), $H_i = 1$ if the property had three bedrooms, and 0 if they had two bedrooms. The regression model is:

$$ln_{Price} = \alpha + \beta_i \boldsymbol{X}_i + \gamma_i \boldsymbol{Z}_i \boldsymbol{H_i} + \delta_i \boldsymbol{H_i} + \varepsilon$$

Where $\boldsymbol{X}_i$ are the characteristics of property i which are the same ones identified in the basic hedonic model outlined in Section 3.2.2, excluding the variable 'number of bedrooms'. $\boldsymbol{Z}_i \boldsymbol{H_i}$ is the interaction term of the independent variable $\boldsymbol{Z}_i$ ('distance to the nearest school', 'education quality' and 'whether or not there is a garden in the dwelling') and the dummy variable $\boldsymbol{H_i}$.

3.3.2 Data collection

Testing the hypotheses requires conducting separate analysis on the revealed preferences of family occupants and non-family occupants. It is difficult to distinguish the two groups of individuals based on rental property data. However, the assumption here is that studios and one-bedroom properties are more likely to be rented by single people, whilst properties with two or more bedrooms tend to be rented by families or couples. This is backed by Figure 3.2, which is based on the empirical evidence from the ONS. A limitation of the assumption is that it does not consider the case of co-habitation of friends in multi-bedroom properties for dwellings of more than one bedroom.

To control for 'house effect', where houses are rented out at higher prices than flats of similar characteristics, the dataset only contained flats that have only one reception room. The dataset also excluded outlier properties that had more than 3 bathrooms.

Table 3.1 outlines the variables included in the baseline hedonic model, and the corresponding definitions of these variables. Rental prices of private residential properties and their corresponding locations, structure, and property-level neighbourhood characteristics including access to tube/train station and access to school were obtained from Zoopla.[19] Zoopla is a major database website that contains sales and rental prices for U.K. homes that have been sold, rented, or are currently listed. The sources of Zoopla listings are from licensed estate agents, where the listings require verification of property ownership. The data points obtained from Zoopla contain the properties' latitude and longitude information. The properties included in the dataset are live listings between January 2018 and October 2018.

On Zoopla, multiple listings may exist for the same property as the landlord may have approached several property agents. To resolve the issue of duplicated observations, the data cleansing process removes all data that share the exact same location, measured by longitude and latitude. Nevertheless, it is also a possibility that these properties are neighbouring properties, making this a limitation of the data cleansing process. To control the macro influences on rental prices, the sample data only contained property listings between January and

[19] Zoopla website link: https://www.zoopla.co.uk/

October 2018. In addition, the sample data does not include listings that do not disclose the following information: whether the advertised property is a house, its furnishing status, the number of bathrooms/bedrooms/receptions, distance to nearest underground/train station/school.

Since not all Zoopla listings detail information on the interior renovation or the condition of the garden, the data collection and compilation process incorporates the following assumptions. First, I assume that the landlord or the agent chooses not to disclose a property's interior status where they believe that it adds no value. Based on this assumption, listings with descriptions of 'modern' or 'renovated' tend to have quality interiors, whereas the ones that do not disclose such information are likely to have average or below interior. It is possible that the interior status of the properties is reflected in their listing photos, but not in the descriptions. However, assessing based purely on photos brings in the researchers' aesthetic subjectivity. Second, since gardens are also an appealing characteristic, I assume that properties that do not disclose the information are likely to not have gardens. These two information asymmetry problems imply that the landlords and agents have more knowledge than the potential renters in the transactions, and information of undesirable property quality tends to be lost in the data. Therefore, I only considered the added-value elements, such as 'containing gardens' and 'recently renovated' in the data collection points.

Ward-level neighbourhood characteristics such as education and environmental scores are obtained by the Greater London Authority's[20] 2014 publication, *London Ward Well Being Probability Scores*. The identification of the relevant ward-level neighbourhood characteristics includes the following procedures. First, I use ArcGIS to map the sampled properties to the areas based on their longitudinal and latitudinal information and hence determined the ward that these properties belonged to using ward boundary information. The boundary information is the most up-to-date version as of 1st June 2019. I exclude data points that are geographically located on the boundaries of wards or contain missing values. I then match the relevant neighbourhood characteristics to the properties.

[20] Data source: https://data.london.gov.uk/dataset/london-ward-well-being-scores

Table 3.1 Variables and their definitions

Variable	Definition	Type	Data Source
Housing Price (ln_price)	Log monthly rental price in £	Dependent	Zoopla[21]
Structural Characteristics			
Garden $(Garden)$	=1 if the property or its condominium has a garden, 0 otherwise	Independent	Zoopla[22]
Neighbourhood characteristics			
Distance to school (ln_school)	Log distance to the nearest school	Independent	Zoopla[23]
Local quality of education $(ln\_quality)$	Education quality is measured by an equally weighted measure of GCSE point scores and unauthorized pupil absence; Higher value means better quality of education	Independent	Greater London Authority[24]
Distance to the nearest station (ln_subway)	Log distance to the nearest underground or train station	Control	Zoopla[25]
Access level (ln_access)	Log of the Public Transport Accessibility Scores (PTALs)[26]	Control	Greater London Authority[27]
Local safety level (ln_safety)	Log of the combined value of crime rate and deliberate fires	Control	Greater London Authority[28]
Local quality of environment (ln_env)	Environment is measured by access to public open space and nature; Higher value means better environment.	Control	Greater London Authority[29]

I use the hedonic modelling method combined with interaction terms for the empirical analysis. One of the main drawbacks of using hedonic modelling is that it is difficult to capture all possible traits of dwellings and neighbourhoods. As

[21] Data source: https://developer.zoopla.co.uk/
[22] Data source: https://developer.zoopla.co.uk/
[23] Data source: https://developer.zoopla.co.uk/
[24] Data source: https://data.london.gov.uk/dataset/london-ward-well-being-scores
[25] Data source: https://developer.zoopla.co.uk/
[26] The Public Transport Accessibility Levels (PTALs) measure the accessibility from a location to the public transport network, which also considers time spent on walking and the service available. The lowest score is 0 and the 6b is the best score (Transport for London, 2017).
[27] Data source: https://data.london.gov.uk/dataset/london-ward-well-being-scores
[28] Data source: https://data.london.gov.uk/dataset/london-ward-well-being-scores
[29] Data source: https://data.london.gov.uk/dataset/london-ward-well-being-scores

such, the model may omit variables that are also correlated with schooling and gardens (Zheng, Hu and Wang, 2016). To control for omitted variable bias, I first test the difference in preferences toward flats with one-bedroom and two-bedrooms, and then compare the results to the difference in preferences toward flats with one-bedroom and two-bedrooms. Categorising family and non-family households on the basis that the number of bedrooms can be subject to selection biases. Selection bias occurs when the randomisation of data selection is not achieved. Although the data only contains flats with only one reception room, there may have been other unobservable area-specific characteristics that affect the number of bedrooms. For example, it is possible that Central London may have stricter planning permissions, which results in relatively more one-bedroom flats development than suburban London. Developers also make their own profit-maximisation assessments for developments. Therefore, they may see certain areas that are suitable for developing flats for families, for example school catchment areas, and consequently focus on developing family flats. Consequently, certain neighbourhood characteristics are more likely to result in the development of one-bedroom flats, whilst certain characteristics are suitable to developing properties with more than one bedroom.

Propensity score matching (PSM) helps reduce the selection bias resulting from such endogeneity. PSM enables the transformation of an observational (non-randomised) study into one that contains characteristics of randomised controlled trail using a propensity score. The propensity score is the probability of an event being assigned as part of the treatment group of the data, conditional on the input characteristics (Austin, 2011). The above argument also suggests that selection bias is less significant when comparing two-bedroom and three-bedroom flats. Hence, they do not require the use of PSM.

Given that education is one of the independent variables in the empirical model, PSM does not need to use it as an input factor. PSM therefore only focuses on using neighbourhood transportation accessibility as the determinant of the treatment variable. The treatment variable is whether a given dwelling has one or two bedrooms. To match the data, PSM uses a probit model. The probit model has a dependent variable which takes only two opposing values (e.g. one or two bedrooms). The reason for using a probit model is that it is more suitable for large datasets of PSM, which is the case for this chapter. In addition, the PSM process uses one-to-one matching because the treatment and control groups have a similar number of datasets. Furthermore, outlier propensity scores that are above the maximum or below the minimum propensity score of the control group have been eliminated. The maximum allowed distance between the treatment group and their match was set at 0.05.

The result of the matching is shown in Figure 3.3 and Table 3.2. The results suggest that all the data points are in common support, which means that there is an overlap between the range of the propensity scores of the treatment and the comparison group. The PSM divides the data into: 1) a treatment group (flats that have two bedrooms) of 11705 data points; and 2) a control group (flats that have one bedroom) of 6803 data points. Table 3.2 suggests that accessibility is statistically insignificant in determining the treatment variable (a.k.a. 'number of bedrooms') when I match the data, compared to the case when I did not match the data. Therefore, the results suggest a good match between the treatment and control groups.

Figure 3.3 Propensity Score graph

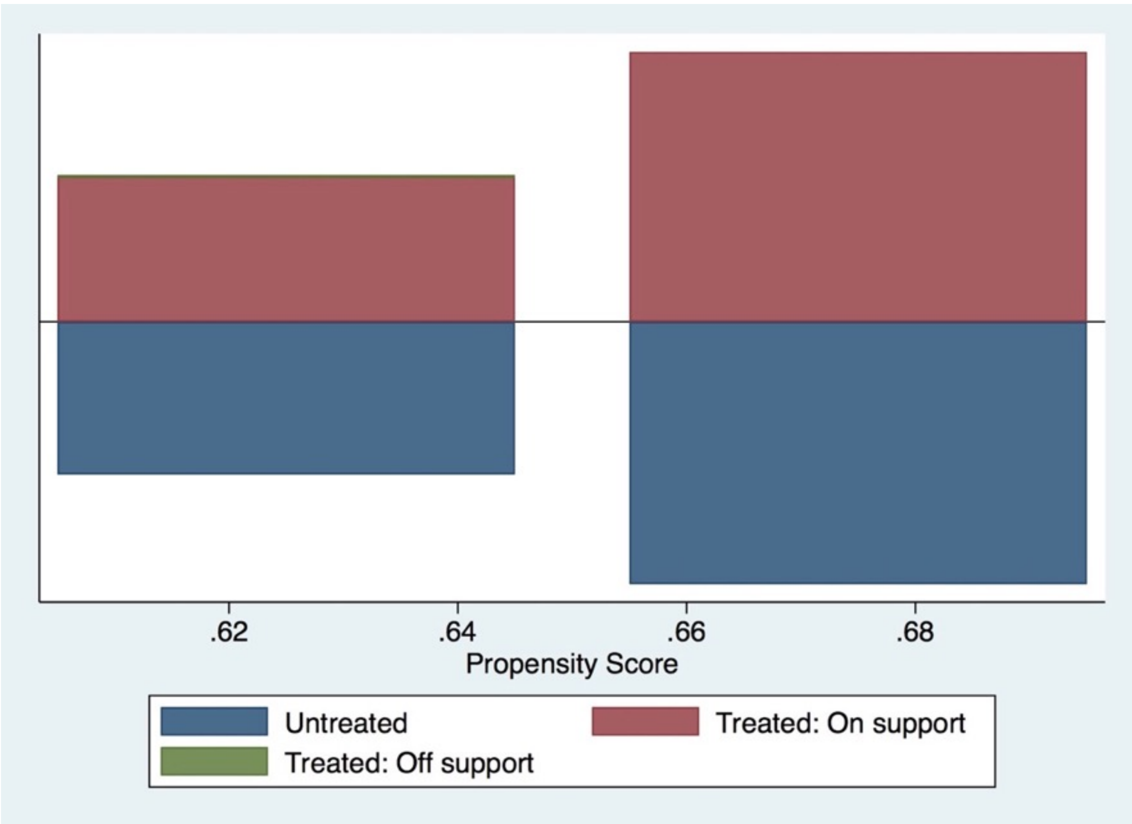


Table 3.2 Propensity score matching result

	Off support	On support	Total
Untreated	0	6,083	6,083
Treat	0	11,705	11,705
Total	0	17,788	17,788
Variable	**Unmatched/Matched**	**t**	$\boldsymbol{p > \lvert t \rvert}$
accessibility	U	4.26	0.000
	M	-0.00	1.000

Table 3.3 outlines the descriptive statistics of the independent and dependent variables. The descriptive statistics show that the independent variable ln_price has a high standard deviation (s.d.). On the other hand, the mean value of $garden$ is 0.109, suggesting that most of the properties do not have gardens.

Table 3.3 Descriptive statistics

	Mean	s.d.	Min	Max
ln_price	6.703	2.585	-2.303	11.37
ln_school	-1.164	2.504	-2.303	8.457
$ln\_quality$	2.744	9.196	-22.69	33.06
$garden$	0.109	0.312	0	1
ln_env	-1.264	9.400	-32.74	26.93
ln_subway	-1.188	1.464	-2.303	9.015
ln_access	5.585	10.845	-17.52	30.160
ln_safety	-1.763	6.979	-32.86	9.417
N	17788	17788	17788	17788

3.4 Results and Findings

3.4.1 Test results

I use Stata/SE-version 15.1 for the empirical tests. Stata is a statistical software package commonly used for quantitative research in social science. The commands that I use in Stata include, but are not limited to, ‘psmatch’ for PSM and ‘regress’ for regression tests. Table 3.4 outlines an extract of the test results. The detailed results are in Table 0.3 in Appendix-Chapter 3. Model (1) is a baseline hedonic model which includes all those properties of one or two bedrooms. Model (2) – (4) are the test results on the same dataset, which include the interaction terms $family * school$, $family * quality$ and $family * garden$

respectively. Here $family = 1$ if the properties have two bedrooms. Model (5) – (7) are test results on the dataset including properties that have two or three bedrooms. The three models include interaction terms $treat * school$, $treat * quality$ and $treat * garden$ respectively. Here $treat = 1$ if the properties had three bedrooms.

The results suggest that, compared to non-family households, families show greater revealed preferences towards rental properties that have gardens and those that are in neighbourhoods with higher education quality. The results in (2) show that both the independent variable ln_school and interaction term $family * school$ are significant. The negative corresponding coefficients for both variables suggest that rental prices negatively correlate to distance to the closest school. However, the effect of the statistical significance is weak for families.

Regarding the results in (3), the variable $ln\_quality$ is not significant as an independent variable. However, the interaction term $family * quality$ is statistically significant with positive corresponding coefficient. The result suggests that $family$ has a moderator effect on the revealed preference on neighbourhood education quality. Compared to non-family households, families pay 0.008% more for every 1% increase in school quality.

In (4), the variable $garden$ as an independent variable is statistically significant with a negative corresponding coefficient. However, the interaction term $family * garden$ is statistically significant with positive corresponding coefficient. The result suggests that $family$ has a significant moderator effect in the positive direction. Comparing to non-family households, families pay 24.9% more for dwellings with gardens.

On the other hand, in (5) – (7), the corresponding signs for the independent variables and their interaction terms with $treat$ are the same. The result therefore suggests that there exists a positive relationship between $garden$ and ln_p, $quality$ and ln_p, as well as a negative relationship between ln_school and ln_p for both two-bedroom and three-bedroom properties. Comparing the findings of (2) – (4) and of (5) – (7) illustrates that the difference in revealed preferences on education quality and garden are unique for family and non-family households.

Table 3.4 Empirical test results

The dependent variable of the empirical model is RENTAL PRICE (natural log), whereas the independent variables are DISTANCE TO SCHOOL (natural log), LOCAL EDUCATION QUALITY (natural log) and GARDEN (dummy variable). The control variables are DISTANCE TO NEAREST TRAIN/UNDERGROUND STATION (natural log), LOCAL ENVIRONMENTAL SCORE (natural log) and NEIGHBOURHOOD-FIXED EFFECT (dummy variable). The interaction terms for model (2) – (4) take the interaction between FAM and the independent variables, where FAM is a dummy variable indicating whether the dwelling is a family household. The interaction terms for model (5) – (7) take the interaction between TREAT and the independent variables, where TREAT is a dummy variable indicating whether the dwelling has 3 bedrooms. The estimation technique is OLS with interaction terms.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln_sch_dist	-0.916***	-0.887***	-0.916***	-0.916***	-0.906***	-0.920***	-0.920***
$ln\_quality$	0.00444***	0.00424***	**-0.00178**	0.00429***	0.00355***	0.00184**	0.00328***
$garden$	0.107***	0.104***	0.105***	-0.0920**	0.0769***	0.0767***	0.0459*
ln_subway	-0.841***	-0.840***	-0.841***	-0.841***	-0.854***	-0.855***	-0.854***
ln_env	0.00585***	0.00581***	0.00583***	0.00585***	0.00869***	0.00898***	0.00887***
Neighbourhood-FE	YES	YES	YES	YES	YES	YES	YES
$\boldsymbol{fam * ln\_sch\_dist}$		**-0.0432*** ***					
$\boldsymbol{fam * ln\_sch\_qua}$			**0.0100*** ***				
$\boldsymbol{fam * garden}$				**0.314*** ***			
$treat * school$					-0.0640***		
$treat * quality$						0.00961***	
$treat * garden$							0.224***
Cons	4.633***	4.639***	4.628***	4.632***	4.691***	4.686***	4.686***
N	17788	17788	17788	17788	15264	15264	15264
adj. R^2	0.904	0.905	0.905	0.905	0.907	0.907	0.907

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.4.2 Robustness test

The robustness test examines the datasets of one- and two-bedroom properties. Table 3.5 outlines an extract of the test results. The detailed results are in Table 0.4 in Appendix-Chapter 3. The independent variable ln_access in (8) – (10) replaces the independent variable ln_subway in (1) – (7). Although both ln_access and ln_subway measure transport accessibility, there are two main differences between the two variables. First, ln_access is a ward-level data whilst ln_subway is at granular level. Second, the calculation of ln_access is based on different aspects related to transportation accessibility, whilst ln_subway is based on the Euclidean distance between a given dwelling and its nearest station. Each measure has its own merits and are reasonable substitutes or each other. Model (8) – (10) also include an additional control variable ln_safety. The purpose of including ln_safety in the robustness check is to improve the explanatory power of the empirical model, given that some of the existing literature suggests the significant relationship between housing price and neighbourhood safety (see Section 3.2.2 in Chapter 3). ln_safety is positively significant for (8) – (10). However, the adjusted-R^2 values are lower in (8) – (10) compared to (2) – (4). The reason is that the independent variable ln_access used in the former is ward-level data, whereas ln_subway is granular and property-specific data. The latter has greater explanatory power.

The output of the robustness test shows very similar results compared to (1) – (7). In (8), both ln_school and $family * school$ are statistically significant with negative corresponding coefficients. In (9), $ln\_quality$ is not statistically significant, however, is significant when interacting with $family$. Finally, $garden$ is statistically significant with a negative corresponding coefficient as an independent variable. However, the interaction term $family * garden$ is positively significant, suggesting a rental premium of gardens for family households.

The final robustness test removes the neighbourhood-FE. The results in Table 3.5 are the test results of the model taking into account neighbourhood-FE, whereas Table 0.5 in Appendix-Chapter 3 contains the results of the tests without considering neighbourhood-FE. Table 0.6 in Appendix-Chapter 3 further outlines the robustness test results for the model excluding neighbourhood-FE. Comparing the results between the model including and excluding neighbourhood-FE, it shows that the findings are consistent with or without neighbourhood-FE.

Table 3.5 Robustness test results

In the robustness test, the dependent variable of the empirical model is RENTAL PRICE (natural log), whereas the independent variables are DISTANCE TO SCHOOL (natural log), LOCAL EDUCATION QUALITY (natural log), GARDEN (dummy variable). The control variables are PUBLIC TRANSPORT ACCESSIBILITY SCORE (natural log), LOCAL ENVIRONMENTAL SCORE (natural log), LOCAL SAFETY SCORE (natural log) and NEIGHBOURHOOD-FIXED EFFECT (dummy variable). The interaction terms for model (8) – (10) take the interaction between FAM and the independent variables, where FAM is a dummy variable indicating whether the dwelling is a family household. The estimation technique is OLS with interaction terms.

	(8)	(9)	(10)
ln_sch_dist	-0.811***	-0.849***	-0.849***
ln_sch_qua	0.00652***	0.000922	0.00664***
$garden$	0.0566	0.0589	-0.146*
ln_access	0.00415***	0.00414***	0.00413***
ln_env	0.00493***	0.00496***	0.00498***
ln_safety	0.0314***	0.0317***	0.0314***
Neighbourhood-FE	YES	YES	YES
$\boldsymbol{fam * ln\_sch\_dist}$	-0.0574***		
$\boldsymbol{fam * ln\_sch\_qua}$		0.00934***	
$\boldsymbol{fam * garden}$			0.326***
Cons	5.723***	5.711***	5.714***
N	15264	15264	15264
adj. R^2	0.678	0.677	0.677

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.5 Discussion

The empirical test results suggest that, within a pool of one-bedroom and two-bedroom flats, the distance to the closest school is statistically significant with a negative corresponding coefficient. However, since the absolute value of the coefficient of the interaction term $fam * ln\_sch\_dist$ (0.0432 in Model (2) and 0.0574 in Model (8)) is less than that of the independent variable ln_sch_dist (0.887 in Model (2) and 0.811 in Model (8)), it implies that $family$ has an enhancement effect on ln_sch_dist. The result means that, compared to the pooled sample, families prefer paying more for dwellings which are within proximity to a school. More specifically, based on Model (2), every 1% increase in distance to the nearest school results in a reduction of 0.93% of rent for family households, whilst a decrease of 0.89% is observed for non-family households. The results suggest that non-family households also appear to prefer living near schools. A possible explanation is that non-family households also benefit from some unobservable positive externalities of being located within proximity to a school. These may include the use of school premises, such as sport pitches, gyms and classrooms. The U.K. government current supports the use of school premises outside school hours.[30]

Contrary to the results pertaining to school distance, school quality plays a significant role in family households' choice of rental properties. In the pooled sample, the independent variable reflecting school quality ln_sch_qua is positive but not statistically significant. However, the result of the interaction term $fam * ln\_sch\_qua$ is both positive and highly statistically significant. Therefore, this suggests that rental capitalisation of neighbourhood school quality exists for family households. According to Model (3), every 1% increase in school quality results in an increase of 0.0082% in rent, which is overall insignificant in terms of size. The overall results are aligned with earlier studies such as those by Rosen and Fullerton (1977), Jud and Watts (1981), and Zheng, Hu and Wang (2016).

Finally, the results also suggest that family households have a stronger revealed preference toward dwellings that have gardens, whilst non-family households

[30] The U.K. government encourages schools to open their premises to be used by the local community. The *Education Act 2002 Section 27* gives the power of all maintained schools to provide facilities and services to "pupils at the school or their families or people who live or work in the locality in which the school is located" (Department for Education, 2018, p. 15).

prefer dwellings with no gardens. In Model (4), the corresponding coefficient of $garden$ is -0.0920, whilst the corresponding coefficient of the interaction term is 0.314. This suggests that $family$ place a strong marginal effect on $garden$, which confirms the research hypothesis. Families pay 24.9% more rent for dwellings with a garden compared to ones without. In contrast, non-family households pay 8.79% less for properties with a garden compared to ones without. The aversion towards dwellings with gardens amongst non-family households can be explained by the hassle involved in maintaining gardens, which include, but are not limited to, dealing with the impacts of seasonal changes on garden. On the other hand, as part of the control variables, ln_env, which reflected the accessibility to green space, is also statistically significant and the significance is consistent across all models. Its positive corresponding coefficient suggests that neighbourhoods with good access to green space is capitalised into rental prices. The results align with existing studies such as by Bhatti and Church (2004).

Above all, the results suggest that family households prefer living within close proximity to a school, and are willing to pay additional rent for neighbourhoods of higher school quality. In addition, family households also place more value on homes with gardens.

3.6 Conclusion

3.6.1 Summary

Social housing policies can draw insights from observing the private rental market, especially regarding understanding renters' preferences. However, little existing literature is focused on the rental market due to the difficulties in obtaining data. In addition, it is argued within this chapter that, on top of the maximisation of economic profits, symbolic profit maximisation should also be considered. Family and non-family households can have different views towards dwellings. Whilst the concept 'family' plays a stronger symbolic role for family households, such units also have a higher demand for mesospace between family members. However, existing literature on how different traits are capitalised upon in the rental sector rarely distinguish between the revealed preferences between family and non-family households.

To bridge this gap within existent literature, I examined the private rental market in London based on Zoopla listings. Compared to non-family households, the results in this chapter show that family households in London are more willing to pay a rental premium for dwellings that have gardens and are in neighbourhoods that possess facilities of good education quality. The latter is a form of institutionalised cultural capital (Bridge, 2006). For gardens, families pay 24.9% more rent for dwellings than for properties without gardens. In contrast, non-family households pay 8.79% less for properties with a garden than ones without gardens. In addition, every 1% increase in the quality of school results in an increase of 0.0082% in rent, which is overall insignificant. Finally, both family and non-family households show strong revealed preferences towards properties that are located near schools. One possible explanation for this is that non-family households also benefit from living within close proximity of a school, because local authorities encourage schools to allow local communities to use their premises during non-school hours.

3.6.2 Limitations and Future Research

The major limitation of this chapter is the assumptions made in distinguishing between family and non-family households. Nevertheless, it is impossible to differentiate between the two types of households from the secondary data alone. For example, a property that contains more than one bedroom can be shared accommodation between non-family members.

The second limitation relates to the use of revealed preference data in general. The rental prices capturing revealed preferences are estimated by landlords or real estate agents. To say that the listing prices are equivalent to how renters price the properties, assuming that the prices are at market equilibrium.

The third limitation is that this study uses 'distance to school' and 'education quality' as schooling related factors. However, this does not consider the eligibility of enrolment into the local schools. Even though 'living close to the school' is one of the key admission criteria for school enrolment (GOV.UK, 2020), the eligibility also depends on the local authority registration address. It is possible that an address located within proximity to a school is not eligible for enrolment as it belongs to a different school catchment area.

The fourth limitation is the drawback of using a traditional hedonic model, prone to omitted variable bias problems. It is not possible to include all relevant characteristics of the properties and the neighbourhoods that they belong to. As a result, how revealed preferences differ between households with and without children could be due to omitted variables that correlate with these differences.

Future research could incorporate the following two improvements. First, they can include surveys and use discrete choice modelling to model the stated preference of renters. Besides, they can consider structural factors within dwellings as indicators for privacy, including doors, windows, and walls. For example, Hashim *et al.* (2006) used a case study approach to visualise privacy through examining the organisation of space, doors and windows. Therefore, future studies could combine data from visual inspections with the analysis of revealed preferences through hedonic modelling. Second, future research can use instrumental variables (IVs) to better resolve the endogeneity problems associated with omitted variable bias and measurement error (e.g. see Rosenthal (2003)). Empirical methods such as boundary discontinuity design can also help reduce the endogeneity issue resulting from the omitted variable bias (e.g. in Gibbons and Machin (2003)). Future research can also incorporate the different rental premiums ascribed to green spaces of varying quality and types.

3.6.3 Policy implications

Currently, there are limited social housing policies that specifically distinguish the different needs for education and privacy between family and non-family households. Despite this, there has been a growing trend of prioritising the allocation of properties to families and increasing their dwellings' sizes. The report *Size Matters* published by the Greater London Assembly (2006) states that "family sized housing has more specific requirements than smaller units because of the presence of children" (p. 20), and "lack of family sized housing will mean that many people are living in overcrowded conditions, with detrimental impacts on family relationships, child development and health" (p. 17). Besides, the report points out that "high-density housing, which tends to be located near city centres, has not traditionally been thought of as suitable for families. However, families can be 'designed in' if high-density developments include associated facilities such as public space, play space for children and youth facilities" (p. 20).

To a large extent, the insights from analysing the rental market echo the report's arguments. The results have the following policy implications regarding the supply side of social housing. The private rental market results show that preferences differ between family households and non-family households, and these insights can also be extended to social housing tenants. Social housing allocations should consider whether the households have children and allocate those households to dwellings closer to schools. Despite an overall increase in educational attainment in the U.K., the difference between children from social renting and owner-occupier families remain significant. For the latter, according to the *1995/96 British Household Panel Survey*, only 6% of girls and 14% of boys left school at 16 years old or younger, whilst the figures are over 30% for boys and 25% for girls for children from social renting households (Coles, England and Rugg, 2000). Since social renting families are less financially able to access public transport or own vehicles than residents of other tenures (Mattioli, Lucas and Marsden, 2018; Tunstall, 2018), the ability to walk or cycle to school increases the likelihood of attendance. Cycling can also result in physical and environmental benefits for children (Goodman *et al.*, 2019).

Social housing providers should also consider allocating dwellings with domestic gardens to family households. Gardens can reduce income-related health inequalities. Even in cases where space is limited, local authorities may consider offering allotment gardens to social renters, since allotment gardens provide at least as much restoration to the users as domestic gardens (Young *et al.*, 2020). Allotments can also offer additional benefits in terms of food security to their users, resulting in financial and health benefits (Gray *et al.*, 2014). For estates with large populations of family households, communal gardens can be incorporated. These gardens are overseen by management companies, and can potentially provide greater psychological restoration compared to domestic gardens, which often cause stress to users arising from maintenance (Young *et al.*, 2020). Communal gardens and allotments can also provide collective health and social benefits by providing social support space– thereby building social capital amongst social renters (McVey, Nash and Stansbie, 2018).

Above all, providing social housing service beyond ‘bricks and mortar’ to family households requires a multi-agency partnership, necessitating a collaborative effort from policymakers across the areas of housing, education, environment and culture to produce a more holistic approach to the delivery of social housing (Coles, England and Rugg, 2000)

4 Habitus, Socio-Economic Status and Housing Preference

4.1 Introduction

Chapter 3 studied how family and non-family households may experience dwellings differently, not only due to objective needs such as education, but also due to stronger attachments to the symbolic concept of ‘family’ amongst family households. According to Bourdieu (1984), capital is defined as differences in disposition relating to the social class to which individuals belong. Extending Bourdieu’s work in *Distinction,* differing dispositions towards dwellings can exist between groups of different socio-economic statuses (SESs). Bourdieu’s *Distinction* focuses on examining the taste and dispositions of the French in the 1960s. Although Bourdieu himself did not specifically study the preference of dwellings as part of his ‘distinction study’, anthropologists typically believe that he originated the discussion of space, through his focus on the interaction between meaning and action in space. In a way, dwellings and neighbourhoods can be regarded as spatialised carriers of culture, meanings, and symbolic power structures of society (Bourdieu, 1996). Given the large financial requirement associated with renting and homeownership, examining housing choices can be one way of studying habitus amongst different SESs. There are limited existing research studies that have extended Bourdieu’s extinction study into housing. Most of the existing studies are qualitative (e.g. Karsten, 2007) whereas the few quantitative studies are primarily based on surveys (e.g. Vasanen, 2012). To my knowledge, there is no existing quantitative study that specifically studies ‘habitus’ in the context of the London housing market. The insights drawn from such a study could be valuable for housing policymakers for two reasons. First, it would enable better understanding of housing preferences of different social groups. Second, it would allow policymakers to understand how social tenants prioritise their preferences in searching for dwellings.

In this chapter, I examine how ‘habitus’ interplays with SES by examining their revealed preferences. To bridge the research gap amongst existing studies, as well as to draw policy implications, this chapter applies hedonic modelling on a large micro-level dataset in the context of Bourdieu’s social theories. The hedonic regression test in this section divides London’s boroughs into different types of neighbourhoods, which include the following categories: SES-1, SES-2, SES-3 and SES-4. I define the four SES groups in an increasing order of their SES, with SES-1 representing the group of the lowest SES and SES-4 represents the group of the highest SES.

4.2 Theoretical Framework

4.2.1 Bourdieusian theories: habitus and socio-economic status

Capital is defined by Bourdieu as resource, and are distinguished in three forms: economic, social, and cultural. Economic capital includes the quantity and security of income; cultural capital includes formal education, specific strands of knowledge of the arts and the possession of cultural items; social capital includes the quantity and quality of social relationships. The three types of capital are transferrable: economic capital enables individuals to purchase cultural capital, whereas cultural capital may be converted into economic and social capital, and vice versa (Bourdieu, 1984).

Quantity and structure are the two dimensions that measure each type of capital (Bourdieu, 1984). Based on the two dimensions, society is divided into those of high quantity and those that have a low quantity of total capital. Within each, there is a divide between those who have a higher portion of economic capital and those with a higher portion of cultural capital. Bourdieu (1984) defined social class based on the three forms of capital, and categorised social class into two levels. The first level includes the upper, middle, and lower classes. The second level further divides each category into three groups based on their occupations.

Individuals belonging to different SES can have different dispositions due to their 'habitus', which is defined as preconscious dispositions including individuals' tastes, ideas of the self, and skills. Bourdieu argued that both family education and schooling play significant roles in developing individuals' habitus. As a result, individuals follow their given orders and rules unconsciously because of habitus, transforming social and economic 'necessity' into 'virtue' (Bourdieu, 1990). Habitus translates the quantity and quality of different forms of capital into observable behaviour. Habitus is also the outcome of social classes, rather than their cause (Bourdieu, 1977). Within social classes, establishing norm results in class solidarity (Bourdieu, 1984), which "legitimise[s] economic and social inequality by providing a practical and taken-for-granted acceptance of the fundamental conditions of existence" (Swartz and Zolberg, 2005, p. 105).

However, habitus is much rooted within sub-conscious thinking, and can be difficult to be observe empirically. Therefore, it is crucial to realise that habitus does not act alone, rather it is embedded in a much wider environment of the 'field', coupled with the influence of capital. Fields are defined as social games where agents meet and struggle for capital. They are also governed by a set of rules and norms. Symbolic power helps legitimise the current distribution of capital through introducing recognition of the current rules governing the fields, through constructing reality (Bourdieu, 1989) and introduces implications which contain discriminatory meanings. The agents within a field may treat the norms and rules as if they are natural laws. Bourdieu (1984) illustrated how the combination of habitus, capital and field translates into practice or behaviour using an abstract formula:

$$[(\text{habitus})(\text{capital})] + \text{field} = \text{practice}$$

In the context of housing, the promotion of home ownership is a form of legitimisation which reinforces the rules and norms within the specific field. A small number of existing studies extend Bourdieu's 'distinction study' and social theories into the housing market; often from tenure choice or consumption perspectives. Amongst the studies examining tenure choice, Silva and Wright (2009) found that higher occupational classes are associated with higher homeownership rates, and that a correlation also exists between tenure and education level. For example, social renters are more likely to be in semi-routine and routine jobs. Ærø's (2006) research is another example of connecting Bourdieusian theories with residential choices. Even though the research did not specifically study residential choices of different socio-economic groups, it examined three forms of relationships between home and place depending on dwellers' occupations. The first type of relationship derives from a residential choice that is predetermined, and treats dwelling and residential areas as an archive of memories. Such a relationship occurs more often amongst self-employed individuals. The second type of relationship involves having proper options for housing and residential choices. Ærø (2006) argued that this typically happens amongst wage earners, who treat dwellings as a base for family life. The third type of relationship treats dwellings in a temporary manner, which often happens amongst highly mobile households. One of the shortcomings of Ærø's (2006) categorisation is that renters typically experience a combination of all three relationship types. For example, the social group with lower SES may also have a pre-deterministic view towards residential choices if they feel that they are financially constrained and unable to escape their living situation. Second, all renters may regard their dwellings as a family base regardless of their occupations or SES (see Section 3.2.1 in Chapter 3). Third, all renters may experience a certain degree of 'temporality' towards rental properties, especially in countries which have an embedded social norm of homeownership. As an example of the second type of research linking Bourdieu's theories to housing, Gram-Hanssen and Bech-Danielsen (2004) conducted 13 qualitative interviews amongst those of the middle- and upper-classes to understand cultural variations related to style and architecture. Their findings show the importance of the idea of 'home' to middle- and upper-class residents. However, their research is not conclusive, where some of the residents interviewed attached the idea of 'home' to their neighbourhood, others attached it to the materialistic structure of their dwellings.

Most of the existing studies are based on qualitative approaches, such as interviews, based on stated preference. Nevertheless, the use of uncovering 'habitus' using interviews has its limitations. The existence of 'habitus' is subtle, and agents may not be fully aware, or able to, articulate it. In addition, interviewees may wish to uphold a particular self-perception, and therefore may not convey their actual preferences. Such limitations can be mitigated by combining the study of revealed preferences. For consumptions such as rental and home purchase, it is highly likely that the final outcome is a result of a careful decision-making process. Therefore, consumers' consumption behaviour to a certain extent reveals their true preferences. The limitation of using stated preference creates a research gap that is worthwhile exploring, using alternative measure of preferences such as the revealed preference.

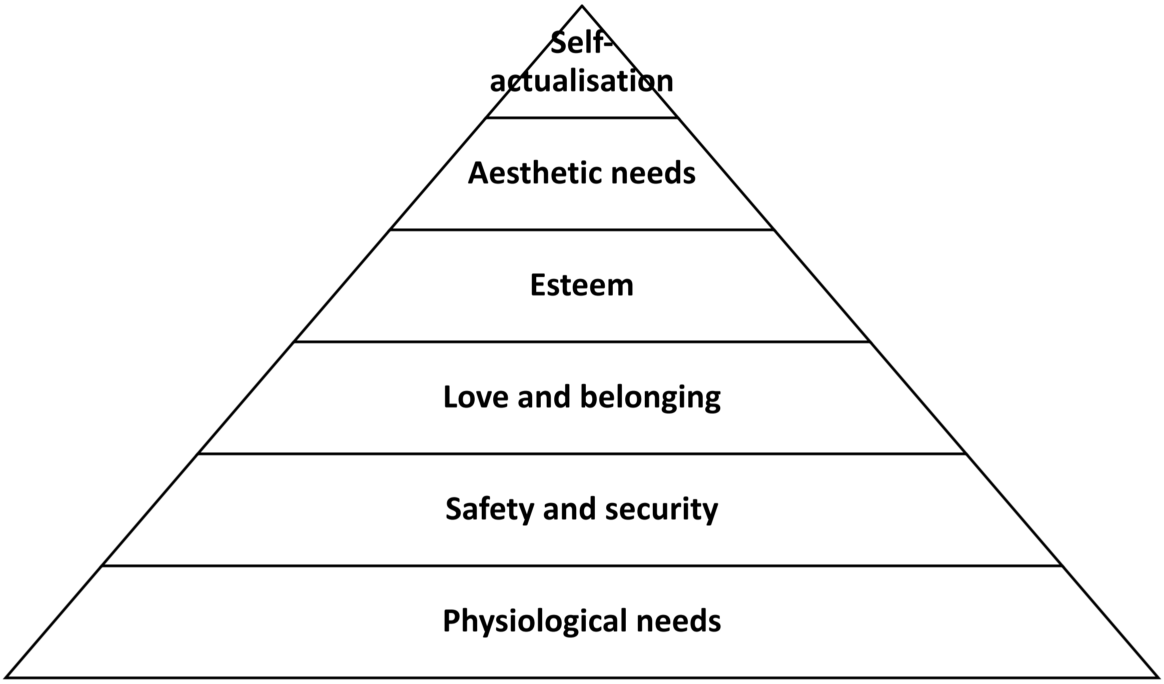
4.2.2 Specifying habitus: the connection with Maslow's Hierarchy of Needs

One of the difficulties in discussing habitus in relation to SES are that tastes are relational, and there are no formal definitions of what counts as 'high' or 'low' taste and needs. Addressing the issue requires incorporating a theory which can put habitus on a quantifiable spectrum.

Bourdieusian social theories and their implications also link to Maslow's Hierarchy of Needs. Maslow's Hierarchy of Needs is a theory suggesting that humans are motivated by a tiered system of needs (Figure 4.1). These are formed from the lowest to the highest tiers of: physiological needs, safety and security, love and belonging, esteem, aesthetic needs and self-actualisation. At first sight, Maslow's theories and Bourdieusian theories on habitus seem incompatible as the former mainly focuses on personal experiences in the world, whilst overlooking the effect of society and social interactions. However, the theories are deeply 'social', especially for the third and fourth levels of the hierarchy, namely 'love and belonging' and 'esteem'. The third level of the hierarchy requires individuals being with their families and friends, whereas the fourth level of the hierarchy requires individuals gaining social recognition (Trigg, 2004). Individuals with higher economic capital have fewer consumption constraints than those with lower economic capital, and hence have greater capacity to pursue the higher levels of the hierarchy (Pasinetti, 2009). Similarly, with increasing economic capital, individuals can move away from need-based consumptions observed in working-class, towards adopting the tastes of the dominant social group. In the context of housing, depending on the level where an individual belong to within Maslow's Hierarchy of Needs, s/he may give emphasis to different traits when seeking a property. In other words, there are different measures or indicators for traits associated with different levels of Maslow's Hierarchy of Needs in the context of social housing. For example, in the context of a constrained financial budget, working-class people may place greater emphasis on meeting functional needs before pursuing non-functional needs such as aesthetics. This means that not all characteristics related to the property bring the same level of utility to all individuals. Gratton (1980) found that social class is a stronger indicator of 'needs' compared to gender or age. In particular, the middle-class are more concerned with 'needs for esteem' and 'needs for self-actualisation', the working-class is more concerned with 'needs for belonging' and 'needs for esteem', and lower classes (such as the indigent) are more concerned with 'needs for belonging' and 'physiological needs'.

However, existing quantitative housing studies rarely consider the perspectives from Maslow's theories. In this chapter, I aim to bridge the research gap by not only bringing in Bourdieu's theories on 'habitus' and SES into the study of housing consumption, but also link the discussion and choice of variables in the empirical models to Maslow's Hierarchy of Needs.

Figure 4.1 Maslow's Hierarchy of Needs



Source: Adapted from Maslow (1943)

4.2.3 Quantifying habitus

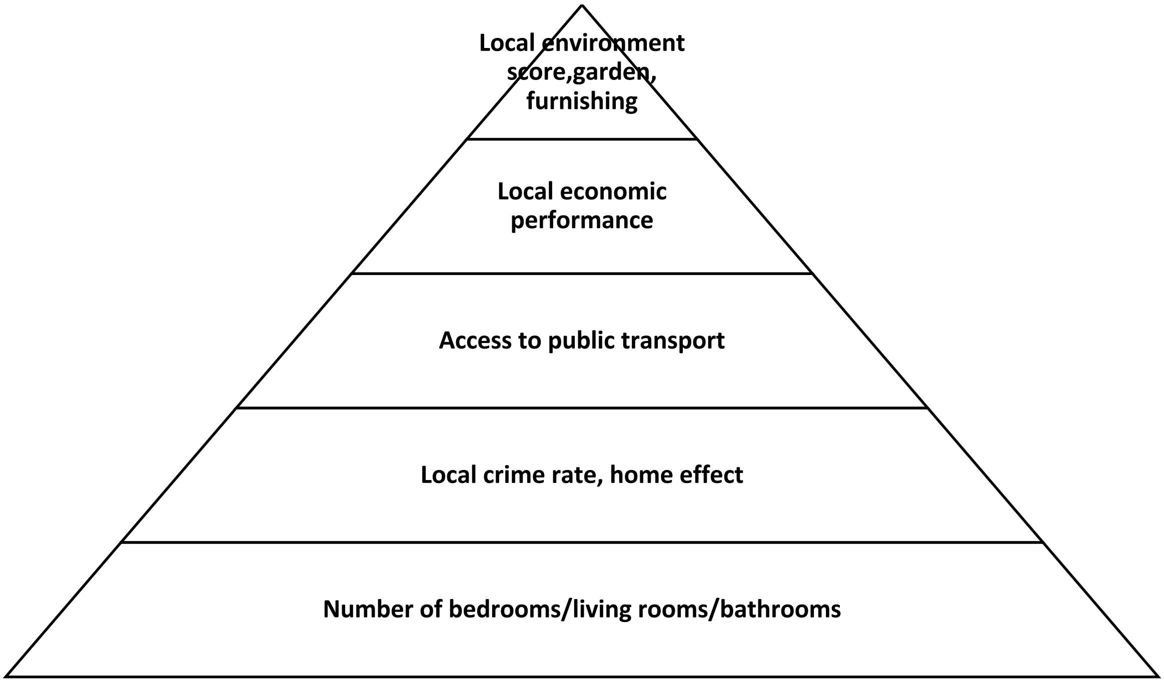
To achieve the research objective, I use proxies to quantify different levels of the Maslow's Hierarchy of Needs. At the lowest level, shelter should provide sufficient space to fulfil physical needs. At the second level, the need for safety and security implies that tenants would want to live in neighbourhoods with low crime rates. The earlier section 3.2.1 discusses how the idea of a 'house' can reinforce security and safety, as well as the symbolic idea 'home'. Possible indicators may include local crime rates and malicious fire rates, and whether the dwelling is a house. At the third level, the need for love and belonging can be associated with the tenants' need to be close to family and friends. These are emotional indicators for the need for love and belonging. Convenient access to public transport also helps build social networks and social capital (Lucas, 2012; Schwanen *et al.*, 2015). A survey conducted by Hine and Mitchell (2003) found that residents whose residence has less ideal transport accessibility are less likely to visit family and friends. At the esteem level, tenants may want to be respected for where they live. Chapter 2 discussed how negative social stigma affects the esteem level of council tenants. Nevertheless, individual tenants may feel differently towards ‘esteem’ depending on how others feel towards their neighbourhood; certain areas of London are regarded to be more prestigious than others (Webber and Burrows, 2018). Therefore, the indicator for such a trait may be the perceived image or prestige of a given neighbourhood, which can be strongly tied to the economic performance of the local neighbourhood. Guerrieri, Hartley and Hurst (2013) found that residents are willing to pay a premium to live next to rich neighbours. However, poorer residents pay less of a premium for such ‘prestige’. The fifth level is the need for beauty and aesthetics. Based on Maslow’s Hierarchy of Needs, aesthetic needs are one of the higher needs in the hierarchical pyramid. This implies that individuals who have their lower needs fulfilled have higher aesthetic needs, which are more likely to be ones with higher SES. The need for beauty and aesthetics may also link to the highest-level need of self-actualisation. Aesthetics and beauty can be a way of portraying personal identities and the sense of ‘self’. Beck (1992) argued that the loss of local community and close family connections in late modernity has resulted in the need of individuals to organise and plan their own lives, to install their personal identities. Extending Beck’s argument, interior design and furnishings can play a significant role in individuals’ quest of using their personal space to create their own identities. Besides furnishing and interior, environment and green space also carry some aesthetic functions, and hence make it suitable to use ‘local environmental scores’ as an indicator of aesthetic levels. Combining the above arguments, those who with higher SES may prefer dwellings that provide them with the flexibility to furnish the dwellings themselves.

To sum up, the connection between Maslow’s Hierarchy of Needs and Bourdieusian social theories enable the possibility to categorise habitus towards housing traits. However, there are caveats of using Maslow’s Hierarchy of Needs to categorise housing traits. It is often easier to observe traits associated with lower level of Maslow’s Hierarchy of Needs than ones in the higher level, since the lower level of needs easily objectify into material objectives. For example, ‘psychological needs’ may set standards on the fulfilment of the needs; the need of food can be fulfilled through a set amount of food and the need for shelter can be fulfilled through a dwelling that contains certain functions. As a result, it is much easier to establish local, or even universal standards, for lower-level needs. For these needs, it is possible to select indicators which measure whether they are achieved by individuals. In contrast, it is not possible to set standards for higher level needs, such as ‘self-actualisation’. The literal meaning of ‘self’ implies that such a need is entirely personal and differs between individuals. Consequently, it is not possible to set indicators to measure whether a person has self-actualised. Instead, the study may explore indicators that imply optimal environments that propel individuals to self-actualise (Table 4.1 and Figure 4.2)

Table 4.1 Maslow’s Hierarchy of Needs, Implication for Housing Choice and Indicators

Needs **(in the order from necessities to luxury)**	**Implication for Housing Choice**	**Indicator**
Physiological needs	Sufficient space	Number of bedrooms
Safety and security	Low neighbourhood crime rates	Local crime rate
	House effect	Dwelling type
Love and belonging	Closeness to friends, closeness to family	Access to public transport
Esteem	Prestige of living area	Local economic performance
Aesthetic needs	Beautiful neighbourhood and home	Local environment score, furnishing

Figure 4.2 Maslow's Hierarchy of Needs, Implication for Housing Choice and Indicators



4.2.4 Research hypothesis

Based on the availability of indicators and data, the empirical analysis forms the following hypotheses:

H_1: Renters with the lowest SES (SES-1) show greater preference to neighbourhoods with high safety scores and houses than SES-2 and SES-3 renters

H_2: Renters with the second lowest SES (SES-2) show greater preference to neighbourhoods with transport closeness than SES-1 and SES-3 renters

H_3: Renters with the second highest SES (SES-3) show greater preference to neighbourhoods with high environmental scores than SES-1 and SES-2 renters

After running the hedonic models for individual social classes, the likelihood test and the Wald Chi-square test are used to examine the differences in the test results between renters of different SESs. The purpose is to examine whether distinctions exist.

4.3 Methodology and Data

4.3.1 Model specification

a. Identification issue

The study examines how renters of different SESs prioritise different traits relating to housing consumption and neighbourhood choice. Therefore, the research question is: “Given the same proportion of income spent on rent, do social groups of different SESs value different traits differently?”

There are two identification issues in this study. First, as income increases, the proportion of income spent on necessities such as housing decreases (Griller, 1996). As a result, it is important to distinguish whether the reasons for certain housing or neighbourhood traits not being ‘prioritised’ amongst lower SES groups are related to budget constraints or preferences. In the case where the distributions of rent-income ratio amongst different SES groups are the same, it is possible to regard the samples of the four groups as random samples. In the case where the three groups cannot be treated as randomly sampled, one of the options is to use PSM (see Section 3.3.2 in Chapter 3 for details). PSM can use matching to create randomly sampled datasets by comparing individuals of different SESs that have similar proportions of income spent on rent.

Second, there exist unobserved characteristics that both affect the clustering of certain social groups, as well as the independent variables and dependent variables. For example, in terms of underground development, in areas where there exist clusters of SES-1 and SES-2 groups, there will be higher demand for public transportation. Consequently, such areas will have better public transportation accessibility. The issue is known as endogeneity. The granular neighbourhood data used in this study can address part of the issue of spatial correlation.

b. Chow’s Test

Chow’s Test is used to examine regression results between neighbourhoods of different SESs. Chow’s Test aims to examine whether the coefficients of two different regressions are equal (Chow, 1960). The null hypothesis of the Chow Test is that the regression models fitted on different SES groups have the same parameters for independent variables as well as intercepts. The test statistic of Chow Test when testing between two SES groups is:

$$\frac{(RSS_T - (RSS_S + RSS_{NS}))/k}{(RSS_S + RSS_{NS})/(N_S + N_{NS} - 2k)}$$

Where RSS_T, RSS_S and RSS_{NS} are the sum of squared residuals of the entire data sample and the data samples of the two compared SES groups, respectively; N_S and N_{NS} are the number of observations of the data samples of the two compared SES groups; and k is the total number of parameters in the regression models.

c. Empirical model

The empirical model is based on hedonic analysis, which incorporates interaction terms. The group regression test aims to capture the difference of preferences between different categories of neighbourhoods in London based on the clustering of SES groups. This section hypothesises that property renters of different population tiers in London may have different preferences regarding rental properties. This section uses the main category of London Output Area Classifications as the indication of neighbourhood type.

The interaction terms aim to examine whether $class$ plays a role in forming and prioritising different housing preferences. In the first part of the empirical analysis, the model includes a dummy variable C_i indicating the SES group that the neighbourhood of the property belongs to. $C_i = 1, 2, 3, 4$ corresponds to SES-1, SES-2, SES-3 and SES-4 respectively. The regression model is therefore:

$$ln_{Price} = \alpha + \beta_i \boldsymbol{X}_i + \gamma_i \boldsymbol{Z}_i \boldsymbol{C_i} + \delta_i \boldsymbol{C_i} + \varepsilon$$

Where $\boldsymbol{X}_i$ are the characteristics of property i which are the same factors identified in the basic hedonic model excluding the variable “number of bedrooms”, and $\boldsymbol{Z}_i \boldsymbol{C_i}$ is the interaction term of the independent variable $\boldsymbol{Z}_i$ (physiological needs, safety and security needs, love and belonging needs, esteem needs and aesthetic needs) and the dummy variable is $\boldsymbol{C_i}$.

The second part of the empirical analysis examines the differences in preferences between the worst-off group and the best-off group[31] when the interaction terms are removed.

4.3.2 Data collection

The data consists of three parts. The first part of the data are housing related variables, which include ‘whether the dwelling is modern’ ($modern$), ‘whether the dwelling is a house’ ($house$), ‘the number of bathrooms’ ($baths$), ‘furnishing state’

[31] The ‘worst-off’ group is defined as renters belonging to SES-1 with rental affordability of over 40% but less than 100%. The ‘best-off’ group is defined as renters belonging to SES-4 with rental affordability of less than 30%.

($furnishing$), 'whether the dwelling has a garden' ($garden$), 'number of reception rooms' ($recept$), '(log) distance to the nearest station'(ln_subway), 'average market price' (ln_market), '(log) distance to the nearest *school'*(ln_school), 'ward-level economic condition' (ln_econ), 'ward-level education quality' (ln_edu), 'ward-level environmental quality' (ln_env) and 'ward-level safety level' (ln_safety).

The second part of the data includes the information related to the SES groups. Based on the *2011 UK Area Classification* (Office for National Statistics, 2016a), *2011 London Output Area Classification* (Census Information Scheme, 2015) classifies areas in London into 8 main categories, consisting of 19 sub-categories.[32] *2011 London Output Area Classification*[33] therefore forms the basis of the area classification for the empirical test in this chapter. The methodology of the *2011 London Output Area Classification* follows the one used for the *2011 Office for National Statistics Output Area Classification.* To construct the classification, the areas were firstly assessed based on the 60 attributes outlined in Table 0.7 in Appendix-Chapter 4. The data was then transformed using an inverse hyperbolic sine transformation to make sure that it was more normally distributed. The results were then categorised into the following hierarchy, which consists of 8 super-groups and 19 sub-groups.

The third part of the data relates to the monthly expenditure of housing as a percentage of monthly income. The rent-income ratio is adjusted by the number of bedrooms, since it is highly unlikely that a single renter rents a property of more than one bedroom. To determine the affordability of a specific dwelling, I first map the individual dwelling to MSOA areas (see Section 1.3.2 in Chapter 1 for definitions),[34] and hence determine the corresponding MSOA area of a given dwelling. The bedroom-adjusted rent-income ratio (HIR_adj_i) of an individual dwelling i is calculated as:

[32] The 19 categories of neighbourhoods include struggling suburbs (A1), suburban localities (A2), disadvantaged diaspora (B1), 'Bangladeshi enclaves' (B2), students and minority mix (B3), Asian owner occupiers (C1), transport service workers (C2), East End Asians (C3), elderly Asians (C4), educational advantage (D1), city central (D2), city and student fringe (E1), graduation occupation (E2), city enclaves (F1), affluent suburbs (F2), affordable transactions (G1), public sector and service employees (G2), detached retirement (H1) and not quite home countries (H2).

[33] Data source: https://data.london.gov.uk/dataset/london-area-classification

[34] The shapefile used for the mapping is based on the new 2018 boundaries: https://data.london.gov.uk/dataset/statistical-gis-boundary-files-london

$$HIR\_adj_i = \frac{income_i}{rent_i \times bed_i}$$

Where $income_i$ is the average monthly income of the corresponding MSOA area that the dwelling belongs to, and $rent_i$ and bed_i are the corresponding monthly rent and number of bedrooms of dwelling i.

4.3.3 Categorising socio0economic groups

Similar to Gratton (1980), Bourdieu's definition on social classes is also occupation-based. Gratton (1980) also linked social classes to types of homes that they reside. First, the lower socio-economic group tend to be unemployed or have occupations in unskilled or semi-skilled manual jobs. They tend to rent privately or rent from councils. In addition, the areas of their dwellings tend to be inner city council estates or inner-city private flats. Second, the working-class tend to have skilled manual or non-manual occupations. They tend to live in council rented or privately-owned dwellings, where the dwellings are typically located in suburban council estates and suburban private estates. Third, the middle-class typically have occupations such as skilled non-manufactural, managerial and professional jobs. They tend to live-in privately-owned dwellings, which are situated in suburban private estates. Therefore, benchmarking Gratton's (1980) definitions, as well as taking into account the characteristics of the sub-group neighbourhoods, I further divided the 8 groups of *2011 London Output Area Classification* into the following four categories. The names of the areas are direct quotations of *2011 London Output Area Classification*:

- Group 1 (SES-1): (A1) Struggling suburbs; (B1) Disadvantaged diaspora; (B2) 'Bangladeshi enclaves'[35]
- Group 2 (SES-2): (A2) Transport service workers; (B3) Students and minority mix; (C2) Transport service workers; (C3) East end Asians; (E1) City and student fringe; (E2) Graduate occupation; (G1) Affordable transitions; (G2) Public sector and service employees

[35] In *2011 London Output Area Classification* report, 'Bangladeshi enclaves' are "neighbourhoods [that] have exceptionally high concentrations of residents or Bangladeshi origin; and also are areas characterised by particularly low levels of use of English as a first language" (Longley and Singleton, 2014, p. 11).

- Group 3 (SES-3): (C1) Asian owner occupiers; (C4) Elderly Asians; (D1) Educational advantage; (D2) City central; (F1) City enclaves; (H2) Not quite home counties
- Group 4 (SES-4): (F2) Affluent suburbs; (H1) Detached retirement

The above categorisation is comparable to Savage *et al's* (2013) classification of social classes. Based on the quantity and structure of economic, cultural and social capital, they categorised social classes into: the precariat, the emergent service workers, the traditional working-class, the new affluent workers, the technical middle-class, the established middle-class and the elite. I simplify Savage *et al's* (2013) classification by grouping the precariat and half of the emergent service workers into SES-1, half of the emergent service workers, traditional working-class and the new affluent workers into SES-2, the technical middle-class and the established middle-class into SES-3, and the elite into SES-4.

Figure 4.3 shows the percentages of neighbourhoods in the sample data belonging to each SES group after further classifying the neighbourhoods into four groups. The figure shows that the distributions in the sample match the distributions across London wards. The percentages of wards in London classified as SES-1, SES-2, SES-3, and SES-4 are 16%, 44%, 29% and 12% respectively. The classification overall aligns with the results from GfK[36] (Savage *et al.*, 2013), which suggested that the results of GfK suggest that percentages of the population who are SES-1, SES-2, SES-3, and SES-4 are 15%, 33%, 46% and 6% respectively. Both classifications suggest that the SES-1 and the SES-4 population in the U.K. are minorities. However, the classification using both *2011 London Output Area Classification* and GfK deviate from that based on *The Great Britain Class Survey* (GBCS). The results from GBCS contain a much lower percentage of the SES-1 population and a much higher percentage of the SES-4 population. However, the figures based on GfK Survey are more accurate, compared to that of GBCS. This is because GBCS was based on online self-

[36] GfK and GBCS categorises the survey respondents into seven categories: precariat (poor economic capital), emergent service workers (moderately poor economic capital), traditional working-class (moderately poor economic capital), new affluent workers (moderately good economic capital), technical middle-class (high economic capital), established middle-class (high economic capital) and elite (very high economic capital). Based on the level of economic capital, the seven classes are merged into four categories: SES-1 (precariat), SES-2 (emergent service workers and traditional working-class), SES-3 (new affluent workers, technical middle-class and established middle-class), and SES-4 (elite).

submissions from the British Broadcast Corporation (BBC) which did not detect repeated submissions. In addition, the channel of the survey means that it is highly likely to over-represent BBC audiences, resulting in selection bias of the data sample.

Nevertheless, there are several problems with the categorisation method used in this chapter. First, since the data is obtained from Zoopla, it is likely that the listings target potential renters who can afford private rental whilst not owning properties. As a result, the neighbourhoods that are dominated by social renters and owner occupiers are under-represented. Second, it is difficult to compare the distribution of the four socio-economic groups in the data sample to that of London wards. Whilst the classification based on the dataset is based on dwelling units, the classification of London wards is based on ward-level information. The two can only be compared if there are the same number of dwellings in each ward.

Table 4.2 Wards in London and in data sample which belong to different socio-economic groups

Socio-economic groups	**Total numbers**	**% of all London**	**% of the sample data**	**% based on GfK**	**% based on GBCS**
SES-1	5465	16	26	15	<1
SES-2	6995	44	34	33	19
SES-3	5515	29	27	46	59
SES-4	2694	12	13	6	22

Source: own construction based on Savage et al. (2013)

Figure 4.3 Distribution of socio-economic groups in the sample data, amongst all London wards, on GfK and GBCS results

Source: own construction

4.3.4 Distribution of housing-income ratio

Following the steps outlined in Section 4.3.4, the rent-income ratio of individual dwellings is then combined with the SES that the neighbourhood belonged to.

Table 4.3 outlines the distribution of HIR_adj_i, under three categories: 1) All sample; 2) $HIR\_adj < 1$; and 3) $HIR\_adj < 0.36$. The reason for focusing on $HIR\_adj < 1$ is that it is not realistic for tenants to spend more than what they earn on rent. On the other hand, the reason for focusing on $HIR\_adj < 0.36$ is that the average rent-to-income ratio[37] in London is 0.359 in 2019 and 0.367 in 2018 (HomeLet, 2019). This study focuses on the sample data that had $HIR\_adj < 0.36$. Table 4.3 shows that the mean value of HIR_adj goes down as the data moves from the SES-1 to SES-3. This is consistent with the earlier hypothesis that, as income goes up, the proportion of income spent on rent goes down. The standard deviation also goes down as the data moves from SES-1 to SES-3, suggesting a more equal distribution amongst tenants with higher monthly income regarding HIR_adj_i. However, SES-4 is an exception, where the corresponding HIR_adj_i of each category is at a similar level as the values of SES-1. A closer inspection of the data shows that the two dwellings that are

[37] Rent-to-income ratio is measured as dividing agreed rent by tenants' salary. The data source is based on HomeLet's tenant referencing service (HomeLet, 2019).

outliers ($HIR\_adj = 12.47$) were both located near Regent's Park.[38] Although the two dwellings have different characteristics, their geographic information suggests that they are likely to be in the same building. The two dwellings both had monthly rental prices of £151667, where the average monthly income (pre-housing expenditure) of the area is £2433.33. However, exclusion of the two outliers still show that the HIR_adj for SES-4 is consistently higher than the SES-2 and the SES-3. This could be because 'income', rather than 'wealth', is used here. As a result, it does not consider renters who afford rent using family wealth instead of their income. In addition, certain wealthy neighbourhoods in London (e.g. South Kensington which belongs to Westminster, as well as Regent's Park which belongs to Kensington and Chelsea) are popular residential areas for wealthy students (e.g. from Imperial College and University College London), who can afford the rent without necessarily being employed. The results are consistent with the 'rents and affordability' data published by Trust for London, which shows that the London boroughs with two of the highest rent affordability levels[39] are Kensington and Chelsea (=107%) and Westminster (=91%).

[38] Regent's Park is one of London's Royal Parks which are owned by the Crown.
[39] 'Rent affordability' is measured by the percentage of gross full-time earnings in the borough divided by the monthly rent level for a two-bedroom property, where the rental data are based on samples from lettings administrative information database (Trust for London, 2018).

Figure 4.4 shows a histogram of percentage distribution of HIR_adj for the four socio-economic groups, where the sample is restricted to dwellings that had HIR_adj of a maximum of 1. Visually, the distributions of the four socio-economic groups are very similar. They all have a right-skewed distribution with a peak at around 0.2. For each socio-economic group, the percentage of population that had HIR_adj at the peak of the graph was between 4% and 6%. Similar conclusions were drawn from Figure 4.5 which shows the distribution for $HIR\_adj_i < 0.36$.

To statistically test whether the rental-income ratio distributions for the four socio-economic groups are the same, a one-way Analysis of Variance (ANOVA) test was used. The purpose of the ANOVA test is to check whether the means of the HIR_adj distribution are equal across the four social classes. The data samples meet the requirements for ANOVA, which are: 1) random and independent samples; 2) underlying normal distributions;[40] 3) same underlying standard deviations.[41] The ANOVA test results are outlined in Table 4.4. The results suggest that both the standard deviation and the mean of the four distributions are the same.[42] Therefore, there is no need for further use of PSM.

[40] Figure 4.4 and Figure 4.5 show that visually the four distributions are normal. However, since the ANOVA test is robust, deviation from normality would not be an issue, especially when a large sample is involved (Kuzma and Bohnenblust, 2005), which is the case of this study.

[41] In Table 4.3, it shows that standard deviations are very close to each other for the four samples, in all four cases: 1) all sample; 2) when $HIR < 1$; and 3) when $HIR < 0.36$. Since ANOVA test is robust, if the largest standard deviation is less than twice the size of the smallest standard deviation, the test gives a good enough result.

[42] The null hypothesis for ANOVA test is that ‘the means are equal’, which in this case is not rejected. The null hypothesis for Bartlett’s test for equal variances is that ‘the variances are not equal’, which in this case is rejected.

Table 4.3 Descriptive statistics of HIR_adj for SES-1, SES-2, SES-3 and SES-4 classified by: 1) All sample; 2) $HIR\_adj < 1$; and 3) $HIR\_adj < 0.36$.

	Mean	**Max**	**Min**	**St. dev**	**N**
SES-1					
All sample	0.3619	5.9010	0.0632	0.2706	5465
< 1	0.3326	0.9931	0.0632	0.1560	5338
< 0.36	0.2357	0.3597	0.0632	0.0606	3335
SES-2					
All sample	0.3143	2.7837	0.0350	0.1751	6995
< 1	0.3056	0.9708	0.0350	0.1355	6949
< 0.36	0.2356	0.3598	0.0350	0.0578	4875
SES-3					
All sample	0.2945	2.0926	0.0366	0.1403	5515
< 1	0.2898	0.9866	0.0366	0.1231	5487
< 0.36	0.2361	0.3597	0.0366	0.0571	4145
SES-4					
All sample	0.3610	12.4658	0.0637	0.4920	2694
excluding two outliers	0.3580	2.0926	0.0637	0.3658	2692
< 1	0.3213	0.9993	0.0637	0.1592	2634
< 0.36	0.2354	0.3594	0.0637	0.0629	1757

Figure 4.4 Histogram on percentage distribution of HIR_adj (max<1) of SES-1 (top left), SES-2 (top right), SES-3(bottom left) and SES-4 (bottom right)

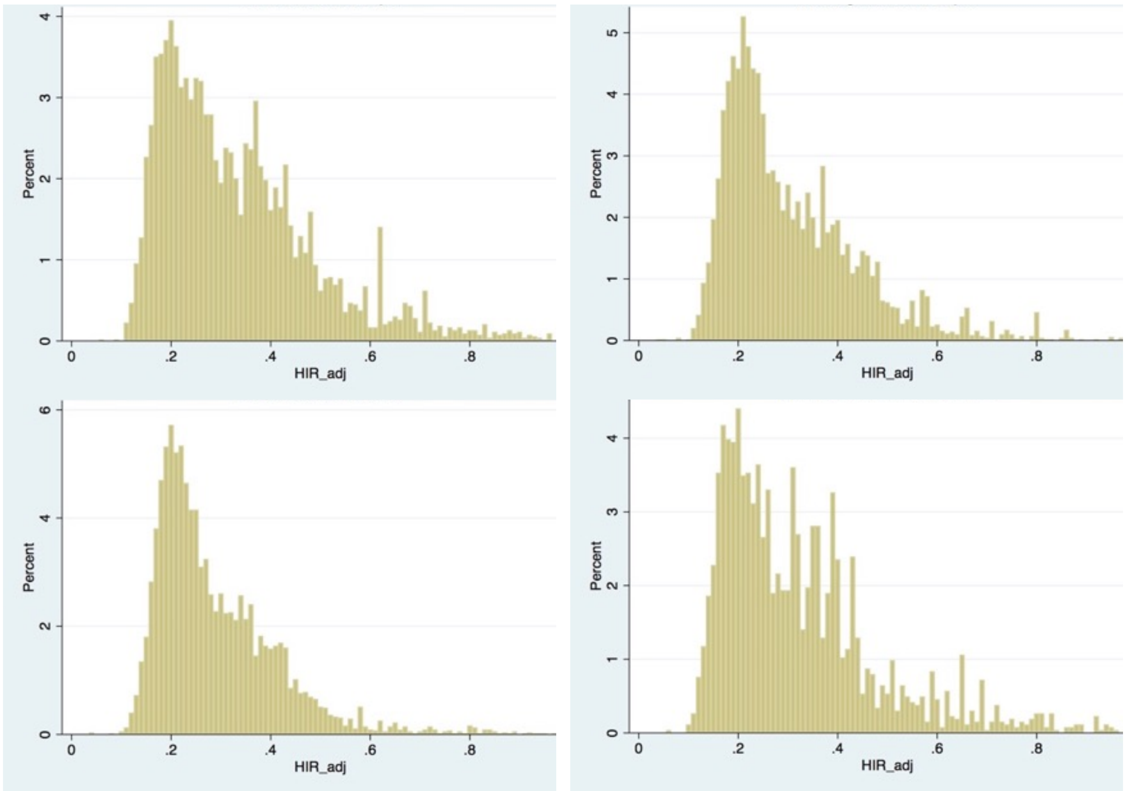


Figure 4.5 Histogram on percentage distribution of HIR_adj (max<0.36) of SES-1(top left), SES-2 (top right), SES-3 (bottom left) and SES-4 (bottom right)

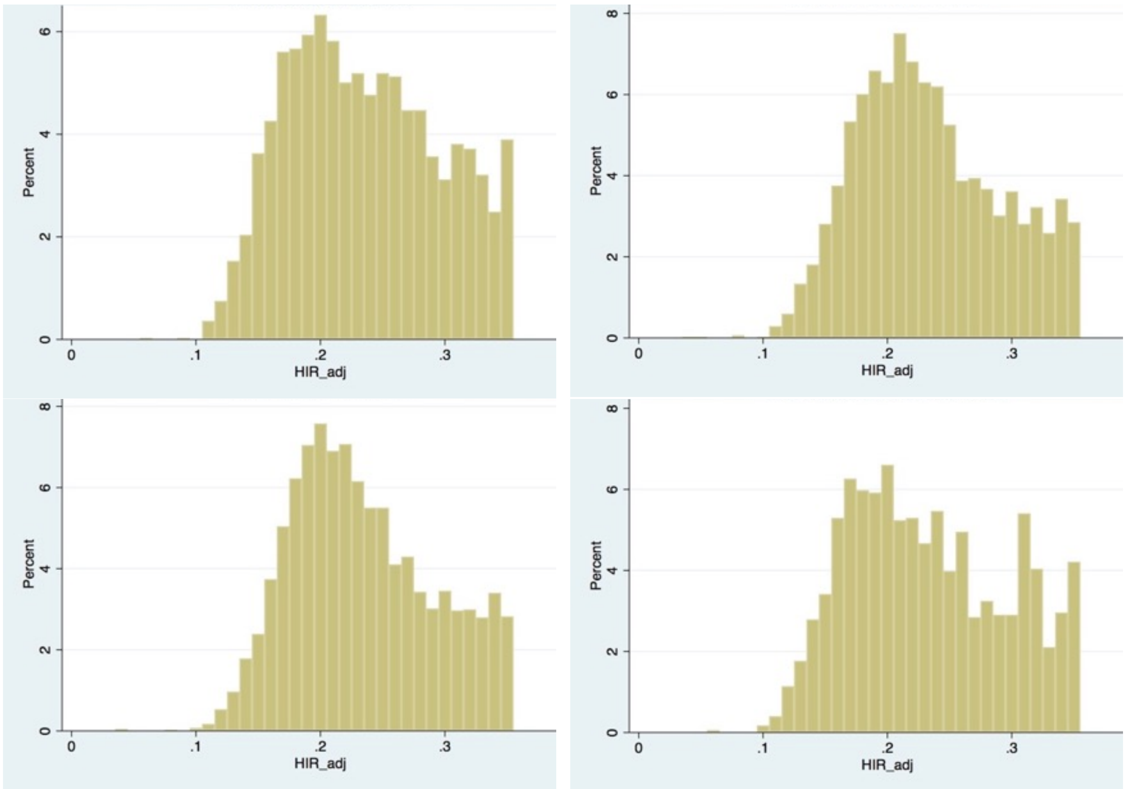


Table 4.4 ANOVA test results

Source	F-statistics	Prob > F
Between groups	1.47	0.2195
Bartlett's test for equal variance	$\chi^2(3)$ = 32.4301	Prob>χ^2= 0.000

4.4 Results and Findings

4.4.1 Regression results

Table 4.5 is an extract of the results which include the interaction terms and independent variables. The detailed results which include standard errors and results for control variables are in Table 0.8 in Appendix-Chapter 4. The results of the interaction terms outlined in Table 4.5 suggest that SES has a negative effect on preferences towards local public open space and public transportation. In other words, individuals from higher social classes place less emphasis on public space, and rental properties locate close to public transportation or open public space are priced lower than ones that do not.

Table 4.6 shows an extract of the hedonic modelling results for the four social classes. The detailed results which include standard errors and results for control variables are in Table 0.9 in Appendix-Chapter 4. The results show that there are several differences in terms of the hedonic modelling results between the four social classes. First, the safety score is only positively significant for SES-1 and SES-3 neighbourhoods, which does not agree with the null hypothesis. Second, distance to underground or train station is negatively significant to rental prices for all neighbourhoods, which also does not agree with the null hypothesis. Third, environmental scores are not a positively significant determinant of rental price for SES-3, which does not agree with the null hypothesis. The results therefore show that revealed preferences do not differ between the three neighbourhoods of different social classes.

To test the differences between the corresponding coefficients of variables amongst different socio-economic groups based on the empirical results in Table 4.6 (see Table 0.9 in Appendix-Chapter 4 for detailed results), I use Chow's test. For Table 4.8, the purpose of the Chow's test was to examine whether the corresponding coefficients of: 1) $beds$, $house$ and $econ$ are each the same across all four socio-economic groups; 2) $subway$ are the same for SES-1, SES-2 and SES-3; 3) $garden$ are the same for SES-2 and SES-3; and 4) env are the same for SES-1 and SES-2.

The results of Chow's test in Table 4.8 suggest that even though the independent variables play a significant role amongst different social groups as shown in Table 4.6, their significances vary across groups. The results in Table 4.8 suggest that, besides $beds$, there are more similarities between adjacent socio-economic groups than across all four groups. For example, in the case of $house$, SES-1, SES-2 and SES-3 share commonality in the elasticity of the variable, whereas SES-4 do not share similar results. The opposite result is found for ln_econ, where the coefficients between SES-1 and SES-2, as well as between SES-2 and SES-3, are each different. However, SES-3 and SES-4 share commonality over the degree of preference towards neighbourhoods of better economic conditions. Overall, SES-1 and SES-2 share a large degree of commonality as to the degree of positive preferences towards public space and transport, which are approximated using ln_subway and ln_env.

Similar results were revealed by the Chow's test comparing the best-off and the worst-off groups (Table 4.9) based on results from Table 4.7 (see Table 0.10 in Appendix-Chapter 4 for detailed results). Based on the empirical results and Chow's test, the two groups share similar degrees of positive preferences towards $beds$, whilst having different degrees of preferences towards ln_econ. In particular, the rental premium for the worst-off group is positively statistically significant, whereas the best-off group pay less rent for being close to public green and open space.

There are also caveats pertaining to both results and the corresponding inferences. Most notably, Chow's test is only able to infer whether the two regressions are the same. It does not disclose whether differences arise from the intercepts or the slopes of the regressions.

Table 4.5 Empirical test results (including interaction terms between socio-economic groups and independent variables)

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BEDROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** TYPES OF FURNISHING (dummy variable), GARDEN OR NO GARDEN (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variables are DISTANCE TO NEAREST SCHOOL (natural log) and EDUCATION QUALITY SCORE (natural log). The interaction terms take the interaction between CLASS and the different categories of independent variables. The estimation technique is OLS with interaction terms.

	(1)	(2)	(3)	(4)	(5)
Physiological needs					
$beds$	0.250***	0.213***	0.214***	0.212***	0.212***
Safety and security					
$house$	0.323***	0.421***	0.314***	0.321***	0.322***
$safety$	0.00924***	0.0221***	0.00828***	0.00872***	0.00924***
Love and belonging					
$subway$	-0.772***	-0.768***	-0.922***	-0.768***	-0.772***
$econ$	0.0138***	0.0147***	0.0136***	0.0262***	0.0140***
Aesthetic needs					
$furnishing$	-0.0262***	-0.0264***	-0.0243***	-0.0253***	0.0242*
$garden$	0.0773***	0.0773***	0.0732***	0.0773***	0.0618
env	0.00150*	0.00131*	0.00164**	0.00137*	0.0110***
Physiological needs					
$class \times beds$	**-0.0165*****				
Safety and security					
$class \times house$		**-0.0444*****			
$class \times safe$		**-0.00611*****			
Love and belonging					
$class \times subway$			**0.0747*****		
$class \times econ$				**-0.00479*****	
Aesthetic needs					
$class \times fur$					**-0.0218*****
$class \times garden$					0.00589
$class \times env$					**-0.00409*****
Cons	4.383***	4.383***	4.413***	4.387***	4.385***
N	14112	14112	14112	14112	14112
adj. R^2	0.878	0.878	0.881	0.878	0.878

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.6 Empirical test results (SES specific)

Physiological needs: NUMBER OF BEDROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** TYPES OF FURNISHING (dummy variable), GARDEN OR NO GARDEN (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variables are DISTANCE TO NEAREST SCHOOL (natural log) and EDUCATION QUALITY SCORE (natural log). The estimation technique is OLS. Model (6) – (9) represent the respective test results for SES-1, SES-2, SES-3 and SES-4.

	(6) SES-1	(7) SES-2	(8) SES-3	(9) SES-4
Physiological needs				
$beds$	**0.248*****	**0.228*****	**0.192*****	**0.249*****
Safety and security				
$house$	**0.260*****	**0.313*****	**0.318*****	**0.0721***
ln_safety	**0.0158*****	**0.00457***	0.00107	0.00406
Love and belonging				
ln_subway	**-0.812*****	**-0.815*****	**-0.717*****	0.0124
ln_econ	**0.0174*****	**0.00852*****	**0.0160*****	0.0159***
Aesthetic needs				
$furnishing$	0.0139	-0.0537***	-0.0112	-0.00166
$garden$	0.0632	**0.0759****	**0.0728***	-0.0324
ln_env	**0.00650*****	**0.00448*****	-0.00176	-0.00170
Cons	4.429***	4.404***	4.442***	5.256***
N	3335	4875	4145	1757
adj. R^2	0.815	0.853	0.883	0.977

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.7 Empirical test results (the 'worst-off' vs. the 'best-off')

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BEDROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** TYPES OF FURNISHING (dummy variable), GARDEN OR NO GARDEN (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variables are DISTANCE TO NEAREST SCHOOL (natural log) and EDUCATION QUALITY SCORE (natural log). The estimation technique is OLS. Model (10) – (11) represent the respective test results for the worst-off of SES-1 and the best-off of SES-4 based on income/rental ratios.

	(10) worst-off of SES-1	(11) best-off of SES-4
Physiological needs		
$\boldsymbol{beds}$	**0.568*****	**0.240*****
Safety and security		
$house$	0.0676	**0.0778***
ln_safety	**0.0241*****	0.00403
Love and belonging		
ln_subway	**-0.907*****	0.0336
ln_econ	**0.0105****	**0.0151*****
Aesthetic needs		
$furnishing$	0.0408	-0.000142
$garden$	-0.00970	-0.0326
ln_env	**0.0102****	**-0.00346****
Cons	3.909***	5.315***
N	1498	1377
adj. R^2	0.903	0.956

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.8 Chow's test (SES-specific)

	SES-1 vs. SES-2	SES-2 vs. SES-3	SES-3 vs. SES-4	All relevant groups[43]
$beds$	Yes	Yes	Yes	No
$house$	Yes	Yes	No	No
$econ$	No	No	Yes	No
$subway$	Yes	No	-	No
$garden$	-	Yes	-	Yes
env	Yes	-	-	Yes

Table 4.9 Chow's test ('the worst-off' vs. 'the best-off')

	Worst-off vs. Best-off
$beds$	Yes
$econ$	No

4.4.2 Robustness test

The purpose of the robustness test is to examine whether the conclusions from the main empirical test remain significant when similar variables are used, or when the composition of the non-core independent variables change. In the robustness test, instead of using 'number of bedrooms' ($beds$) as a proxy for size, 'number of bathrooms' ($baths$) is used. Amongst the 'aesthetic needs' factors, 'furnishing status' ($funishing$) and 'whether or not the dwelling has a garden' ($garden$) are replaced by 'whether or not the dwelling is recently renovated or a new build' ($modern$). One of the control variables 'local school quality' (ln_school) is dropped from the model.

An extract of the results of the robustness test are outlined in Table 4.10 (see Table 0.11 in Appendix-Chapter 4 for detailed results), where the conclusions align with the main regression results from Table 4.6. The results on $modern$

[43] The 'relevant group' refers to the social groups that are of the interest of comparing the coefficients. For example, for $garden$, the 'relevant group' includes SES-2 and SES-3; whereas for $beds$, the 'relevant group' includes all socio-economic groups. The test is conducted by adding 'accum' function following 'suest' and 'test' in STATA.

suggest that both SES-1 and SES-4 place negative value towards properties that are newly renovated, whereas SES-2 and SES-3 are willing to pay premiums for such properties. Nevertheless, the corresponding coefficient of $modern$ for SES-2 is statistically insignificant and small. Table 4.11 outlines an extract of the robustness test results for the comparison between the 'best-off' and 'worst-off' (see Table 0.12 in Appendix-Chapter 4 for detailed results). The results are consistent with the main regression results in Table 4.7. Even though env is not significant for both the 'best-off' and the 'worst-off', their corresponding signs are consistent with the main results.

Table 4.10 Robustness test (SES specific)

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BATHROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** MODERN/NEWLY RENOVATED OR NOT (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variable is DISTANCE TO NEAREST SCHOOL (natural log). The estimation technique is OLS. Model (12) – (15) represent the respective test results for SES-1, SES-2, SES-3 and SES-4 respectively.

	(12) SES-1	(13) SES-2	(14) SES-3	(15) SES-4
Physiological needs				
$baths$	0.207^{***}	0.217^{***}	0.207^{***}	0.257^{***}
Safety and security				
$house$	0.550^{***}	0.590^{***}	0.529^{***}	0.305^{***}
ln_safety	0.0137^{***}	0.00834^{***}	0.000281	0.00405
Love and belonging				
ln_subway	-0.812^{***}	-0.806^{***}	-0.713^{***}	0.0198
ln_econ	0.00796^{***}	0.00976^{***}	0.0113^{***}	0.00839^{***}
Aesthetic needs				
$modern$	-0.0941	0.00530	0.131^{*}	-0.00452
ln_env	0.00594^{***}	0.00534^{***}	-0.00136	-0.00192
Cons	4.671^{***}	4.515^{***}	4.541^{***}	5.405^{***}
N	3335	4875	4145	1757
adj. R^2	0.805	0.848	0.881	0.975

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.11 Robustness test (the 'worst-off' vs. the 'best-off')

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BATHROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** MODERN/NEWLY RENOVATED OR NOT (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variable is DISTANCE TO NEAREST SCHOOL (natural log). The estimation technique is OLS. Model (16) – (17) represent the respective test results for the worst-off of SES-1 and the best-off of SES-4 based on income/rental ratios.

	(16) worst-off of SES-1	(17) best-off of SES-4
Physiological needs		
$baths$	**0.549*****	**0.257*****
Safety and security		
$house$	**0.459*****	**0.305*****
ln_safety	**0.0187*****	0.00405
Love and belonging		
ln_subway	**-0.926*****	0.0198
ln_econ	-0.00531	0.00839***
Aesthetic needs		
$modern$	-0.163	-0.00452
ln_env	0.00166	-0.00192
Control variables		
ln_school	-0.867***	-0.901***
Cons	4.004***	5.405***
N	1498	1757
adj. R^2	0.889	0.975

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.5 Discussion

Unlike Bourdieu's *Distinction* which was able to distinguish the tastes between different social groups, the results from this chapter should be interpreted as: what do different socio-economic groups prioritise for renting? The empirical test results suggest that although all socio-economic groups have similar preferences towards factors such as size, house effect, neighbourhood prestige and proximity to school, the more well-off socio-economic groups are not willing to pay premiums for proximity to underground and public open green space. It was observed that both SES-3 and SES-4 dislike having too much public open green space near where they live. In addition, only SES-1 is willing to pay a premium for additional furnishing. When comparing the proportion of SES-1 that have rental affordability of between 0.4 and 1 ('the worst-off') with the proportion of SES-4 that have rental affordability less than 0.36 ('the best-off'), the results show that greater premium is placed on property size and safety amongst 'the worst-off' compared to 'the best-off'. Table 4.7 suggests that 'the worst-off' pay 76% more for an additional bedroom in their dwellings, whereas the premium paid by the 'the best-off' was 24%. The results have high goodness-of-fit, and the conclusions hold following robustness tests.

Regarding Maslow's Hierarchy of Needs, the results do not give a conclusive answer to whether, as individuals move further up in the hierarchy of socio-economic groups, their needs also move up along the hierarchical pyramid. Nevertheless, the results do suggest that the residents in SES-4 neighbourhoods prefer non-furnished dwellings and are not willing to pay premiums for existing renovation.

The findings further reveal that SES-1 and SES-2 are fully dependent on public transport and public open green space, whereas the SES-4 pay to get away from the 'public'. Comparing the 'worst-off' and the 'best-off' makes the distinction even more significant. Based on Table 4.7, the 'worst-off' pay 0.91% of premium for every 1% reduction in distance to the nearest underground or train station, whereas the result is insignificant for the 'best-off'; it is highly likely that residents living in richer neighbourhoods have their own private means of transportation. In addition, for every 1% increase in the 'access to public open green space score', the 'worst-off' are willing to pay a 0.01% premium in rent, whereas the 'best-off' pay 0.003% less in rent. The logic behind 'paying to get away from the public' is perhaps similar to the rationale behind the emergence of gated communities as a global phenomenon in certain cities (Grant and Mittelsteadt, 2004), especially in areas with high wealth inequality (Blandy, 2006).

4.6 Conclusion

4.6.1 Summary

Extending Bourdieu's social theories, tenants' 'habitus' should also be reflected in their housing preferences. Individuals belonging to lower socio-economic groups may emphasise physiological needs, whilst those belonging to higher socio-economic classes may pay a premium to meet their aesthetic needs. This chapter connects Bourdieu's social theories to Maslow's Hierarchy of Needs, hypothesising that SES-1 neighbourhoods in London see more significant premiums placed on need-based housing features, whereas SES-4 neighbourhoods see more significant premiums placed on non-need-based housing features. The research used rental listing data from Zoopla between April 2018 and November 2018, which contained detailed characteristics of listed properties. The categorising of the neighbourhoods into socio-economic groups was based on MSOA level data combined with the *2011 London Output Area Classification*. The neighbourhoods were categorised into neighbourhoods of SES-1, SES-2, SES-3 and SES-4 residents. The classification overall matches the results produced by *GfK Social Class Survey,* which is based on Bourdieu's theories.

The results suggest the following two key findings. First, most of the social groups have similar preferences toward physiological needs, neighbourhood prestige and education factors. However, SES-3 and SES-4 tenants place negative values on public transport and public green open space. Conversely, both the SES-1 and the SES-2 place premiums on these two attributes. When comparing the worst-off group to the best-off group, the divide between dependence on public space and infrastructure for the former group, and the attempt to stay away from them for the latter group, is even more evident. On the other hand, there are a few findings that disagree with the original hypotheses. For example, safety is positively significant for SES-1 and SES-3 neighbourhoods.

4.6.2 Limitations and future research

This study has several limitations, which require further investigation. First, there are several unresolved endogeneity issues. For example, 'local economic condition' is used as a proxy for a given neighbourhood's perceived prestige. However, this indicator is often also correlated to local rental prices. There are still unobserved characteristics in neighbourhoods that can also affect both rental prices and the distribution of socio-economic groups. For example, low-income neighbourhoods are more likely to have a low average rental price and attract lower socio-economic groups. Second, the definition and identification of SES need to be further understood. There are various definitions of SES in the existing literature. For example, Bourdieu categorises social classes based on occupation, whilst this study uses neighbourhood characteristics. Third, one of the empirical model's major flaws is that it does not consider the dwellings' proximity to Central London.[44] As a result, the empirical results cannot uncover whether different socio-economic groups have different preferences over proximity to the city centre. Fourth, the empirical study is based on secondary data, and cannot reveal more in-depth underlying drivers of the observed phenomenon. For example, this chapter has shown that both the 'worst-off' and the 'best-off' show positive preferences toward dwellings of larger size. However, the degree of such preference differs between the two. Nevertheless, no mechanism allows further exploration and interpretation of the difference. Above all, this chapter examines how habitus and subjectivity are objectified into housing choices, using revealed preference data. One of the key caveats is that the mechanism which objectifies subjectivity is complex, and my chosen proxies may not fully reflect real-life situations. Besides, the results show a correlation between metropolitan habitus and socio-economic groups, where no causal relations can be inferred.

Future research can improve the study by considering the following aspects. First, surveys can resolve the endogeneity issue between the correlation of 'perceived neighbourhood prestige' and 'rental price'. To fully consider unobserved characteristics, boundary discontinuity design could be adopted, where the clusters of different socio-economic groups bordering each other are compared.

[44] According to *The London Plan,* since 2011, Central London (Central Activities Zone) includes Camden, Islington, Kensington and Chelsea, Lambeth, Southwark, Westminster and City of London (Mayor of London, 2016).

Second, future studies can incorporate an occupation-based categorisation of socio-economic groups, using Labour Force and Household surveys. Finally, interviews can help uncover the underlying drivers of the different degrees of preferences pertaining to the same variable across different social groups. The results from the interviews and the surveys can be fed into discrete choice modelling.

4.6.3 Policy implications

I can draw several policy implications from the results and findings. Given the reliance on public space and transportation by SES-1 and SES-2, social housing policymakers and providers should ensure housing units are located close to public transportation, parks and other public greeneries. However, this need has not been fulfilled in real life for access to green space. The *2010 Urban Green Nation Report* suggests that residents living in disadvantaged areas tend to have less access to green space compared to their more affluent peers (Commission for Architecture and Built Environment, 2010). Future social housing policy initiatives should aim to incorporate communal gardens into housing estates, or to prioritise social housing tenants with access to allotments. The provision of green spaces within or close to social housing units is crucial for Central London tenants, where local green spaces lack. Besides, and when considering public transportation in delivering social housing, policymakers and planners should also be aware of the transportation affordability to social housing tenants. However, given that current urban developments in the U.K. aim for mix-usage of private and social housing (Mayor of London, 2016), it is impossible to set price discrimination between the two types of residents. Therefore, a transportation subsidy scheme that supports social tenants' travel might be plausible. Furthermore, the lack of connectivity between social housing residents and opportunities in London through transportation access might be due to physical difficulties, given the higher-than-average disability rate amongst social housing residents. Therefore, corresponding policies should help reduce the frictions that occur throughout the travel.

The results of this chapter suggest that tenants in Central London place a premium on properties that are furnished, where rental prices are also higher. Housing units provided to social tenants should consider providing furniture and electrical appliances in the housing unit. However, most of the current social housing units are provided without floor coverings, window coverings, electrical appliances or furniture. One of the reasons behind this approach is that social tenant lettings are normally offered with long-term secured contracts. Therefore, they are expected to make furnishings and decoration part of their personal responsibilities (Robson, 2018). Future social housing policy initiatives could offer furnishing packages to social renters and be designed in line with circular economy objectives. Policymakers may collaborate with second-hand furnishing providers to assemble such packages, further facilitating the adoption of a circular economy on used goods.

5 ‘Metropolitan Habitus’ in Central and Suburban London: A spatial analysis

5.1 Introduction

As one of the key concepts in Bourdieu’s theories, habitus refers to individuals’ embodied habits and perception of the social world, due to their personal history and macrostructure that they have been exposed to. Habitus is not only revealed through behaviour and dispositions, it can be spatialised. Space and neighbourhoods can be the field that reflects and reproduces economic, social and cultural capital. The different combination and interplay of the capitals result in the creation of ‘neighbourhood milleux’ (Bridge, 2006) or ‘metropolitan habitus’ (Butler and Robson, 2003). ‘Metropolitan habitus’ provides a spatial reflection of the distinctive habitus of the residents. The ‘metropolitan habitus’ influences individuals’ decisions involving the neighbourhood, such as moving decisions, and housing consumption. Even though the rental and purchase of housing are predominantly determined by economic capital, these decisions are also influenced by the perceived ‘metropolitan habitus’ (Butler and Robson, 2003). Consumers of the housing market may sort themselves into areas that have perceived ‘metropolitan habitus’ aligned to their habitus, hence reinforcing the ‘metropolitan habitus’. As a result, residents in different regions can exhibit distinctive habitus, which can be reflected in housing choices.

Based on information published on *The London Plan*, Greater London contains sub-areas including Central London, East London, North London, South London and West London. This is illustrated in Table 5.1. The regional division is based on the spatial divide of London in the spatial development plan for the Greater London Area, *The London Plan* (Mayor of London, 2016). However, London has distinctive mini sub-areas, and the above division may not fully capture the distinctive ‘metropolitan habitus’ between these sub-areas. Nevertheless, the division has some implications regarding different statutory monitoring, engagement, and resource allocation.

Table 5.1 Regional divide of Greater London

Region	Boroughs
Central London	Camden, City of London, Kensington and Chelsea, Islington, Lambeth, Southwark, Westminster
East London	Barking and Dagenham, Bexley, Greenwich, Hackney, Havering, Lewisham, Newham, Redbridge, Tower Hamlets, Waltham Forest
West London	Brent, Ealing, Hammersmith and Fulham, Harrow, Richmond-upon-Thames, Hillingdon, Hounslow
South London	Bromley, Croydon, Kingston upon Thames, Merton, Sutton, Wandsworh
North London	Barnet, Enfield, Haringey

Source: Adapted from The London Plan (Mayor of London, 2016)

The differing characteristics and historical contexts between Central and suburban London motivated me to study the 'metropolitan habitus' of residents in different areas in London – in other words, how 'habitus' is manifested in neighbourhoods. The study of this topic is currently limited, particularly with respect to applications through a quantitative research lens. Even though Chapter 4 studied 'habitus' of different SES based on neighbourhood micro-information, the results are more likely to be driven by institutional factors in this chapter.

5.2 Theoretical Framework

5.2.1 Literature review and theoretical framework

Central and suburban London exhibit several key differences. Between the 1860s and 1970s, the elite and the middle-class relocated from Central London to suburban London. At the same time, 51 schools which serve the upper and middle-classes also made similar moves, acting as both a response and a component of the socio-spatial change (Gamsu, 2016). There are several factors which have driven relocation from Central to suburban London. One of the most compelling theories argues that this is a consequence of a combination of financial and institutional efforts. David Harvey (cited in Butler and Hamnett, 2012) argued that the process is primarily driven by the logic of capital, reflecting the change of investment cycles. After the Second World War, the shift of preference from the inner city to the suburbs in North America and the U.K. was a result in the shift in investment preferences from inner city to the suburban housing markets and shopping centres. At that time, land in the suburb was much cheaper and provided better return on investment as compared to the inner city. Meanwhile, the State also facilitated such transitions by investing in public transport development in the suburbs (Butler and Hamnett, 2012). As a result, the housing situation differs between Central London and suburban London, with the latter having higher homeownership rates and lower overcrowding rates (Mayor of London, 2015). Applying this through a Bourdieusian lens shows that the relocation of the field of power can imply that elites can influence urban planning and housing policies to favour their needs. Historically, a binary relationship existed between urban and suburban London, where SES-3 and SES-4 relocated to the suburb with aspirations to remove themselves from the deprived inner-city population. Nevertheless, such a binary relationship is not clear cut, where some parts of the suburb also contain the features of an inner city (Mace, 2015).

Whilst suburbs share common characterises, there exist locational differences between suburban sub-areas. For example, South London is more polycentric than North London as a result of the railway planning of the 19th Century (Mace, 2015). The phenomenon reflects historical urban development and planning, as well as the positions of different locations in the spatial hierarchy of England. Seeing the suburban areas as a homogenous whole therefore does not justify their heterogenous characteristics (Cochrane, 2011).

The varying historical contexts of the sub-regions and recent developments facilitated by devolving local governance have shaped the regions' current characteristics. Central London, which contain the West End[45] and the City,[46] has historically been the CBD of London. However, the business districts have also been expanding to areas outside Central London. Docklands in East London is now the other key financial centre in London besides the City, with Croydon in East London and Heathrow in West London both becoming sub-CBDs (Butler

[45] West End of London is an area in Central London, which consists of London's most famous tourist attractions and entertainment venues.
[46] The City of London contains London's main CBD and financial centre.

and Hamnett, 2009). North London was once a working-class quarter, however, it has been slowly occupied by the middle-class through gentrification since the 1960s (Glass, 1964). Recent regeneration in London has mostly focused on the previously deprived East London (Poynter, 2009). The area became part of the largest European urban regeneration programme; the 2012 London Olympic and Paralympic Games were key catalysts for recent regenerations in London. In the lead up to the 2012 Olympics, regeneration focused on the East London, with Greenwich, Hackney, Newham, Tower Hamlets and Waltham Forest identified as 'Olympic boroughs'. The spill-over effect of the 2012 Olympics included improvements in environment, neighbourhood quality and improved housing stocks, along with gentrification of local low-income residences (Poynter, 2009). The historical picture in South London and the South East London differ from East London. The relocation of the elite and the middle-class from inner city to the suburb between 1860s and 1970s resulted in rising concentration of elites, especially financiers, in the South East (Gamsu, 2016). Finally, West London contains more mixed populations. Boroughs such as Hammersmith and Fulham and Richmond-upon-Thames are popular residential locations for the White middle-class population group, whereas boroughs such as Brent, Harrow, Hounslow, Newham and Tower Hamlets have large populations of ethnic minorities, accounting for over 50% of borough-level populations in 2018 (Office for National Statistics, 2019b).

5.2.2 Research hypothesis

Based on the above, the empirical test aimed to study the commonalities and differences between sub-regions in London. The two research hypotheses developed for the study conducted in this chapter were:

H_1*: Central London and East London attract urban settlers, showing greater revealed preferences to accessibility and modern dwellings*

H_2*: South London and North London attract suburban settlers, showing greater revealed preferences to houses, garden and local environment*

5.3 Methodology and Data

5.3.1 Model specification

Spatial hedonic modelling is used to examine the spatial differences of revealed preference towards private rental properties. Standard hedonic regression model violates Tobler's (1970) first law of geography, which states that "everything is related to everything else, but near things are more related than distant things" (p. 236). Spatial autocorrelation is defined as the similarities which exist between observations that are spatially close by. When there is spatial autocorrelation, the nearby observations in the sample are very similar, which does not obey the assumption of the independence of residuals in the model. Spatial autocorrelation may arise for the following reasons. First, it is more likely to occur amongst environmental and neighbourhood variables due to the spill over effect on aspects such as transportation, poverty, and green space. Second, properties that locate closely to each other tend to have similar characteristics and locational features, as they are likely to be in the same development or planning (Bourassa, Hoesli and Sun, 2005). Third, the modelling is based on empirical transaction prices, which tend to be based on the transaction prices of the neighbourhood using comparison methods (Bowen, Mikelbank and Prestegaard, 2001). Fourth, misspecification can result in spatial autocorrelation. It arises from missing important variables, having unimportant extra variables, and/or an unsuitable functional form (Orford, 2000). In addition, spatial autocorrelation relates to spatial aggregation, the presence of uncontrolled-for non-linear relationships, and the omission of relevant variables. The drawbacks of the conventional hedonic model motivate this chapter to include a spatial analysis on rental housing prices to reduce the effect of spatial autocorrelation.

- **Model 1: Basic hedonic model**

The hedonic model is:

$$P_i = P_i(\boldsymbol{S_i}, \boldsymbol{N_i}, \boldsymbol{E_i})$$

Where P_i is the value of a specific dwelling *i*, $\boldsymbol{S_i}$, $\boldsymbol{N_i}$ and $\boldsymbol{E_i}$ are, respectively, vectors of structural, neighbourhood and environmental characteristics. The model means that the price of a specific dwelling i is a function of its own structural, neighbourhood, and environmental characteristics. The details of hedonic models are outlined in Section 3.2.2.

The model assumes a semi-log hedonic function. The semi-log hedonic function includes all independent variables in natural log form, except dummy variables including bedroom number, bathroom number, living room number, furnishing state, renovation state, garden state, and whether the property is a house.

- **Model 2: Spatial hedonic model**

Compared to conventional hedonic models, the spatial hedonic model aims to take into account spatial autocorrelation (Anselin, 1988, 1995). The spatial hedonic model is a sub-set of the hedonic model. It is often applied to housing markets to capture the spatial heterogeneity and dependency of neighbouring properties (Anselin, 1998).

The spatial relation between locations is captured by a spatial weighting matrix. The spatial weighting matrix, which contains the spatial relationships between spaces, is defined as:

$$W = \begin{pmatrix} w_{11} & \cdots & w_{1n} \\ \vdots & \ddots & \vdots \\ w_{n1} & \cdots & w_{nn} \end{pmatrix}$$

Where w_{ij} is the distance between area i and area j. For example, w_{11} indicates the distance between 'area 1' and itself, which is 0; w_{12} means the distance between 'area 1' and 'area 2'. Neighbouring areas are defined using simple inverse distances, and the distance between two properties is measured using their corresponding longitude and latitude. The spatial weighting between the two locations is between 0 and 1, with the weighting and the corresponding distance having an inverse relationship. The process applies row standardisation to W to ensure all elements in the same row add up to 1. Moran's I, which ranges between -1 and 1, checks the spatial autocorrelation of monthly rental prices:

$$I = \frac{\sum_{i=1}^{n}\sum_{i=1}^{n} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{S^2 \sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}}$$

Where S^2 is the sample variance and w_{ij} is the spatial weighting matrix. x_i and x_j are corresponding values of area i and area j, and $\bar{x}$ is the main value of the dataset of a given variable. The purpose of Moran's I is to calculate the product of the difference between x_i and x_j with the overall mean, and then divide the result by the sample variance.

The three spatial econometrics models used in this Chapter are: Spatial Error Model (SEM), Spatial Autoregressive Model (SAR) and Spatial Durbin Model (SDM). The details of the models are outlined in the subsequent sub-sections.

- **Model 2(a): Spatial Error Model (SEM)**

SEM assumes that the effect from neighbouring regions only arises because of error terms. In other words, the OLS model does not meet the assumption of uncorrelated error terms, and there exist covariates that are spatially correlated.

The mathematical expression for SEM is:

$$Y = X\beta + \varepsilon$$

$$\varepsilon = \lambda W\varepsilon + \zeta$$

Where W is the spatial weighting matrix, λ is the spatial autocorrelation coefficient and ζ is the error term of the regression model.

- **Model 2(b): Spatial Autoregressive Model (SAR)**

The assumption of SAR is that the dependent variable not only depends on the independent variables, but also on the dependent variables of its neighbours. In other words, on top of the violation of the assumption in SEM, the OLS model also does not meet the assumption of the observations being independent. For example, it is possible that an event happening in one place can result in a similar event happening in its neighbouring places. The foundation of the model is therefore a spatial spill over effect, which states that seemingly unrelated activities occurring in one area can affect other areas. The mathematical expression for SAR is:

$$Y = \rho WY + X\beta + \varepsilon$$

Where W is the spatial weighting matrix, ρ is the corresponding spatial autocorrelation coefficient.

- **Model 2(c): Spatial Durbin Model (SDM)**

The assumption of SDM is that the dependent variable of a given area is not only dependent on the independent variables relating to the given area, but also dependent on the independent variables of its neighbouring areas. The model therefore includes the lagged terms of both the dependent and the independent variables. Mathematically, it is expressed as:

$$Y = X\beta + WX\theta + \rho WY + \varepsilon$$

Where $WX\theta$ represents the lagged influence of the independent variables of the neighbouring areas and ρWY represents the lagged influence of the dependent variables.

5.3.2 Data collection

A more ideal approach to examining social renters' preferences is through direct surveying. However, such a process can take a long time and there are no existing datasets. Due to the restrictions and limitations of data, the hedonic tests were conducted on the private rental market rather than the social rental market. This was because rents in the social housing market minimally differ and are capped due to government subsidies. As such, they are not a full reflection of renters' revealed preferences.

The collected data included rental prices and housing characteristics, ward border information and ward-level neighbourhood characteristics. The dataset excluded the City of London area, since the thesis examines the research question at ward-level whilst this area only contains one ward. The data used for the study included the listings of rental properties on Zoopla between January 2018 and October 2018, and included their prices, locations and corresponding characteristics. The spatial hedonic models also included neighbourhood and environmental characteristics obtained from sources including *London Ward Well Being Probability Scores* published by the Greater London Authority.

a. Ward border information

I obtained the border information of London ward in shapefile format from the Greater London Authority (2018). [47] The information includes geographic data of boundaries of all wards as well as boroughs in London. The version is an updated 2018 version which involved changes of boundaries for Bexley, Croydon, Redbridge, and Southwark following the Election of 3rd May 2018.

b. Rental price and housing characteristics

The data source of the rental listings was Zoopla, which is the same as Chapter 3. Section 3.3.2 in Chapter 3 provides the details of the listings. Table 5.2 outlines

[47] Data source: https://data.london.gov.uk/dataset/statistical-gis-boundary-files-london

the variables included in the baseline hedonic model, and the corresponding definitions of these variables.

Table 5.2 Variables and their definitions in baseline hedonic model

Variable	Definition
PRICE	Log monthly rental price in £
Structural Characteristics	
BEDROOM	Number of bedrooms
BATHROOM	Number of bathrooms
LIVINGROOM	Number of living rooms
HOUSE	=1 if the property is a house, 0 otherwise
GARDEN	=1 if the property or its condominium has a garden, 0 otherwise
MODERN	=1 if the property is recently renovated or previously renovated to a high standard, 0 otherwise
FURNISHING	= 1 if the property is unfurnished, =2 if the property is part-furnished, =3 if the property is furnished or listed as "furnished or unfurnished"
Neighbourhood characteristics	
DST_trspt	Log distance to the nearest underground or train station
DST_schl	Log distance to the nearest school
EDU	Education quality is measured by an equally weighted measure of GCSE point scores and unauthorized pupil absence; Higher value means better quality of education
ECON	Economics security is measured by unemployment rate; Higher value means more secure economic condition
HEALTH	Measured by an equally weighted measure of life expectancy, childhood obesity and incapacity benefits claimant rate; Higher value means better health measure
SAFETY	Measured by an equally weighted measure of crime rate and deliberate fire rate; Higher value means better safety measure
Environmental characteristics	
ENV	Environment is measured by access to public open space and nature; Higher value means better environment.

a. Ward-level neighbourhood characteristics

Ward-level neighbourhood characteristics such as economic security scores, health scores, safety scores, education scores, as well as environmental scores were obtained from the *London Ward Well Being Probability Scores* published by the Greater London Authority in 2014.[48] The measurements and definitions of the scores are outlined in Table 5.3.

Table 5.3 Neighbourhood characteristics and their measures

Neighbourhood score	Measurement
Economic security score	Unemployment rate
Health score	Life expectancy, childhood obesity and incapacity benefits claimant rate
Safety score	Crime rate and deliberate fires
Education score	GCSE point scores, unauthorised pupil absence
Environmental score	Access to public open space and nature

Source: Adapted from Greater London Authority (2014)

The identification of the relevant ward-level neighbourhood characteristics included the following procedures. The first step used geographic information software ArcGIS to map the properties to the areas based on their longitudinal and latitudinal information, and hence determine the ward that they belong to using ward border information. The process excluded data points that were geographically located at the borders of any ward or contained missing values. The second step matched the relevant neighbourhood characteristics to the properties.

Table 5.4 contains the descriptive statistics of the variables for the entire dataset. The total number of properties included in the sample data is 15025. The descriptive statistics show that an average dwelling is a "two-bedroom-one-bathroom" property for all boroughs. In addition, only 2.3% of the properties are 'modern' or 'recently renovated'. 21.8% of the properties in the dataset are houses, which approximately aligns with the percentage of the population living

[48] Data source: https://data.london.gov.uk/dataset/london-ward-well-being-scores

in houses in London. Third, average dwellings in the dataset are partially furnished. Finally, 17.2% properties in the dataset have a garden. The raw data also revealed significant price disparities between London boroughs, in which Bexley had the lowest average rent of £1177.87, and Kensington and Chelsea had the highest average rent of £5904.43.

Table 5.4 Descriptive Statistics (All)

	Mean	s.d.	Min	Max
$price$ (£)	2090.71	2467.87	433	94521
$modern$	0.023	0.137	0	1
$house$	0.218	0.402	0	1
$furnishing$	2.102	0.976	0	3
$beds$	2.210	1.042	1	9
$baths$	1.363	0.615	1	11
$garden$	0.172	0.353	0	1
$reception\ rooms$	1.110	0.426	0	21
$dist\_subway (km)$	0.350	0.251	0.100	4.200
$dist\_school\ (km)$	0.179	0.091	0.100	1.100
$score\_safety$	26.86	9.894	1	51.16
$score\_health$	1.359	8.510	-21.81	18.87
$score\_education$	2.794	9.133	-22.69	33.06
$score\_access$	4.475	10.91	-17.52	30.16
N	15025			

Table 5.5 shows the descriptive statistics of selected variables of the sub-regions. There are three key observations which arise from the descriptive statistics. First, properties in Central London are much more expensive than those in the suburbs. Second, Central London properties are less likely to be houses or to have gardens. Finally, even though there are differences between suburban sub-regions, the difference is not as significant as the difference between the suburbs and Central London.

Table 5.5 Descriptive Statistics (selective comparisons of mean value)

	Central London	East London	West London	South London	North London	Total
$price$ (£)	3234.8	1537.2	1810.3	1762.7	1825.1	2466.1
$modern$	0.025	0.015	0.029	0.028	0.018	0.023
$house$	0.093	0.297	0.262	0.210	0.249	0.165
$furnishing$	2.548	1.716	2.175	1.801	2.150	2.217
$beds$	2.164	2.180	2.252	2.173	2.314	2.164
$baths$	1.497	1.241	1.364	1.328	1.350	1.441
$garden$	0.109	0.189	0.221	0.162	0.183	0.151
N	3625	3133	3857	2564	1846	15025

The construction of spatial weighting matrix requires datasets that contain non-identical geographical locations. Therefore, for listings of the same location, which represent the same building or nearby buildings, the rearranged dataset contained their average characteristics. The data cleansing process reduced the original dataset for the pooled OLS from 26,030 listings to 15,025 listings.

5.4 Results and Findings

I used a mixture of statistical software and geographic information systems to conduct the empirical test. I used GeoDa to construct the spatial weighting matrix and calculate the spatial autocorrelations. GeoDa is a statistical software which carries out visualisation, analysis and modelling on spatial data. I used QGIS 3.8 to determine which sub-regions a given property belongs to. QGIS is a geographic information system application for geospatial data analysis. Due to the size of the spatial weighting matrix, I used RStudio to run the spatial regression tests. RStudio a development environment based on programming language R, which is commonly used for statistical computing and graphics.

Table 5.6 shows that the Moran's I statistics of the rental price of each London region as well as their statistical significance under OLS, the spatial-lag model, the spatial-error model and the spatial-Durbin model. The results show that all the London regions have high Moran's I which is statistically significant. The null hypothesis of the Moran's I test is that the data is spatially randomly disbursed. Therefore, the results imply a rejection of the null hypothesis, indicating that the data is not randomly disbursed. In addition, z-Value is positive for all London revisions, suggesting that the data is spatially clustered. Finally, the Moran's I statistics for the rental prices in the five regions are each between 0.8 and 0.9, implying high spatial correlation of rental prices for all London regions. The statistical significance of Moran's I statistics for all London regions suggests the need to incorporate spatial factors into the baseline model.

Table 5.6 Moran's I statics

	Dependent variable (rental price)
Central London	0.805^{***}
East London	0.805^{***}
West London	0.830^{***}
North London	0.904^{***}
South London	0.929^{***}

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The extract of results for the spatial analysis models for Central London, East London, West London, North London and South London are outlined in Table 5.7 to Table 5.10). The detailed results are outlined in Table 0.13 to Table 0.16 in Appendix-Chapter 5. Model (1) – (5), (6) – (10), (11) – (15) and (16) – (20) represent the respective results for each sub-region under the hedonic model, SEM, SAR and SDM respectively. The results of the spatial models are very similar to the results of the baseline models. Overall, the results for the sub-regions in London share commonalities and differences. First, in terms of the first research hypothesis, accessibility plays an important role in determining rental prices in Central London, where the effect is statistically significant under all models. However, the rental premium of modern or recently renovated dwellings is not significant for Central or East London. For the second research hypothesis, 'house effect' is positively significant for most of the suburban sub-regions, except for West London where the effect is positive but not statistically significant. On the other hand, private renters are willing to pay a premium for dwellings with gardens in most of the sub-regions in London, apart from North London. This effect is statistically significant under all models for Central and East London.

To understand whether the spatial models reduce the spatial autocorrelation of the original baseline models, I further examined the residual of Moran's I. The results in Table 5.11 show that the spatial models overall can reduce the level of spatial autocorrelation of the baseline models for all datasets, especially in cases using SEM, where the residual Moran's I is no longer statistically significant for Central London, North London and South London datasets. The Lagrange Multiplier Tests examine which alternative models are the most appropriate for the estimation by comparing to the baseline model, and by testing the distinction between spatial error models and spatial lag models. In this case, both SAR and SEM are suitable for the sub-regions, where the p-values of LM tests are significant in both cases for all the sub-regions. The above results suggest that the use of spatial models does eliminate the spatial autocorrelation of the original non-spatial model. SEM is the best fit for the data, which means that it is the basis of my discussion and analysis for the next section.

Table 5.7 Hedonic modelling

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is OLS. Model (1) – (5) represent the respective test results for Central, East, West, North and South London.

	(1) CENTRAL	(2) EAST	(3) WEST	(4) NORTH	(5) SOUTH
Quality of housing					
$house$	-0.026	**0.235***	-0.002	**0.027**	0.022
$modern$	0.032	-0.090	0.070	-0.006	0.002
$furnishing$	**0.015***	-0.059***	0.014	0.008	0.006
$beds$	**0.028***	**0.160***	**0.181***	**0.093***	**0.035**
$baths$	**0.273***	**0.052***	**0.111***	**0.140***	**0.151***
$reception$	**0.128***	0.019	**0.052**	**0.056***	**0.028***
$garden$	**0.039**	**0.077***	-0.005	-0.031***	0.013
Quality of area					
ln_env	**0.033***	0.020	0.019	**0.020***	-0.009
ln_safety	**0.034***	-0.103***	0.073	0.010	-0.079***
ln_school_dist	0.003	0.066***	-0.883	0.015*	-0.015
ln_school_qua	-0.033***	**0.072***	-0.014	**0.020**	0.013
ln_access	**0.084***	-0.300***	-0.112	**0.015***	-0.034*
ln_subway	0.0002	**-0.915***	0.004	0.002	**-0.091***
Quality of life					
ln_econ	**0.059***	-0.150***	-0.013	-0.023	**0.163***
ln_health	**0.055***	**0.090***	**0.105***	**0.036**	-0.090***
Avg price	YES	YES	YES	YES	YES
Cons	2.591***	6.311	3.853	3.872***	2.308***
N	3,625	3,133	3,857	1,846	2,564
adj. R^2	0.800	0.952	0.974	0.808	0.878

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.8 Spatial Error Model

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is Spatial Error Model. Model (6) – (10) represent the respective test results for Central, East, West, North and South London.

	(6) CENTRAL	(7) EAST	(8) WEST	(9) NORTH	(10) SOUTH
Quality of housing					
$house$	-0.025*	**0.138*****	0.006	**0.023***	**0.027****
$modern$	0.042	−0.105**	0.084	0.001	0.016
$furnishing$	**0.012****	−0.017***	0.019	0.005	−0.003
$beds$	**0.060*****	**0.098*****	**0.145*****	**0.106*****	**0.112*****
$baths$	**0.263*****	**0.032****	**0.095*****	**0.135*****	**0.141*****
$reception$	**0.142*****	0.010	**0.058*****	**0.054*****	**0.042*****
$garden$	**0.038*****	**0.032***	−0.002	-0.031***	0.006
Quality of area					
ln_env	**0.014***	0.015	0.007	**0.017*****	−0.018**
ln_safety	**0.021****	−0.078***	0.018	0.008	−0.043***
ln_school_dist	0.005	0.028**	**−0.464*****	0.013*	−0.007
ln_school_qua	−0.041***	**0.029****	0.008	0.009**	−0.003
ln_access	**0.064*****	−0.038***	−0.032**	0.013	−0.002
ln_subway	−0.003	**−0.289*****	−0.004	−0.002	**−0.043*****
Quality of life					
ln_econ	**0.046*****	−0.056***	−0.045***	-0.015	**0.063*****
ln_health	**0.037*****	**0.151*****	**0.108*****	**0.028***	−0.037***
Avg price	YES	YES	YES	YES	YES
Cons	1.651	-0.841***	0.232	2.126	0.187
Akaike Inf. Crit	73.593	2,209.483	3,085.274	−1,350.236	−1,095.783
Wald Test (df=1)	165.966	8,845.149***	3,027.409	148.027	1,469.072
LR Test (df=1)	169.517	3,091.911***	1,999.210	117.469	1,136.577

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.9 Spatial Lag Model

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is Spatial Lag Model. Model (11) – (15) represent the respective test results for Central, East, West, North and South London.

	(11) CENTRAL	(12) EAST	(13) WEST	(14) NORTH	(15) SOUTH
Quality of housing					
$house$	-0.021*	**0.121*****	0.019	**0.031***	**0.042*****
$modern$	0.042	−0.081*	0.046	0.008	0.017
$furnishing$	**0.014****	−0.017**	0.017	0.003	0.0003
$beds$	**0.045*****	**0.120*****	**0.164*****	**0.102*****	**0.092*****
$baths$	**0.260*****	**0.034****	**0.074*****	**0.134*****	**0.124*****
$reception$	**0.126*****	**0.050*****	**0.083*****	**0.055*****	**0.028*****
$garden$	**0.039****	**0.034****	0.007	-0.029***	0.011
Quality of area					
ln_env	**0.034*****	**0.035***	0.016	**0.023*****	**0.032****
ln_safety	**0.037****	−0.090***	−0.057**	0.002	−0.006
ln_school_dist	0.004	0.032**	**−0.601*****	0.016*	0.008
ln_school_qua	−0.031***	0.035	0.016	**0.023****	**0.031***
ln_access	**0.086*****	−0.146***	−0.061***	0.004	**0.028***
ln_subway	−0.001	**−0.549*****	0.015	0.004	**−0.017***
Quality of life					
ln_econ	**0.061*****	−0.037	0.023	-0.025	**0.036***
ln_health	**0.061*****	**0.188*****	**0.160*****	**0.041***	0.010
Avg price	YES	YES	YES	YES	YES
Cons	2.804	17.427	0.232	4.185	3.458
Akaike Inf. Crit	130.442	2,280.967	3,035.476	−1,316.413	−1,350.389
Wald Test (df=1)	125.564	47,832,761.0	5,906,476.00	118.055	2,493.168
LR Test (df=1)	112.668	3,020.426	2,049.008	83.646	1,391.184

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.10 Spatial Durbin Model

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is Spatial Durbin Model. Model (16) – (20) represent the respective test results for Central, East, West, North and South London.

	(16) CENTRAL	(17) EAST	(18) WEST	(19) NORTH	(20) SOUTH
Quality of housing					
$house$	-0.024*	**0.130*****	0.019	**0.036*****	**0.041*****
$modern$	**0.055***	−0.108**	**0.070****	−0.002	0.007
$furnishing$	**0.012****	−0.012**	**0.019*****	0.001	−0.001
$beds$	**0.076*****	**0.110*****	**0.166*****	**0.122*****	**0.102*****
$baths$	**0.262*****	**0.037****	**0.088*****	**0.134*****	**0.131*****
$reception$	**0.139*****	**0.036*****	**0.070*****	**0.057*****	**0.035*****
$garden$	**0.039*****	**0.034****	0.004	-0.030***	0.011
Quality of area					
ln_env	0.017	**0.033***	0.029	0.017	**0.036****
ln_safety	**0.029***	−0.062***	−0.066***	−0.014	0.018
ln_school_dist	0.010	0.027	**−0.547*****	0.008	0.010
ln_school_qua	−0.043***	0.010	0.023	0.016	0.024
ln_access	**0.072*****	−0.105***	−0.041***	−0.062	**0.030***
ln_subway	−0.008	**−0.426*****	0.010**	0.010	0.007
Quality of life					
ln_econ	**0.046***	−0.001	0.057	-0.022**	−0.031
ln_health	**0.052*****	**0.151*****	**0.146*****	**0.049****	**0.048*****
Avg price	YES	YES	YES	YES	YES
Cons	−692.143	−418.645	2,381.042	3,431.805	−937.089
Akaike Inf. Crit	41.967	1,823.798	2,681.140	−1,398.353	−1,448.839
Wald Test (df=1)	79.022	9,950.771	1,843.485	90.307	1,421.790
LR Test (df=1)	77.859	2,371.528	1,499.816	79.800	1,042.342

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.11 Moran's I statics for residuals

	OLS	Spatial Lag	Spatial Error	Spatial Durbin
Central London	0.075^{***}	**0.0081**	**-0.00592**	**-0.00663**
East London	0.42^{***}	0.276^{***}	0.172^{***}	0.164^{***}
West London	0.303^{***}	0.200^{***}	0.0377^{***}	0.066^{***}
North London	0.1001^{***}	0.0418^{***}	**0.004**	0.021^{*}
South London	0.442^{***}	0.0709^{***}	**-0.07**	**-0.054**

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5.12 LM test results

		LMerr	LMlag	RLMerr	RLMlag	SARMA
Central London	**value**	121.43	193.41	14.672	86.656	208.08
	df	1	1	1	1	2
	p-	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	1.3×10^{-4}	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$
East London	**value**	2250.1	2675.4	462.36	887.61	3137.7
	df	1	1	1	1	2
	p-	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$
West London	**value**	1525.8	1746.6	551	771.72	2297.6
	df	1	1	1	1	2
	p-	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$
North London	**value**	78.581	112.8	9.7613	43.981	122.56
	df	1	1	1	1	2
	p-	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 1.8 \times 10^{-3}$	$< 3.3 \times 10^{-11}$	$< 2.2 \times 10^{-16}$
South London	**value**	1964	1507.2	595.47	138.7	2102.7
	df	1	1	1	1	2
	p-	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$	$< 2.2 \times 10^{-16}$

5.5 Discussion

In terms of rental price determinants, regions outside Central London share several common traits based on the test results of the hedonic, SAR, SEM and SDM models. Nevertheless, regional differences exist for the empirical results, which are mainly reflected in the preference towards houses and gardens. There is a stronger preference towards houses in suburban London, whereas Central London private rental tenants are more willing to pay greater premiums for garden and accessibility. In the discussion section, I discuss the findings from the following aspects: 1) size of living space; 2) house effect; 3) garden.

First, the number of bedrooms, living rooms and bathrooms are factors that are consistently significant across all areas in London, both in Central and suburban

London. The finding reveals that properties with more bedrooms are associated with higher rental prices. In addition, larger properties are more likely to have more living rooms and bathrooms, which may be the explanation for the positive relationships between rental prices and number of bathrooms, and rental prices and number of living rooms. The results imply the importance of size of living space in determining renters' preference. The significance of living space may arise from the need for space for personal, family and social activities (Robert-Hughes, 2011), social status (Foye, 2017), and the need for personal privacy between family members.

Second, the results indicate a strong 'house effect' in suburban London, implying that properties that are houses, have rental premium compared to properties which are not. The drivers of the preferences arise from the need for both privacy and social interaction, which are both difficult to achieve in atomised urban mega-cities. Flats, especially ones in high-rise buildings, are more likely to cause a sense of isolation and alienation due to lack of opportunities and spaces to socialise within the buildings, whilst overcrowding can result in lack of perceived privacy which has particularly significant impacts on large families. In addition, high-rise dwellings also result in higher perceived crime rates. The strong preference towards living in a house rather than a flat is a common attitude amongst people in the U.K. Britain has one of the lowest distributions of populations living in flats, which is 14.8%, compared to 64.9% in Spain and the European average of 46% (Eurostat, 2020a). The bias against flats is not merely because of the objective reason that flats have less space, and consequently are uncomfortable to live in. The bias may also arise from subjective reasons, such as the negative stigma that British society has towards council flats (Power and Provan, 2007). Such unbalanced preferences imply a potential imbalance between the demand for council houses that are houses and ones that are flats. Since it is more cost effective to build council flats than houses, flats may be solutions for creating a greater supply of council houses. However, applicants' strong preference towards houses may create further tensions as houses may be over-subscribed, and flats may be left vacant.

Third, echoing Wilson's biophilia hypothesis mentioned in Chapter 3, the empirical results suggest that renters in Central London place a high revealed preference on gardens, compared to suburban areas. On the other hand, Central

London and suburban areas both show revealed preferences towards properties located in neighbourhoods with higher environmental scores. This is perhaps because urbanisation has increased the difficulties for city-dwellers trying to access nature. The scarcity may result in renters being more willing to pay significantly more for properties that have gardens. The lack of green public and semi-public space and household gardens in Central London compared to areas outside Central London, result in both gardens and access to nature becoming rare commodities. This leads to higher monetary value attached to properties that have good accessibility to nature compared to properties outside Central London.

5.6 Conclusion

5.6.1 Summary

In the previous chapter, I examined how habitus differs between different socio-economic status groups, using microdata. In this chapter, I argue that distinctions in preferences, or 'metropolitan habitus', exist across areas in London. More specifically, the incentives for living in Central London should differ from the incentives for living in suburban London. This chapter uses spatial hedonic models to test whether rental preferences differ between Central and suburban London. Using property listings on Zoopla between January 2018 and October 2018, the results suggest the following key findings. First, compared to private tenants in suburban London, private tenants in Central London are more willing to pay a premium for dwellings that contain at least one garden and properties with good transport accessibility. Second, private tenants in suburban London show a more substantial 'house effect', where they have a stronger revealed preference towards houses. Third, spatial autocorrelation exists in all sub-areas in London, where properties located close to each other have a high correlation in rental prices. Above all, even though there exists a distinction in 'metropolitan habitus' between Central London and Suburban London, there are overlapping and shared habitus between the areas. Examples of such shared 'metropolitan habitus' include preference towards dwellings of larger sizes. Nevertheless, habitus may not be reflected in housing choices but also in the use of welfare services. The next chapter will further explore this perspective.

5.6.2 Limitations and future research

There are two main limitations to this study. First, there exists heterogeneity even within sub-areas of London. As a result, categorising the areas into sub-areas may not be a suitable reflection of their differences. For example, in West London's Paddington area, it is observed that the areas to the north of the Greater Western Railway rail lines historically primarily housed the working classes. In contrast, the areas to the south are home to various luxury developments (Raco and Henderson, 2009). Besides, some of the areas in suburban London have developed into sub-centres of London, as in the case of Croydon (Mace, 2015). These sub-centres or edge cities may exhibit greater urban rather than suburban characteristics.

Second, though the results provide implications for the correlation between the independent variables and the dependent variables, their causality inference is limited. The empirical study does not capture some of the confounding factors. For example, lower land prices in suburban London allow developers to build more houses. As a result, houses will be more common in suburban London than in Central London. On the other hand, residents who prefer living in houses will also seek to relocate to suburban London. Consequently, the distribution of houses in the dataset is not randomised.

Since the differing preferences toward Central and suburban London properties align with the predictions by bid-rent function and existing literature in planning (e.g. Cochrane, 2011; Mace, 2015), future research may bridge the research gap of this study through the following means. First, the research could construct a bid-rent function for the private rental market in London. In other words, the research may consider studying how the gradients of the bid-rent function changes as the locations of the properties or the land move away from Central London towards suburban areas. Second, the datasets for future research may exclude the edge cities in suburban London when comparing suburban London to Central London. Third, future research can utilise qualitative studies, such as interviews, to obtain a more in-depth understanding of the living experience in suburban London, and how habitus differs between urban and suburban residents. Examples of such studies include Mace (2019). Finally, future studies can consider including neighbourhood variables that can better reflect different habitus or cultural capital in the dataset. For example, the neighbourhood variable data can include the number of artisan coffee shops and art galleries to represent the habitus of workers in the creative industry, or the locations of public schools as the habitus of the elites (e.g. Gamsu, 2016).

5.6.3 Policy implications

The results have the following policy implications, especially regarding the design of social housing.

First, renters place a significant emphasis on size and space. Besides, there is a strong preference towards houses than flats in regions where houses are widely available. In sub-regions such as Central London where public green space is lacking, there is also a strong preference towards dwellings with domestic gardens.

The current housing policymakers in the U.K. are aware of the importance of size and space to dwellers' wellbeing. For example, the review report of the Housing Space Standard quotes a statement from the World Health Organization (WHO) Expert Committee which mentioned that (Mayor of London, 2006):

> "One of the fundamentals of the healthful residential environment should be safe and structurally sound, adequately maintained, separate, self-contained dwelling unit for each household so desired, with each dwelling unit providing at least the following […] At least a minimum degree of desired privacy: a) For individual persons within the household; b) for members of the households against undue disturbance by external factors […]" (p44).

Besides, *The Housing Space Standard* (Ministry of Housing, 2015) sets the standards for the minimum personal space requirement of dwelling units. However, compared to the rest of the country, significantly more Londoners live in flats than houses. According to the *English Housing Survey 2017* (Ministry of Housing Communities & Local Government, 2019), over 50% of dwellings in London are flats compared to 16% in the rest of England. The minimum space requirements in housing policies and people's preferences regarding housing and gardens form a contradiction with the current shortage of buildable land in the capital. The contradicting reality sets a challenge for policymakers.

One of the approaches to resolve the contradiction is to incorporate design features in future policies that allow more efficient use of space. Good architectural design can reduce the gap between residents' preferences and the government's deliverables. For example, the adoption of Defensible Space Theory (DST)[49] can help policymakers design council estates that are also safe spaces. Furthermore, to achieve a greater balance between privacy and social interaction, social housing estates may include transition spaces between public and private spaces (Yancey, 1971). These semi-public spaces can consist of gardens and courtyards. Another potential solution to achieve balance is to contain more communal space in housing estates whilst reducing non-living space (such as utility rooms) within individual dwelling units. These communal spaces can be used for socialising, and as a space for children's activities. The feeling of being part of a social network can also help improve the social tenants' mental health (Kawachi and Berkman, 2001). Another potential solution to mitigate the conflict between space shortage and the need to curate private and public spaces is co-living. In *The London Plan* (Mayor of London, 2017), Policy H18 discussed the possibility of building co-living communities. These communities are defined as "large-scale purpose-built shared living" of "good quality and design" and "may have a role in meeting housing need in London if, at the neighbourhood level, the development contributes to a mixed and inclusive neighbourhood" (p. 197).

[49] Defensible Space Theory is a theoretical framework to improve safety and reduce crime rates (Taylor and Harrell, 1996). The Second-Generation Defensible Space Theory suggests that features that help create defensible space can reduce victimisation rates and improve sense of security, encourage more residents to use the communal space, and hence create a virtuous cycle. Based on the theory, social housing estates should avoid having too many storeys or being too large, since it increases the monitoring difficulty. Other fixtures that can help improve safety include light installation throughout the estates (Newman, 1972).

6 Migrants in Social Housing: The role of habitus

6.1 Introduction

In the U.K., the supply of social housing has fallen short of increasing demand, particularly in the case of London (Wilson, Barton and Smith, 2018). Between 2015 and 2016, a quarter of social housing applicants in England had been on the waiting list for more than five years, and nearly a tenth had been on the waiting list for more than ten years (Department for Communities and Local Government, 2017a). There is also an asymmetric distribution of demand across London, with more severe demand-supply imbalances in some boroughs relative to others. As can be seen in Table 0.17 in Appendix-Chapter 6, a combination of the three boroughs of Islington, Lambeth and Tower Hamlets accounted for 25.8% of the total waiting list. Simultaneously, boroughs such as Harrow, Sutton, and Hammersmith and Fulham show short waiting lists. The raw data also suggests that the lengths of waiting lists have been consistent over the years.

This chapter not only uses econometrics to determine the factors that affect waiting list lengths in London, it also extends the discussion to the role of habitus in immigration and social welfare usage based on Bourdieu's analysis. In addition to the evident housing crisis and varying waiting list lengths, London also has a heterogeneity of space and cultural diversity (Nathan and Lee, 2013), that make it a unique study case. The discussion of Bourdieu's concepts on habitus and how they relate to welfare models will continue to form the research hypotheses for the empirical model. Besides culture and habitus, there are several other factors that can attributable to social housing demand. First, individuals tend to opt to rent through the social housing market as they are unable to afford to rent in the private housing market.[50] Second, a given authority's housing stock can also affect the waiting list length. Finally, waiting list length can also be affected by the size of the workforce or efficiency of the housing unit of a particular local authority. Local authorities that have a higher number of employees have more human resources to process the waiting lists.

[50] Housing affordability is defined as house prices divided by income (Office for National Statistics, 2018a). Similarly, housing rental affordability can be defined as rents divided by income. The key variables here can be represented with the independent variable, 'average income', and rents can be represented with the independent variable, 'median private market rental price'.

6.2 Literature Review and Research Hypotheses

6.2.1 Literature review and theoretical framework

The examination of the relationship between migration and housing welfare is important for the discussion of social housing policies. First, under Tiebout's 'foot voting' argument, agents express their preferences through physical migration when they move to locations that are more beneficial to them. This is something which is often connected to the availability of public services (Oates, 1969). Combined with traditional push-pull migration analysis, it implies that most immigrants emigrate from origin countries of lower income to ones of higher income. This leads to questions about whether generous welfare policies attract low-skilled immigrants (Barrett and McCarthy, 2008). Second, migrants may use housing welfare differently based on their 'habitus' (see Section 4.2.1 in Chapter 4 for the detailed discussion on 'habitus'), resulting in different avenues of welfare support access. Migrants' countries of origin can have very different welfare models compared to the U.K. due to the varying degrees of individualism and collectivism in the society. The idea that individuals should be responsible for their own wellbeing has become hegemonic in Western capitalist societies (Steele and Lynch, 2013). Furthermore, more urbanised economies have higher degree of individualism and atomisation than less urbanised economies. This is because industrialisation, accompanied by development of markets and division of labour, frees workers from family-based production units and encourages them to enter a bigger production mechanism and larger market (Brown and Harrison, 1978). Researchers, such Bauernschuster *et al.* (2012), have shown that individualism facilitates economic growth and collectivism impedes the growth. On the other hand, Ball (2001) argues that there is a two-way causal relationship between the individualism-collectivism dimension and economic growth. Many non-high-income countries have more collectivist cultures, examples of which include India, Indonesia, and Ecuador. Collective culture produces a stronger family-dependent welfare system, since stronger community networks and support structures are present (Finlayson, 1994). As a result, societies with greater degree of collective culture are more likely to emphasise the role of family and community as welfare providers.

According to Esping-Andersen (1990), the three main types of welfare models are social democratic, conservative, and liberal, based on the degree of decommodification (see Section 2.2.1 in Chapter 2 for details). The different types of welfare models imply the different degrees of attributing the welfare provision responsibilities to the individuals, market, and family for welfare support (see Section 8.2.1 in Chapter 9 for details). Jones (1990) later added that the East Asian welfare model is unique due to the strong family concept rooted in Confucianism. However, to a certain extent, East Asian welfare model is regulated by social norm. Citizens of countries such as East Asian countries, where collectivism culture is strong, are more affected by social norms (Jetten, Postmes and McAuliffe, 2002). In the context of the East Asian welfare model, not being able to provide welfare support to family members can be perceived by social norms as failure to fulfil family duty and consequence of inadequate moral education (Chan, Cole and Bowpitt, 2007). According to *The Analects of Confucius,* "If you govern the people legalistically and control them by punishment, they will avoid crime, but have no personal sense of shame. If you govern them by means of virtue and control them with propriety, they will gain their own sense of shame, and thus correct themselves" (Muller, 2020, para. 22).

Besides Eastern Asian culture, some other cultures also have a long history of using family and community support for welfare provision. For example, Indian culture endorses strong kinship relations and family ties, which often involve extended family. The family networks are able to provide members with both economic and emotional support (Chadda and Deb, 2013).

Bourdieu's theory on habitus argues that the formation of habitus mostly arises from family education, with schooling also playing a role in certain societies. Therefore, first-generation immigrants in the U.K. are more likely to hold similar beliefs to their home culture, while second generation immigrants are more likely to be influenced by British values. Based on Bourdieu's theories, such behaviour may also stem from conformity with socio-economic group to which they associate and consequently look to for social validation, as well as through habitus. Bourdieu's 'habitus' also has implications regarding how cultural heritage influences individuals' behaviour in an unfamiliar field. Migrants in a new environment or a new culture may still behave in accordance to their previously familiar culture or traditions (Erel, 2010). The habitus on individuals accepting welfare support remains conditional on their culture and former social groups. Therefore, migrants coming from a society which has a strong reliance on family as the welfare providers may persist with the existing model. Habitus can also remain on non-first-generation immigrants, particularly for ethnic minorities. According to Bourdieu, given that the symbolic power concentrates in the hand of the State, ethnic immigrants can experience an even greater discontinuity in their cultural capital than those who are the ethnic majority. This is because that the cultural capital of the ethnic minorities are further misaligned with the symbolic capital legitimated by the state (cited in Erel, 2010). The difficulties faced by non-first-generation non-White immigrants in trying to assimilate encourage them to cling onto their 'habitus' and form their own communities of support (Ahmed and Jones, 2008).

The discussion on whether migrants have taken up social housing resources has become a recurring theme in public discussion. The topic has become more prominent in the past few years with the rise of radical-right populism in Europe and the United States, which has resulted in cuts in welfare entitlements for migrants (Schain, 2018). The *2013 British Social Attitude Survey* reveals that 24% of the general public believe that the main motivation for immigration is to claim welfare (British Social Attitudes, 2013). Similar results were also reflected in the 2008 European Social Survey, where 44% of European citizens believe migrants have a net negative impact on the economy (Dustmann and Frattini, 2013). There have also been policy changes in response to these public views which have restricted the welfare access of migrants (Boeri, 2010). However, these views are unfounded. Chan, Cole and Bowpitt (2007) argued that there exists a myth of welfare dependency of ethnic minorities in the U.K. A number of studies explore the interaction between immigration and welfare policy developments, mostly in of public policy and welfare economics (e.g. Barrett and McCarthy, 2008). Borjas (1999) studied the differences in welfare uses between immigrants and natives in the United States using data between 1980 and 1990, and found no conclusive evidence for differences in benefit elasticity.[51] Similarly, using a panel data analysis across 14 countries in the EU between 1994 and 2001, De Giorgi and Pellizzari (2009) also found that the attractiveness of generous welfare states to immigrants is statistically significant but very small. More recent studies include Bruckmeier and Wiemers (2017), who used a probit model, facilitated with

[51] Benefit elasticity of a particular group is defined as change in welfare participation level of the given group brought about by a change in benefit level (Borjas, 1999).

microsimulations, to estimate the likelihood of observed welfare take-up of immigrants in Germany and native Germans. The microsimulation model was adopted from the Tax-Transfer Microsimulation Model from the Institute for Employment Research of the German Federal Employment Agency, whose purpose was an ex-ante evaluation of policy reforms targeted at low-income households, utilising microlevel household data. Bruckmeier and Wiemers (2017) used the model to examine whether a given household is entitled for given benefits, and then compared the non-take-up results across different migration backgrounds. Their results suggest that, once observed and unobserved household characteristics are controlled, immigrants are not more likely to take up welfare than their native German counterparts. Similarly, Dustmann and Frattini (2013) found that immigrants in the EU are less likely to claim benefits than their native counterparts, and have the similar likelihood as the latter in living in social housing. Using mixed methods including qualitative and quantitative analysis, Albertini and Semprebon (2018) found that only a minority of non-EU immigrants in Italy expect to use public welfare support. More specifically, public support is mostly used by younger family members, whilst elderly family members are typically supported through informal family and community networks.

Some of the existing studies also look at how welfare usage patterns differ between first- and non-first-generation immigrants. Fertig and Schmidt (2001) found first-generation immigrants in Germany have lower welfare participation rates than non-first-generation immigrants, whilst non-first-generation immigrants had similar welfare participation levels as native Germans. Nevertheless, immigrant networks may still contribute to the formation of social capital, even for second generation immigrants (Anthias, 2007; Ryan *et al.*, 2008). This is especially the case when immigrant groups are also networks for creating and validating cultural capital (Erel, 2010). According to Bourdieu's theories on symbolic power, ethnic minority immigrants have distinctive differences in appearance compared to the dominant class. Bourdieu's theories imply that immigrants can exhibit disposition due to their habitus and cultural capital from their home origin background, which can be reproduced through family and immigrant groups. Therefore, amongst non-first-generation immigrants, ethnic minorities can feel more distant, especially in societies that are more conservative on immigration issues or where the State has a monopoly of symbolic power (Erel, 2010). In the context of the U.K., non-White immigrants may be more attached to their habitus compared to immigrants who are White In the U.K., British born White population and non-White population exhibit different patterns in assimilation, both culturally and economically (Lindley, 2002). In addition, non-White immigrants are more likely to receive racism (Valentine and McDonald, 2004). Valentine and McDonald's (2004) interviews suggest that there is a tendency of some of the interviewees to regard non-White people as asylum seekers.

However, most studies do not consider the differing 'habitus' of different types of potential welfare recipients. As a result, existing studies tend to divide the sample into 'natives' and 'immigrants', without exploring the possible role that ethnicity can play in welfare receipt. In addition, researchers such as Borjas (1999), De Giorgi and Pellizzari (2009) and Bruckmeier and Wiemers (2017) are built on utility maximisation theory, which is a common theoretical framework in the domain of studying immigrants' welfare participation. In particular, they emphasise on the maximisation of economic capital. As a result, their hypotheses tend to assume that generous welfare policies will induce low-skilled migration.

However, using a utility maximisation, especially focusing on the utility maximisation of economic capital, in studying welfare participation has limitations. First, such approach neglects the history and background of immigrants, which are important factors in forming their 'habitus'. Immigrants also exhibit 'welfare habitus', which is the habitus that they have towards welfare (Peillon, 1998; Godin, 2020). For example, Bangladeshi women in London show strong sense of responsibility of providing care to their family members, mostly derived from their Islamic religious beliefs (Ahmed and Jones, 2008). Welfare habitus is also shown in a generational form in the U.K., where the older generation is more aligned with the beliefs that the State is the provider of welfare, and are less accustomed to requirement of citizen consumers within the welfare system (Moffatt and Higgs, 2007). Second, the 'welfare maximisation approach' adopted by orthodox economists neglect the existence of other forms of capital, including symbolic and social capital. In a country such as the U.K. where benefits are means-tested and there have been ongoing discussions on immigrants' uptakes on benefits, claiming benefits brings economic capital at the cost of symbolic capital. Since individuals maximise both economic and symbolic capital, those who are potentially in need of benefits “aim at minimising the stigma which goes with taking up social benefits, to reduce or even eliminate negative symbolic capital” (Peillon, 1998, p. 222).

6.2.2 Research hypothesis

Based on the above, the analysis consists of two parts. The first part determines the drivers behind waiting list lengths, and the second part examines how ethnicity and place of birth contributes to the number of benefit claimants in London. Therefore, this chapter forms the following research hypotheses for the two empirical tests.

- ***Empirical Test 1: Drivers of waiting list lengths in London***

H_1: Waiting list lengths are positively correlated with the number of benefit claimants

H_2: Waiting list lengths are positively correlated with the average rental price in the local market

H_3: Waiting list lengths are negatively correlated with housing stock

H_4: Waiting list lengths are negatively correlated with the efficiency of the local authority

- ***Empirical Test 2: Whether ethnicity and origin-of-birth affect number of benefit claimants in London***

H_1: Non-White economic inactive or unemployed population born overseas are the least likely to apply for social housing compared to the other ethnic groups

H_2: Non-White economic inactive or unemployed population born in the U.K. are the second least likely to apply for social housing compared to the other ethnic groups

H_3: White economic inactive or unemployed population born within the U.K. are the most likely to apply for social housing compared to the other ethnic groups

6.3 Methodology and Data Collection

6.3.1 Empirical test specification

The data used for the empirical tests are borough-level annual data from 2011-2016. These exclude local authorities that no longer manage their own housing stocks.[52] The details of the data sources are outlined in Section 6.3.4. The econometric method used for the analysis is panel data regression, which includes random effect (RE), fixed effect (FE), and sys-GMM models. There are three main benefits to using panel data regressions. First, they resolve the issue of omitted variable bias, which is normally caused by unobserved individual differences or heterogeneity. Second, the approach provides more information on the dynamic behaviour of variables over time. Third, since panel data reflects both the time and entity aspects of the data, it improves the accuracy of the estimation for data which includes the time dimension.

Immigrants are more likely to be unemployed than natives due to factors such as lower education levels and discrimination (Bruckmeier and Wiemers, 2017). This creates an endogeneity issue (See Section 3.2.2 in Chapter 3 for detailed discussion of the issue). To control for the characteristics of immigrants and natives, I solely investigate the unemployed and economically inactive population. These groups are divided into the following three categories: 1) White population born in the U.K., 2) Minority population born in the U.K., and 3) Immigrant population born outside the U.K.

- **Panel unit root test**

I first conduct unit root tests on both independent and dependent variables, where the test adopted is the Levin-Lin-Chu unit root (LLC) test (Levin, Lin and Chu, 2002). The purpose of the unit root test is to examine whether the panel data has a unit root. If it does, then the panel data has a pattern that is unpredictable. The function for LLC test is (Levin, Lin and Chu, 2002):

$$\Delta y_{it} = \delta y_{i,t-1} + z'_{it}\boldsymbol{\gamma}_i + \sum_{j=1}^{p_i} \theta_{ij}\Delta\gamma_{i,t-j} + \varepsilon_{it}$$

Where δ is the common autoregression coefficient.

[52] The local authorities that no longer manage housing stocks themselves include Bexley, Bromley, Merton and Richmond-upon-Thames.

The null hypothesis of LLC test is that the series contains unit root, whereas the alternative hypothesis is that the series is stationary.

- **Model 1: Pooled cross-sectional data regression**

Pooled panel data regression assumes that all individuals in the data set can be described by the same regression function, and can be mathematically expressed as:

$$y_{it} = \alpha + \boldsymbol{x}_{it}\boldsymbol{\beta} + \boldsymbol{\gamma}_i\boldsymbol{\delta} + \varepsilon_{it} \qquad \textit{Eq. (1)}$$

Where y_{it} is the dependent variable, α is the interception term, $\boldsymbol{x}_{it}$ is the array of independent variables where $\boldsymbol{\beta}$ is the corresponding coefficients, u_i is the time constant unobserved heterogeneity, and ε_{it} is the idiosyncratic error. The time constant unobserved heterogeneity refers to the unobserved variables that are also correlated to the dependent variable or the independent variables, and these variables vary across entities but not time. On the other hand, idiosyncratic error refers to variables that impact the dependent variables, and these variables vary over time and across entities. The empirical test uses cluster-robust standard errors in the regression, since autocorrelation tends to exist between different time periods for a given individual.

The existence of unobserved heterogeneity and idiosyncratic error, as well as the nature of the panel data, imply that pooled cross-sectional regression may not be the most suitable approach. Pooled cross-sectional regression is suitable to model cases where there are more than two time periods, and for each time period a sample population is drawn independently. In such case, the population samples of different time periods are independent to each other. However, in the case of this chapter, each time period looks at the same sets of local authorities. The population sample are therefore dependent on each other. In addition, the panel data used in this research contains local authority dependent variables (e.g. demographics and local authority efficiency). The data also contains unobserved time dependent variables (e.g. possible macro-economic and social influence which cause changes in waiting list lengths and number of benefit claimants across London). Therefore, the estimation resulting from the pool regression is likely to be biased and inconsistent. To resolve the limitation of pooled regression, I need to use alternative panel data estimation methods, including RE, FE and sys-GMM.

- **Model 2: Random effect panel data regression (RE)**

The RE model assumes the regression equation:

$$y_{it} = \boldsymbol{x}'_{it}\boldsymbol{\beta} + \boldsymbol{z}'_i\boldsymbol{\delta} + u_{\boldsymbol{i}} + \varepsilon_{it} \qquad \textit{Eq. (2)}$$

Where $u_{\boldsymbol{i}}$ is independent of the explanatory variables (x_{it}, z_i).

- **Model 3: Fixed effect panel data regression (FE)**

The two FE models are an entity-FE model and a time-FE model. The purpose of using an FE model is to remove omitted variable bias, which may arise from unobserved heterogeneity in the model. By subtracting group-level mean values from the variables, FEs can remove such heterogeneity.

- **Model 3(a): Entity-fixed effect panel data regression (entity-FE)**

The purpose of using an entity-FE model is to remove the omitted variable bias caused by variables that vary across entities but do not vary over time. Given the original pooled regression function:

$$y_{it} = \alpha + \boldsymbol{x}_{it}\boldsymbol{\beta} + u_i + \varepsilon_{it} \qquad \textit{Eq. (3)}$$

Taking the average value of the equation Eq. (3) over time gives:

$$y_{it} = \alpha + \boldsymbol{x}_{it}\boldsymbol{\beta} + \boldsymbol{\gamma}_i\boldsymbol{\delta} + \varepsilon_{it} \qquad \textit{Eq. (4)}$$

Subtracting equations Eq. (3) and Eq. (4) gives:

$$y_{it} - \bar{y}_i = (\boldsymbol{x}_{it} - \overline{\boldsymbol{x}}_i)\boldsymbol{\beta} + (\varepsilon_{it} - \bar{\varepsilon}_i) \qquad \textit{Eq. (5)}$$

Therefore:

$$\tilde{y}_{it} = \widetilde{\boldsymbol{x}}_{it}\boldsymbol{\beta} + \tilde{\varepsilon}_{it} \qquad \textit{Eq. (6)}$$

Where $\tilde{y}_{it} = y_{it} - \bar{y}_i$, $\widetilde{\boldsymbol{x}}_{it} = \boldsymbol{x}_{it} - \overline{\boldsymbol{x}}_i$ and $\tilde{\varepsilon}_{it} = \varepsilon_{it} - \bar{\varepsilon}_i$

Entity-FE model is applicable to both empirical test 1 and 2. In the context of empirical test 1, there may be unobserved characteristics associated to borough-level waiting list lengths. An example of such characteristics is low-cost living which attracts social housing applicants. In the context of empirical test 2, there may be unobserved characteristics associated to borough-level benefit claiming population. For example, there may be structural unemployment in the local area. The interpretation of the entity-FE coefficients in the context of this research is the average change in the dependent variable as the independent variables increase by one-unit or 1% over the years.

- **Model 3(b): Time-fixed effect panel data regression (time-FE)**

Model 3(b) tests the data using a time-FE model. The model helps remove the omitted variable bias caused by variables that vary over time but do not vary across entities. The time-FE model assumes an original regression function:

$$y_{it} = \alpha + \boldsymbol{x}_{it}\boldsymbol{\beta} + \gamma_t + \varepsilon_{it} \qquad \text{Eq. (7)}$$

Taking the average value of the equation Eq. (7) across entity gives:

$$\bar{y}_t = \boldsymbol{\alpha} + \overline{\boldsymbol{x}}_t\boldsymbol{\beta} + \gamma_t + \bar{\varepsilon}_t \qquad \text{Eq. (8)}$$

Subtracting equations Eq. (7) and Eq. (8) gives:

$$y_{it} - \bar{y}_t = (\boldsymbol{x}_{it} - \overline{\boldsymbol{x}}_i)\boldsymbol{\beta} + (\varepsilon_{it} - \bar{\varepsilon}_t) \qquad \text{Eq. (9)}$$

Therefore:

$$\tilde{y}_{it} = \widetilde{\boldsymbol{x}}_{it}\boldsymbol{\beta} + \tilde{\varepsilon}_{it} \qquad \text{Eq. (10)}$$

Where $\tilde{y}_{it} = y_{it} - \bar{y}_t$, $\widetilde{\boldsymbol{x}}_{it} = \boldsymbol{x}_{it} - \overline{\boldsymbol{x}}_t$ and $\tilde{\varepsilon}_{it} = \varepsilon_{it} - \bar{\varepsilon}_t$

Time-FE model is applicable to both empirical test 1 and 2. In the context of empirical test 1, in a given year, there could be macro-economic events or cyclical events that affect all local authorities' waiting list lengths, but are not included as part of the independent variables. In the context of empirical test 2, in a given year, there could be policy-related factors resulting in unemployed or economic inactive population being more likely to claim benefits, which affect all local authorities. The interpretation of the time-FE coefficients in the context of this research is the average change in the dependent variable as the independent variables increase by one-unit or 1% between the local authorities.

- **Model 3(c): Two-way fixed effect panel data regression (2way-FE)**

The benefit of using a 2way-FE model is that it controls for both unobservable macro factors which can be achieved through entity-FE, and the temporal shocks which are achieved by time-FE (Gabel *et al.*, 2012). The purpose of using a 2way-FE model is to remove the omitted variable bias caused by variables that vary across entities but do not vary over time, as well as variables that vary over time but do not vary across entities. In the 2way-FE model, the original model is assumed to be (Baltagi, 2005):

$$y_{it} = \boldsymbol{\alpha} + \boldsymbol{x}_{it}\boldsymbol{\beta} + \gamma_t + u_i + \varepsilon_{it} \qquad \textit{Eq. (11)}$$

Taking the average value of the equation Eq. (11) across entity of the original regression gives:

$$\bar{y}_t = \boldsymbol{\alpha} + \overline{\boldsymbol{x}}_t\boldsymbol{\beta} + \gamma_t + \bar{\varepsilon}_t \qquad \textit{Eq. (12)}$$

Here u_i is eliminated because $\sum_i u_i = 0$ to avoid dummy variable trap. [53]

Taking the average of the resulting equation Eq. (12) across time gives:

$$\bar{\bar{y}} = \boldsymbol{\alpha} + \bar{\bar{x}}\boldsymbol{\beta} + \bar{\bar{\varepsilon}} \qquad \textit{Eq. (13)}$$

Where $\bar{\bar{y}} = \sum_i \sum_t y_{it}/NT$ in which N and T represent number of entities and length of time respectively. The logic for $\bar{\bar{x}}$ and $\bar{\bar{\varepsilon}}$ are the same. Similar to u_i, λ_t is eliminated here because $\sum_t \lambda_t = 0$.

Taking the average value of the equation over time of the original regression Eq. (11) gives:

$$\bar{y}_i = \boldsymbol{\alpha} + \overline{\boldsymbol{x}}_i\boldsymbol{\beta} + \bar{\varepsilon}_i \qquad \textit{Eq. (14)}$$

Subtracting Eq. (12) from Eq. (11) gives:

[53] A dummy variable trap is defined a situation when one variable can be predicted from the other variables included in the model.

$$y_{it} - \bar{y}_t = (\boldsymbol{x}_{it} - \overline{\boldsymbol{x}}_t)\boldsymbol{\beta} + (\varepsilon_{it} - \bar{\varepsilon}_t) \qquad \textit{Eq. (15)}$$

Subtracting Eq. (14) from Eq. (13) gives:

$$\bar{\bar{y}} - \bar{y}_i = (\bar{\bar{x}} - \overline{\boldsymbol{x}}_i)\boldsymbol{\beta} + (\bar{\bar{\varepsilon}} - \bar{\varepsilon}_i) \qquad \textit{Eq. (16)}$$

Adding Eq. (15) and Eq. (16) gives:

$$y_{it} - \bar{y}_t - \bar{y}_i + \bar{\bar{y}} = (\boldsymbol{x}_{it} - \overline{\boldsymbol{x}}_t - \overline{\boldsymbol{x}}_i + \bar{\bar{x}})\boldsymbol{\beta} + (\varepsilon_{it} - \bar{\varepsilon}_t - \bar{\varepsilon}_i + \bar{\bar{\varepsilon}}) \qquad \textit{Eq. (17)}$$

Therefore:

$$\tilde{y}_{it} = \widetilde{\boldsymbol{x}}_{it}\boldsymbol{\beta} + \tilde{\varepsilon}_{it} \qquad \textit{Eq. (18)}$$

Where $\tilde{y}_{it} = y_{it} - \bar{y}_t - \bar{y}_i + \bar{\bar{y}}$, $\widetilde{\boldsymbol{x}}_{it} = \boldsymbol{x}_{it} - \overline{\boldsymbol{x}}_t - \overline{\boldsymbol{x}}_i + \bar{\bar{x}}$ and $\tilde{\varepsilon}_{it} = \varepsilon_{it} - \bar{\varepsilon}_t - \bar{\varepsilon}_i + \bar{\bar{\varepsilon}}$.

In the discussions in relation to model 3(a) and model 3(b), both time-FE and entity-FE may exist in the context of empirical test 1 and 2, which justifies the use of 2way-FE model.

- **Model 4: Dynamic panel data regression (sys-GMM)**

In the case of choosing where to live, individuals' decision-making processes tend to be based on past information. For example, when social housing applicants submit their applications, they may decide whether they should apply by assessing the waiting list lengths in the previous period. Meanwhile, there may also be an accumulation of waiting list cases from previous years. Therefore, the model should take into consideration the lagged terms of some variables by using dynamic panel data regression.

The model for dynamic panel data regression is as follows:

$$y_{it} = \alpha + \beta y_{i,t-1} + \gamma \boldsymbol{x}_{it} + u_i + \varepsilon_{it} \qquad \textit{Eq. (19)}$$

The Gaussian Mixture Model (GMM) used is system-GMM (sys-GMM), instead of difference-GMM (diff-GMM). The reason of using sys-GMM instead of diff-GMM is that, one of the key drawbacks of using diff-GMM is that the variables that do not vary significantly over the time will get eliminated in the differencing process. In the case, variables such as number of primary schools and number of secondary schools do not vary significantly over the time. Therefore, to solve the issue, I use sys-GMM. Comparing to diff-GMM, sys-GMM can improve the efficiency of the estimation, and estimate the coefficients of variables that do not change with time (Blundell and Bond, 1998).

6.3.2 Model fitness test specification

a. Pooled panel data regression vs. random effect panel data regression

The first test examines the significance of the time effect, by testing whether a pooled panel regression or a RE model suits the data better using Breusch and Pagan Lagrangian multiplier test (LM-test). The null hypothesis of the LM-test is:

H_0: All the parameters are jointly 0

Whereas the alternative hypothesis suggests that

H_1: All the parameters are not jointly 0

The null hypothesis means that the preferred model is pooled panel regression. The alternative hypothesis is that the preferred model is RE model.

b. Pooled panel data regression vs. fixed effect panel regression

The second test examines the significance of the individual effect by testing whether a pooled panel regression or an entity-FE model suits the data better using F-test. The null hypothesis of the F-test is:

H_0: All the parameters are jointly 0

Whereas the alternative hypothesis suggests that

H_1: All the parameters are not jointly 0

The null hypothesis means that the preferred model is pooled panel regression. The alternative hypothesis is the preferred model is FE model.

c. Fixed effect panel data regression vs. random effect panel data regression

To determine whether FE or RE model should be adopted, I apply Hausman Test (Hausman, 1978). The null hypothesis of Hausman Test is:

$$H_0: Cov(x_i, e_i) = 0$$

Whereas the alternative hypothesis is:

$$H_1: Cov(x_i, e_i) \neq 0$$

Where $Cov(x_i, e_i)$ is the covariance between the regressor x_i and its unique errors e_i. The basis of Hausman's Test is to examine whether the unique error correlates to the regressor. The null hypothesis states that they do not, and that the preferred model is RE model. The alternative hypothesis is the preferred model is FE model.

d. Overidentification for sys-GMM regression

For the dynamic panel data regression, Sargan test is used to examine whether there are overidentification issues in the models. The null hypothesis of the Sargan test is:

$$H_0\text{: overidentifying restrictions are valid}$$

Whereas the alternative hypothesis is:

$$H_1\text{: overidentifying restrictions are not valid}$$

When null hypothesis is rejected, there is an issue of overidentification, and the model needs to be reconsidered.

6.3.3 Identification issues

There are two main identification issues that require addressing: 1) the relation between applicants on the waiting list and benefit claimants; and 2) whether migration is indeed an exogeneous variable to benefit claims.

First, there is an overlapping population between council housing applicants on waiting lists and benefit claimants. Most of the councils require the applicants to be on a low-income band or with insufficient savings.[54] Therefore, these eligible applicants are also highly likely to be benefit claimants. Besides income assessments, the eligibility of council housing applicants is also based on living conditions, where incidences such as being affected by domestic violence and overcrowding are also considered. Therefore, the population of benefit claimants is not perfectly correlated with the population of applicants on waiting lists.

Second, there is potentially an endogeneity issue in the empirical model as immigration may not be exogeneous. In the case of this chapter, endogeneity is

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[54] Based on Citizenship Advice (2018), the two key requirements for being accepted onto the waiting list are: 1) "be on a low income or not have a large amount of savings", and 2) have lived in the area for a number of years, or have a job or family there, i.e. a 'local connection'(para. 8). A household's low-income band is calculated based on guidelines published by Department for Work and Pensions (2016) and depends on the number of adults and children in the household.

caused by the simultaneity (see Section 3.2.2 in Chapter 3 for definition). Areas in London, where the cost of living is low, is more likely to attract immigrants who have lower income. In addition, there is a self-selection issue. In the context of immigration, Brücker *et al.* (2001) argued that immigrants have unobserved characteristics resulting in them deciding to move to a country with more generous welfare benefits. For example, immigrants may have greater difficulty in gaining access to employment than their native counterparts in agricultural and service sectors. Similarly, within a city, immigrants may move to boroughs with more generous welfare provisions. As a result, such areas can have both a large population of unemployed and economically inactive immigrants, as well as high benefit claimant population. The endogeneity issue can be further reinforced by the network effect, leading clustered distributions of immigrants (Borjas, 1999; Brücker *et al.*, 2001). However, due to the difficulty in finding an instrumental variable for immigration which is entirely exogenous to the population of benefit claimants, this research assumes that immigration is an exogenous variable. In addition, the endogeneity issue is reduced by only looking at population that are either economically inactive or unemployed population. The limitations of the model will be further discussed in Section 6.6.2.

6.3.4 Data collection

The data used for the study is secondary data collected from officially published sources. Table 6.1 and Table 6.2 outline the variables included in empirical tests 1 and 2 respectively, which also list the definitions of the variables, their types, and data sources.

- ***Empirical Test 1: Drivers of waiting list lengths in London***

For the empirical model in empirical test 1, the dependent variables is the (log) values of waiting list length $(ln\_waiting)$. The independent variable is the (log) value of number of benefit claimants $(ln\_benefits)$. Control variables include the (log) values of borough-level population $(ln\_population)$, housing stock level (ln_stock) and local authority efficiency level $(ln\ \_efficiency)$**.** The pooled OLS and sys-GMM models also include the lagged term of the dependent variable. The robustness models also include (log) values of the population of private renters ($ln\_privaterenters$) and population of outright owners $(ln\_outrightowners)$.

Income level is not included in the first model as benefits are already means tested. Therefore, including income level in the model causes endogeneity issues. The staff headcount of each local authority is used as an indicator of the efficiency level in housing related work within the local authority for the following reason. It is the difference in waiting list length between different local authorities that this chapter is concerned with. By assuming each local authority assigns the same proportion of staff to the housing unit and all have the same productivity, using the headcount level of each local authority for all local authorities does not affect the result. The data used is published quarterly, where the empirical test uses the data published in the fourth quarter to represent end-of-year results.

Table 6.1 Data collection for empirical test 1

Variable	**Definition**	**Type**	**Data source**
Waiting list length ($ln\_waiting$)	Number of people on the local authority waiting list	Dependent	Ministry of Housing, Communities & Local Government.[55]
Number of benefit claimants ($ln\_benefits$)	Number of people claiming benefits in each local authority	Independent	Department for Work and Pensions.[56]
Population ($ln\_population$)	Population of a local authority	Control	Office of National Statistics (ONS).[57]
Housing stock level (ln_stock)	Local authorities housing stock level	Control	Ministry of Housing, Communities & Local Government.[58]
local authority efficiency level ($ln\ \_efficiency$)	Headcounts working for each local authority	Control	Local Government Association.[59]
Population of private renters ($ln\_privaterenters$)	Population of private renters in each local authority	Control	Office for National Statistics.[60]
Population of outright owners ($ln\_outrightowners$)	Population of outright owners in each local authority	Control	Office for National Statistics[61]

[55] Data source: https://www.gov.uk/government/collections/local-authority-housing-data
[56] Data source: https://www.gov.uk/government/collections/dwp-statistical-summaries
[57] Data source: https://data.london.gov.uk/dataset/office-national-statistics-ons-population-estimates-borough
[58] Data source: https://www.gov.uk/government/collections/local-authority-housing-data
[59] Data source: https://lginform.local.gov.uk/reports/lgastandard?mod-metric=549&mod-area=E92000001&mod-group=ADASSRegions_GreaterLondon&mod-type=namedComparisonGroup
[60] Data source: https://data.london.gov.uk/dataset/housing-tenure-borough
[61] Data source: https://data.london.gov.uk/dataset/housing-tenure-borough

- ***Empirical Test 2: Whether ethnicity and place of birth affects the number of benefit claimants in London***

In the empirical model of empirical test 2, the dependent variable is the (log) number of benefit claimants ($ln\_benefits$), whereas the independent variables include (log) values of economic inactivity as well as unemployment by ethnicity and birthplace. Control variables include (log) values of borough-level population ($ln\_population$), median borough-level rent (ln_rent), median borough-level income (ln_income) , employees paid below the London Living Wage ($ln\_belowllw$) and waiting list lengths ($ln\ \_waiting$). The pooled OLS and sys-GMM models also include the lagged term of the dependent variable.

Unemployment and economic inactivity are distinct concepts. The unemployed population refers to people "without a job, have been actively seeking work in the past four weeks and are available to start work in the next two weeks; or out of work, have found a job and are waiting to start it in the next two weeks" (Office for National Statistics, 2019a, para. 62). The economically inactive population refers to "people not in employment who have not been seeking work within the last 4 weeks and/or are unable to start work within the next 2 weeks" (Office for National Statistics, no date, para. 1). Regarding the economic inactivity level, the demographics in the dataset include: (1) White population born in the U.K.; (2) White population born outside the U.K.; (3) minority population born in the U.K.; and (4) minority population born outside the U.K. The datasets (2) and (4) are combined to produce the variable 'economic inactivity level of immigrant' population' (ln_migin). The datasets (1) and (3) are labelled as 'economic inactivity level of White population' ($ln\_UKWminin$) and 'economic inactivity level of minority population born in the U.K.' ($ln\_UKminin$) respectively. Similar operations are also applied to the unemployment level of various demographics. A more ideal dataset would be one that further categorises the country of origin of the economically inactive or unemployed immigrants, which will therefore allow the empirical test to distinguish the types of welfare states that immigrants came from. However, such dataset does not exist for the U.K. context.

A few data points for the unemployment level are missing in the datasets. The reconstruction of data points follows the assumption of an equal rate of change in unemployment levels across all demographic categories in a given year for a given borough. Based on that assumption, the average rate of change in unemployment levels in the demographic categories with available data is first calculated, and then applied to the data for the year before. In the case that the data of the year before is missing, the data of the year after is used for the estimation. Finally, the main caveat of the dataset is that unemployment and economic inactivity data also takes into account temporary migrants. Since temporary migrants may not settle in the U.K. for the long-term, they may also claim in their home countries for benefits instead of in the U.K., which can result in a lower actual observed benefit claiming rate.

Table 6.2 Data collection for empirical test 2

Variable	Type	Data source
Number of benefit claimants $(ln\_benefits)$	Dependent	Department for Work and Pensions[62]
Economic inactivity level of White population $(ln\_UKWminin)$	Independent	Office for National Statistics (ONS) [63]
Economic inactivity level of immigrant' population (ln_migin)	Independent	ONS[64]
Economic inactivity level of minority population born in the U.K. $(ln\_UKminin)$	Independent	ONS[65]
Unemployment level of White population $(ln\_UKWminum)$	Independent	ONS[66]
Unemployment level of immigrant' population (ln_migum)	Independent	ONS[67]
Unemployment level of minority population born in the U.K. $(ln\_UKminum)$	Independent	ONS[68]
Population $(ln\_population)$	Control	ONS[69]
Mean borough-level rent (ln_rent)	Control	Valuation Office Agency[70]
Mean borough-level income (ln_income)	Control	ONS[71]
Employees paid below London Living Wage $(ln\_belowllw)$	Control	ONS[72]
Waiting list length $(ln\_waiting)$	Control	Ministry of Housing, Communities & Local Government[73]

[62] Data source: https://www.gov.uk/government/collections/dwp-statistical-summaries
[63] Data source: https://data.london.gov.uk/dataset/economic-activity-rate-employment-rate-and-unemployment-rate-ethnic-group-national
[64] Data source: https://data.london.gov.uk/dataset/economic-activity-rate-employment-rate-and-unemployment-rate-ethnic-group-national
[65] Data source: https://data.london.gov.uk/dataset/economic-activity-rate-employment-rate-and-unemployment-rate-ethnic-group-national
[66] Data source: https://data.london.gov.uk/dataset/economic-activity-rate-employment-rate-and-unemployment-rate-ethnic-group-national
[67] Data source: https://data.london.gov.uk/dataset/economic-activity-rate-employment-rate-and-unemployment-rate-ethnic-group-national
[68] Data source: https://data.london.gov.uk/dataset/economic-activity-rate-employment-rate-and-unemployment-rate-ethnic-group-national
[69] Data source: https://data.london.gov.uk/dataset/office-national-statistics-ons-population-estimates-borough
[70] Data source: https://data.london.gov.uk/dataset/average-private-rents-borough
[71] Data source: https://data.london.gov.uk/dataset/earnings-place-residence-borough
[72] Data source: https://data.london.gov.uk/dataset/earning-below-llw
[73] Data source: https://www.gov.uk/government/collections/local-authority-housing-data

The time period for the analysis are the years between 2012 and 2016. The individuals in the dataset are taken from 28 boroughs in London, excluding the City of London, Bexley, Bromley, Merton and Richmond-upon-Thames. The reason of excluding the 5 boroughs is that the City of London is a sui generis region, and the rest four are no longer housing stock holding authorities. For example, according to a Freedom of Information request, [74] the "London Borough of Bexley is not a stock holding authority. Its housing stock was transferred by in 1998 to Orbit South and London & Quadrant Housing Associations".[75]

The descriptive statistics in Table 6.3 have the following implications. First, waiting list lengths vary across local authorities with a minimum value of 433 people to a maximum value of 32045. Similarly, average rents have a high standard deviation with the minimum average rent of £425 per month and the maximum average rent of £2492 per month. High standard deviations are also reflected in variables such as the number of renters, number of benefit claimants, economic inactivity levels and unemployment levels. Second, the standard deviation of the monthly income is not as high as the other variables, where the maximum value (£793.9) is merely double the minimum value (£369.8). Third, the descriptive statistics show that the minority population born in the U.K. have both the lowest average economic inactivity and unemployment. On the other hand, the immigrant population has the highest level of both economic inactivity and unemployment. The boroughs with the highest levels of unemployment and inactivity amongst immigrants are Brent and Newham, which also have the highest population of immigrants as well as immigrants who are of an ethnic minority.

[74] The Freedom of Information Act grants the right to obtain recorded information kept by public authorities (GOV.UK, no date b).
[75] Source: https://www.whatdotheyknow.com/request/council_housing_details_6#incoming-1296892

Table 6.3 Descriptive statistics

	Mean	s.d.	Min	Max
Waiting list length	10115.86	6872.963	433	32045
Housing stock	14540.68	7669.023	4480	39845
Rent (£ per month)	1289.205	361.923	425	2492
Economic inactivity (White, born UK) (persons)	15125	5665	6000	30600
Economic inactivity (minority, born UK) (persons)	7054	3970	900	20200
Economic inactivity (born outside UK) (persons)	21507	8444	3400	15700
Unemployment (White, born UK) (persons)	3592	1829	600	8500
Unemployment (minority, born UK) (persons)	2630	1633	143	8700
Unemployment (born outside UK) (persons)	5253	2499	1323	16600
Borough population	268830	57187	155594	386083
Number of renters	25945	11668	6600	57100
Number of benefit claimants	36061	16254	7587	75334
Income (£ per week)	528.6351	72.25283	369.8	793.9
Employees below London Living Wage	21648.81	12778.23	7000	90000

6.4 Results and Findings

6.4.1 Diagnostic test results

a. Panel unit root test

The result of the LLC unit root test is outlined in Table 6.4 and Table 6.5. At 0.1% significance level, all the variables do not contain unit roots and are therefore declared to be stationary.

Table 6.4 Panel unit root test results for empirical test 1

	p-value
$ln\_waiting$	0.0000***
$ln\_benefits$	0.0000***
$ln\_population$	0.0000***
ln_rent	0.0000***
$\Delta ln\_efficiency$[76]	0.0000***
Δln_stock[77]	0.0000***
$ln\_privaterenters$	0.0005***
$ln\_outrightowners$	0.0000***
$ln\_waiting\_lag$	0.0000***

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6.5 Panel unit root test results for empirical test 2

	p-value
$ln\_UKWminin$	0.0000***
ln_migin	0.0000***
$ln\_UKminin$	0.0000***
$ln\_UKWminum$	0.0001***
ln_migum	0.0000***
$ln\_UKminum$	0.0000***
$ln\_population$	0.0000***
ln_rent	0.0000***
ln_income	0.0000***
$ln\_belowllw$	0.0000***
$ln\_waiting$	0.0000***

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[76] The LLC test results for $ln\_efficiency$ gives a p-value of 0.6090 suggesting that the variable contains unit roots. The variable is then transformed into: $\Delta ln\_efficiency_t = ln\_efficiency_t - ln\_efficiency_{t-1}$.

[77] The LLC test results for ln_stock gives a p-value of 0.7347, suggesting that the variable contains unit roots. The variable is then transformed into: $\Delta ln\_stock_t = ln\_stock_t - ln\_stock_{t-1}$.

b. Multicollinearity

Variance inflation factors (VIF) is used to test multicollinearity between variables within the empirical models (Table 6.6 and Table 6.7). The results suggest that there is no multicollinearity of the variables for both empirical test 1 and empirical test 2, since p-values are greater than the critical values (VIF=10).

Table 6.6 VIF results for empirical test 1

	VIF
$ln\_benefits$	3.42
$ln\_population$	4.42
ln_rent	2.30
$\Delta ln\_efficiency$	1.10
Δln_stock	1.08
$ln\_privaterenters$	3.58
$ln\_outrightowners$	2.82
$ln\_waiting\_lag$	2.16

Table 6.7 VIF results for empirical test 2

	VIF
$ln\_UKWminin$	2.50
ln_migin	3.26
$ln\_UKminin$	4.77
$ln\_UKWminum$	2.15
ln_migum	2.93
$ln\_UKminum$	3.22
$ln\_population$	4.69
ln_rent	3.77
ln_income	2.67
$ln\_belowllw$	1.79
$ln\_waiting$	2.17
$ln\_benefits\_lag$	3.07

6.4.2 Regression results

- ***Empirical Test 1: Drivers of waiting list lengths in London***

I use Stata/SE-version 15.1 for the empirical tests, which is statistical software commonly used for quantitative research in the social sciences. Table 6.8 shows the results of the first empirical test, which tests the determinants of council housing waiting list length. The results from pooled OLS suggest that waiting list length is highly positively correlated to the waiting list length in the previous year, suggesting the need for the sys-GMM model in this case. However, results from sys-GMM are not statistically significant.

The key empirical results are summarised as follows. First, the results from the pooled OLS in (1) suggest that the main determinant of social housing waiting list length is the number of benefit claimants in that given year. The result is also confirmed by the output results of RE model in (2), time-FE model in (3), entity-FE model in (4), 2way-FE model in (5), and sys-GMM model in (6). Their positive corresponding coefficients confirm H_1 for empirical test 1. Second, local market rental level is found to be negatively correlated to local authorities waiting list length. The results confirm H_2 for empirical test 1. However, the results are not statistically significant in the FE or sys-GMM models.

The result can be due to lower income constraints in areas with more benefit claimants, which suppresses the local rental market. It is also possible that residents are pushed out from areas with high rents in the course of gentrification, and consequently settle in areas with lower rents. Third, both the pooled OLS and RE model suggest that council housing waiting list length is negatively correlated with housing stock, suggesting that boroughs that have more housing stock have shorter council housing waiting lists. This result confirms H_3 for empirical test 1. However, the results are not significant based on FE and sys-GMM models.

The pooled OLS model also shows a positive correlation between waiting list length and its lagged variable, suggesting the need to use a sys-GMM in this case. Finally, none of the models shows statistical significance for $ln\_efficiency$, which rejects H_4. For the FE-panel model, the three measures of goodness-of-fit for estimators $(\widehat{\boldsymbol{\beta}}, \widehat{\boldsymbol{\delta}})$ are: within R-squared, between R-squared and overall R-squared, which are measured by $[\mathrm{Corr}(\tilde{y}_{it}, \tilde{\boldsymbol{x}}_{it}\widehat{\boldsymbol{\beta}})]^2$, $[\mathrm{Corr}(\bar{y}_i, \bar{\boldsymbol{x}}_i\widehat{\boldsymbol{\beta}} + \boldsymbol{\gamma}_i\widehat{\boldsymbol{\delta}})]^2$ and $[\mathrm{Corr}(y_{it}, \boldsymbol{x}_{it}\widehat{\boldsymbol{\beta}} + \boldsymbol{\gamma}_i\widehat{\boldsymbol{\delta}})]^2$ respectively. The adjusted R-squared reported here is adjusted on the within R-squared. Adjusted-R^2 is 0.624, suggesting a satisfying level of goodness-of-fit of them model.

A series of statistical tests were then conducted to identify the most suitable model. The LM-test aims to identify whether the a pooled OLS or a RE model is more appropriate to model the data. The test result shows that $\mathrm{Prob} > \mathrm{chi}^2 = 0.0000$, which suggests that the null hypothesis should be rejected, and the alternative hypothesis should be adopted. In other words, a RE model is a more suitable choice in this case. Second, the F-test aims to identify whether fixed effects exist in the data. The null hypothesis favours a pooled OLS over a FE model. The result shows that $\mathrm{Prob} > \mathrm{F} = 0.0000$ for all the three FE models (time-FE, entity-FE and 2way-FE), which suggests that the null hypothesis should be rejected in all three cases. Therefore, FE models are preferred over OLS models. Third, a Hausman Test aims to identify whether FE models or a RE model should be used in this case. The results of the Hausman Test for time-FE, entity-FE and 2way-FE are 0.0007, 0.0011 and 0.0007 respectively. The null hypothesis should be rejected at 5% significance level and FE models are preferred over a RE model in this case. Finally, the Sargan Test aims to identify whether there are over-identification issues in the sys-GMM model. The result of Sargan Test for the sys-GMM ($\mathrm{Prob} > \mathrm{chi}^2 = 0.0928$) shows that the null hypothesis is not rejected for the model under Sargan test. Therefore, there are no overidentification issues in the model, and the sys-GMM is valid in this case.

Table 6.8 Determinants of local authority waiting list length

The dependent variable of the empirical model is POPULATION ON THE WAITING LIST (natural log). The independent variables are POPULATION OF BENEFIT CLAIMANTS (natural log), BOROUGH-LEVEL POPULATION (natural log), MEAN RENT (natural log), LOCAL AUTHORITY EFFICIENCY (first difference of natural log), SOCIAL HOUSING STOCK LEVEL (first difference of natural log). The pooled OLS and the sys-GMM also include a lagged variable POPULATION ON THE WAITING LIST FROM LAST YEAR (natural log). Model (1) – (6) represent the respective test results of pooled OLS, Random Effect Model (RE), Time-Fixed Effect Model (time-FE), Entity-Fixed Effect Model (entity-FE), Two-way Fixed Effect Model (2way-FE) and System-GMM Model.

	(1) **pooled OLS**	(2) **RE**	(3) **time-FE**	(4) **entity-FE**	(5) **2way-FE**	(6) **sys-GMM**
$ln\_benefits$	**0.897*****	**2.145*****	**2.673*****	**2.926*****	**2.673*****	**2.531*****
$ln\_population$	-0.291	-0.603	2.451	-2.444	2.451	0.202
ln_rent	**-0.694*****	**-0.624****	0.551	0.286	0.551	-0.217
$\Delta ln\_efficiency$	0.0630	-0.218	-0.165	-0.198	-0.165	0.170
	(0.363)	(0.281)	(0.315)	(0.275)	(0.268)	(0.374)
Δln_stock	0.209	1.248	2.524	1.935	2.524	4.222
$ln\_waiting\_lag$	**0.524*****					0.0378
Cons	3.440	-1.392	-53.60	6.987	-53.14	-18.67*
	(2.742)	(5.775)	(42.81)	(18.87)	(28.17)	(9.045)
N	140	140	140	140	140	112
adj. R^2	0.758		0.707	0.694	0.630	
LM-test		0.0000				
F-test			0.0000	0.0000	0.0000	
Hausman test			0.0000	0.0000	0.0000	
Sargan test						0.0969

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- ***Empirical Test 2: Whether ethnicity and place of birth affects the number of benefit claimants in London***

Following the results of the first set of empirical tests on determinants of council housing waiting list lengths, the second set of tests examine the determinants of benefit claims. Table 6.9 shows the results. First, the pooled OLS shows a positive correlation between number of benefit claimants and its lagged variable, suggesting the need of using a sys-GMM model. Second, the results suggest that claimant level is not determined by the unemployment level. It therefore implies that benefit claimants are either economically inactive or in employment. For the former, amongst the independent variables $ln\_UKWminin$, $ln\_UKminin$ and ln_mingin, $ln\_UKWminin$ is the only statistically significant variable, and the result is consistent across all six models (7) – (12).

Models (7) and (9) – (11) show the opposite conclusion regarding the relationship between local market rental levels and the number of benefit claimants: model (7) suggests that areas with higher rents have more benefit claimants, whereas the FE model (9) – (11) suggests the opposite. Based on Hausman's test, FE is a more suitable model. Hence the conclusions should be drawn based on (9) – (11). Second, $ln\_UKminin$ is statistically significant under the RE model, and its corresponding coefficients are positive for all six models (7) – (12). On the other hand, ln_mingin is not statistically significant for any of the six models, and its corresponding coefficients are negative in most cases. The above results therefore confirm the hypotheses that the White economically inactive population are more likely to claim benefits than economically inactive immigrants or U.K.-born minorities.

Ethnic minority groups, such as the Chinese, tend to have strong family values (Fuligni, Tseng and Lam, 1999). Therefore, even for ethnic minority populations born in the U.K., their close and extended family may be able to provide a safety net when they experience adverse financial circumstances. These findings concur with the data published by Ministry of Housing Communities & Local Government (2019d), which revealed that Asian households made up 4.5% of new social housing lettings in 2016/17, which makes them underrepresented (as they are 7.7% of the overall population).

The results of sys-GMM suggest that the number of employees below the London Living Wage[78] is positively correlated to the number of benefit claimants. The result suggests that this population group are likely not to receive sufficient income to cover their living costs.

The results of the statistical tests which aim to test the goodness-of-fit of the empirical models are outlined as follows. First, the results of the LM-test ($\mathrm{Prob} > \mathrm{chi}^2 = 0.0000$) implies the rejection of the null hypothesis. Therefore, the RE model is favoured over the pooled OLS. Second, the results of F-test are $\mathrm{Prob} > \mathrm{F} = 0.0000$ for all the three FE models, implying the rejection of the null hypothesis. Therefore, fixed effects are evident in the data. Third, the results of Hausman test are $\mathrm{Prob} > \mathrm{chi}^2 = 0.0000$ for all three FE models, implying that the FE models are more suitable than the RE model. Finally, the result of Sargan Test for the sys-GMM ($\mathrm{Prob} > \mathrm{chi}^2 = 0.2713$) shows that the null hypothesis is not rejected for the model under Sargan test. Therefore, there are no overidentification issues for the model, and the sys-GMM is valid in this case.

[78] As of August 2020, London Living Wage is "an hourly rate of pay, currently set at £10.55. It is calculated independently to reflect the high cost of living in the capital, giving a worker in London and their family enough to afford the essentials and to save" (Mayor of London, 2020, para. 1).

Table 6.9 Determinants of benefit claimants

The dependent variable of the empirical model is POPULATION OF BENEFIT CLAIMANTS (natural log). The independent variables are NATIVE WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), IMMIGRANT ECONOMIC INACTIVITY LEVEL (natural log), UK-BORN NON-WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), NATIVE WHITE POPULATION UNEMPLOYMENT LEVEL (natural log), IMMIGRANT UNEMPLOYMENT LEVEL (natural log), UK-BORN NON-WHITE POPULATION UNEMPLOYMENT LEVEL (natural log). The control variables include BOROUGH-LEVEL POPULATION (natural log), BOROUGH-LEVEL MEAN RENT (natural log), BOROUGH-LEVEL MEAN INCOME (natural log), POPULATION PAID BELOW LONDON LIVING WAGE (natural log), POPULATION ON THE WAITING LIST (natural log). The pooled OLS and the sys-GMM also include a lagged variable POPULATION OF BENEFIT CLAIMANTS FROM LAST YEAR (natural log). Model (7) – (12) represent the respective test results of pooled OLS, Random Effect Model (RE), Time-Fixed Effect Model (time-FE), Entity-Fixed Effect Model (entity-FE), Two-way Fixed Effect Model (2way-FE) and System-GMM Model.

	(7) **pooled**	(8) **RE**	(9) **time-FE**	(10) **entity-FE**	(11) **2way-FE**	(12) **sys-GMM**
$\boldsymbol{ln\_UKWminin}$	**0.250*****	**0.150***	**0.120***	0.106	**0.120***	**0.159***
ln_migin	0.0564	0.0561	-0.0576	-0.0547	-0.0576	-0.127
$ln\_UKminin$	0.0378	**0.104***	0.0411	0.0381	0.0411	0.0164
$ln\_UKWminum$	-0.00365	-0.00452	0.00170	-0.000777	0.00170	-0.0109
ln_migum	-0.0244	0.0222	-0.0163	-0.0225	-0.0163	-0.0337
$ln\_UKminum$	0.0506	0.0282	0.0106	0.0107	0.0106	0.0130
$ln\_population$	-0.141	-0.0232	-0.0447	0.0786	-0.0447	-0.113
ln_rent	0.363***	0.0389	-0.190*	-0.164*	-0.190*	0.0786
ln_income	-0.0954	0.210	-0.450	-0.308	-0.450	0.270
$ln\_belowllw$	0.00143	0.0230	0.0611	0.0374	0.0611	0.160*
$ln\_waiting$	0.164***	0.239***	0.204***	0.215***	0.204***	0.263***
$ln\_benefits\_lag$	0.0000191					0.267***
Cons	4.542**	3.462	11.80	9.532	11.80	2.691
	(1.667)	(3.135)	(8.513)	(5.728)	(8.469)	(5.449)
N	140	140	140	140	140	112
adj. R^2	0.898		0.637	0.710	0.637	
LM-test		0.0000				
F-test (df=27)			0.0000	0.0000	0.0000	
Hausman test			0.0000	0.0000	0.0000	
Sargan test						0.2713

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.4.3 Robustness test

- **Determinants of Waiting List Lengths**

The purpose of the robustness test is to use alternative proxy variables to measure the effect of the proposed independent variables in the model. Table 6.10 shows the results of FE robustness tests on waiting list length determinants, where additional variables include (log) values for the population of private renters ($ln\_privaterenters$) in model (14), and both $ln\_privaterenters$ and the population of outright homeowners ($ln\_outrightowners$) in model (15) respectively. The results suggest that a positive correlation between list length and benefit claimants still holds.

Similar alternative proxies are further tested using the sys-GMM model (Table 6.11). The results are similar to ones outlined in the main empirical tests. Therefore, the conclusions remain robust. In addition, model (18) shows that the waiting list length in a borough is also caused by local private renter population. A possible explanation may be a large private rental market drives up the demand, resulting in residents with low affordability being pushed out of the market.

Table 6.10 2way-FE robustness test for test on local authority waiting list length determinants

The dependent variable of the empirical model is POPULATION ON THE WAITING LIST (natural log). The independent variables are POPULATION OF BENEFIT CLAIMANTS (natural log), BOROUGH-LEVEL POPULATION (natural log), MEAN RENT (natural log), LOCAL AUTHORITY EFFICIENCY (first difference of natural log), SOCIAL HOUSING STOCK LEVEL (first difference of natural log), POPULATION OF THE PRIVATE RENTERS (natural log) or POPULATION OF OUTRIGHT OWNERS (natural log). The estimation method is Two-way Fixed effect Model. Model (13) – (15) represent the respective test results of three robustness tests. (13) does not include POPULATION OF THE PRIVATE RENTERS or POPULATION OF OUTRIGHT OWNERS, and (14) does not include POPULATION OF OUTRIGHT OWNERS.

	(13)	(14)	(15)
$\boldsymbol{ln\_benefits}$	**2.673*****	**2.724*****	**2.705*****
$ln\_population$	2.451	2.329	2.114
ln_rent	0.551	0.628	0.671*
$\Delta ln\_efficiency$	-0.165	-0.145	-0.153
Δln_stock	2.524	2.471	1.895
$ln\_privaterenters$		0.314	0.588
$ln\_outrightowners$			0.641*
Cons	-53.14	-55.85	-62.44*
N	140	140	140
R^2	0.726	0.728	0.739

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6.11 sys-GMM robustness test for test on local authority waiting list length determinants

The dependent variable of the empirical model is POPULATION ON THE WAITING LIST (natural log). The independent variables are POPULATION OF BENEFIT CLAIMANTS (natural log), BOROUGH-LEVEL POPULATION (natural log), MEAN RENT (natural log), LOCAL AUTHORITY EFFICIENCY (first difference of natural log), SOCIAL HOUSING STOCK LEVEL (first difference of natural log), POPULATION OF THE PRIVATE RENTERS (natural log) or POPULATION OF OUTRIGHT OWNERS (natural log). The estimation method is sys-GMM Model. Model (16) – (18) represent the respective test results of three robustness tests. (16) does not include POPULATION OF THE PRIVATE RENTERS or POPULATION OF OUTRIGHT OWNERS, and (17) does not include POPULATION OF OUTRIGHT OWNERS.

	(16)	(17)	(18)
$ln\_waiting\_lag$	0.153	0.144	0.135
$\boldsymbol{ln\_benefits}$	**2.603*****	**2.703*****	**2.729*****
$ln\_population$	-0.642	-1.444	-2.320
ln_rent	0.237	0.288	0.387
$ln\_efficiency$	0.0490	0.121	0.189
ln_stock	-0.521	-0.779	-0.661
$ln\_privaterenters$		0.609	0.794*
$ln\_outrightowners$			0.427
Cons	-8.714	-4.372	-2.156
N	112	112	112

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- **Determinants of Population of Benefits Claimants**

Finally, Table 6.12 and Table 6.13 show the robustness test results for the determinants of the population of benefit claimants for both the FE model and sys-GMM model respectively. Model (16) removes the variable ln_income and model (17) removes the variables ln_income and $ln\_belowllw$. Both models (20) and (21) confirm the results of model (19). This further confirms that economic inactivity among the White population is positively correlated with the number of benefit claimants. All the three models show good levels of adjusted R^2, which are 0.638, 0.631 and 0.621 respectively.

The robustness tests of the sys-GMM model present similar results. The lagged term of the dependent variable is significant in all three models (22) – (24). The robustness checks further confirm the earlier results that economic inactivity among White population is positively correlated with the number of benefit claimants.

Table 6.12 2-way FE model robustness test for test on benefit claimants

The dependent variable of the empirical model is POPULATION OF BENEFIT CLAIMANTS (natural log). The independent variables are NATIVE WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), IMMIGRANT ECONOMIC INACTIVITY LEVEL (natural log), UK-BORN NON-WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), NATIVE WHITE POPULATION UNEMPLOYMENT LEVEL (natural log), IMMIGRANT UNEMPLOYMENT LEVEL (natural log), UK-BORN NON-WHITE POPULATION UNEMPLOYMENT LEVEL (natural log). The control variables include BOROUGH-LEVEL POPULATION (natural log), BOROUGH-LEVEL MEAN RENT (natural log), BOROUGH-LEVEL MEAN INCOME (natural log), POPULATION ON THE WAITING LIST (natural log) and POPULATION PAID BELOW LONDON LIVING WAGE (natural log). The estimation method is Two-way Fixed effect Model. Model (19) – (21) represent the respective test results of three robustness tests. (19) does not include POPULATION PAID BELOW LONDON LIVING WAGE, (20) does not include BOROUGH-LEVEL MEAN INCOME, and (21) does not include BOROUGH-LEVEL MEAN INCOME or POPULATION PAID BELOW LONDON LIVING WAGE.

	(19)	(20)	(21)
$\boldsymbol{ln\_UKWminin}$	**0.122***	**0.130***	**0.131***
ln_migin	-0.0522	-0.0659	-0.0603
$ln\_UKminin$	0.0397	0.0447	0.0433
$ln\_UKWminum$	0.000224	-0.00324	-0.00505
ln_migum	-0.0126	-0.00666	-0.00222
$ln\_UKminum$	0.0104	0.00892	0.00856
$ln\_population$	0.0433	-0.0198	0.0785
ln_rent	-0.183*	-0.193*	-0.185*
ln_income	-0.465		
$ln\_waiting$	0.205***	0.211***	0.212***
$ln\_belowllw$		0.0674	
Cons	11.26	8.504	7.788
N	140	140	140
adj. R^2	0.638	0.631	0.631

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6.13 sys-GMM model robustness test for test on benefit claimants

The dependent variable of the empirical model is POPULATION OF BENEFIT CLAIMANTS (natural log). The independent variables are NATIVE WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), IMMIGRANT ECONOMIC INACTIVITY LEVEL (natural log), UK-BORN NON-WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), NATIVE WHITE POPULATION UNEMPLOYMENT LEVEL (natural log), IMMIGRANT UNEMPLOYMENT LEVEL (natural log), UK-BORN NON-WHITE POPULATION UNEMPLOYMENT LEVEL (natural log). The control variables include BOROUGH-LEVEL POPULATION (natural log), BOROUGH-LEVEL MEAN RENT (natural log), BOROUGH-LEVEL MEAN INCOME (natural log), POPULATION ON THE WAITING LIST (natural log) and POPULATION PAID BELOW LONDON LIVING WAGE (natural log). The estimation method is sys-GMM Model. Model (22) – (24) represent the respective test results of three robustness tests. (19) does not include POPULATION PAID BELOW LONDON LIVING WAGE, (20) does not include BOROUGH-LEVEL MEAN INCOME, and (21) does not include BOROUGH-LEVEL MEAN INCOME or POPULATION PAID BELOW LONDON LIVING WAGE.

	(22)	(23)	(24)
$\boldsymbol{ln\_benefits\_lag}$	**0.267*****	**0.281*****	**0.262*****
$\boldsymbol{ln\_UKWminin}$	**0.159***	**0.153***	**0.147***
ln_migin	-0.127	-0.126	-0.0924
$ln\_UKminin$	0.0164	0.0134	0.0258
$ln\_UKWminum$	-0.0109	-0.0109	-0.0211
ln_migum	-0.0337	-0.0361	-0.0426
$ln\_UKminum$	0.0130	0.0156	0.00754
$ln\_population$	-0.113	-0.120	0.459
ln_rent	0.0786	0.140	
$ln\_waiting$	0.263***	0.262***	0.259***
ln_income	0.270		
$ln\_belowllw$	0.160*	0.156	
Cons	2.691	4.016	-0.620
N	112	112	112

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6.5 Discussion

The empirical results suggest that waiting list lengths at the local authority level are predominantly determined by the number of benefit claimants in the local authority. Based on models (3) – (6), a 1% increase in the number of benefit claimants corresponds to a 3% increase in the local authority's waiting list. In addition, immigrants and minorities who are economically inactive or unemployed are less likely to claim benefits than their White population counterparts.

According to models (9) – (12), a 1% increase in the White population born in the U.K., who are economically inactive, contributes a 0.1% increase in the number of benefit claimants. No statistical significance is found among all other unemployment or economic inactivity related variables.

One of the possible explanations for lower benefit claiming behaviour amongst immigrants compared to natives is the potential lower English literacy levels, leading to an inability to gain access to welfare. However, such an explanation is not able to fully explain the phenomenon. The results suggest that even minorities who are born in the U.K. are less likely to claim benefits than their peers. Since the empirical study only focuses on the unemployed and economically inactive population, it controls for the variation in education or illiteracy level between different ethnic groups.

Nevertheless, the findings of this study are not able to definitively conclude whether the benefit claiming behaviour amongst immigrants and minorities is due to cultural or social factors, otherwise known as ‘habitus’. However, it is possible that minorities and immigrants are concerned about being stigmatised for claiming benefits given the increasing political focus in the past few years in the U.K.[79]

Finally, the results confirm the possibility of there being a ‘working poor’ population in London. Although the relationship between the number of people earning below the London Living Wage and number of benefit claimants is only statistically significant in the pooled regression, the sign of the corresponding coefficient is consistently positive across all models. Therefore, policymakers and local governments should reconsider eligibility of welfare provision in the U.K., which largely falls under ‘personal responsibility’ under neoliberalism.

6.6 Conclusion

6.6.1 Summary

Chapters 3 to 5 focused on how individual ‘habitus’ and needs are reflected in housing choices. The chapter further used ‘habitus’ to understand the drivers that exist behind the different waiting list lengths between different London Boroughs, and immigrants’ participation in the welfare system.

According to Chan, Cole and Bowpitt (2007), there are myths about immigrants taking up welfare resources in the U.K. Bourdieu’s theories on ‘habitus’ offer an explanation as to why some immigrants may be less likely to take state support. Even though economic capital plays an important role in migration decision-making processes, the process should not be reduced to a process purely based on economic rationality. To test the research hypothesis, I used panel data regressions, the random effect (RE) model, and the fixed effect (FE) model. I first used these econometric methods to test the determinants of social housing

[79] A Google news search on ‘migrant claiming benefits UK’ shows the resulted numbers of news articles were 2,410 in 2014, 4,240 in 2015, 6,240 in 2016, 6,520 in 2017, 10,700 in 2018 and 21,000 in 2019.

waiting list lengths, followed by consideration of how different ethnicities and nationalities contribute to the number of benefit claimants. Although the results show that a shortage of housing is a cause of long social housing waiting lists, certain issues beyond supply may significantly impact waiting list lengths.

First, the number of people claiming benefits predominantly determines waiting list lengths. Second, amongst those who are economically inactive the White population born in the U.K. are more likely to claim benefits than immigrants born outside the U.K., or minorities born in the U.K. The results, therefore, offer a convincing rejection of the myth of ‘immigrants taking up welfare’. The results confirm the roles that habitus and other non-economic capital play in welfare participation. Third, the unemployment level is not correlated with waiting list lengths though the number of employees paid below the London Living Wage in a given borough does contribute to the waiting list length in that borough. The finding, therefore, confirms the phenomenon of the ‘working poor’ in London (Sykes *et al.*, 2015). Finally, and contrary to earlier research studies, rental prices do not seem to be a significant factor in determining a given area’s waiting list length. In contrast, the results from pooled OLS and RE models suggest that areas with lower average rents have longer waiting list lengths.

One of the policies to resolve the issues of imbalanced waiting lists amongst different boroughs is the Housing Mobility Scheme, which is explored in Chapter 7.

6.6.2 Limitations and future research

The empirical study suffers from several limitations. First, the study assumes that economies with individualistic cultures are more developed industrially than economies with collective cultures. Second, the empirical models use borough-level median rental prices of the local rental market as a proxy for living costs. However, living costs and income opportunities vary across neighbourhoods in London. Third, the empirical model has a potential endogeneity issue. Poorer neighbourhoods in London may have more informal living arrangements and living costs and, as such, are attractive to new immigrants who are not yet financially established. As a result, migration in an area is not an exogenous variable to the number of benefit claimants in that area. Furthermore, there also exists a reverse causality issue between waiting list length and benefit claims.

Future research may improve on the following four aspects. If possible, it may incorporate datasets which contain details on the country of origin of unemployed or economically inactive immigrants. Such approach would enable a more accurate grouping of the welfare states and cultures that the studied individuals are exposed to. Second, to resolve the empirical model's existing endogeneity issue, future studies should identify an instrumental variable that correlates with migration and ethnicity, but simultaneously does not correlate with benefit claims. Finally, a discrete-choice model could be used to understand further the differences in benefit claiming behaviour within the U.K.'s White population and ethnic minorities.

6.6.3 Policy implications

The findings present three policy implications. First, the results suggest that the number of benefit claimants in a given year is the key driver of waiting lists. Some benefit claimants are employed workers, and there is a positive correlation between claims and the number of employees paid below the London Living Wage. Paying employees above the London Living Wage is not compulsory, though there are currently over 1,500 employers who do so (Mayor of London, 2020). To reduce the number of benefit claimants, policymakers may consider enforcing laws to ensure employers pay employees the London Living Wage.

Second, 'habitus' is one of the potential explanations for minorities and migrants being less likely to claim benefits in London. Another explanation is that they can be less aware of their entitlements. Therefore, the government can improve the situation by improving communication with communities of migrants. Some NGOs, such as Migrant Help, already assist vulnerable migrants in claiming benefits. In addition, the Department for Work and Pensions can provide language support for Universal Credit applications (Migrant Info Hub, 2020). Some ethnic minority communities also use their means to support migrants who do not have sufficient language skills. For example, the Chinese Information and Advice Centre provides information on access to benefits in Chinese (Chinese Information and Advice Centre, 2016). The findings of this chapter show that these attempts are worthwhile in fostering equal opportunities in welfare access.

Third, in a polarised political moment, the media should consider facilitating fair, open, and democratic discussions. Stereotyping and scapegoating undermine assimilation, which can result in increased tensions between different social groups. On the other hand, the strong kinship and family ties of certain ethnic minority cultures may inspire future welfare approaches in the U.K. For example, the government may support family-friendly venues to give discounts and vouchers to families, especially ones with elderly members or ones in need of care. Events venues may create family-friendly zones to foster an environment for more intimate experiences for families.

Finally, housing stock levels negatively correlates with waiting list lengths, which further suggests a need to increase council housing stock. Even though this thesis addresses issues that are 'beyond supply' in social housing, the results nevertheless indicate the importance of addressing this key structural issue.

7 The Embeddedness of Relocation: An agent-based modelling approach

7.1 Introduction

To achieve labour market efficiency, conventional labour market theorists argue that workers should locate and relocate to areas where they find relevant employment opportunities (Lux and Sunega, 2012; Zabel, 2012; Haas and Osland, 2014). Such relocation helps form efficient labour markets (Lux and Sunega, 2012; Zabel, 2012).

In the U.K., social tenants exhibit higher unemployment rates compared to those living in private rental properties. Whilst the social rental sector contains a higher proportion of economically inactive population than the other housing tenures, the persistent unemployment issue can be partly attributed to the friction in relocation amongst social tenants. Survey data shows that social renters are less likely to relocate (Hills, 2007). The *English Housing Survey 2015 to 2016* (Department for Communities and Local Government, 2017) revealed that only 8% of social renters moved in 2015-2016. Most of them moved for a larger property or due to changes in family structure. In contrast, only 2% relocated for job-related reasons. Their reluctance in moving may arises from social renters' lack of confidence in obtaining a new property promptly due to long waiting lists. Since the introduction of the *Localism Act 2011,* social housing applications in all London boroughs have become much more stringent. Besides, each local authority oversees its own housing waiting list, meaning that existing social tenants have the risk of not finding an accommodation immediately once they move out of their currently residing borough. As a result, the cost of moving across boroughs has increased, leaving tenants unwilling to move to other neighbourhoods unless they first secure a home. The earlier chapters discuss the current issue of social tenants being reluctant to move and how these problems may result in negative externalities. Negative externality is defined as the cost borne by third parties (OECD, 2003). An example of negative externalities here is low labour market participation. Based on the philosophy of housing mobility schemes, one possible solution would be to reduce the cost of moving (Wilson, 2014).

To combat this issue, the Greater London Authority launched a mobility scheme called Housing Moves. The purpose of the scheme is to enable social tenants within London to relocate to other boroughs. Most of the London boroughs and housing associations are now participating in the scheme. The scheme places tenants in priority bands, which are determined as below with Band 1 tenants classified as the highest priority (Mayor of London, 2012):

- Band 1: Tenants that are willing to downsize
- Band 2: Tenants that are subject to new employment or training which leads to direct employment
- Band 3: Tenants that are currently living in overcrowded dwellings
- Band 4: Tenants that are caretakers
- Band 5: Tenants that are eligible but do not belong to the above four categories

The housing mobility schemes align with the logic of free-market capitalism. To improve labour market participation, the schemes help reduce the costs of labour mobility. The schemes assume that the only constraint that prevents individuals from moving is the lack of housing supply or availability in the destination neighbourhood. However, there may be other factors that also play determinant roles in the relocation decision-making process. Besides economic capital, social and cultural capital can also play important roles in the decision-making process for relocation. Above all, understanding tenants' relocation neighbourhood choice is an important part of the housing decision process (Baker, 2008). Given that the previous chapters' focus on individual dwellings, this chapter shifts the discussion to an understanding of relocation neighbourhood choice.

In this chapter, I use the gravity model and Agent-based Modelling to explore how social tenants may obtain their neighbourhood choice under freedom of movement. Besides, this section explores the decision-making process under the influence of bounded rationality, such as herding behaviour, endowment effects and status quo. From a theoretical perspective, the study connects Bourdieu's social theories with relocation choices.

7.2 Theoretical Framework

7.2.1 Determinants of relocation

A relocation decision consists of two sub-level decisions: the decision to move away and the decision to move into a new residence. The two sub-level decisions are push and pull factors, and residents conduct a cost-benefits analysis (Baker, 2008).

Push-pull factors can be placed in one of the two categories. The first are objective attributes based on material costs and benefits (e.g. public services, environment, and job opportunity). The second are subjective attributes based on the residents' feelings and experiences. Through conducting a postal survey of London, John, Dowding and Biggs's (1995) study showed both categories play a role in the relocation decision-making process, where the roles of taxation and public services were the most significant.

The cost of living includes the cost of housing (Rabe and Taylor, 2012; Haas and Osland, 2014) and the cost of commuting (Cameron and Muellbauer, 1998). Benefits from residing in a specific neighbourhood include low noise level (Mohan and Twigg, 2007), education (Parkes, Kearns and Atkinson, 2002), security (Kearns and Parkes, 2003), local healthcare, green spaces, and local job opportunities (Moore and Rosenberg, 1993; Lee and Roseman, 1999). Between EU countries, for example, wage differences contribute to relocation decisions (Fidrmuc, 2004). On the other hand, depending on the distances involved, commuting can be a substitute for relocation (Reitsma and Vergoossen, 1988). Cheaper commutes enable longer commutes and discourage relocation. In these cases, decisions on where to live can be independent of the decisions of where to work (Cameron and Muellbauer, 1998).

Subjective factors include neighbourhood satisfaction, housing satisfaction, and the general appearance of the neighbourhood (Parkes, Kearns and Atkinson, 2002). Furthermore, other factors that matter include friendliness, community belonging (Mee, 2009). Social position may also affect residential satisfaction, since households of higher social status have more relocation choices than those of lower social status (Clark, Deurloo and Dieleman, 2006). Nevertheless, measuring subjective factors to model the push-pull effect has limitations. It can suffer from survivorship bias, since residents who are not satisfied with their neighbourhoods would have moved to a more satisfactory one, whereas the residents who are not able to move may have adapted to their living conditions (Parkes, Kearns and Atkinson, 2002). Some of these factors manifest themselves as ties to a certain area. Studies have also found that residents, especially tenants living in social housing, prefer short-distance mobility (Baker and Arthurson, 2007). Baker and Arthurson's (2007) study of residential satisfaction in an Australian regeneration project highlighted that tenants in public housing relocate a much shorter distance than the national average. They found that 87% of households moved within 5km. Most studies attribute the local ties factor to relocation for work (Mulder and Malmberg, 2014), the issues with children having to change schools, and local social networks (Baker and Arthurson, 2007). Neighbourhood attachment and social networks are both social capital, along with civic participation (Li, Pickles and Savage, 2005). According to Bourdieu (1986), such social capital is a type of resource which links groups and social networks, and its volume is dependent on the size of the networks that the agent is able to mobilise. Social capital helps people, especially those belonging to low socio-economic groups, to not only ‘get by’ but also ‘get ahead’ in life (Curley, 2010).

The existence and the important role that social networks and social capital play in relocation decisions have the following implications for social tenants. First, the decision to relocate is a push-pull evaluation of a combination of economic, social, and cultural capital. Second, the ties to social networks also mean that residents may make relocation decisions based on their friends’ relocation behaviour. Finally, the reluctance to move can also be for psychological reasons. Homeowners or renters may attach higher value to properties that they own or ones that they live in, which is defined as the endowment effect (Kahneman *et al.*, 1991). Knetsch and Sinden (1984) reported experiments examining the disparity between the willingness to pay and compensation demanded, and found that the latter far exceeded the former. In the context of relocation, individuals may become attached to their dwellings or the communities that they belong to, even though moving may result in net benefits for them. In addition, individuals may prefer staying in their current residence rather than make changes due to a status quo bias. Such bias may result in social tenants being more reluctant to move to another area for work. On the other hand, residents may also want to move to a place due to the popularity of the place based.

As illustrated by Bourdieusian theories, individuals' aim to maximise both physical and symbolic benefits. Therefore, the modelling of neighbourhood choices and relocation decisions must combine rational choice, psycho-social, and heuristic theories.

7.2.2 Gravity model for relocation

Gravity models are popular tools for studying relocation flows between location pairs (Anderson, 2011; Willekens, 2016). The theoretical basis for the model is the random utility maximisation which is a common foundation for many economic theories. According to the gravity model, individuals make moving decisions by comparing the expected benefits and costs of relocation (Warin and Svaton, 2008). The gravity model takes the underlying assumption that the relocation flows between two locations are directly proportional to their sizes and inversely proportional to the distances between the two locations. The sizes are typically approximated using population or area sizes, whereas the distance between the two locations is typically measured using Euclidean distance, travel distance, or travel time. Extended gravity models also include other push-pull factors, including income levels, public services (such as education quality), neighbourhood safety, and access to green space. Therefore, the gravity model can be used in combination with Tiebout model (see Section 6.2.1 in Chapter 6 for details on Tiebout model).

There are several benefits of using gravity models to study relocation. Above all, gravity models are easily extended to include more control variables. In the context of this study, gravity models can model the 'rational choice decision' part of relocation decisions. However, the models also have their limitations. Whilst gravity models can provide insights into factors driving relocation process at the macro level, they do not address decision-making processes at the micro level nor do they take into account psycho-social factors driving relocation decision-making processes. Most importantly, the fundamental philosophy of the gravity model is based on RAT, which argues that social decisions are the aggregates of individuals' independent and rational decisions (Goldthorpe, 1998). However, one of the limitations of RAT is that, though objective factors play significant roles in the decision-making, individuals experience bounded rationality. Bounded rationality argues that individuals make rational decisions within a framework that is restricted by factors such as information, time limit and cognitive limitations

(Simon, 1955). RAT is also highly ‘asocial’, where decisions are made based on utility maximisation independent of social constructs or individuals’ situatedness.

Conventional gravity model based on RAT is hence not able to take into account individuals that are embedded in the social construct. Polanyi was the first person to coin the term ‘embeddedness’ (Beckert, 2009). Whilst his original definition of ‘embeddedness’ described the relationship between societies and economic processes, it has also been criticized as being overly vague (Talmud, 2013). Based on Granovetter's (1990) work on ‘embeddedness’, Zukin and DiMaggio (1990) provided a more detailed breakdown of the framework of embeddedness: structural embeddedness, cognitive embeddedness, cultural embeddedness, and political embeddedness.

Economists who have used ‘embeddedness’ in social network analysis include Gary Becker. Becker differs from Bourdieu in the way that he treats all social relations as economic relations, and is much more aligned to RAT. For example, according to Becker, even marriage is a market where decisions are consequences of utility maximisation (Bridge, 2001). Bourdieu criticised Becker’s approach, arguing that the Beckerian approach reduced the decision-making process into a simple cost-benefit analysis. Whilst Bourdieu’s criticism highlights the limitation of Becker’s reductionist approach, it does not imply that cost-benefit analyses are invalid in understanding decison-making processes within a social network (Odabaş and Adaman, 2018). Although Bourdieu objected RAT, he did not refute the rational choice assumption. Instead, he argued that rational choice can take different forms based on the agents’ historicity and habitus, as well as the field to which they belong. It is a form of rational decision-making process that is more arbitrary and less consistent in actions than the one suggested by RAT. Though Bourdieu has never provided a toolkit to resolve such limitations in economic social network analysis, his criticism suggests that future research should take into account different ‘possibilities’ of decision outcomes. In other words, the utility maximisation approach used in orthodox economics is still applicable if the modelling process considers the agents’ embedded situations and adjust their utility functions accordingly (Bridge, 2001). The main implication of the above discussion is that it is necessary to incorporate different situatedness and subjectivism of individuals when they make relocation decisions.

7.2.3 Agent-based modelling (ABM)

Bourdieu criticises RAT for only studying the actions of agents guided by a rational internal logics, “executing a sort of perfectly rational internal program of action” (Bourdieu and Wacquant, 1992, p. 136). ABM can resolve some of the limitations of the gravity model including Bourdieu’s rejections to RAT in modelling relocation behaviour. ABM is a type of computational model which uses simulations to construct actions and integrations between agents based on a set of behavioural rules. The objective of the model aims to examine the process at macro level. In general, an ABM includes (Heppenstall *et al.*, 2012):

1. Several agents, who operate within the same or different pre-set behavioural rules;
2. Behavioural rules derived from literature studies and relevant theories, where the rules can be rational, heuristic or randomised;
3. The learning and adaptation of agents towards the environment
4. An interactive relationship between agents
5. A non-agent environment which include the initial settings and/or the background process

ABM is a suitable tool to explore the research question for the following three reasons.

First, ABM is cost-effective in modelling rule-based events. Individuals operate within their own frameworks which guide their actions. Therefore, individuals have decision-making rules which are consistent with their frameworks. Even for individuals that do not follow any rules, consistency in that attribute is a behavioural rule in and of itself. Therefore, ABM can simulate realistic situations. Second, ABM provides an alternative option to traditional economic modelling by incorporating bounded rationality (Tesfatsion, 2002). Since ABM allows the model to set behavioural rules for agents, it allows for sub-optimal (i.e. less rational) behaviour.

Second, contrasted with rational economics theories, which standardise agents making economic decisions, ABM provides a more realistic set-up of the decision-making environment and process. However, so far, the ABM that has been developed to understand individuals’ choices in migration is focused on an urban analysis perspective. There is room to further develop the models from a behavioural science's context. Similar insights have also been applied to the analysis of location choices and land value betterment (Wang and Baddeley, 2016).

Third, ABM can illustrate the evolutionary process of the social or ecological systems that are represented by the agents. Instead of treating the system as static, as in the case of orthodox economics, ABM treats the research subjects as ever evolving and changing. Unlike orthodox economics models, ABM explores emergent phenomenon rather than an equilibrium state. The focus on the dynamic instead of the equilibrium is much more akin to the real world.

One of the seminal contributions pertinent to this analysis is Schelling's (1971) segregation model, an ABM which demonstrated that agents would have ended up segregating themselves from other agents over time even in cases when they did not mind living in a mixed neighbourhood. The basic model is explained as follows. Suppose there are two types of agents, namely blue and red. These agents each live on a single unit square. It assumes that an agent is happy if 30% of his nearest neighbours are the same type of agents as s/he is, otherwise, s/he is unhappy. If the agent is happy, s/he will stay. Otherwise, s/he will move to a random location. The algorism then repeats. The model defined the 'tipping point' as the minimum fraction of minority people in the neighbourhood leading to racial segregation.

Variations of Schelling's segregation model have been developed over the years. The original model, which only included two types of residents was later adapted into models which included three (Clark and Fossett, 2008), and even four, groups (Crooks, 2010). In addition to the ethnicity features that the original model examined, later models also studied the role of income and quality of property (Clark and Fossett, 2008), the availability and attractiveness of public goods (Wasserman and Yohe, 2001), cultural differences (Benenson, 1999), property types, and inertia (Torrens, 2007) in agents' preferences in moving.

Schelling's model is also linked to Bourdieu's social theories by emphasising the role of coordination, where agents make moving decisions based on observations of other agents' behaviour. It also highlights historicity, where agents' past behaviour and tradition contribute to how they make current decisions. Events such as gentrification are the consequence of class habitus manifested in new field (Bridge, 2001).

Based on Klabunde and Willekens's (2016) literature survey, there are six types of ABMs for modelling relocation: 1) minimalist models, 2) microeconomic expected utility maximisation models, 3) psycho-social and cognitive models, 4) heuristics without direct empirical correspondence models, 5) decision theory-based and direct observational models, and 6) empirical models. The minimalist model is the simplest form, where the agents are active randomly moving particles. The microeconomic expected utility maximisation model aligns with standard economic theories, where the relocation decisions are based on utility maximisation. The psycho-social and cognitive models are based on psycho-social theories, such as the theory of planned behaviour (e.g. Kniveton, Smith and Wood, 2011) and Maslow's motivation theory (e.g. Reichlová, 2005). The heuristics models use simple rules to illustrate social influences. Finally, there are models which are derived from direct observations and empirical studies (Table 7.1).

Amongst existing ABM models, Reichlová (2005) developed a migration model based on Maslow's (1943) Hierarchy of Needs, which explains the minimal migration within Europe despite income differences. In the model, migration is influenced stepwise by income, safety, and social needs, where agents aspire to move to locations that support higher level achievements of Maslow's Hierarchy of Needs. In addition, individuals' social networks contain their social capital, resulting in their preferences towards moving to areas where their social networks reside. As both inter-regional migration and immigration relate to movements of people between places, the studies on immigration behaviour can also be applied to relocation behaviour within cities such as London. Whilst movement constraints tend to be higher for immigration, potential movers fundamentally go through similar cost-benefit evaluations, comparing origin and destination areas. The ABM in this study combines micro-economics, psycho-social, heuristics, and empirical relevance. Existing ABMs that make similar combinations include Klabunde (2018), who used large survey data and existing literature to form behavioural rules where the moving decisions are dependent on factors including expected income and ties to the networks of other migrants. This study differs focuses on inter-borough relocation, whilst Klabunde's (2018) studies migration behaviour. However, even though the combination of decision theory and empirical observation can improve the rigour of the ABM, the nature of the approach means that the results are often case specific and difficult to be generalised (Klabunde and Willekens, 2016).

Table 7.1 Different types of ABMs for modelling neighbourhood relocation

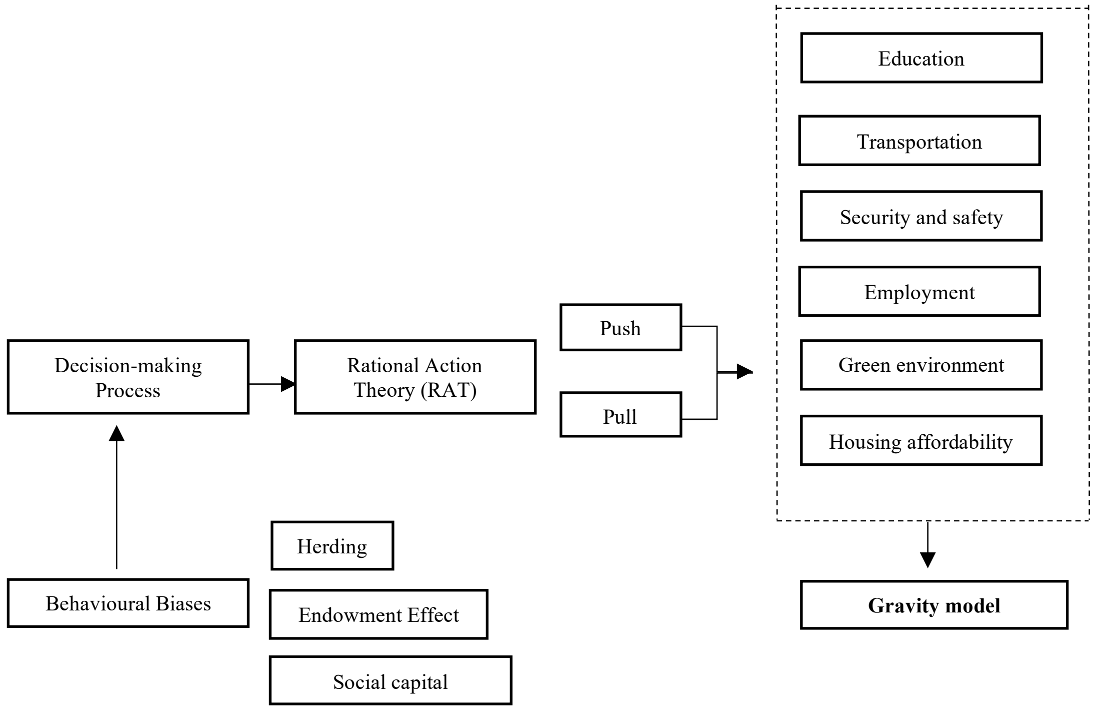
Decision theory	**Difference desired-actual behaviour**	**Social influence**	**Uncertainty**	**Life course**	**Time for decision**	**Empirical relevance**	**Simple**	**Falsifiable**
Minimalist								
Micro-economics								
Psycho-social								
Heuristics								
Mixture								
Empirical								

Source: Klabunde and Willekens (2016)

7.3 Methodology

The methodology consists of two phases. The first phase uses a gravity model to determine the drivers of the annual relocation flow between borough i and borough j using empirical data. The second phase uses ABM constructed from the findings of the first phase, and Bourdieusian theories to model the decision-making processes of individual households. In particular, I use the coefficients found in the first phase to set the weighting of different factors in the rational decision-making process.

Figure 7.1 ABM modelling framework



Source: own construction

For each household, the part of the decision-making process which is subject to RAT can be formulated into an optimisation problem:

$$\text{Max}\, u(x_i, \forall i)$$

Subject to: $\sum p_{x_i} x_i = M$

Where u is a utility function, x_i concerns the net effect of all attributes considered in the push-pull model, p_{x_i} is the corresponding price for attribute x_i,[80] and M is the total housing budget for a given household. Using a Lagrangian approach, the optimisation problem is transformed into:

$$L = u(x_i, \forall i) + \lambda[M - \sum p_{x_i} x_i]$$

Differentiating L with respect to x_i, $\forall i$, and set the right-hand-side of the derivatives to zero, the first order conditions are:

$$\frac{\partial u}{\partial x_i} - \lambda p_{x_i} = 0 \;\; \forall i$$

And $M - \sum p_{x_i} x_i = 0$

[80] $p_{x_i} = 0$ if x_i is a public or a quasi-public good. A public good is defined as a type of good that is non-exclusive or non-rivalrous. Examples of public goods include open parks. On the other hand, a quasi-public good is partially exclusive or partially rivalrous. Examples of quasi-public goods include public transport and state school provisions.

7.3.1 Model specification

a. Gravity model

The basic form of the gravity model of relocation is:

$$F_{ij} = G\frac{M_i M_j}{D_{ij}}$$

Where F_{ij} is the relocation flow between two locations i and j, D_{ij} is the distance between i and j, M_i and M_j are the sizes of the two corresponding locations, and G is a constant.

Taking the natural log of the equation, it becomes:

$$\ln(F_{ij}) = \alpha + \beta_1 \ln(M_i) + \beta_2 \ln(M_j) - \beta_3 \ln(D_{ij}) + \epsilon_{ij}$$

Where α is a constant, β_1, β_2 and β_3 are corresponding coefficients of the independent variables $\ln(M_i)$, $\ln(M_j)$ and $\ln(D_{ij})$, and ϵ_{ij} is the error term.

The extended gravity model is:

$$\ln(F_{ij}) = \alpha + \beta_1 \ln(M_i) + \beta_2 \ln(M_j) - \beta_3 \ln(D_{ij}) + \sum \gamma_l \ln(X_i)_l + \sum \theta_l \ln(X_j)_l + \delta_{ij} + \epsilon_{ij}$$

Where $\mathbf{ln}(\boldsymbol{X_i})$ and $\mathbf{ln}(\boldsymbol{X_j})$ are the location-specific independent variables that are hypothesised to contribute to the relocation decision-making process, which in the case of this chapter, include proximity to central London, housing costs, education quality, and access to green space. $\boldsymbol{\gamma}$ and $\boldsymbol{\theta}$ are the corresponding coefficients for $\mathbf{ln}(\boldsymbol{X_i})$ and $\mathbf{ln}(\boldsymbol{X_j})$. δ_{ij} is a adjacency dummy variable, which equals to 1 when i and j are rook-adjacent to each other,[81] and 0 otherwise.

b. Agent-based modelling

In this study, the set-up stage of the ABM consists of two parts: 1) setting up the agents; and 2) setting up the neighbourhoods. The profiles of both the agents and the neighbourhoods are simulated. The simulated data of the economic and cultural capital of agents are used to construct their SES. Adapted from Bourdieu's class theories from *Distinction* represented in Figure 7.2, there are four types of social groups:

[81] Rook-adjacency is defined as sharing a border of some length.

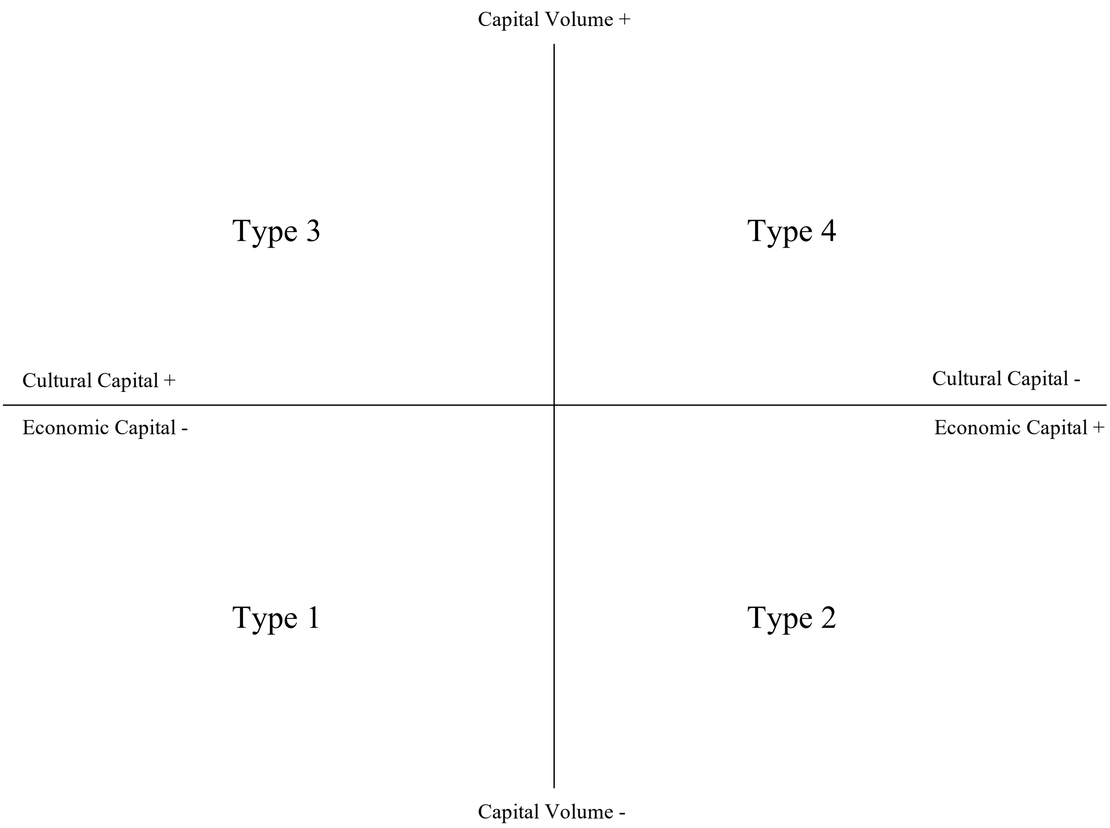
Type 1 (Total low - cultural high): Low total capital (Bottom 50% of the population), lower proportion of economic capital (economic capital $< 50\%$ of total capital)

Type 2 (Total low - economic high): Low total capital (Bottom 50% of the population), higher proportion of economic capital (economic capital $\geq 50\%$ of total capital)

Type 3 (Total high - cultural high): High total capital (Top 50% of the population), lower proportion of economic capital (economic capital $< 50\%$ of total capital)

Type 4 (Total high - economic high): High total capital (Top 50% of the population), higher proportion of economic capital (economic capital $\geq 50\%$ of total capital)

Figure 7.2 Dimension of economic – cultural capital



Source: adapted from Bourdieu (1984)

The decision-making stage for agents within the ABM consists of three phases: 1) constructing objective preferences taking budget constraints into account; 2) constructing subjective preferences; and 3) making moving decisions.

Table 7.2 Set up of the ABM model

Step	Description		Theoretical/Empirical basis
Set-up			
Agents	Each agent has four pre-defined attributes: 1) ethnicity; 2) income (which represents economic capital); 3) education level (which represents cultural capital). The model uses the simulated income level and education level to approximate agents' economic capital and cultural capital respectively. The distributions used for the simulation are based on census data. Given that there is a band-wise distribution of each characteristics, the probability of an agent with a specific set of characteristics is: $P\{\text{eth} = i, \text{inc} = j, \text{edu} = k, \text{reli} = m\} = P\{\text{eth} = i\}P\{\text{inc} = j\}P\{\text{edu} = k\}P\{\text{reli} = m\}$	**Ethnicity** (eth_i) is divided into the following categories: $\begin{cases} \text{eth}_i = 1 \text{ if the agent is White} \\ \text{eth}_i = 2 \text{ if the agent is Asian} \\ \text{eth}_i = 3 \text{ if the agent is Black} \\ \text{eth}_i = 4 \text{ if the agent is Mixed/Other} \end{cases}$ **Cultural capital** (edu_i) is approximated using qualification level: $\begin{cases} \text{edu}_i = 1 \text{ if the agent has no qualifications} \\ \text{edu}_i = 2 \text{ if the agent has NVQ Level 1 education} \\ \text{edu}_i = 3 \text{ if the agent has NVQ Level 2 education} \\ \text{edu}_i = 4 \text{ if the agent has a qualification on trade apprenticeship} \\ \text{edu}_i = 5 \text{ if the agent has NVQ Level 3 education} \\ \text{edu}_i = 6 \text{ if the agent has NVQ Level 4 + education} \end{cases}$ **Economic capital** (inc_i) is approximated using income level: $\begin{cases} \text{inc}_i = 1 \text{ if the agent is in the bottom } \frac{1}{6} \text{ of the the income distribution} \\ \text{inc}_i = 2 \text{ if the agent is between the bottom } \frac{1}{3} \text{ and } \frac{1}{6} \text{ of the income distribution} \\ \text{inc}_i = 3 \text{ if the agent is between the bottom } \frac{1}{3} \text{ and } \frac{1}{2} \text{ of the income distribution} \\ \text{inc}_i = 4 \text{ if the agent is between the top } \frac{2}{6} \text{ and } \frac{1}{6} \text{ of the income distribution} \\ \text{inc}_i = 5 \text{ if the agent is between the top } \frac{1}{3} \text{ and } \frac{1}{6} \text{ of the income distribution} \\ \text{inc}_i = 6 \text{ if the agent is in the top } \frac{1}{6} \text{ of the the income distribution} \end{cases}$ The **Religion** of a given agent belongs to one of the following categories:	1) Bourdieu's division of social classes using economic and cultural capital; 2) Results from gravity models

	$\begin{cases} \text{rel}_i = 1 \text{ if the agent has no religion} \\ \text{rel}_i = 2 \text{ if the agent is Christian} \\ \text{rel}_i = 3 \text{ if the agent is Buddhist} \\ \text{rel}_i = 4 \text{ if the agent is Hindu} \\ \text{rel}_i = 5 \text{ if the agent is Jewish} \\ \text{rel}_i = 6 \text{ if the agent is Muslim} \\ \text{rel}_i = 7 \text{ if the agent is Sikh} \\ \text{rel}_i = 8 \text{ if the agent is of any other religion} \end{cases}$	
	Finding friends: Within the social group that a given agent belongs to, the people belonging to the same social group are labelled as ‘friends’ of the agent. The closeness between two agents within the same social group is identified by examining the shared characteristics (amongst ethnicity, income level, education level and religion) between the two agents. If the two agents are more likely to be friends if they share more traits. I use three steps to identify a given agent’s friends: 1) construction of socio-economic groups based on population consensus and survey data; 2) identification of the agent’s SES; 3) random selection of the top five other individuals in the socio-economic group that the agent shares the most traits with.	Individuals who share a similar identity are more likely to be in contact with each other (Lazarsfeld and Merton, 1954). Such a phenomenon is referred to as ‘homophily’ (Currarini, Jackson and Pin, 2009). Lazarsfeld and Merton (1954) distinguished between two types of homophily, which are ‘status homophily’ and ‘value homophily’. The former revolves around informal, formal, and ascribed status; whereas the latter revolves around beliefs, values, and attitudes.
Neighbourhoods	The **ethnic** make-up of a given borough is the aggregate of the ethnicity of the agents living in the borough. The **cultural capital** of a given borough is the aggregate of the cultural capital of the agents living in the borough. The **economic capital** of a given borough is the aggregate of the economic capital of the agents living in the borough. The approach used to construct a neighbourhood’s **SES** is similar to the approach used to construct the SES of an agent.	1) Bourdieu’s division of social classes using economic and cultural capital; 2) Theories on cultural capital; 3) Results from gravity models

	Other **push-pull factors** include percentage of open and green space, employment density, and transportation accessibility measured by PTAL.	
Behavioural Rules		
Objective preference	**Utility maximisation:** The objective preference is based on hedonic modelling, where the assessment of the neighbourhoods is based on the neighbourhood characteristics which are considered during individuals' evaluation of the push-pull factors. The characteristics include: 1) transportation access; 2) jobs density; 3) income level; and 4) access to public open and green space. **Budget constraints:** The budget constraint for a given individual i is measured as less than i's monthly income.	Results from the gravity models
Subjective preference	1. **Endowment effect:** Regarding the borough that the agent is currently living in, the model considers an endowment effect arise from status quo bias, relocation cost, and inertia. Therefore, the rating of the borough m will be positively biased. The model therefore calculates the preference for his/her current borough using hedonic modelling, and then inflate the value by a *biasness factor* (b_i)*:* $U_i^k = b_i \times f(\text{education, job, transport, environment, safety, social group, ethnicity})\ \forall k = m$ Where individual i does not show any endowment effect when $b_i = 1$, and shows biased preference towards his/her current neighbourhood when $b_i > 1$.	
	2. **Living with people who are similar.** For the subjective preference, the model assumes that agents prefer to stay in neighbourhoods that have a similar mix of as themselves in terms of ethnicity, religion, and SES. The model includes characteristics for agents that are most representative of their SESs and social positions based on Bourdieu's social theories.	Hedman, van Ham and Manley (2011) found that households are very likely to select neighbourhoods where the population make up are similar to their own features.
	3. **Herding towards public information:** After each round, the boroughs are ranked based on the average ranking received by the entire population. It is assumed that the highest ranked one is the most popular one. When agents herd towards public information, they adjust their ranking of boroughs based on the public ranking of the previous round.	

	4. **Herding towards friends:** After each round, for each agent, the boroughs are ranked based on the average ranking received by their friends. It is assumed that the most populated borough is the most popular one. When agents herd towards their friends, they adjust their rankings of boroughs based on their friends' ranking of the previous round.
Moving decision	Moving decisions are made combining objective and subjective preference, endowment effect and herding behavior, as well as the weighting placed on the proximity between the origin and destination boroughs.

Table 7.3 Input of ABM models

ABM	Objective preference	Subjective preference		Herding		Rating of a given borough *k* for an agent *i*	Weighting in the rating equation[82]					
	Hedonic modelling	**Endow ment effect**	**Living with similar people**	**Friends**	**General public**		**Objective (distance)**	**Objective (others)**	**Subjective**	**Friends' choice**	**Public choice**	**Endow ment**
1	YES	NO	NO	NO	NO	$R_i^k = \alpha_i U_i^k + \beta_i FI_i^k + \gamma_i PI_i^k + \varepsilon_i,$ $\beta_i < \gamma_i$	0.3[83]	0.7	0	0	0	1[84]
2a)	YES	YES	NO	NO	NO	Where $U_i^k = f\left(\mathrm{edu}_i^k, \mathrm{job}_i^k, \mathrm{PTAL}_i^k, \mathrm{env}_i^k, \mathrm{class}_i^k, \mathrm{eth}_i^k\right)$	0.3	0.7	0	0	0	> 1
2b)	YES	YES	YES	NO	NO	$\forall k \neq m$	0.3	0.7		0	0	> 1
3a)	YES	YES	YES	YES	NO	And $U_i^k = b_i f\left(\mathrm{edu}_i^k, \mathrm{job}_i^k, \mathrm{PTAL}_i^k, \mathrm{env}_i^k, \mathrm{class}_i^k, \mathrm{eth}_i^k\right)$	0.3	0.7			0	> 1
3b)	YES	YES	YES	YES	YES	$\forall k = m$	0.3	0.7				> 1

Note

1. U_i^k is the expected utility of living in borough k to agent i. For the borough that the agent is currently staying at, U_i^k equals to his/her adjusted rating, whereas U_i^k stays the same for the other boroughs. I_i^k is the social information that he/she receives about borough k.
2. FI_i^k and PI_i^k is the information from friends and the general public (excluding their friends) respectively. α_i, β_i and γ_i represent the weighting of private information, information from their friends and information from the general public when agent i makes a moving/staying decision. At the first round $R_i^k = U_i^k \ \forall k$.
3. FI_i^k equals to the average rating of borough k of all friends in the previous round and PI_i^k equals to the average rating of borough k of all other agents excluding friends in the previous round.

[82] Note that all weightings except the endowment factor should add up to 1.
[83] The result is based on gravity models. When running the empirical test with distance as the only independent variable and relocation flow as dependent variable, it shows that the model can explain approximately 30% of the outcome (Table 0.27 in Appendix-Chapter 7).
[84] An endowment factor of 1 means that the resident does not display any endowment effect. If it is greater than 1, it means that there is endowment effect.

7.3.2 Data collection

In the study of relocation in this chapter, the insights are based on the overall population. Even though it is important to study the specific situations of social renters and contextualise their conditions, it is equally important to understand social renters based on the profile of the wider population. Social renters "should be regarded as movers first and public tenants second. That is, public renters make decisions about their house and its location in much the same way as the wider population, although these decisions tend to be made under greater constraint" (Baker, 2008, p. 1716).

a. Rational Action Theory: The gravity model

Table 7.4 outlines the variables, their definitions, and corresponding data sources in the gravity model. All the variables, except Adj_{ij}, are in natural log forms. The data are annual data between 2012 and 2017, apart from natural fixed variables such as area sizes, access to open and green space, distance between boroughs, distance to central London and the adjacency dummy variable.

Table 7.4 Variables and their definitions, types and data sources

Variable	Definition	Type	Data Source
Annual relocation flow from i to j[85] $(Reloc_{ij})$	Residential moves between local authorities based on NHS Patient Register	Dependent	Office for National Statistics[86]
Distance between i and j $(Dist_{ij})$	Euclidean distance between the centre[87] of the boroughs	Independent	Greater London Authority[88]
Housing costs in i and j	Mean and median borough-level private rent $(Rent\_mean_i, Rent\_mean_j)$ and $(Rent\_median_i, Rent\_median_j)$; Mean and median borough-level housing price $(Sale\_mean_i, Sale\_mean_j)$ and $(Sale\_median_i, Sale\_median_j)$	Independent	Valuation Office Agency[89] Land Registry [90]
Income level in i and j	Mean and median borough-level income of taxpayers $(Income\_mean_i, Income\_mean_j)$ and $(Income\_median_i, Income\_median_j)$	Independent	HM Revenue & Customs[91]
Proximity to Central London[92] in i and j	Distance to Central London: driving distance $(London_i, London_j)$, driving time $(London\_dri_i, London\_dri_j)$, public transport time $(London\_pub_i, London\_pub_j)$ [93]	Independent	Google Map
Public transport access in i and j $(PTAL_i, PTAL_j)$	PTAL is a measure of accessibility of a point to the public transport network, which also considers walk access time and service availability. The lower the value is, the worse the accessibly level is.	Independent	Transport for London[94]

[85] i and j are corresponding London boroughs.
[86] Data source: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/migrationwithintheuk
[87] The centre of a borough is defined as the centroid determined by software QGIS.
[88] Data source: https://data.london.gov.uk/dataset/statistical-gis-boundary-files-london
[89] Data source: https://data.london.gov.uk/dataset/average-private-rents-borough
[90] Data source: https://data.london.gov.uk/dataset/average-house-prices
[91] Data source: https://data.london.gov.uk/dataset/average-income-tax-payers-borough
[92] Central London is defined as 'Holborn, London', based on Ahlfeldt and Kavetsos's (2014) research.
[93] The driving and the public transportation time length are the shortest time required on Monday at 8:00am to approximate the time required to for a typical commute.
[94] Data source: https://data.london.gov.uk/dataset/public-transport-accessibility-levels

Variable	Definition	Type	Data Source
Education quality in i and j (Edu_i, Edu_j)	Average GCSE and equivalents point score per pupil, based on the old grading system before 2016 and the new system afterwards	Independent	Department of Education (old system[95] and new system[96])
Population in i and j $(Population_i, Population_j)$	Population are projected based on housing-led model and Office for National Statistics Mid-Year Estimates	Independent	Greater London Authority[97]
Area sizes in i and j $(Area_i, Area_j)$	Area sizes are in square kilometres	Independent	Greater London Authority[98]
Access to public open space and nature in i and j $(Green_i, Green_j)$	Percentage of households with access of at least one open space	Independent	Greenspace Information for Greater London CIC (GiGL)[99]
Adjacency (Adj_{ij})	$Adj_{ij} = 1$ if i and j are rook-adjacent; and 0 otherwise	Independent/ Dummy	Determined from map

95 Data source: https://data.london.gov.uk/dataset/gcse-results-by-borough--old-grading-system-
96 Data source: https://data.london.gov.uk/dataset/gcse-results-by-borough
97 Data source: https://data.london.gov.uk/dataset/land-area-and-population-density-ward-and-borough
98 Data source: https://data.london.gov.uk/dataset/land-area-and-population-density-ward-and-borough
99 Data source: https://data.london.gov.uk/dataset/access-public-open-space-and-nature-ward

One of the limitations of the gravity model is that it encounters difficulties when the data set includes negative or zero values, since it is not possible to take natural logs of zeros or negative values. One solution is deleting the zero values (Burger, van Oort and Linders, 2009), which is the approach that this study takes. However, the downside to such a solution is that it is not able to consider the relevant information on pairs of boroughs where there are no relocation flows. Nevertheless, the drawback does not have a significant impact on the results of the study. Examining the data sets shows that only two data sets are deleted for including zero values.

b. Agent-based modelling

Table 7.5 Data to construct ABM: definition and data source

Variable	Definition	Data Source
Agent Characteristics		
Education	Qualification level of working age population[100]	Office for National Statistics[101]
Income	Median gross earnings per capita	Office for National Statistics[102] HM Revenue & Customs[103] [104]
Ethnicity	Population percentage based on ethnicity	Office for National Statistics[105]
Religious belief	Population percentage of different religious identities	Office for National Statistics [106]
Neighbourhood characteristics		
Distance between boroughs	The Euclidean distance between the centroids of two boroughs	Greater London Authority[107]
Job density	Calculated as the number of jobs per capita of working age (for males and females between the age of 16 and 64),	Office for National Statistics[108]
Access to open and green space	Percentage of households with access to at least one open space	Greenspace Information for Greater London CIC
Income	Mean income (personal incomes by tax year) based on the Survey of Personal Incomes by HMRC	HM Revenue & Customs[109]
Rental price	Median private rental prices for boroughs	Valuation Office Agency[110]

[100] The qualification level is divided into the following 6 categories: 1) No qualification (no academic or professional qualification); 2) Level 1 (1 – 4 GCSEs or equivalent); 3) Level 2 (5+ GCSEs or equivalent); 4) Trade apprenticeship (Apprenticeship); 5) Level 3 (2+ A-levels or equivalent); 6) Level 4+ (Degree or above).

[101] Data source: https://data.london.gov.uk/dataset/qualifications-working-age-population-nvq-borough

[102] Data source: https://data.london.gov.uk/dataset/earnings-place-residence-borough

[103] Data source: https://www.gov.uk/government/statistics/percentile-points-from-1-to-99-for-total-income-before-and-after-tax

[104] The data on gross earnings per capital of each borough in London is from Office for National Statistics (2019). In order to construct the income distribution, the data of *Percentile point from 1 to 99 for total income before and after tax* published by HM Revenue & Customs is used. The dataset contains the percentile points of before tax income in the U.K. for each year between 2012 and 2017. For the income distribution of each borough, the distribution accordingly by comparing the median income to the 50th percentile of the distribution is adjusted.

[105] Data source: https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/national-and-regional-populations/regional-ethnic-diversity/latest

[106] Data source: https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/religion

[107] Data source: https://data.london.gov.uk/dataset/statistical-gis-boundary-files-london

[108] Data source: https://data.london.gov.uk/dataset/jobs-and-job-density-borough

[109] Data source: https://data.london.gov.uk/dataset/average-income-tax-payers-borough

[110] Data source: https://data.london.gov.uk/dataset/average-private-rents-borough

7.4 Results and Findings

7.4.1 Gravity model results

An initial examination of the data suggests that most of the relocation occurs between boroughs that are either adjacent or close to each other. Table 7.6 suggests that a significant proportion of the population that moved between London boroughs were below the age of 18, suggesting a large proportion of moves associated with family relocation. Table 7.7 outlines the test results for the gravity model. Models (1) – (7) are the results from running the model on the entire data sample and year-specific data samples between 2012 and 2017.[111] The overall results vary little amongst the samples of different years.

Table 7.6 Age distribution of relocation population (% in a given year)

	2011	2012	2013	2014	2015	2016	2017	2018
Total	78354	69942	71818	72063	72674	74639	77535	78996
<18	19%	20%	20%	21%	20%	21%	20%	20%
18-20	6%	5%	5%	5%	4%	5%	5%	5%
21-29	23%	20%	20%	19%	19%	19%	19%	19%
30-39	22%	22%	21%	21%	21%	21%	21%	20%
40-49	12%	14%	14%	14%	14%	14%	14%	14%
50-59	8%	9%	9%	9%	9%	9%	10%	10%
60-69	4%	5%	5%	6%	6%	6%	6%	6%
>69	5%	6%	6%	6%	6%	6%	6%	6%

Overall, the adj-R^2 suggests that the gravity model can explain over 65% of the inter-borough relocation in London. Most of the relocation behaviour is explained by proximity between the origin and the destination, where $Dist_{ij}$ is statistically significant with a negative coefficient of around -0.9. In other words, a 1% decrease in the distance results in 0.9% increase in relocation flow. The significance of the variable along with the sign of its coefficient align with the predictions of the gravity model. Given that London is a city and that the cost of moving should not vary significantly between location pairs that are close to and far away from each other, the preference towards areas that are within close proximity therefore may be due to individuals' preferences to live in areas with which they are familiar. However, relocation is not more likely to occur between adjacent local authorities as the independent variable Adj_{ij} is not statistically

[111] Alternative tests which include the same variables with the addition of education quality show that education quality does not play any role in determining relocation decision. The results are outlined in Table 0.26 in Appendix-Chapter 7.

significant. On the other hand, the population sizes of the origin points and destinations, which are proxies for the sizes of the two locations, are also found to not be statistically significant. Comparing the results between $London\_pub_i$ and $London\_pub_j$, their respective signs suggest that residents that previously lived near central London are more likely to move to areas further away.

Furthermore, the results suggest that house prices in the origin local authority are positively correlated with relocation flows. The higher the house price of the origin borough, the more likely that an outward relocation occurred. The opposite was also the case. This may be due to households possessing more purchasing power when they were able to sell their properties in more expensive boroughs. Combined with the conclusions from Table 7.6, it appears that a large proportion of moves were motivated by households wanting more space. This is possibly due to changes in family structure or the ages of children. As a result, they tended to move from places with higher average housing costs to places with lower costs.

The 'family moving' explanation of internal relocation also aligns with the following four observations. First, the reasoning also aligns with the results of $Green_j$, which is positive, statistically significant, and high in magnitude. It implies that movers were attracted to green spaces, which may also be due to the demand for outdoor space for child rearing. Second, most moves occurred between local authorities that are close to each other. It is possible that parents liked to keep their children in the same school catchment area to avoid school changes, which may affect the child's educational development. The result is also consistent with the insignificant role that education quality plays in determining relocation flows (Table 0.26 in Appendix-Chapter 7). Third, the reasoning is also consistent with the findings of $London\_pub_i$ and $London\_pub_j$, where relocation occurred in the direction from areas closer to central London towards areas further away. Fourth, income did not play a consistently significant role in determining relocation behaviour as other earlier empirical studies predicted. Therefore, it rules out the possibility that the moves occurred to pursue better employment opportunities.

Table 7.7 Empirical test results of the gravity model: All age group

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN i and j (natural log). The independent variables are DISTANCE BETWEEN i and j, respective POPULATION IN i and j (natural log), MEDIAN HOUSING SALES PRICE IN i and j (natural log), MEDIAN INCOME LEVEL IN i and j (natural log), PUBLIC TRANSPOT ACCESSIBILITY TO CENTRAL LONDON FROM i and j (natural log), ENVIRONMENT SCORE IN i and j (natural log) and WHETHER OR NOT i and j ARE ADJACENT (dummy variable). The estimation method is OLS based on gravity model. Model (1) – (7) represent the respective test results on the entire population of all years, and individual years between 2012 and 2017.

	(1) All	(2) 2012	(3) 2013	(4) 2014	(5) 2015	(6) 2016	(7) 2017
$Dist_{ij}$	**-0.861*****	**-0.933*****	**-0.892*****	**-0.877*****	**-0.853*****	**-0.895*****	**-0.851*****
$Population_i$	-0.104	0.105	-0.507**	-0.143	-0.293	-0.522**	2.924***
$Population_j$	0.0969	0.138	0.148	0.172	0.00282	0.00522	-0.0101
$Sale\_median_i$	**0.679*****	**0.549*****	**0.502*****	**0.547*****	**0.515*****	**0.635*****	**0.401*****
$Sale\_median_j$	0.0523	0.0283	-0.108	-0.0723	-0.167*	-0.267**	-0.0983
$Income\_median_i$	**-2.268*****	**-2.207*****	**-1.905*****	**-2.352*****	**-1.886*****	**-1.987*****	**-1.843*****
$Income\_median_j$	**0.493*****	**0.521*****	**0.387***	**0.437***	**0.266**	**0.222**	**0.383****
$London\_pub_i$	**-0.109*****	**-0.118***	**-0.175*****	**-0.211*****	**-0.167*****	**-0.153****	**-0.140*****
$London\_pub_j$	0.0807***	0.0501	0.0114	-0.00103	0.0261	0.0480	0.0314
$Green_i$	0.148***	0.0550	0.126*	0.196***	0.164***	0.140**	0.0422
$Green_j$	**0.260*****	**0.274*****	**0.235*****	**0.265*****	**0.236*****	**0.196*****	**0.202*****
Adj_{ij}	0.0315	0.00914	0.0353	0.0181	0.0356	-0.000519	-0.0216
Cons	18.88***	20.13***	21.11***	23.46***	21.07***	22.67***	13.68***
N	5952	992	992	992	992	992	992
adj. R^2	0.655	0.680	0.665	0.659	0.666	0.657	0.669

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7.8 outlines the robustness test results, which use mean values for housing sales and income levels in model (8), approximates of the sizes of the borough using area sizes instead of population sizes in model (9), approximates of proximity to central London using driving time during peak commuting hour in (10), and approximates of proximity to London using driving distance during peak commuting hour in (11). The results of the robustness tests align with primary findings, which also give very similar levels of goodness-of-fit.

Table 7.8 Robustness test: All age groups

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN i and j (natural log). The independent variables are DISTANCE BETWEEN i and j, respective POPULATION IN i and j (natural log), MEDIAN HOUSING SALES PRICE IN i and j (natural log), GEOGRAPHIC SIZES IN i and j (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM i and j (natural log), DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM i and j (natural log) , DISTANCE TO CENTRAL LONDON FROM i and j (natural log) and WHETHER OR NOT i and j ARE ADJACENT (dummy variable). The estimation method is OLS based on gravity model. Model (8) – (11) represent the respective robustness test results on the entire population of all years. Model (8) excludes GEOGRAPHIC SIZES IN i and j, DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM i and j, and DISTANCE TO CENTRAL LONDON FROM i and j. Model (9) excludes POPULATION IN i and j, DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM i and j, and DISTANCE TO CENTRAL LONDON FROM i and j. Model (10) excludes GEOGRAPHIC SIZES IN i and j, PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM i and j, and DISTANCE TO CENTRAL LONDON FROM i and j Model (11) excludes GEOGRAPHIC SIZES IN i and j, PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM i and j, and DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM i and j.

	(8)	(9)	(10)	(11)
$Dist_{ij}$	**-0.859*** **	**-0.859*** **	**-0.879*** **	**-0.876*** **
$Population_i$	-0.168*		-0.165*	-0.166*
$Population_j$	0.108		0.105	0.103
$Area_i$		-0.0330		
$Area_j$		0.0284		
$Sale\_mean_i$	-0.0261*	-0.0269*	-0.00492	-0.0124
$Sale\_mean_j$	**-0.189*** **	**-0.189*** **	**-0.166*** **	**-0.180*** **
$London\_pub_i$	-0.0390*	-0.0392*		
$London\_pub_j$	0.0609**	0.0610**		
$London\_dri_i$			0.0392*	
$London\_dri_j$			0.128***	
$London_i$				0.0110
$London_j$				0.0709***
$Green_i$	**-0.0819*** **	**-0.0808*** **	**-0.123*** **	**-0.105*** **
$Green_j$	**0.218*** **	**0.218*** **	**0.148*** **	**0.171*** **
Adj_{ij}	0.0539**	0.0533**	0.0347	0.0367
Cons	8.459***	8.321***	7.800***	8.346***
N	5952	5952	5952	5952
adj. R^2	0.618	0.618	0.620	0.619

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

If the results of Table 7.7 were primarily driven by samples of families from a large under-18 population and family-rearing age population, examining the group of inter-borough migrants that were not in families may potentially yield different results. Table 7.9 outlines the results of testing the gravity model only on inter-borough relocators that were between the ages of 20 and 29. The assumption is that residents below the age of 30 were less likely to have formed families, and therefore were more likely to move for personal reasons. On the other hand, residents between the age of 18 and 20 may have moved for higher education, whereas residents below the age of 18 were most likely to move as part of their families. The findings in Table 7.9 support the hypothesis, suggesting that inter-borough migrants between the ages of 20 and 29 were more likely to move for higher incomes, where boroughs with higher median income levels were less likely to lose their residents and were more attractive to newcomers. Contrasted with the results found in Table 7.7, which tests the entire population sample, the empirical test results in Table 7.9 suggest that residents belonging to the age group between 20 and 29 were unlikely to move into adjacent boroughs. Finally, similarly to the findings from the empirical tests on the entire data sample, residents living in boroughs with high average house prices were more likely to migrate. In addition, boroughs with high access to open and green space were also more attractive to migrants.

Contrary results exist regarding preferences for proximity to central London. Whilst the empirical test results on the entire data sample suggested that inter-borough relocation typically occurred from areas closer to central London to areas further away from central London, the opposite is true for residents between the ages of 20 and 29. Areas that are located further away from central London were less attractive to residents belonging to that age group. On the other hand, areas that are located further away from central London were also less likely to have relocation outflows. This implies that residents who already lived close to central London were more likely to move even closer to the centre. Additional tests outlined in Table 7.10 also suggest that boroughs with high median rent levels were less attractive to young adult residents. Nevertheless, the result is not consistently statistically significant across all years.

The findings relating to 20 to 29-year olds can provide more direct guidance to mobility schemes such as Housing Moves, since its objective is to reduce the friction incurred in employment-driven inter-borough movements. As a result, the findings of models (12) – (18) will be used to construct the utility function for individuals in the ABM. However, compared to the empirical test results on the full sample, the results on the age group between 20 and 29 have much lower goodness-of-fit. The empirical model on the full sample has over 65% explanatory power, whereas the latter only has approximately 38% explanatory power. ABM can potentially help find the unobserved variables.

When translating the results of the gravity model into decision-making processes in ABM, there are two key implications. First, the determinants of the utility function when making relocation decisions include income level, average education levels, and transportation access. This is based on the empirical findings which suggest the significant role income levels play in driving relocation decisions for the age group between 20 and 29. On the other hand, education level is used as an indicator on the suitability of the potential employment opportunities for a given individual. Second, housing affordability is used as a proxy for the income constraint in the utility maximisation function.

Table 7.9 Empirical test results of the gravity model: Age group 20 – 29

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN i and j (natural log). The independent variables are DISTANCE BETWEEN i and j, respective POPULATION IN i and j (natural log), MEDIAN HOUSING SALES PRICE IN i and j (natural log), MEDIAN INCOME LEVEL IN i and j (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM i and j (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM i and j (natural log), ENVIRONMENT SCORE IN i and j (natural log) and WHETHER OR NOT i and j ARE ADJACENT (dummy variable). The estimation method is OLS. Model (12) – (18) represent the respective test results on the 20-29 population of all years, as well as individual years between 2012 and 2017.

	(12) All	(13) 2012	(14) 2013	(15) 2014	(16) 2015	(17) 2016	(18) 2017
$Dist_{ij}$	**-0.427*****	**-0.450*****	**-0.440*****	**-0.433*****	**-0.403*****	**-0.441*****	**-0.410*****
$Population_i$	-0.0896	0.0699	-0.157	-0.272	-0.107	-0.477**	0.822
$Population_j$	-0.00416	-0.0114	0.0473	0.0689	-0.172	0.0717	-0.103
$Sale\_median_i$	**0.349*****	**0.320*****	**0.257****	**0.377*****	**0.190***	**0.251****	**0.141***
$Sale\_median_j$	0.0840**	0.0346	0.0422	0.0985	-0.0411	-0.243**	-0.0908
$Income\_median_i$	**-1.524*****	**-1.667*****	**-1.649*****	**-2.076*****	**-1.075*****	**-1.023*****	**-0.929*****
$Income\_median_j$	**0.545*****	**0.564*****	**0.670*****	**0.678*****	**0.369***	**0.185**	**0.324***
$London\_pub_i$	-0.0228	-0.0259	-0.0664	-0.0795	-0.00776	0.00771	-0.0362
$London\_pub_j$	-0.0131	-0.0135	-0.0586	-0.0388	-0.0229	-0.0224	-0.0145
$PTAL_i$	**0.0774*****	**0.102***	**0.129****	**0.120****	**0.0832***	**0.141*****	**0.0878***
$PTAL_j$	**0.112*****	**0.155*****	**0.150*****	**0.142*****	**0.141*****	**0.146*****	**0.128*****
$Green_i$	**0.133*****	**0.109**	**0.209****	**0.280*****	**0.0894**	**0.153***	**0.0937**
$Green_j$	**0.143*****	**0.195****	**0.221*****	**0.174****	**0.164****	**0.0952**	**0.120***
Adj_{ij}	**-0.113*****	**-0.121****	**-0.121****	**-0.118****	**-0.0920***	**-0.103***	**-0.132*****
Cons	12.79***	14.64***	15.42***	17.64***	12.25***	13.85***	9.893***
N	5950	992	992	991	991	992	992
adj. R^2	0.371	0.393	0.383	0.374	0.359	0.396	0.370

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7.10 Empirical test results of the gravity model: Age group 20 – 29 (Using median rent levels as proxies for housing costs)

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN i and j (natural log). The independent variables are DISTANCE BETWEEN i and j, respective POPULATION IN i and j (natural log), MEDIAN RENTAL COST IN i and j (natural log), MEDIAN INCOME LEVEL IN i and j (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM i and j (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM i and j (natural log), ENVIRONMENT SCORE IN i and j (natural log) and WHETHER OR NOT i and j ARE ADJACENT (dummy variable). The estimation method is OLS. Model (19) – (25) represent the respective test results on the 20-29 population of all years, as well as individual years between 2012 and 2017.

	(19) All	(20) 2012	(21) 2013	(22) 2014	(23) 2015	(24) 2016	(25) 2017
$Dist_{ij}$	**-0.424*****	**-0.448*****	**-0.434*****	**-0.434*****	**-0.400*****	**-0.443*****	**-0.415*****
$Population_i$	-0.0810	0.145	-0.225	-0.237	-0.276	-0.529**	0.951
$Population_j$	-0.000268	-0.0139	0.0443	0.0703	-0.165	0.0742	-0.105
$Rent\_median_i$	0.136***	0.0386	-0.358***	-0.110	-0.264*	-0.0955	-0.280**
$Rent\_median_j$	0.0599	**-0.0959**	**-0.313****	**-0.208***	**-0.413****	**-0.310****	**-0.332*****
$Income\_median_i$	**-0.795*****	**-1.111*****	**-0.904*****	**-0.925*****	**-0.393***	**-0.826*****	**-0.671*****
$Income\_median_j$	**0.377*****	**0.471*****	**0.487*****	**0.329****	**0.174**	**0.416*****	**0.359*****
$London\_pub_i$	-0.0139	-0.0445	-0.0835	-0.0821	-0.00999	0.00407	-0.0370
$London\_pub_j$	-0.00391	-0.0201	-0.0707	-0.0525	-0.0304	-0.0291	-0.0115
$PTAL_i$	**0.104*****	**0.143****	**0.190*****	**0.161*****	**0.159*****	**0.191*****	**0.143*****
$PTAL_j$	**0.109*****	**0.169*****	**0.183*****	**0.160*****	**0.189*****	**0.146*****	**0.155*****
$Green_i$	0.0940***	0.102	0.123	0.176**	0.0845	0.131*	0.0802
$Green_j$	0.124***	0.188**	0.176**	0.117	0.157**	0.0903	0.113*
Adj_{ij}	**-0.103*****	**-0.113***	**-0.104***	**-0.110***	**-0.0851***	**-0.104***	**-0.133*****
Cons	9.766***	13.69***	16.34***	14.44***	11.69***	14.66***	11.39***
	(0.535)	(1.427)	(1.452)	(1.579)	(1.390)	(1.556)	(2.010)
N	5950	992	992	991	991	992	992
adj. R^2	0.354	0.383	0.389	0.362	0.364	0.390	0.377

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7.4.2 Agent-based modelling results

For the ABM programming, I use Spyder 4.1.3 which is based on the computational language Python. The key benefits of using a Python-based computational language include the open-source nature of the platform, and the simple application of the agent-based programming. Due to limitations of computational power on personal computers, I use Amazon Web Services (AWS), which is a free online cloud service provided by Amazon to run the programmes. The specific product that I use is EC2, which is a virtual machine service that behaves like a fully functioning computer. The link to access EC2 via AWS is: aws.amazon.com/ec2

This section outlines the results of:

- Model (1) – Relocation decisions are made based on the baseline hedonic model. The construction of the model is based on the results on objective preferences from the gravity models;
- Model (2) – Relocation decisions that consider both objective and subjective preferences: 2a) When the endowment effect is considered in the model; 2b) When both the endowment effect and preference towards living with people who are similar are considered in the model;
- Model (3) - Relocation decisions contain herding behaviour: 3a) When herding towards friends is considered in the model; 3b) When herding towards both friends and the public is considered in the model.

Model (2) aims to consider psychological and social decision rules. More specifically, model 2(a) considers the scenario when endowment effect exists in the decision-making process and model 2(b) considers the role of social networks. On the other hand, model (3) considers the influence of others' decisions on individuals' decisions. Since the input values are multi-dimensional, they can result in many combinations. It is not possible to outline all the possible scenarios. Therefore, several representative cases are outlined here. Figure 7.3 to Figure 7.7 illustrate the results for the selected scenarios in Table 7.11.[112] Due to limitations in personal computing capacity, the set up assumes that there are 1000 residents in the system.

[112] $\text{objective(distance)} = 0.7$ in all the models.

Table 7.11 Weighting of inputs in moving decision function

Model	Figures	Objective (others)	Subjective	Friends' choice	Public choice	Endowment
1	Figure 7.3	0.7	0	0	0	0
2a)	Figure 7.4	0.7	0	0	0	1.2
2b)	Figure 7.5	0.35	0.35	0	0	1.2
3a)	Figure 7.6	0.3	0.2	0.2	0	1.2
3b)	Figure 7.7	0.2	0.2	0.2	0.1	1.2

The figures outlined in Figure 7.3 to Figure 7.7 draw the following key observations from the findings. First, when preference is formed based on objective factors and agents do not herd towards public opinion, all boroughs seem to end up with evenly distributed waiting lists in the long-term. However, migration concentrates in Bromley for the first few rounds due to higher quality of living and affordable rental prices in the area. Similar patterns are also observed when individuals herd towards decisions made by their friends (Figure 7.6) or the general public (Figure 7.7). Second, when endowment effect is taken into account (Figure 7.4), where residents rate their neighbourhoods 20% higher than other ones, residents are less likely to move. In this case, most of the residents concentrated in Bromley. Similar patterns of concentration are also observed when both endowment effect and subjective preference towards living with people from similar SESs are considered (Figure 7.5).

Figure 7.3 ABM Model 1 results: 2012 – 2017

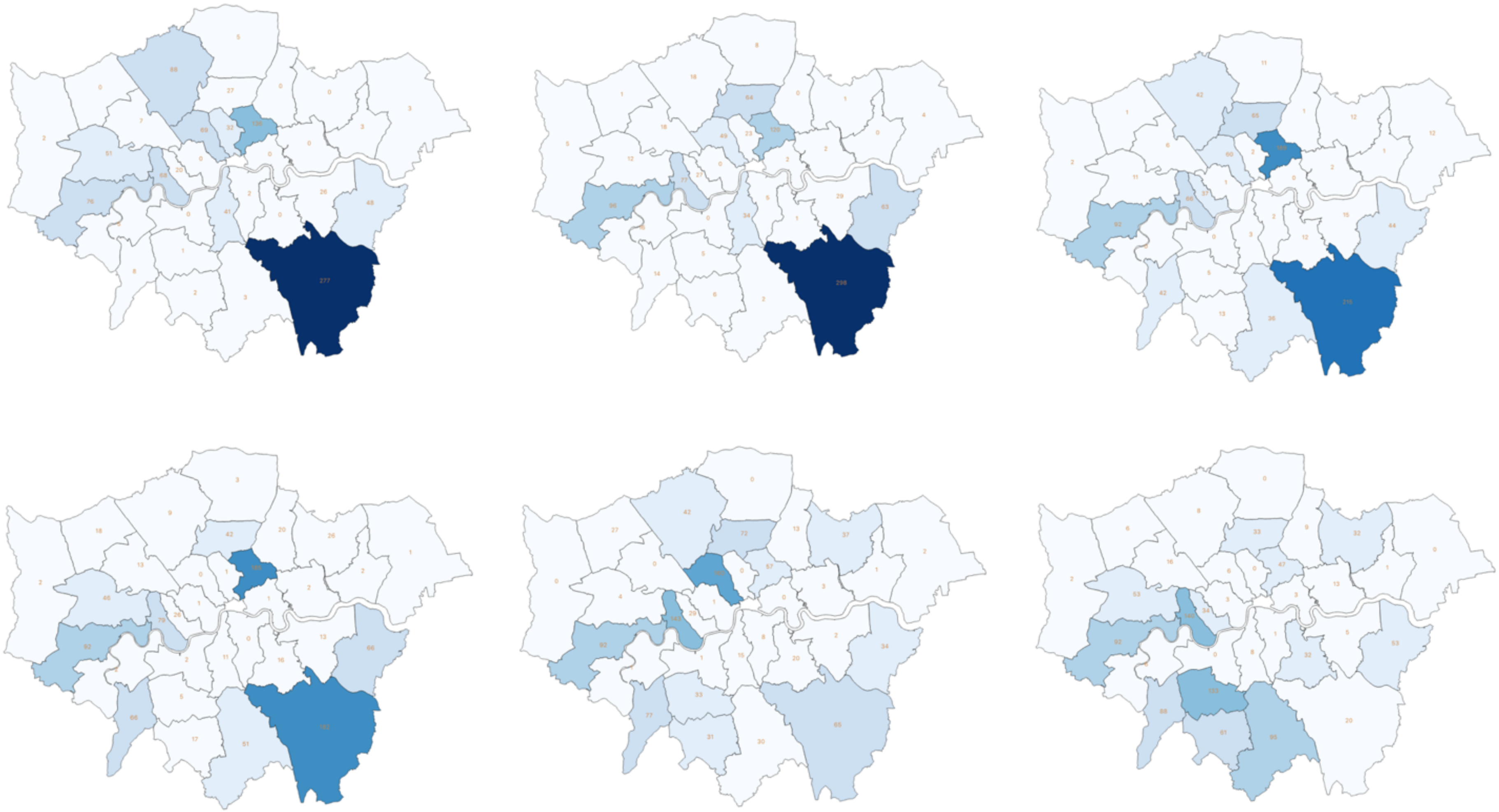


Figure 7.4 ABM Model 2(a) results: 2012 – 2017

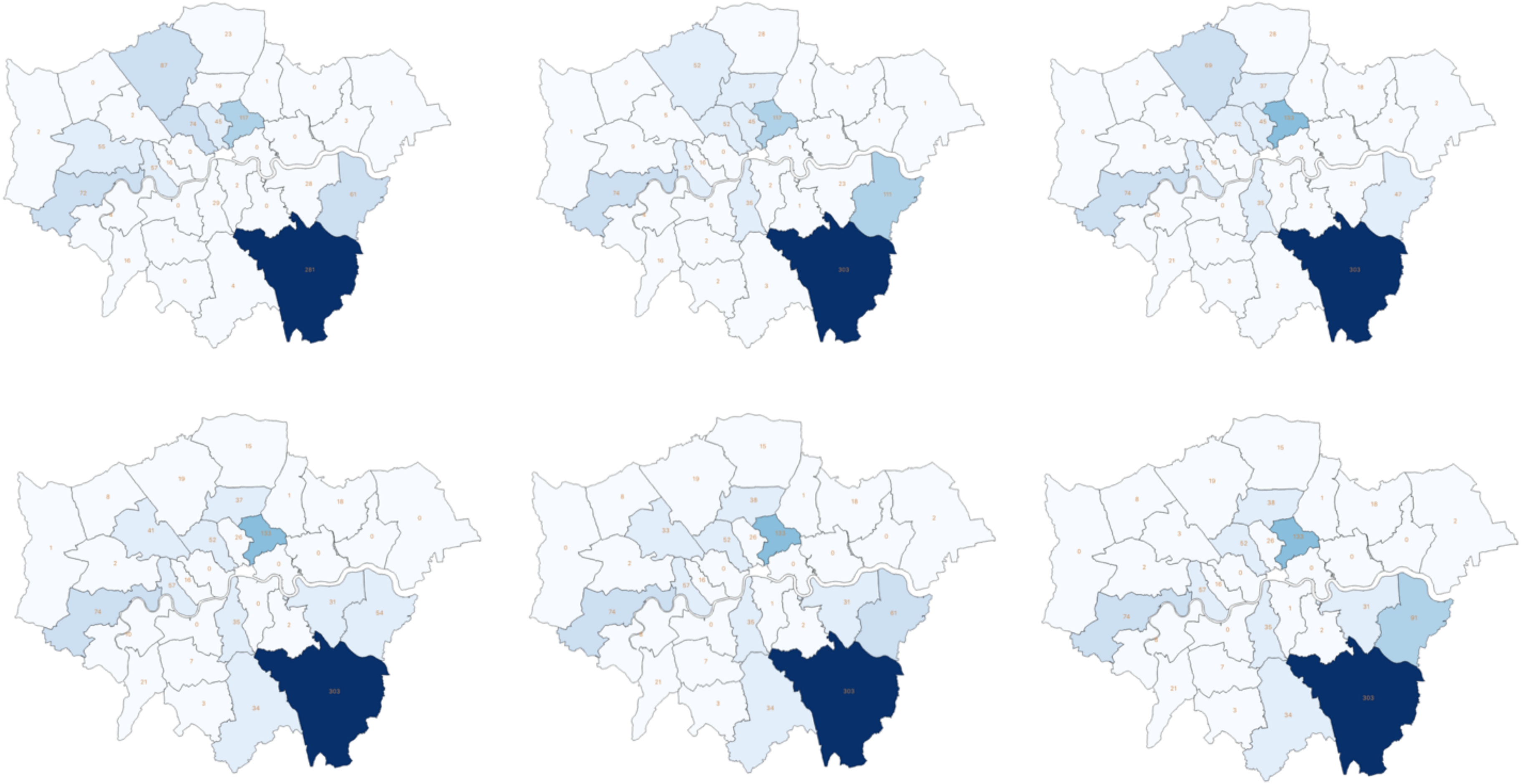


Figure 7.5 ABM Model 2(b) results: 2012 – 2017

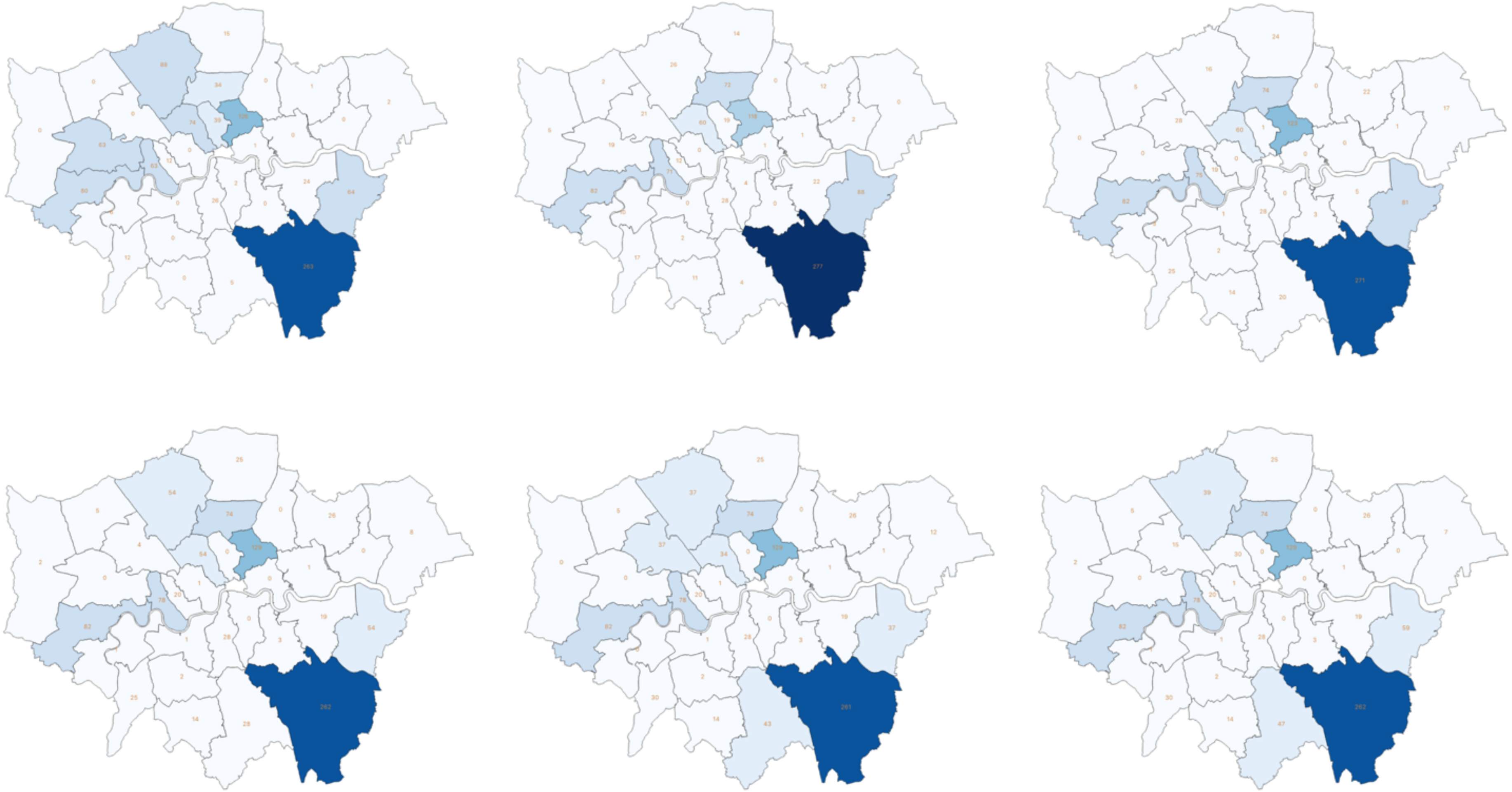


Figure 7.6 ABM Model 3(a) results: 2012 – 2017

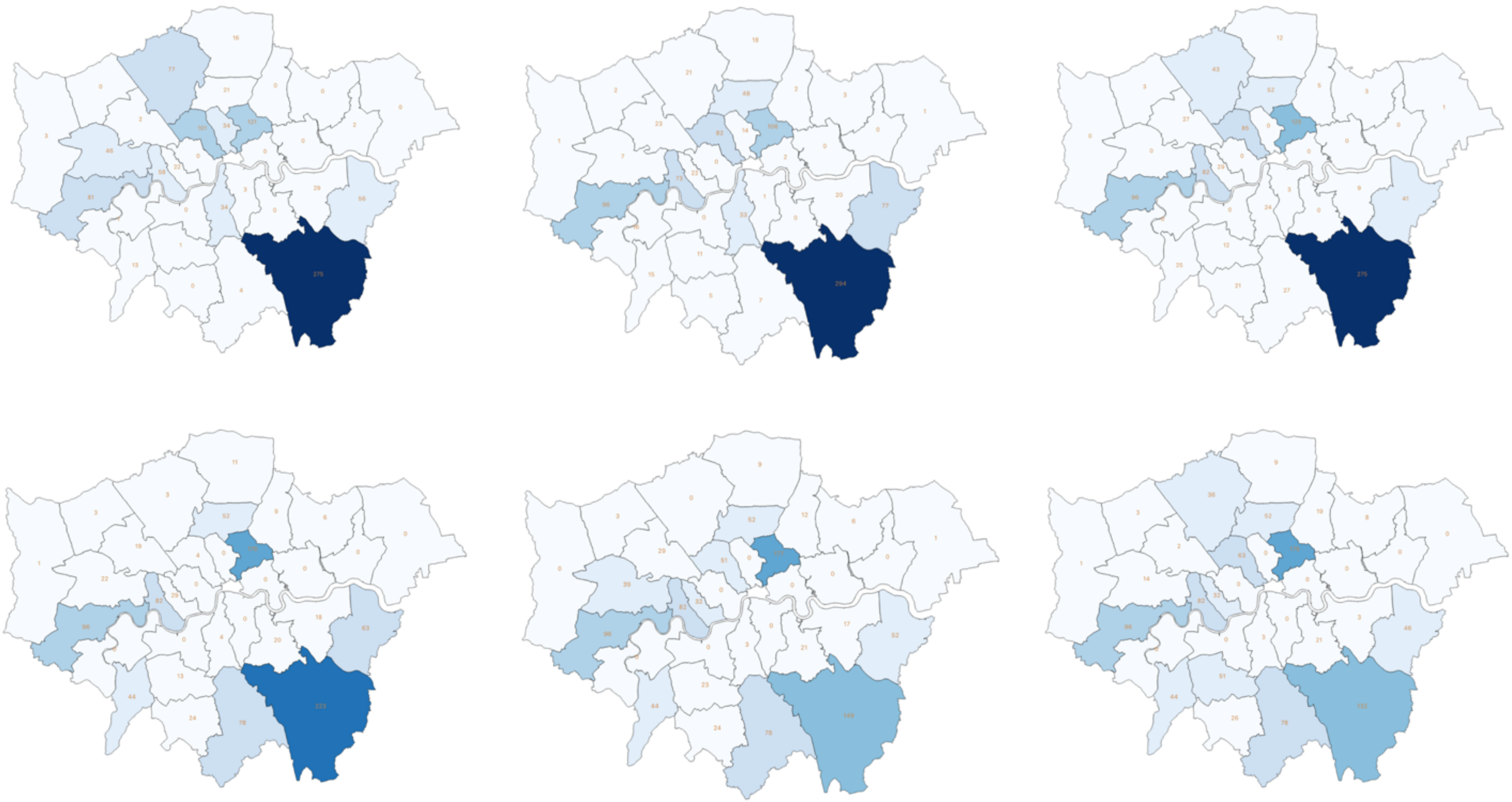
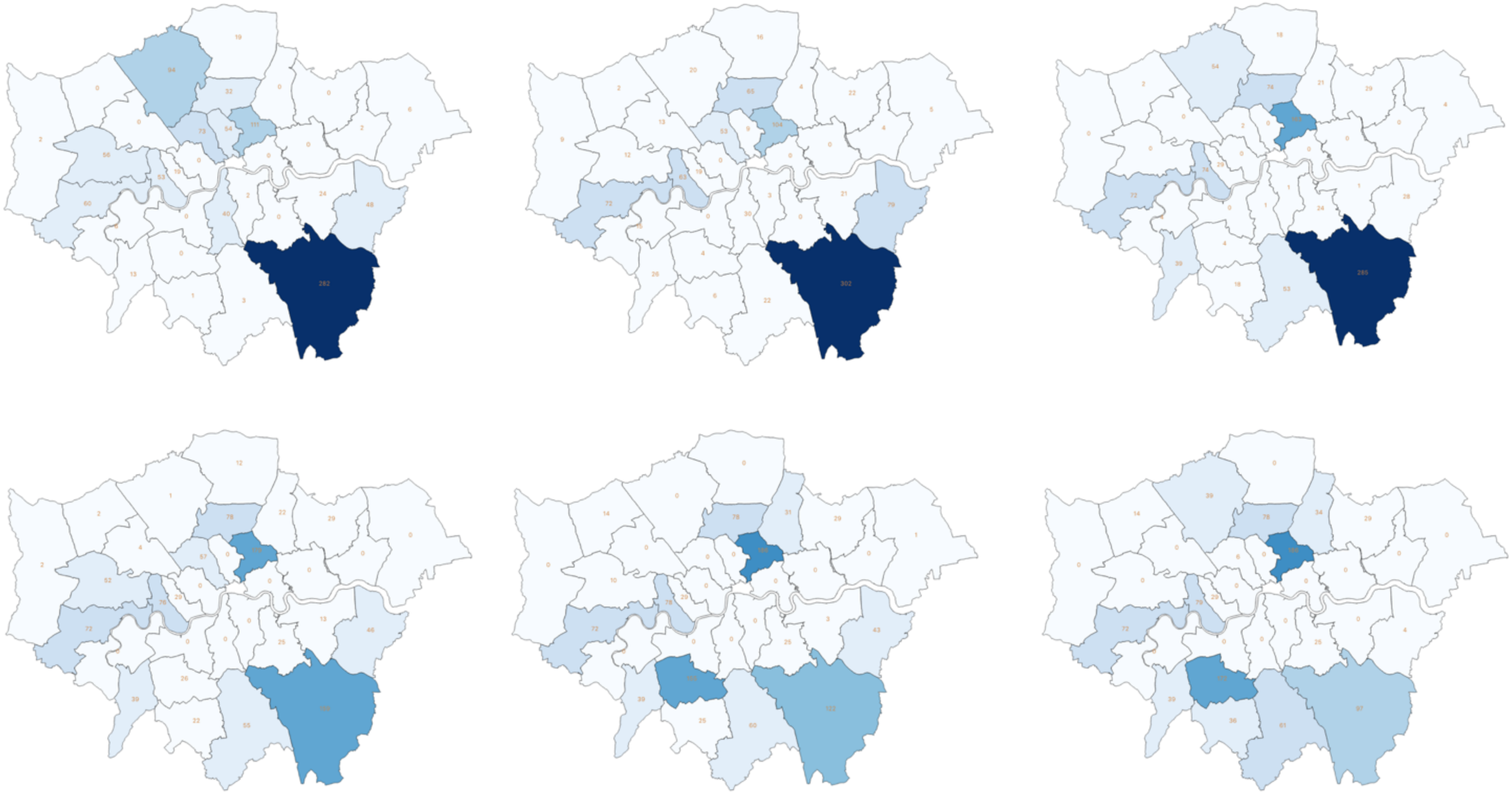


Figure 7.7 ABM Model 3(b) results: 2012 – 2017



7.4.3 Forecast and effectiveness of mobility schemes

The concentration of relocated population in Bromley for some of the models do not agree with the empirical data, which does not suggest a similar pattern. This is because ABM measures the intention of relocation, whereas the empirical data on inter-borough migration measures the actual behaviour. This differs as the intention of relocation does not necessarily translate into actual migration behaviour since residents with moving intentions may not find a place to live in.

To examine the differences between the predicted and actual values, I calculate the mean absolute percent error (MAPE), where:

$$\mathrm{MAPE} = \left[\frac{1}{n}\sum_{i=1}^{n}\frac{\left|\tilde{Y}_i - Y_i\right|}{|Y_i|}\right] \times 100\%$$

Where Y_i and $\tilde{Y}_i$ are the predicted migration intention in ABM and the actual observed migration behaviour respectively.

To calculate the MAPE of the predicted values, the ranking of the predicted inflow and outflow of a given borough i in year t is compared to the actual ranking of inflow and outflow of relocation.

- **MAPE for ABM output**

The MAPE for the ABM outputs for models 1, 2(a), 2(b), 3(a) and 3(b) in terms of inflow relocation and outflow relocation is outlined in Table 7.12 and Table 7.13. The results suggest that model 1, which assumes that agents make entirely objective decisions, has the highest MAPE for both measures. This suggests it has the least accuracy. The model that provides the best overall accuracy are the models with the endowment effect 2(b) and where both the endowment effect and subjective preferences are considered. Apart from model 1, all other models observed improved MAPE over the long term.

Table 7.12 MAPE for inflow relocation

Model	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
1	1.7774	1.7370	2.1442	2.1967	2.1152	2.0629	2.0056
2(a)	1.7367	1.7443	1.8919	1.9552	2.0014	2.0067	1.8893
2(b)	1.7533	1.7995	1.5581	0.8324	0.9033	0.8097	1.2761
3(a)	1.7257	1.5827	1.4670	1.1881	1.2175	1.0220	1.3672
3(b)	2.1079	1.7073	1.4714	1.1562	0.9450	0.8486	1.3727

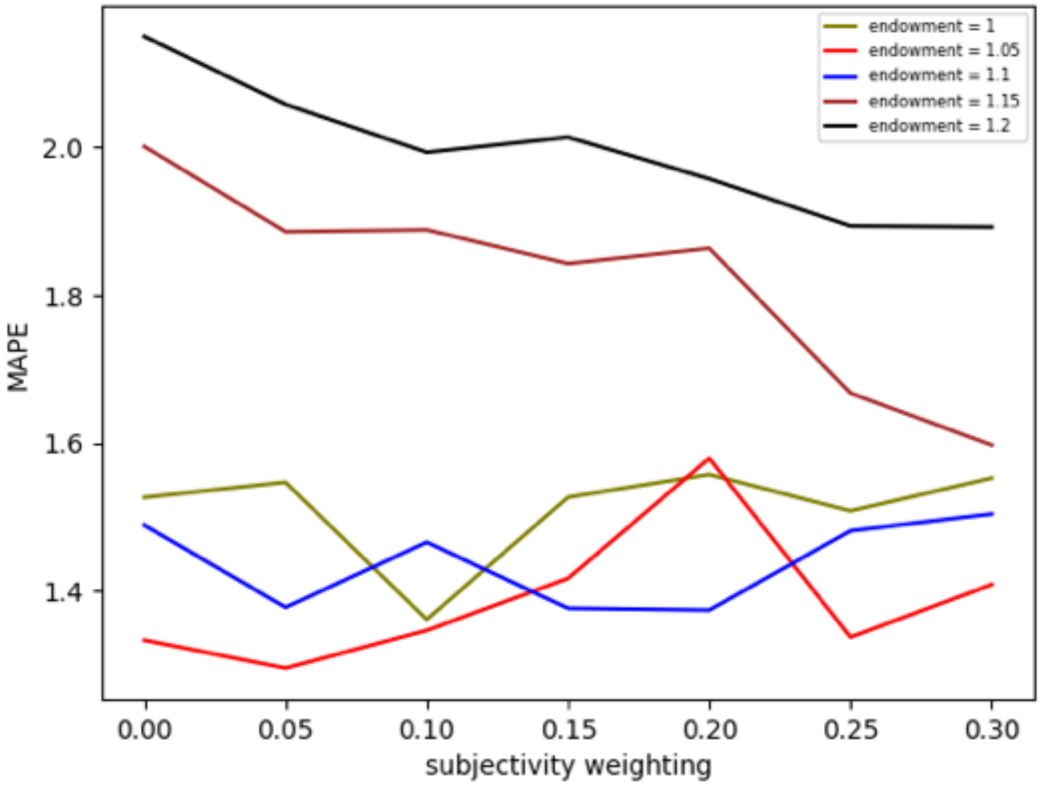
Table 7.13 MAPE for outflow relocation

Model	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
1	1.5944	1.4864	1.8863	2.4939	2.0113	1.2641	1.7894
2(a)	1.1302	1.0093	0.9082	0.8400	0.8415	0.8712	0.9334
2(b)	1.1303	1.1810	1.0304	1.0154	0.8376	0.8084	1.0005
3(a)	1.7257	1.5827	1.4670	1.1881	1.2175	1.0220	1.3672
3(b)	1.2754	1.2724	1.1131	1.1931	0.8967	0.7837	1.0891

- **MAPE for subjectivity vs. endowment**

This section examines how MAPE varies with changing weightings for subjectivity and the endowment effect. Due to limitations in personal computing capacity, the set up assumes that there are 100 residents in the system. The results are outlined in Figure 7.8, where the x-axis is the weighting for subjectivity and the y-axis is the corresponding MAPE. The lines of different colours correspond to scenarios representing different levels for the endowment effect. The results reveal the following two findings. First, increasing the weighting of subjective preference does not have significant impact on MAPE when the endowment effect is low. However, when the endowment effect is high, increasing the weighting of subjective preference reduces MAPE. Second, the lowest level of MAPE occurs when the weighting for subjective preference is 0.05 and when the endowment effect is 1.05.

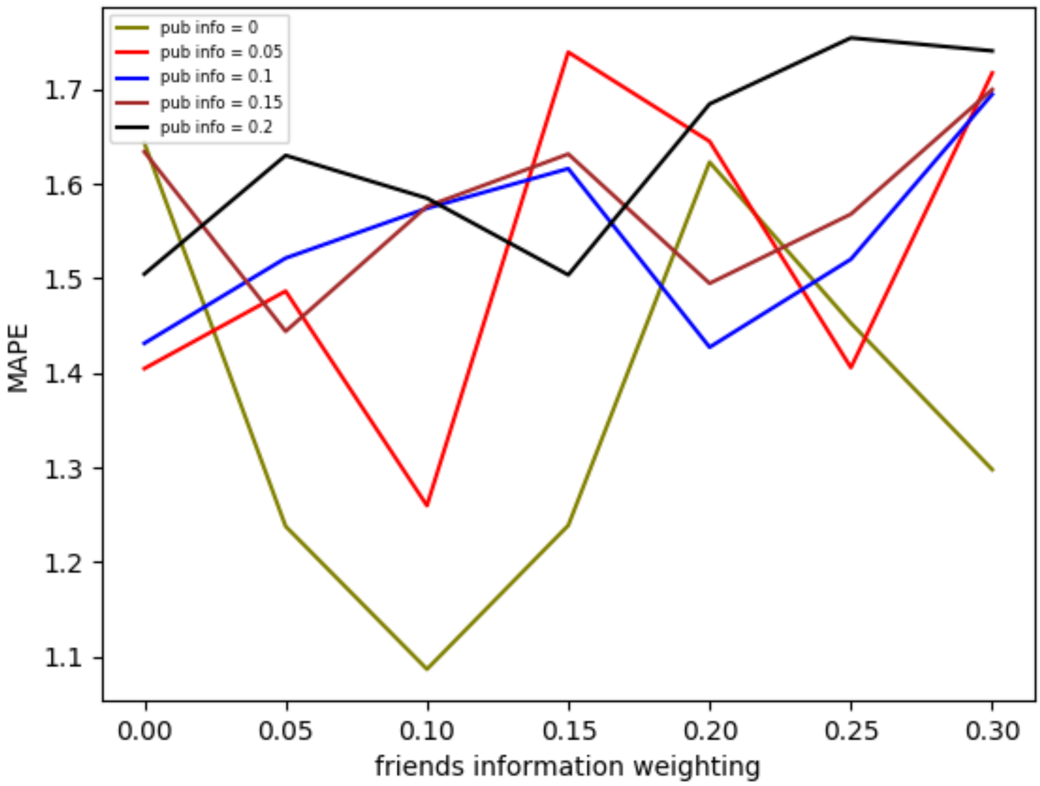
Figure 7.8 MAPE for changing weighting in subjective preference and changing endowment effect



- **MAPE for herding towards friends vs. herding towards public information**

This section examines how MAPE varies with changing weightings for herding towards friends' and public behaviour. The results are outlined in Figure 7.9, where the x-axis is the weighting for friends' behaviour and the y-axis is the corresponding MAPE. The lines of different colours correspond to scenarios representing different weightings for public information. The results produce two key findings. First, when the weighting for public information is low, the corresponding MAPE values fluctuate. However, when the weighting for public information is high, the corresponding MAPE values are consistently high. Second, even though the MAPE values combined with smaller weights for public information tend to fluctuate, both lines ('pub info = 0' and 'pub info = 0.05') hit the lowest MAPE when the weighting for friends' behaviour equals 0.1.

Figure 7.9 MAPE for changing weighting in friends' information and changing weighting in public information



7.5 Conclusion

7.5.1 Summary

The earlier chapters discussed how 'habitus' is reflected in housing choices and the use of welfare services. The conclusions from these chapters imply that individuals aim to maximise economic capital in their decision-making processes and with regards to other forms of capital. The findings may also apply to interborough relocation decisions in London. This chapter examined the drivers behind interborough relocations in London, and analysed the effectiveness of housing mobility schemes in London.

One current social housing issue is that social renters become reluctant to move once they settle in one place. The potential causes of such reluctance include the high costs associated with moving. For example, the cost of moving is estimated to be £8,451.49 (Communities and Local Government Select Committee, 2018).

Besides, social renters may need to reapply to be on social housing waiting lists once they move. The long waiting list lengths across London boroughs further increase the uncertainties associated with moving. As a result, and according to the Mayor of London (2012), social tenants are unwilling to take up job opportunities that are in another part of the city. Therefore, one of the objectives of the housing mobility scheme was to "reduce levels of worklessness in the social housing sector […] should also support households who are in employment but who need to move in order to sustain it" (Mayor of London, 2012, p. 28). Consequently, unemployment and poverty remain as issues through a continuous negative cycle. Section 7.1 reviewed the recent Greater London Authority housing mobility program, Housing Moves, and argued that labour mobility may help resolve the unemployment issue due to residential immobility. The objectives of these mobility schemes also align with the 'right of freedom of movement' as part of *The Universal Declaration of Human Rights* (The United Nations, 1948):

> "Everyone has the right to freedom of movement and residence within the borders of each state" (Article 13(1)).

Besides economic constraints, there are other non-economic constraints that may also inhibit social tenants from moving. For example, social tenants may lose their social capital, including their social network in moving, which creates additional uncertainty for moving processes. Social tenants' habitus can also result in a preference for staying instead of moving.

Given that the main objective of housing mobility schemes is to improve labour mobility across boroughs, there is a need for discussions to focus on the population that is most likely to relocate for employment-related reasons. In the second half of this chapter, the Agent-based Modelling (ABM) therefore concentrated on residents aged between 20 and 29. In the ABM, agents' decisions were formed from three steps: 1) forming objective preferences, 2) forming subjective preferences, and 3) forming the final moving decision as a combination of the two. The objective preference was based on utility maximisation, whilst the subjective preference was developed in relation to Bourdieu's social theories in the context of capital and social class. The formation of subjective preferences considers the endowment effect and herding behaviour.

Finally, the results simulated by ABM were tested against empirical data, where the accuracy of the predictions was calculated using MAPE.

The key findings of ABM include the following. First, MAPE is the lowest when individuals' moving decisions are based on objective and subjective preferences. In particular, the scenario that generates the lowest MAPE is when decisions are modelled predominantly with objective preferences, along with a small weighting on subjective preferences. Second, endowment factors also play a role in decision-making process; where MAPE is lowest n there is only a small degree of endowment effect. Finally, several factors which may hinder the implementation of housing mobility schemes in London emerged. First, in the process of the Freedom of Information request to local authorities in London, I noticed that there were issues with data management in local authorities. For example, the details of data records kept by local authorities were inconsistent. Some boroughs (e.g. Camden) showed more robust systems and governance in maintaining records. The negative consequence of poor data management is that local authorities may not achieve optimal assignment or oversight of properties. Besides, having inconsistent data management processes between different local authorities may undermine the feasibility and efficiency of housing mobility schemes.

Improving the housing mobility scheme, and improving social housing allocation can also enable better waiting list and housing stock management. The next chapter explores this perspective through comparing three different allocation schemes.

7.5.2 Limitations and future research

Nevertheless, there are limitations to this chapter, particularly in relation to ABM. First, ABM is heavily dependent on assumptions. Each input's error can aggregate to substantial errors for the output, meaning that that the simulation's outcome may heavily deviate from real-life scenarios. One of the ABM's assumptions is that all residents make relocation decisions every year, an unrealistic expectation of tenants. Second, it assumes a uniform endowment effect that is most likely to vary. However, for a given individual, the endowment effect will not be the same for different years. For example, it ought to be much higher when individuals have just moved to a place that they like, and lower when they stay with their parents. Third, this study assumes that a given agent's characteristics, such as religious beliefs, education level, income, and ethnicity, are independent of each other. However, these factors are most likely connected, and Bourdieu has also discussed how social, cultural and economic capital are interchangeable (see Section 4.2.1 in Chapter 4 for detailed discussion). Fourth, there can be an 'overfitting' issue with the ABM. Overfitting of ABM means that the model contains too many parameters, and it ends up closely describing the specific dataset rather than the general case. Finally, there is an inconsistency between the intended model and the programmed model. To resolve this potential issue, there should be greater model validation processes that check if the model performs in the researcher's intended way (Richiardi *et al.*, 2006). This study aimed to mitigate this by validating the model by comparing the simulated results to the empirical internal relocation data in London between 2012 and 2017. However, LeBaron (2000) pointed out that validation of ABM remains a very weak area. Therefore, the accuracy of the predicted results and actual empirical results remains a weakness of this study.

Both the gravity model and ABM show the limitation that they have in modelling human behaviour. Therefore, the study of human behaviour should consider incorporating elements from a philosophical perspective beyond a positivist approach. I will discuss this limitation in Section 9.3.2 in Chapter 9. Alternatively, instead of adopting a theory-driven modelling approach, policymakers can include data-driven techniques such as big data analysis and machine learning. For example, the clustering process in machine learning can help categorise agents into subgroups and assign them corresponding behavioural rules.

7.5.3 Policy implications

The differing findings to renters' preferences in different London boroughs suggest that policies may need to be localised. To an extent, localised policies take a bottom-up approach, which is built on local information (Sausman, Oborn and Barrett, 2016). The policy implications for this chapter are two-fold. The first implication relates to how mobility policies can be determined, and the second implication provides recommendations to housing mobility schemes such as Housing Moves.

First, regarding how mobility policies can be determined, the results and analysis in this chapter imply the possibility of using computational simulations, such as ABM, in policymaking and forecasting of policy effectiveness. These results suggest that the effectiveness of mobility schemes depends on how decision-makers perceive and incorporate the decisions of others. Furthermore, when there is insufficient information on social tenants' relocation behaviour, Baker (2008) suggested inputting non-social tenant relocation preferences into social housing policy development. To better use the information gained from non-social tenants, policymakers should adjust the input parameters of forecast models to fit the social renters' circumstances. ABM provides the possibility to make this adjustment.

Second, the empirical and simulation results have the following implications regarding the effectiveness of mobility schemes. First, agents' preferences to relocate to nearby areas limits the effectiveness of these schemes. Mobility schemes tend to assume that the sole factor that prevents individuals from moving across boroughs come from restrictions in housing supply in the destination neighbourhood. However, the above analysis shows that restriction in housing supply is not the only factor restraining relocation. Individuals also prefer living in familiar areas, possibly because of their existing social networks and individual habitus. This means that whilst it is important to help social tenants improve their economic capital with the assistance of mobility scheme, the scheme should not cause the loss of social capital in the process of moving. Given that both social and economic capital are the components of the overall capital, enhancing both types can help the overall empowerment of social tenants. However, under the current housing mobility schemes, such concern is not considered. Policymakers should therefore consider increasing employment opportunities locally instead of encouraging inter-borough relocations. The gravity models also show that family households move for very different reasons compared to non-family households. Therefore, local authorities should more closely consider individual situations when offering housing swaps. On the other hand, individuals with a preference to move to nearby areas may arise from endowment effects. Therefore, policymakers should consider schemes that support social renters in settling into unfamiliar neighbourhoods by familiarising them with local areas and public services.

8 Social Housing Allocation

8.1 Introduction

According to Bourdieu, ‘doxa’ is the experience whereby “the natural and social world appears as self-evident” (Bourdieu, 1977, p. 164) which “goes without saying and therefore goes unquestioned” (Bourdieu, 1977, p. 166). In today’s public policy realm, the choice agenda has become a doxa to ‘empower’ all public policy users (Hastings and Matthews, 2015). Since the 1970s, social housing allocation schemes in the U.K. have gone through a shift from Direct Offering (DO) to Choice-based Letting (CBL), in which the latter emphasises ‘individual choice’ and ‘personal responsibility’. The positive welfare implications of allowing individuals to make their own choices with regards to housing services can be traced back to welfare theories despite a number of restrictive assumptions. For example, one assumption suggests that those who demand and supply housing services are perfectly informed about the options available, and can search for potential alternatives freely. However, these assumptions are not fully apparent in real-life situations, particularly in the context of housing services. The middle-class can mobilise their cultural, social, and symbolic capital to have advantageous access to public services (Hastings and Matthews, 2015). As such, the objective of ‘choice-based’ policies, which aim to specifically ‘empower’ public service users, may inadvertently exacerbate existent inequality and social divides. The notion of ‘choice’ becomes irrelevant, perhaps an illusion, if the choices available to users reflect neither their preferences nor needs. Moreover, as responsibility shifts from the State to the individual, public service users who cannot benefit from the choice agenda may be subjected to further symbolic violence.

This chapter goes beyond the ‘doxa’ of choice-based public policies and explores alternative allocation mechanisms by examining their effectiveness. Recent innovations in mechanism design and matching-searching models that utilise technological developments have been devised to provide additional insights into this area. I specifically focus on matching-searching models as a way to resolve the social housing allocation problem. In particular, I examine alternative welfare states and their social housing allocation policies using computational methods. The theoretical implications are translated into computational simulations, where

I compare the welfare and efficiency implications resulting from three allocation mechanisms: DO, CBL, and the Gale-Shapley matching scheme (GSMS). DO is need-based, CBL is choice-based, and GSMS is a combination of both. I use statistical distributions of empirical data to simulate profiles for both social housing applicants and housing stocks, and then match them with the three corresponding allocation mechanisms. Based on my knowledge, there has been no existing study that has attempted to apply GSMS on empirical data to model social housing allocation in London.

The empirical data on which the simulation is based is taken from population census returns in the London Borough of Southwark. This data and area were chosen for the following reasons. First, the data for Southwark is the most complete for the input variables required for the allocation models. Second, as of 2018, Southwark has the second-highest percentage of tenants renting from housing authorities amongst London Boroughs, following Hackney (Office of National Statistics, 2018). Therefore, the profile of tenants in Southwark is more representative of the profile of social tenants in London relative to other boroughs.

The three allocation schemes are run on simulated data for two scenarios: 1) when housing demand equals housing supply; and 2) when demand exceeds the supply of housing. As I explained below, the results show that GSMS consistently provides a higher matching rate, and better aggregate welfare for both applicants and landlords.[113] On the other hand, CBL produces better results in matching rates and aggregate welfare for applicants and landlords than DO.

8.2 Theoretical Framework

8.2.1 Welfare states and implications for housing allocation

The allocation schemes adopted by different countries tend to align with their welfare regimes (see Section 2.2.1 in Chapter 2 for details on welfare regimes). Adapted from Aspalter (2006), Table 8.1 outlines the underlying assumptions, behind the four types of welfare regimes discussed in Section 2.2.1 in Chapter 2.

[113] 'Landlords' here can potentially include local authorities, housing associations, and private landlords who lease their properties to local authorities.

Table 8.1 Characteristics of social democratic, conservative, East Asian and liberal welfare regimes

	Social-democratic welfare regime	**Conservative welfare regime**	**East Asian welfare regime**	**Liberal welfare regime**
Underlying assumptions	The rights to welfare based on citizenship	Redistribution to serve social investments	Limited rights to access welfare provision or redistribution with family as a last resort of welfare provision	Limited rights to access welfare provision or redistribution
Role of factors				
Individual	Strong	Weak	Strong	Strong
Family	Weak	Strong	Strong	Weak
Market	Weak	Weak	Strong	Strong
State	Strong	Strong	Weak	Weak
Tools and instruments	E.g. universal income	E.g. occupational social security schemes	E.g. private savings and insurance, mean-tested benefits	

Source: Adapted from Aspalter (2006)

The differences between the underlying assumptions of the four types of welfare states arise from their differing views on who should bear responsibility for individuals' well-being and personal circumstances. The philosophy of the welfare regimes is also reflected in the allocation approaches. Countries with robust state participation in the social housing sector have more paternalistic allocation methods (e.g. social-democratic welfare states), whereas countries with market participation in social housing provision (e.g. liberal welfare states) have a greater emphasis on individual choice.

Most countries follow a social housing provision which lies on a spectrum between government provision and market mechanisms, with an increasing trend of shifting to the latter. For example, since the late 1970s most European countries, including the former Soviet Union countries, have shifted to market-oriented approaches (Poggio and Whitehead, 2017). Similarly, in Australia, where social housing allocation is based on need, there has been an increasing discussion on incorporating choice-based allocation that is similar to the U.K. (Baker, 2008).

The shift from DO to CBL showcases how social housing policies shift from a more paternalist approach to one that requires greater personal responsibility, echoing the rise of neoliberal public policies. However, without critiquing the idea of 'choice' and how it plays out in the realm of social housing policies, it can result in a disconnection between what is intended to be delivered by choice-based policies and what is delivered. The purpose of a choice-based letting scheme is to empower tenants, by changing the power relationship between landlords and tenants. However, the outcome of the policies from tenants' perspectives depends on whether choices can be made 'rationally' (Brown and King, 2005). Elster (1999, as cited in Brown and King, 2005) argued that the prerequisite of a rational choice requires an interplay of the agent's desires, beliefs, and information. In the context of applying choice-based policies in social housing, the most significant caveat relates to the information which tenants are assumed to have, in terms of the availability, transparency and symmetry of information. In addition, the 'residualisation' of social housing has further reduced supply availability and created additional constraints for potential social tenants' choices. The lack of social housing stock means that tenants often have to choose between choices that do not take into account their preferences at all. For example, the notion of 'choice' becomes irrelevant for a tenant who prefers an outdoor space but is not offered any options with such trait by the choice-based letting system.

Therefore, the gap between the intention of choice-based letting scheme and the reality of social housing delivery creates an 'illusion of choice', and shifts responsibility from the state to individuals. The implication of this is two-fold. First, policymakers need to discuss what 'choice' means in the context of social housing, and how it is defined. In particular, there needs to be a discussion of how policies can facilitate the interplay of desire, beliefs, and information to enable agents to form better choices. Second, policymakers need to be open to discussions of alternative approaches outside the 'choice-based' policies, as this chapter illustrates.

8.2.2 Gale-Shapley Matching-Searching (GSMS)

Chapter 2 has discussed how DO and CBL work in the context of U.K. social housing allocation. This section focuses on the discussion of GSMS, which is the third allocation method proposed in this chapter. GSMS is an increasingly popular two-way matching system used for things like kidney donation, college admission, and on-campus housing allocation. However, the discussion on application of GSMS has remain limited.

The theoretical basis for GSMS is the extended Gale-Shapley model, which extends to the unequal numbers of men and women of the stable marriage problem (SMP). SMP examines matches in the marriage market. There are several analogies between the marriage market and the housing market. First, both the marriage market and the housing market face bipartite matching problems with two-sided preferences. Second, both markets involve a single side proposing to the other side. Third, searching costs are involved in both markets. However, differences between the marriage market and the housing market also exist. For example, an order of preference for both sides in the marriage market is pre-determined by participants prior to matching, whilst the order of preference of housing sellers or landlords is not decided until a proposal bid is received.

The original SMP looks at a bipartite matching of the same sizes from both sides, and is outlined as follows (Gale and Shapley, 1962):

Consider n men and n women, where each man and woman have their strictly ordered preference of the opposite gender. SMP aims to produce stable marriage. Under a stable marriage, that there does not exist any other alternative matches (M_i, W_i) that both the man M_i and the woman W_i would be individually better off than their current matches.

By removing the restrictions on the ‘equal number of men and women’, McVitie and Wilson (1970) outlined the Unequal Stable Marriage Problem (USMP) as follows:

Consider the SMP with m men and n women, where $m > n$. The USMP aims to have as many men and women married as possible. As a result, there will be $|m - n|$ men left single. McVitie and Wilson (1970) outlined and proved the following three scenarios:

(1) A particular stable solution which is male optimal
(2) Any valid stable matching solutions
(3) All stable matching solutions

In the following sub-sections, I will discuss how GSMS works in practice, the key theorems and proofs that are relevant for the matching algorithm, and how I measure welfare in the model.

a. Gale-Shapley matching process

The base Gale-Shapley matching algorithm assumes an equal number of participants from both sides. Assuming that there are n applicants and n properties (equivalent to the n men and n women in the original SMP), the Gale-Shapley algorithm, which produces an applicant-optimal result, runs as follows:

1. As long as there remains an unmatched applicant A, the applicant proposes to let their most favourable property P as follows:
   i) A proposes to the landlord of property P;
   ii) If P is available, it becomes 'under-offer' to A, and the pair (A, P) is added to the list of matches M;
   iii) If P is already under-offer to another applicant A' and the landlord of P prefers A' to A, then A remains unmatched.
   iv) If P is already under-offer to another applicant A' and the landlord of P prefers A to A', then P breaks the under-offer agreement. (A', P) is removed from M and (A, P) is added to M. A' becomes unmatched.
2. The list M is a stable match.

b. Gale-Shapley matching: relevant proofs

The four key definitions are outlined below.

Definition 1 'stable matching': A match is stable if no matched pair has an incentive to break off the match.

Definition 2 'valid match': An applicant and a property form a valid match if there exists a stable matching that pair the two together.

<u>Definition 3</u> 'best valid match' ($\boldsymbol{best(a)}$): For every applicant, his/her best valid match is the most preferred valid match for the applicant based on his/her preference rankings of the properties.

<u>Definition 4</u> 'applicant optimal' ($\boldsymbol{M}$): A match M is stable if each of the applicant a is paired with their $best(a)$.

The three theorems related to GSMS that are relevant to this study are: 1) the maximum number of iterations is n^2; 2) the existence of stable matching; and 3) the existence of optimal matchings favouring either side. The details and proofs of the three theorems are outlined below.

<u>Theorem 1</u> The maximum number of iterations is $\boldsymbol{n^2}$ (Gale and Shapley, 1962)**:**

In the case where there are n applicants and n properties, the matching terminates with all applicants paired with a property.

Proof:

(Proof by contradiction) Suppose that there is an applicant A who is not matched with any property. This means that this applicant has already seen all properties available. Based on the algorithm, this implies that the applicant has been rejected by every property. This also implies that every property is under-offer and has remained so. Hence there are n properties matched to $n-1$ applicants. This is a contradiction since the match between applicant and property is a one-to-one match.

<u>Theorem 2</u> Existence of Stable Matching (Gale and Shapley, 1962)**:**

A stable matching exists for every market.

Proof:

(Proof by contradiction) Suppose that there exists an applicant-property pair (A, P) at the end of the matching process. Suppose that A prefers some other property P^*. Since A prefers P^* to P, based on the algorithm, A would have already proposed to P^*. The algorithm implies that P^*must have already rejected A for another applicant. Therefore, P^* prefers the final match to A, and therefore has no incentive to break its current match. Hence the pairs produced by the algorithm are stable.

<u>Theorem 3</u> Existence of Optimal Matchings Favouring Either Side (Gale and Shapley, 1962)**:**

When all applicants and landlords have strict preferences, there always exists an applicant-optimal stable matching and a landlord-optimal stable matching. Furthermore, the matching produced by the deferred acceptance algorithm, where the applicant proposes first, is the applicant-optimal stable matching. The landlord-optimal stable matching is the matching produced by the algorithm when the landlord proposes.

Proof:

(Proof by contradiction) Based on the definition of the algorithm, the applicants will propose in a decreasing order of preference. Suppose that there exists some applicants who are matched to properties other than their best valid match. It therefore implies that these applicants were rejected by their valid matches. Let A be the first such applicant who was rejected by his/her valid match P. Since P is a valid match of A, there therefore exists a stable match M, where A and P are matched. When P rejects A, P forms a new match with another tenant A', where P prefers A' to A. Let P' be A''s match in M. Since A is the first applicant to be rejected by his/her valid match, it implies that A' has not yet been rejected by a valid match at the time when A is rejected. Therefore, A' prefers P to P'. However,

P also prefers A' to A. Therefore, A and P is not a stable match in M. By the definition of M, this is a contradiction.

c. Overall welfare to landlords and tenants

Some home buyers and sellers prefer to wait before committing to a match. This links to insights from real options theory by focussing on the value of waiting under conditions of uncertainty and irreversibility (Dixit and Pindyck, 2012). There is not an agreed conclusion as to whether waiting is an optimal strategy. Akbarpour, Li and Oveis Gharan (2014) studied a one-sided market (a simplified organ exchange) and found that there are benefits of waiting depending on the discount rate and information structure. This means that some applicants may choose not to participate in earlier rounds. Waiting times can be considered welfare losses for individuals, since they will need to secure temporary housing during the waiting time. The effect of waiting can be incorporated by comparing the average waiting time incurred under the three different models. For simplicity I assume that potential tenants gain welfare when they are matched with properties, whereas the ones that are not matched have welfare of 0 unit.

8.3 Model Specification and Data Sources

8.3.1 Computational modelling of the allocation schemes

The application of GSMS, as well as its comparison to DO and CBL, are realised using computational modelling and simulation. Previous studies have proposed alternative approaches to social housing allocation utilising recent computational and technological development. For example, Baker (2008) proposed an allocation framework for Australia which enables residential choice through spatial technology. Under the proposed allocation method, tenants are able to see all spatial information allowing them better access to information, which enables enhancements in their decision-making process. There are two key benefits of using computational simulation to explore and compare alternative allocation methods. First, it enables the testing of hypothetical allocation methods against empirical data. Second, it allows flexibility in the exploration of different scenarios.

a. Model 1: direct-offering scheme (DO)

The following simulation mimics the DO when property j becomes available. Figure 8.1 shows the flow chart for model 1, where S_i and C_i refer to the rating and requirement of applicant i, and Q_j and R_j refer to the rating and requirement of property/landlord j respectively. When j becomes available, the most prioritised applicant will be assessed against it. If the applicant meets the requirements of the landlord, and the property meets the applicant's requirements, the property will be assigned to the applicant. Under this scheme, the applicants are not able to show their preferences towards the remaining available housing stock, and matches are predominantly determined by a central matching function.

The pseudocode of Model 1 and calculation the corresponding social welfare are in Figure 0.1 in Appendix-Chapter 8 respectively.

b. Model 2: choice-based letting scheme (CBL)

The bidding and the viewing stage form the two stages of CBL. Figure 8.2 shows the flow chart for model 2, where S_i and C_i refer to the rating and criterion of applicant i, and Q_j and R_j refer to the rating and criterion of property/landlord j. Similar to DO, the applicants are first ranked in terms of their priority. The applicant with the highest priority will then select a property j which has the highest Q_j, subject to the constraint that Q_j is greater than the applicant's criterion R_j.

The pseudocode of model 2 is in Figure 0.2 in Appendix-Chapter 8.

c. Model 3: Gale-Shapley matching-searching (GSMS)

Applicants are separated into bands based on their priority. Band 1 will be the most prioritised band; band 2 is the second most prioritised, and so on. Figure 8.3 shows the flow chart for model 3. The logic of the flowchart is based on the matching process outlined in Section (a) under Section 8.2.2.

The algorithm stops when the vacant property list is exhausted. In cases where there are more properties offered than applicants in the band one waiting list, the unmatched properties will be offered to band 2 waiting list applicants, and the above algorithm repeated. The pseudocode of model 3 is in Figure 0.3 in Appendix-Chapter 8.

It should be noted that, in most cases, housing demand far exceeds housing supply. Therefore, the GSMS is one of unequal sets. The code is adapted from McVitie and Wilson (1970). Meanwhile, both model 1 and model 2 only match applicants that satisfy the criteria set by the landlords. For example, applicants that have pets will not be matched to properties that do not allow pets. However, such a mechanism is not included in model 3 since the matching is based on ordered preferences. The following measures are used to resolve the issue. First, for each potential applicant, the dataset establishes the ineligible properties based on landlords' requirements. Following this, these ineligible properties are removed from the applicant's list of available properties.

Figure 8.1 Model 1 flow chart

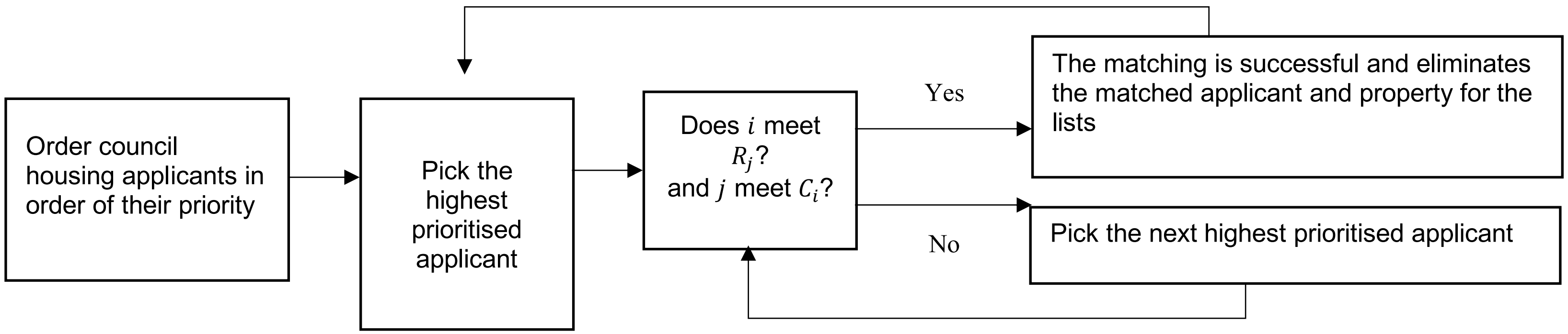


Figure 8.2 Model 2 flow chart

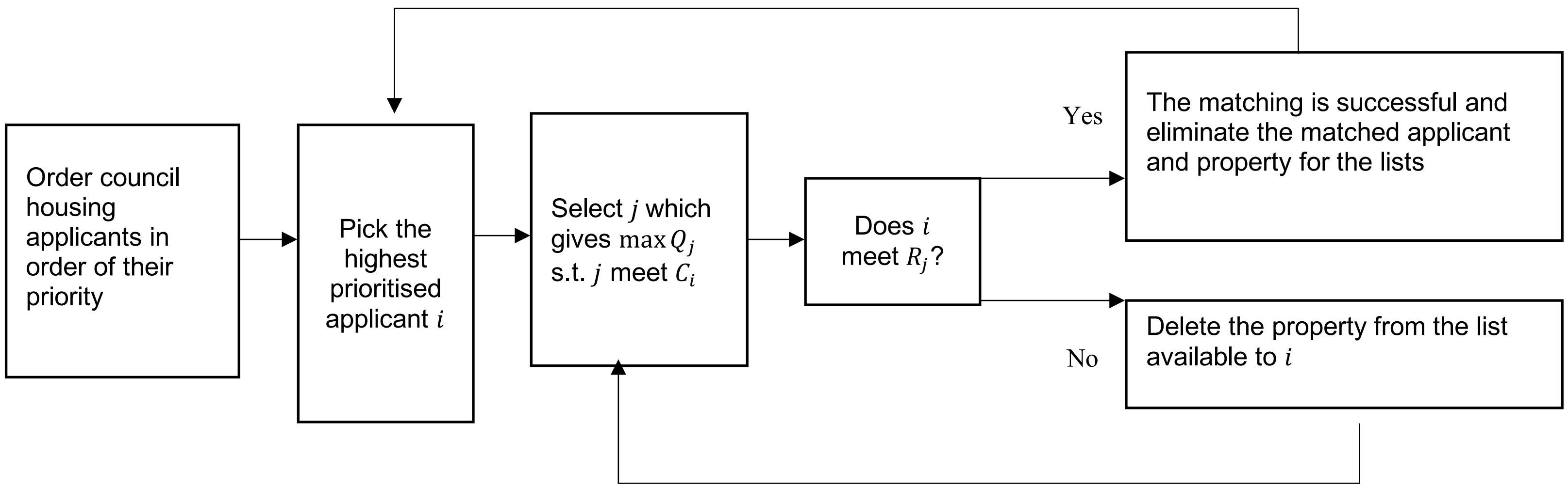
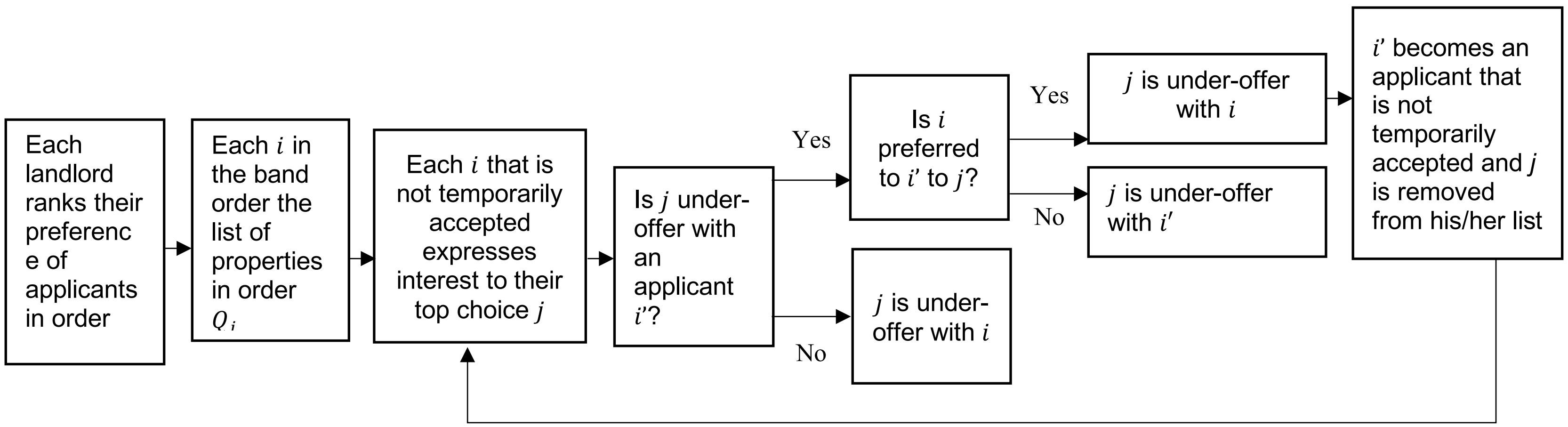


Figure 8.3 Model 3 flow chart



8.3.2 Model specification

This chapter compares the efficiency of DO, CBL and GSMS via three criteria: 1) the percentage of successful matches; 2) individuals' satisfaction with the chosen/allocated property; and 3) landlords' satisfaction with the chosen/allocated tenant.

Percentage of successful matching

The percentage of successful matches is:

$$S = \frac{M}{P}$$

Where M and P are the numbers of matched properties and the number of total available properties respectively.

Individuals' satisfaction with the chosen/allocated property

The definition of individual utility in the context of this chapter is an individual's satisfaction with the matched property. The model assumes that the total social welfare is the summation of the individuals' utility:

$$\mathrm{SWF} = \sum_{i=1}^{n} U_i$$

Where n is the number of matched applicants and U_i is the utility of individual i.

a. Preference of landlords

Tenant-specific characteristics including weekly income, family size, credit score, crime history, pet ownership and priority on the waiting list, are used to simulate the sample population. I assume that criminal records (CR_i), credit scores (CS_i), and rent affordability (RA_i) are basic qualities of applicants that landlords assess when they review applications. Each applicant is scored based on CR_i, CS_i and RA_i. However, an individual landlord may put different weights on different factors when making their assessments. The basic model randomly generates weighting values α_j, β_j and γ_j for each landlord j:

$$TS_{i,j} = \alpha_j RA_i + \beta_j CS_i + \gamma_j CR_i$$

Where $TS_{i,j}$ is the score allocated to individual applicant i by landlord j. $\alpha_j + \beta_j + \gamma_j = 1$, $\alpha_j, \beta_j \geq 0$ and $\gamma_j \leq 0$, as RA_i and CS_i affect applicant scores positively, while CR_i affects the scores negatively.

In GSMS, individual landlords rank potential applicants based on their preferences, which differ in the weightings that they assign to CR_i, CS_i and RA_i, as well as preferences to pet ownership (PO_i). The ranking considers PO_i as a hard requirement, where I assume that landlords' that do not allow pets will always prefer an applicant with no pets to ones with pets, even when the latter have higher overall scores. Therefore, a landlord j who has pet ownership requirements first ranks applicants without pets ($PO_i = 0$) based on $TS_{i,j}$, where j prefers applicant i with the highest $TS_{i,j}$. The landlord then ranks applicants with $PO_i = 1$ on the same basis. The second group of applicants are always preferred to than the first group. A landlord j without pet ownership requirements ranks the applicants solely based on $TS_{i,j}$, where j prefers applicant i with the highest $TS_{i,j}$.

b. Preference of applicants

I use a simple hedonic model to construct the utility of applicants, assuming that tenants have stable preferences for specific attributes of properties (see Chapter 3 to 5 for the implications of hedonic modelling). These preferred traits include proximity to underground or train stations, closeness to Central London, good housing quality, and interior space. Similarly to how applicant scores are constructed for each landlord j, I randomly generate weighting values θ_i, μ_i,ρ_i and δ_i to construct landlord score $LS_{i,j}$.

$$LS_{i,j} = \theta_i(NR_j - FS_i) + \mu_i DL_j + \rho_i DP_j + \delta_i Q_j$$

Where FS_i is the family size of applicant i, NR_j, DL_j, DP_j and Q_j are number of rooms, distance to Central London, distance to the closest public transport station and housing quality score of the property offered by landlord j. Here $\theta_i + \mu_i + \rho_i + \delta_i = 1$. θ_i and $\delta_i \geq 0$ and μ_i and $\rho_i \leq 0$, as $NR_j - FS_i$[114] and Q_j affect the

[114] $NR_j - FS_i$ is interpreted as number of spare rooms.

property scores positively, whilst DL_j and DP_j affect the property scores negatively.

8.3.3 Data sources and data collection

Due to difficulties in obtaining data on individual applicants and landlords, I construct population and housing samples which satisfy pre-defined probability distributions through simulations. These pre-determined probability distributions are based on historical empirical data. For example, to develop the income profile of the individual applicants, I simulate their income levels such that the overall population follows the same income distributions as the historical empirical data. The benefit of using simulated data is the flexibility of generating large datasets and creating agent-based features.

The modelling process uses data from Southwark Council's published reports and census data. The justification for using these data is in Section 8.1. With reference to Table 8.3 below, the modelling process first obtains the population distributions of each distribution band. The process then calculates the respective probability of each variable falling into each band. Following this, I can construct a random sample dataset which follows the pre-determined probability distribution. I list the data sources of the variables for the characteristics of the applicants and properties in Table 8.3 and Table 8.4, respectively. Table 8.2 provides supplementary explanations of how individual sample profile data are generated.

Characteristics of applicants

Table 8.2 Individual-specific variables

Variable	Source	Comment
Weekly income of applicant (in household unit) (I_i)	Household income distribution of the overall population (Southwark Council, 2015)	The simulated income distribution of households is based on Institute of the Fiscal Studies (IFS)'s finding that median income of social housing households was 66% of median income of the overall population in England[115]
Family size (FS_i)	Southwark Housing Key Statistics 2015 (Southwark Council, 2015)	
Potential rent (PR_i)	Southwark Housing Key Statistics 2015 (Southwark Council, 2015)	• PR_i equals to the rent for a social housing property that is of size FS_i • Rent affordability (RA_i):$RA_i = 1 - PR_i/Y_i$
Credit score (CS_i)	N/A	There is no publicly available information on individuals' credit scores. The process therefore randomly generates values between 1 and 10 to indicate such information, where 1 and 10 represents the lowest and the highest respectively.
Criminal record (CR_i)	Home Office (2014) National Statistics (2017)	$CR_i = 0$ for no criminal record, $CR_i = 1$ for non-prison related criminal record and $CR_i = 2$ for prison related criminal record
Pet ownership (PO_i)	Statista (2017)	Pet ownership in the U.K. was 44% (Statista, 2017)
Priority of applicants *(P_i)*	166A(3) of *The Housing Act 1996* (House of Commons, 2018)	Priorities are: 1) Homeless people 2) People who are owed by any local authority under section 190(2), 193(2) or 195(2) (or under section 65(2) or 68(2) of the Housing Act 1985); or people who are living in accommodation secured by such local authority under section 192(3); 3) People living in insanitary or overcrowded housing; or would end up living under such conditions without housing provision 4) People who are moving for medical or welfare reasons; 5) People who need to move to specific local area, else would result in hardship

[115] Source: https://www.ifs.org.uk/uploads/publications/bns/BN178.pdf

Table 8.3 Variables: characteristics of applicants

Variable	Type	Band	Probability
Family size (FS_i)	Categorical	1	0.45
		2	0.32
		3	0.17
		4	0.06
Criminal record (CR_i)	Categorical	No criminal record= 0	0.84
		Non-prison related record = 1	0.15
		Prison related criminal record= 2	0.01
Pet ownership (PO_i)	Categorical	Non-pet-owner= 0	0.56
		Pet-owner= 1	0.44
Priority *(P_i)*	Categorical	Unintentionally homeless and in priority need= 1	0.49
		Intentionally homeless and in priority need= 2	0.15
		Homeless but not in priority need= 3	0.14
		Not homeless= 4	0.22
Weekly income of applicant (in household unit) (I_i)	Numerical	Follows the income distribution at 66% of the population average income	
Credit score (CS_i)	Numerical	Random number between 1 and 10, based on normal distribution	

Characteristics of properties

Table 8.4 Variables: characteristics of properties

Variable	Type	Band	Probability
Number of rooms (NR_j)	Categorical	1	0.31
		2	0.34
		3	0.32
		4	0.03
Distance from Central London (DL_j)	Numerical	Random numbers between 2 and 12, based on normal distribution, and then rescaled from *D* to *D'* based on the following equation: $D' = \frac{D - \min(D)}{\max(D) - \min(D)}$	
Distance to the nearest public transportation (DP_j)	Numerical	Random numbers between 0 and 1, based on normal distribution	
Quality factor (Q_j)	Numerical	Random numbers between 0 and 1, based on normal distribution	

8.4 Results and Findings

In this section, I test the three allocation models in the following two situations: 1) supply = demand; 2) supply < demand. For the programming, I used Spyder 4.1.3 (see Section 7.4.2 in Chapter 7 for more details). Due to the limitation of personal computational power, I use Amazon Web Services to run the programs (see Section 7.4.2 in Chapter 7 for more details).

Case 1: supply = demand

In case 1, supply = 100 and demand = 100, which represents 100 applicants with 100 houses. I repeat the process 10 times. The matching rates of the three allocation mechanisms and corresponding aggregate social welfare for applicants and landlords are plotted in Figure 8.4 to Figure 8.6. The x-axis plots the run number of the simulation, and the y-axis illustrates the matching rate (Figure 8.4), aggregate welfare for applicants (Figure 8.5), and aggregate welfare for landlords (Figure 8.6).

The results suggest that the matching rate for GSMS is always 100%, which aligns with the proof in Section (b) in Section 8.2.2. On the other hand, the matching rate for CBL is higher than that of DO, where the former is typically between 80% to 85% and the latter is typically between 70% to 80%. For aggregate social welfare, DO produces the lowest aggregate welfare for both applicants and landlords. GSMS produces the highest social welfare for both cases. Although CBL and GSMS produce similar level of aggregate tenants' welfare, GSMS produces much higher aggregate welfare for landlords. The relative levels between the three allocation schemes are overall consistent for both landlords' welfare and applicants' welfare.

Figure 8.4 Matching rate: supply = demand

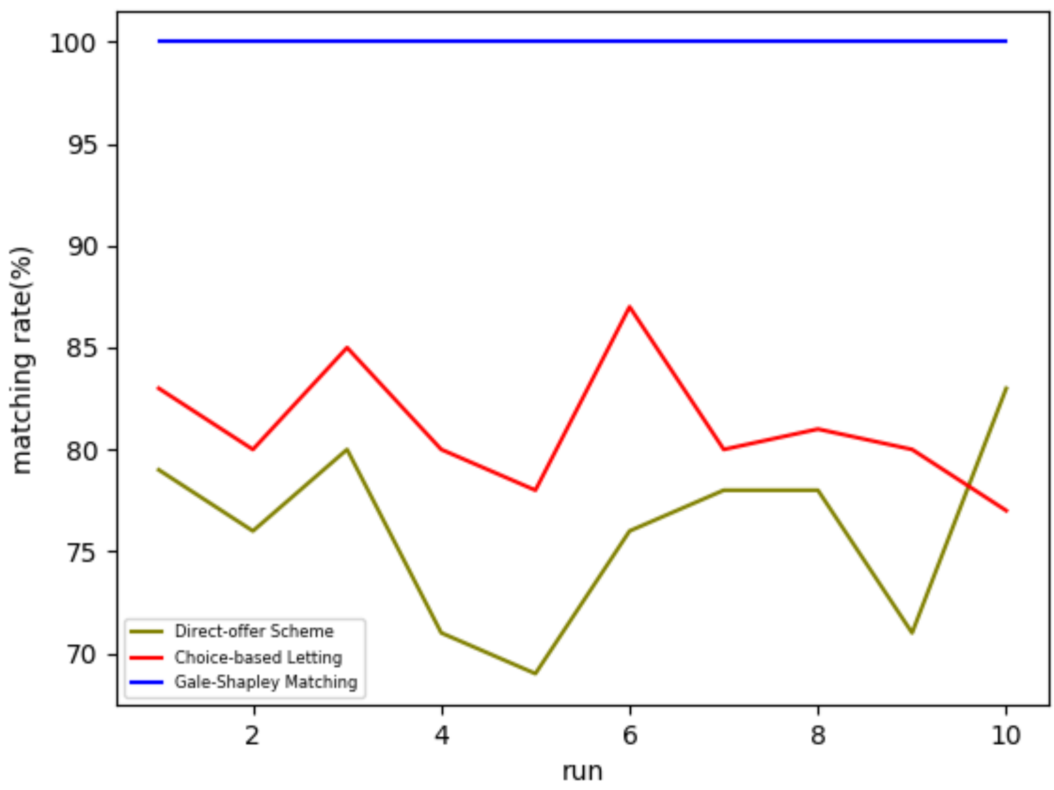


Figure 8.5 Aggregate social welfare for applicants: supply = demand

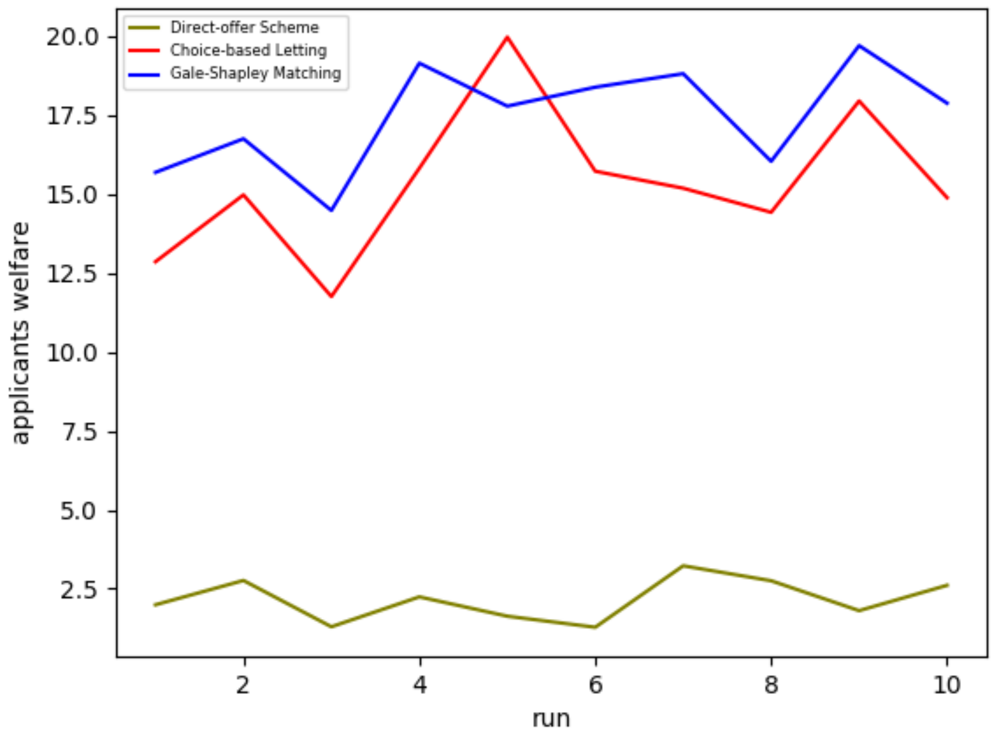
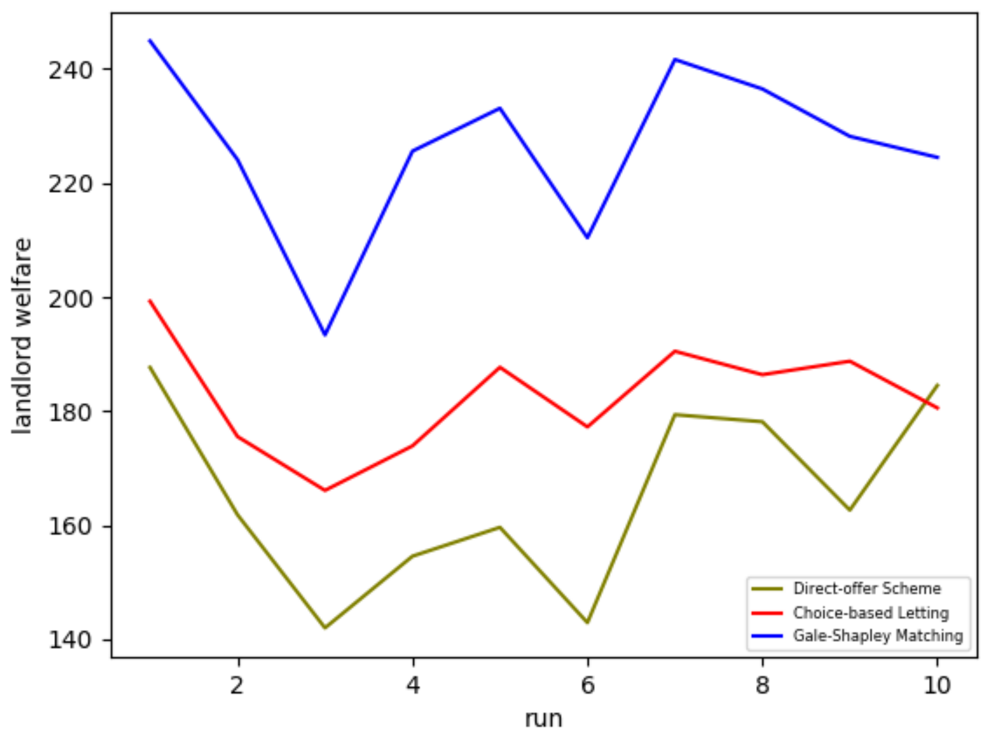


Figure 8.6 Aggregate social welfare for landlords: supply = demand



Case 2: supply < demand

In case 2, supply $= 50$ and demand $= 100$, which represents 50 houses and 100 applicants respectively. This process is repeated 10 times. The matching rates of the three allocation mechanisms and the corresponding aggregate social welfare for applicants and landlords are plotted in Figure 8.7 to Figure 8.9. The matching rate for CBL is between 94% and 100%, whereas the matching rate for DO fluctuates between 84% and 100%. GSMS still produces the highest aggregate social welfare for both applicants and landlords, compared to the other two allocation schemes. CBL produces higher welfare for applicants than DO. However, the two schemes result in similar levels of aggregate landlord welfare.

Figure 8.7 Matching rate: supply < demand

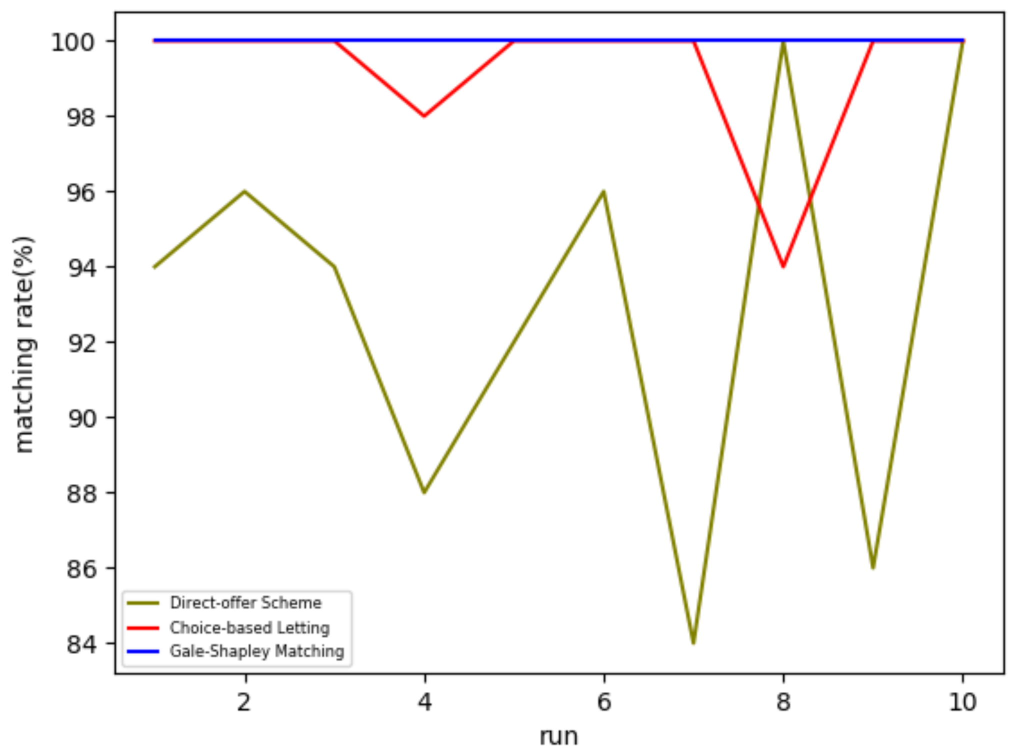


Figure 8.8 Aggregate social welfare for applicants: supply < demand

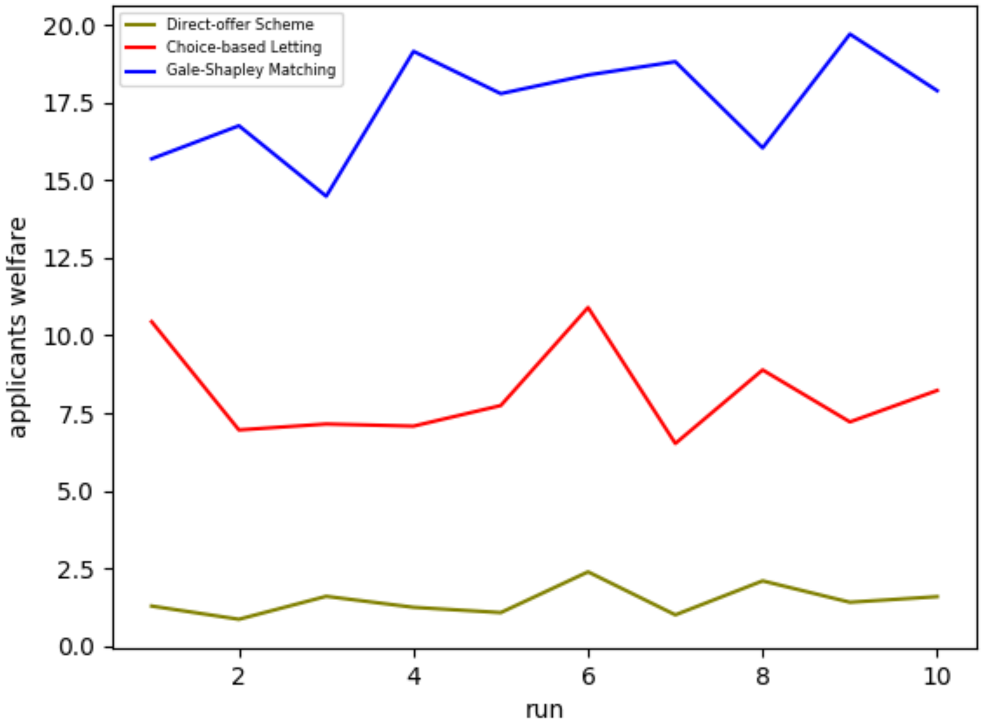
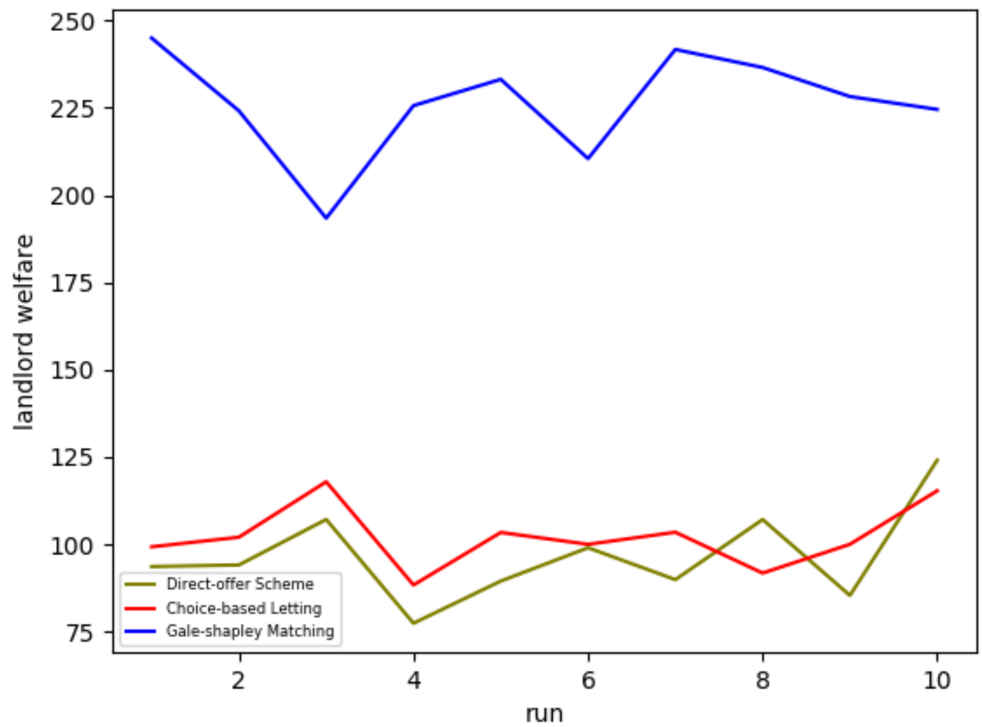


Figure 8.9 Aggregate social welfare for landlords: supply < demand



The results of the simulations show that in both situations, GSMS provides the best outcomes for both applicants and landlords. This is based on both aggregate social welfare and matching rates. However, the GSMS approach is limited by a greater requirement to have higher computational power relative to CBL and DO. For a housing supply match with n applicants and n properties, the computing time for GSMS is (n^2), whilst the computing time for both DO and CBL is $\mathcal{O}(n)$.

One of the possible objections of using allocation schemes which involves a central allocator, such as GSMS, is that they contain elements of paternalism. These schemes violate 'personal responsibility' and 'freedom of choice' promoted by neoliberalism and recent public policies (see Chopra, 2003). To counter such objection, I argue that it is important to carefully examine the 'choices' presented to social renters. Individuals with more economic capital face more possibilities and choices in life, whereas those with inadequate economic capital, such as the social renters, have to make their choices within limited options (Butler and Hamnett, 2012). For example, as observed from the data used for this chapter, there is limited housing stock available for families that need more than 3 bedrooms. This means that when these families are presented with 'choices' when eligible properties become available, they will have to take whatever is available. To a certain extent, 'habitus', similar to revealed preferences and 'choices', are just outcomes of social classes; they reflect how the lack of capital can translate into dispositions and behaviour, which reinstate the social classes that individuals belong to (see Section 9.3.1 in Chapter 9 for further discussion).

Finally, this chapter concerns the redistributive power of the State in relation to economic resources. However, according to Bourdieu (2014), the State's redistributive power goes beyond materialistic resources and extends to the redistribution of the symbolic power. It is also in the redistributive process of material resources that a symbolic effect is created. One such example is the institutionalisation of the homeownership ideology and narratives toward social tenants in the U.K., as discussed in Chapter 2.

8.5 Conclusion

8.5.1 Summary

Chapter 7 examined the potential effectiveness of housing mobility schemes such as Housing Moves by examining the drivers of inter-borough relocations in London. This chapter further examined existing housing allocation policies by comparing the currently dominating Choice-based Letting scheme to alternative forms of allocation schemes. Since the 1970s, social housing allocation schemes have shifted from DO to CBL. The latter removes the paternalism of the former, and provides individual applicants with a higher degree of personal choice. How Chapter 8 relates to Bourdieu's theories is the attempt to explore the 'alternatives' beyond the given 'doxa'. Within the domain of public policy, the 'doxa' is having 'choice' as the centre of policy making. Bourdieu's critique on 'doxa' encourages discussions involving, instead of dismissing, alternative approaches. In this chapter, I examined the effectiveness of CBL compared to DO, and thereafter introduced and examined a new allocation scheme based on GSMS.

The results suggest that GSMS provides better results in terms of matching rate, the aggregate welfare for both the applicants and landlords. On the other hand, CBL improves on all the above three indicators comparing to DO. Nevertheless, the proposed GSMS has its own limitations. Most notably, to match n applicants to n properties, the computing time for GSMS is $\mathcal{O}(n^2)$, whilst the computing time for both DO and CBL is $\mathcal{O}(n)$.

8.5.2 Limitations and future research

Whilst these initial findings open a range of unique insights, I should point out several caveats. First, the constructed sample does not fully reflect real-life populations and is solely based on the profile of tenants in Southwark. Restrictions in data access predominantly cause this limitation. Second, in both CBL and the proposed GSMS, there are issues relating to how property viewings occur in the application and allocation process. Under the programmed CBL, I assume that applicants take up properties that they deem favourable. However, in real-life situations, viewings also play an important role in the decision-making process as an applicant may decide not to take the property after a viewing. Third, the allocation mechanism has a shortcoming in that it is highly dependent on one's computational power. Although GSMS provides matches that result in improved overall social welfare, it has lower matching rates than CBL and DO models in situations when demand exceeds supply. Finally, the modelling of all three allocation schemes is not dynamic. In other words, the modelling process does not consider the continuous arrival of new applicants or the addition of newly available properties.

Despite these shortcomings, the results and findings represent a promising starting point in applying matching-search models to social housing allocation. Future studies may consider modelling a dynamic GSMS by incorporating Poisson distributions. Besides, research can further expand the simulated applicants' profiles and properties to better match real-life data. One of the possible approaches is using discrete-choice modelling as it enables the incorporation of stated preferences. This can be achieved through surveys and interviews to complement the approaches that are based on revealed preference. The information on stated preference helps provide a better understanding of the decision-making processes of social tenants. It also supports the establishment of indicators of preferences that can be quantified and generalised. The information on both revealed and stated preferences can then be fed into the choice model.

8.5.3 Policy implications

I aimed to bridge subjectivity and objectivity in housing policy in this thesis. Using bottom-up computational model to simulate social housing allocation is one of the examples of this aim. Based on the results and findings, policymakers may seek to adopt GSMS to improve social welfare for both renters' and landlords'.

GSMS may be a useful approach in matching social housing demand and supply through the following three reasons. First, mathematical proofs in Section 8.2.2 show that GSMS always ensures stable matches. This eliminates some costs to public services associated with property swaps. Second, the overall welfare for both tenants and landlords under GSMS exceeds the cases under DO and CBL. Although GSMS contains elements of paternalism and does not centre on 'choice', it brings the discussion of welfare for both the tenants and the landlords. In contrast, CBL's emphasis on 'choice' weaves into the political narrative that social tenants are provided with choices, whilst dismissing the structural inequality and their heavily constrained choices in life.

Despite several caveats associated with the adoption of GSMS, various mitigants that can be incorporated to potentially improve the GSMS mechanism. However, these improvements require a reform of existing policies. The simulated matching reveals that a key constraint in matching applicants to potential properties arises from the differences between applicants' household family sizes and the number of bedrooms in the available properties. For example, there are fewer properties that accommodate large households that require a lot of space compared to properties that accommodate single-person or small family households. As a result, applicants with larger households have fewer choices and must wait longer for an eligible property to become available. Therefore, when the government seeks to deploy market-based policies to resolve housing issues, it may need to introduce incentives for the development of homes that better meet the demographic profiles of social tenants. However, as discussed in Chapter 2, the private sector may still lack these incentives.

Nevertheless, the suitability of using the GSMS algorithm for social housing allocation depends on the philosophy of the social housing welfare model in the U.K. Compared to CBL, GSMS and DO are more paternalistic, and this may not be compatible with the ongoing shift towards choice-based and neoliberal social policies. Since the Blair administration came into power in the mid-1990s, the ongoing social reforms have resulted in state actions being able to both "create and inhibit the development of aspirational citizens", who are "eager to take on greater responsibility for themselves and the well-being of their communities" (Raco, 2009, p. 436). This results in a shift from 'expectational citizenship' to 'aspirational citizenship'. 'Expectational citizenship' sees the State as a provider, whereas the 'aspirational citizenship' sees the State as a facilitator (Raco, 2009). GSMS would demand a return to 'expectational citizenship'.

9 Conclusion

9.1 Introduction

Since rapid urbanisation began in the 18th century, housing crises have played a recurring theme in London's development. This phenomenon has been exacerbated in recent decades as the affordability of housing continues to deteriorate, driven by increasing commodification and financialisaton of properties. To combat this growing pressure on housing, the U.K. government has utilised social housing as a tool to subsidise the people that are unable to directly purchase properties or afford to rent in the private market. This has been particularly evident since the end of the Second World War. However, this has also been a gradual development, and social housing in the U.K. has gone through various significant changes alongside wider shifts in social welfare models and attitudes toward homeownership. London is not unique in experiencing a housing crises, with other large metropolitan cities in the world, such as New York (USA), also having similar issues (see Madden and Marcuse, 2016). Nevertheless, social housing in London makes a unique case study given the capital city's higher than national average population, greater ethnic diversity living in social housing, and an overall net positive inflow of population.

The contributions of this thesis are both methodological and theoretical. The theoretical and conceptual contribution aim to extend the current utility maximisation model beyond the maximisation of economic profits, by incorporating Bourdieusian theories. The methodological contribution includes the use of revealed preference to determine social housing preferences, which has relevant policy implications to social housing policy makers. Furthermore, the methodology of this thesis combines econometrics, Bourdieu and computational methods.

Even though the discussion in the thesis focuses on the case in London, it has wider implications to the other cities. As discussed in Chapter 1, the social housing model in the U.K., which involves a hybridity of market and state approach, has become a popular approach in other 'non-global' cities. The discussion on the in this thesis is therefore relatable to cities which have undergone a similar transition process as London in terms of welfare provision.

However, the purpose of using London as a case study is not to set London as a 'model' city for housing welfare policies. Instead, in the context of post-colonial discussion, we should aspire to study London and all the other cities as 'ordinary' which have their own uniqueness and challenges.

In this chapter, I will summarise and discuss the main themes that emerge from this thesis, as well as reflect on a few key themes relating to earlier chapters. I will also discuss potential future research directions.

9.2 Summary of Main Themes

9.2.1 The symbolic in the housing field

Bourdieu discussed the importance of understanding the genesis of a given policy or institution as means to fully explore the plethora of possibilities. He argued that doing so enables the consideration of alternative perspectives that are beyond existing dominant and conformed thoughts. When referring to housing policies in France between 1970s and 1980s, Bourdieu (2014) said:

> "The alternative between collective housing estates and small privately-owned bungalows is a false alternative; there is a third possibility, that of small rented bungalows, which does not currently exist […] The alternative, the opposition between collective and individual housing, is swept away by a historical process that has constituted the problem in a form whose genealogy we can investigate" (p. 119).

Chapter 2 took a historical perspective in addressing the evolution of social housing policies in the U.K. Furthermore, it discussed the various mechanisms and shortcomings of the current system in London. Symbolic capital and power exist in the housing field, intertwining with the evolution of social housing policies. However, neoclassical economics assumes that individuals only maximise material profit when making decisions. Such views contrast Bourdieusian social theories, which suggest that both material and non-material products carry symbolic meaning, where an individual's objective is to maximise both material and symbolic profit. In the context of housing, material profit is often economic and monetary. Examples of material profit include private properties and monetary profit. On the other hand, symbolic profit is not materially visible, with examples including cultural and social capital (Bourdieu, 1986). When applied to a property-owning society such as the U.K., homeownership takes on a symbolic meaning. This symbolic power can determine the rules of the field and social norms (Bourdieu, 2014). The influence of social norms flows to individual's decision-making process, such as the homeownership decision. However, most housing literature in orthodox economics disciplines are based on RAT, and hence omit the discussion of social norms when discussing the possible solutions for improving social housing provision. Nevertheless, as I discussed in Chapter 2, the symbolic meaning of renting and homeownership has significant social implications.

Another form of symbolic meaning is conveyed through physical dwellings. Physical dwellings do not act as forms of space, but also carry symbolic meaning from a phenomenological perspective. The symbolic meanings associated to physical dwellings define an individual's experience within them. For families, there is a dual requirement of boundary, not only between the household and the external environment, but also between family members. This can lead to greater needs for mesospace (see Section 3.2.1 in Chapter 3 for definition), such as gardens, compared to non-family households. Based on Zoopla rental listing data and the assumption that one-bedroom dwellings are more likely to be dwellings for non-family households, the results in Chapter 3 suggest that families are willing to pay 24.9% more rent for dwellings with a garden compared to ones without. The results contrast with non-family households, who would pay 8.79% less for properties with a garden compared to ones without.

9.2.2 Habitus

Conventional economic theories and housing policies rely on the assumption of RAT and agents making utility maximisation decisions independent of their social situations. However, evidence from sociology and phenomenology highlight that, instead of making individualistic actions independent of society and personal history, agents are embedded in his/her own subjective reality. As such, one of the central themes of this thesis is 'habitus', a term coined by Bourdieu (1984).

In a way, this term contains both subjectivity and objectivity of an individual's behaviour. More specifically, "[habitus] is the subjective embodiment of the determining influence of social structure" (Griller, 1996, p. 6).

Habitus is manifested in physical space (Bridge, 2001). As a result, the distribution of residential profiles in space is not random (Webber, 2007). The spatial differences in the distribution of habitus within large global cities is called 'metropolitan habitus' (Butler, 2002; Webber, 2007). Understanding habitus enables social housing policymakers to have better knowledge of the dispositions of social tenants. The metropolitan habitus that Chapter 4 aimed to uncover is akin to Bourdieu's class habitus, as discussed in his book *Distinction*. The approach that I take to uncover the distinction in habitus between socio-economic groups is inspired by Savage *et al.*, (2013) and Webber (2007). Savage *et al.* (2013) went beyond the occupation-based classification of social classes proposed by Bourdieu (1984). Alternatively, they defined social classes based on cultural, social and economic capital. Webber (2007) used small area classifications to examine whether there is quantitative evidence of the existence of metropolitan habitus. Chapter 4 used Output Area Classification to categorise the areas in London into different social classes, and subsequently examined whether there existed housing habitus amongst different social classes. The key implication from the results is that lower social classes are more dependent on public transport and open green space. On the other hand, SES-4 value such services negatively.

Chapter 5 uncovered the metropolitan habitus that was more likely to be led by institutions, such as planning history. The urban/suburban geographical divide between suburban and Central London, and their different urban development history, imply that residents of these areas experience differences in metropolitan habitus. The results from Chapter 5 show that there exists observable differences in metropolitan habitus between Central and suburban London. However, such a divide is less obvious amongst suburban London regions. One of the main caveats of making inference from the results in both Chapter 4 and 5 is the difficultly in concluding whether the habitus is an outcome or an indicator of socio-economic status. I will provide further discussion regarding this limitation in Section 9.3.1.

Chapter 6 shows that the main driver of housing waiting list lengths across London boroughs is the number of benefit claimants at borough-level. The results from Chapter 6 also contribute to the recent political debate regarding welfare uptakes by migrants. It argued that migrants were not more likely than the native population to claim benefits given similar personal circumstances. Extending Bourdieu's discussion on habitus, migrants may carry their habitus from their country of origin to the newly migrated country. Consequently, migrants who arrive from a society with a stronger tradition of using family and community networks for welfare provision are more likely to continue to do so following migration.

9.2.3 Bringing Bourdieu into social housing policy making

In this thesis, I propose that studies concerning social housing policies should look beyond a pure focus on supply issues. Bourdieu's social theories are not only able to provide theoretical frameworks for social housing studies as demonstrated in Chapter 2 to 6, but can also provide a basis for social housing policy evaluations as demonstrated in Chapter 7 and 8. Following over a half-century of post-war globalisation, there has been a notable rise in political and religious extremism. They also showcase the increasing political and social divides between the winners and losers of the established social and political system. In this context, social class related theories such as Bourdieusian theories should be firmly placed in the centre of the housing discussion albeit with a contemporary adaptation. For example, as illustrated in Chapter 7 and 8, recently developed computational methods, such as ABM and simulations, can also be used alongside Bourdieusian theories. Instead of adopting universal objectivity for agents portrayed by RAT, these computational modelling methods can establish possibilities of social renters' behaviour based on their habitus.

As such, Bourdieusian theories can play an important role in the discussion of social housing policies for the following two reasons. First, the State is itself a field with agents who are elected representatives. Consequently, the field of State also contains habitus, capital and norms, where agents aim to maximise both their physical and symbolic profits (Bourdieu, 2014). When discussing the power dynamic between social housing tenants and policymakers, Bourdieu (2014) argued that:

> "The most disadvantaged interests, those connected with public housing, were championed by those people who were connected with the interests of the dominated, because they were in institutions that owed their existence to the struggles of the dominated or to the action of philanthropists who spoke for the dominated" (p. 369).

Therefore, the formulation and development of social housing policies are not always aligned with the welfare maximisation of the policy recipients. Bourdieu saw the rise of neoliberal policies in the 20th century being a threat to all forms of the 'collective', such as public services (Bourdieu, 2014). Bourdieusian theories therefore provide critical perspectives of existing housing policies.

Second, as I discussed in Chapter 1, the main theme of this thesis is to discuss social housing beyond the supply issue. Whilst the supply issue is material and visible, other non-material and invisible factors such as symbolic meaning and violence, habitus and social classes are equally important as they directly relate to the welfare of social tenants. As Bourdieu (1996) stated, "in the social world, words make things, because they make the meaning and consensus on the existence and meaning of things, the common sense, the doxa accepted by all as self-evident" (p. 67). Through the translation of subjectivity into objectivity, invisible symbolic drivers can become visible. In the context of social housing, social and cultural capital that is symbolic can be translated into housing and neighbourhood choices. More widely, in the domain of social policy development, expectations of citizen responsibilities can be institutionalised and turned into social realities (Raco, 2009). Therefore, Bourdieu's theories provide a rich theoretical framework and methodological approach to study social housing policies as they go beyond the dichotomy of objectivity/subjectivity, agency/structure and material/symbolic.

Chapter 7 and 8 illustrated how Bourdieusian theories could be brought into social housing policy using two examples. Chapter 7 specifically examined the role of social networks and learning in relocation decisions in London. Conventional housing mobility schemes such as Housing Moves are based on the intention of reducing labour market friction by enabling movement of workers, allowing social tenants of one London borough to be able to apply for housing in other boroughs. As Baker (2008) pointed out, social tenants should be viewed as tenants first and then social tenants. This is driven by the view that social tenants fundamentally undergo a similar decision-making process for relocation as non-social tenants. Therefore, understanding the relocation decision-making process of private tenants can provide insights for social tenants. This is what Chapter 7 attempted to address. Based on borough-level data between 2011 and 2017, residents in London had a higher likelihood of moving to another borough which is nearby, away from Central London, and to seek better access to open and green space. On the other hand, residents aged between the age of 20 and 29 were most likely to relocate for employment, transport access and housing cost improvements. This distinguishes them amongst other age group behaviour. Nevertheless, similar to the overall population, this age group also showed strong preferences for moving to nearby boroughs. The preference towards moving to nearby locations could be due to material factors such as distance to work and schools, and immaterial factors such as attachment to familiar areas. The existence of social networks and social capital can also be the motivations of such preferences. The ABM used in Chapter 7 confirmed that even though individuals maximise their utilities based on objective factors, subjective factors including social networks and learning also play important roles.

Finally, Bourdieu talked about four types of reproductions namely economic, culture, human and social reproductions. The four types of reproductions are closely linked to the three forms of capital, which are social, economic and cultural. All social agents reproduce the existing social order to different levels (Loyal, 2017). Without market intervention, all the different forms of capital and established social orders, as well as social inequality, are likely to be reproduced. Bourdieu’s research mostly concerns the education system as the powerhouse for reproduction. Nevertheless, the same reproduction process also exists in housing and social policies. Reproduction in social housing can occur in all four types of reproductions. Whilst welfare policies can alter or change the process of reproduction, they may also reinforce the reproduction process. This is similar to the example of education institutions that Bourdieu used. Even though Bourdieu saw the State as a monopoly of symbolic resources, and sometimes economic resources, he did not deny its possible redistribution effect. To improve the redistribution of social housing resources, Chapter 8 explored three different types social housing allocation schemes using data simulated based on empirical data in London. The first type is the previously adopted DO, which can be viewed as the State playing a redistributive role. The second type is CBL, which is the dominant allocation scheme currently adopted. The fundamental philosophy of CBL is to allow social tenants to make their own choices, and to minimise the redistributive power of the State in the process. I also proposed a new allocation scheme based on GSMS, which has been adopted in many market designs including school admission. The advantages of GSMS include guaranteed matching for existing stocks, maximising tenants' welfare when the tenants initiate the proposals to landlords, and allowing landlords to convey their preferences. Moreover, GSMS can be regarded as an allocation scheme which utilises both the roles of the State's central redistributive power and individuals' choices.

9.3 Reflection

This section reflects on two core points arising from the earlier sections of this thesis, namely the key theoretical frameworks adopted in this thesis and the research philosophy assumed. For the former, I reflect on the theoretical frameworks of habitus and revealed preference, whilst for the latter, I discuss the suitability of approaching the research question in a positivist manner.

9.3.1 Habitus and revealed preferences: choice or lack of choice?

In this thesis, the key theories that I use to model choices are revealed preference and 'habitus'. Revealed preference theory argues that the best way to measure consumers' preferences are by equating their preferences to their observed consumption behaviour. The theory assumes that consumers make rational choices given limits to affordability. On the other hand, habitus takes a more ingrained view of individuals' preferences, arguing that individuals' dispositions and preferences are shaped by their nearby social world and personal history.

When applying the two theories to better understanding housing choices, both revealed preference and 'habitus' face the same fundamental problem – Do people make their housing choices out of their choices or preferences, or due to a lack of choice? It is likely that social tenants prefer living with people who share similar traits with them, not out of their own choice, but due to the lack of choice in the housing market. The discussion of choice is only valid when there is an abundance of economic resources to be deployed. For example, the suburbanisation of the middle class is partly the result of the desire to stay away from impoverished neighbourhoods (Hamnett and Butler, 2011). The 'taste of necessity' of residents of lower SES, as well as the notions of choice and habitus, may simply restate some fundamental economic truths about class, income and housing affordability in cultural terms. Therefore, a pure focus on 'habitus' and revealed preferences, which are potential outcomes of social inequality, can conceal deeper discussions on the drivers of class struggles behind these outcomes. In addition, constructing policies based on habitus and revealed preferences can also be problematic as it may merely give social tenants an illusion of choice. Although the shift from DO to the CBL seemingly grants social renters with the right to exercise their own choice, the limited options provided to social renters mean they continue to make heavily constrained choices. These constrained choices are conducted in a context where the lack of choices is not much better than no choice at all. Massey (as cited in Raco and Freire-Trigo, 2019) criticised a hybrid approach which incorporates individual voices during the decision-making process. She argued that it created "an illusion of inclusiveness that leaves unchallenged the antagonistic framings that underpin democratic debates, themselves a consequence of the deepening of structural changes and inequalities that are emerging under conditions of neo-liberal reform" (p. 388).

Second, whether 'habitus' is an outcome or an indicator of social classes is not entirely clear in Bourdieu's writings, and his explanation is sometimes circular (Riley, 2017). In *Distinction*, social classes are defined based on occupations, and habitus is consequently derived from such definitions of social classes. However, Bourdieu himself argued that habitus was an indicator rather than an outcome of social class, and to a certain extent there existed a two-way causal relationship. Bourdieu's interpretation, therefore, creates a circular problem for his methodology in determining the relationship between social class and habitus. Savage *et al.*'s (2013) classification is also circular to a certain degree. By defining social classes based on social, economic and cultural capital, it becomes difficult to make inferences of habitus without falling into tautology.

The third reflection on habitus and Bourdieu's class theories relate to their applicability to modern society. Bourdieu's *Distinction* is based on 1960s French society, where his research showed a distinctive separation of social classes. However, there has been academic discussion on how modern social classes exist in different forms as compared to Bourdieu's era (Savage *et al.*, 2013), where the wealth-elite today differs from the upper-class aristocratic types portrayed in *Distinction* (Savage, 2015). At the same time, technology has redefined individuals' social world, which is no longer limited to those who the individuals' are in touch with within the physical world (Julien, 2015).

Finally, whilst the RAT emphasises individual agency, habitus may fall into determinism. In other words, individuals' behaviour is determined by pre-existent causes, where they do not have agency or free will. The study of individuals' choices and behaviours, either from the neoclassical economic or sociological perspective, is based on a particular way of modelling of a human being (Granovetter, 1985). Granovetter (1985) criticised sociology research, arguing that it contained 'over-socialised' agents in its models, with agents characterised as being overly sensitive to the opinions and behaviours of the others. In contrast, neoclassical economists tended to contain 'under-socialised' individuals in their models, where agents' behaviours and preferences tended to be mostly propelled by economic interests. Granovetter (1985) argued that the issues of both lay in the atomised view of the agents:

> "In the under-socialized account, atomization results from narrow utilitarian pursuit of self-interest; in the over-socialized one, from the fact that behavioural patterns have been internalized and ongoing social relations thus have only peripheral effects on behaviour" (p. 485).

Granovetter's comments regarding the balance between under- and over-socialised agents echoes Bourdieu's research objective. His ambition was to create a framework which allowed the exercise of freewill within a limit, to bridge subjectivity with objectivity as well as to avoid the under- or over-socialised account (Steinmetz, 2011). Bourdieu aimed to unite phenomenology, the study of experience from a first-person perspective, with structuralism, the study of human behaviour as part of a broad system they belonged to. However, the case of ‘habitus’ illustrates that the role of individual agency in the decision-making process is not clear. In particular, his objective is difficult to achieve through modelling, and is one of the main difficulties experienced in writing this thesis. This was particularly evident in Chapter 7 when constructing the ABMs. As such, how agents’ build up their behaviour from stimuli both from themselves and their embedded environment remain unanswered in this thesis.

9.3.2 On studying economic behaviour through positivism

The methodological reflection in this section links to the theoretical reflection outlined in the previous section. Conventional quantitative housing studies are often based on positivism. Positivism in social science is a scientific way of studying the social world, which aims to establish universal rules of the social world (Turner, 2001). Bourdieu objected positivism as well as the positivism/relativism dichotomy. In his speech at the University of Oslo in 1996, he said, “my entire scientific enterprise is based on the belief that the deepest logic of the social world can be grasped”, and “I try to propose a model which aspires to universal validity” (p. 8).

Whilst this thesis aims to bridge the subjectivity and objectivity dichotomy, much of the methodology remains positivist. Positivist research in social science shares similarities with natural science in methodology (Bransen, 2001). To examine the suitability of a positivist approach in studying economic behaviour, I will begin my discussion by examining the definition of a scientific methodology. The Science Council (no date) defines scientific methodology as follows:

> “Scientific methodology includes the following: 1) Objective observation: Measurement and data (possibly although not necessarily using mathematics as a tool); 2) Evidence; 3) Experiment and/or observation as benchmarks for testing hypotheses; 4) Induction: reasoning to establish general rules or

> conclusions drawn from facts or examples; 5) Repetition; 6) Critical analysis; 7) Verification and testing: critical exposure to scrutiny, peer review and assessment”.

The first reason that a positivist approach is not able to fully answer the research question in this thesis concerns observation and evidence. In this thesis, the construction of the symbolic, such as the habitus and social classes, was based on observable factors including characteristics of renters and relocators. For example, economic capital and education level (as an indication of cultural capital) were the main variables considered in modelling socio-economic groups in Chapter 7. In contrast, unobservable factors such as belief, tastes and social networks were neglected. What constitutes as the agent’s background was therefore heavily dependent on the available data. On the other hand, revealed preference was used to translate unobservable preference into observable behaviour. However, there are limitations of using revealed preference as a means of measuring or quantifying individual preferences. These arise from the following aspects. First, the approach is not able to quantify values that are subjective or non-material. These values, which include security and belonging, are highly personal and therefore do not have universal standards. In addition, the pricing mechanism cannot reflect the heterogeneity in preferences and subjectivity of market participants. Maton's (2012) warning towards conducting empirical research on habitus rightly outlines the limitation of this thesis. According to Maton (2012), empirical evidence only provides observations of the effects of habitus, rather than habitus itself. As a result, empirical research may mix up habitus with practices or beliefs.

The second reason that a positivist approach is not able to fully answer the research question concerns the possibility of conducting a ‘critical analysis’ in the research process. The critical analysis stage is the sixth step in the Science Council’s definition of scientific methodology. During this stage, researchers should remain objective and not reject any possible hypotheses without convincing evidence. For a social science study, it is unlikely that a researcher focusing on social phenomenon is able to achieve comparable levels of objectivity observed in other sciences such as physics. This is in-part due to the researchers’ position as being part of the phenomenon. Breuer (1995) went one step further by proving the impossibility of obtaining universal physical theories, since any theory would be wrong when applied to a system which contained the observer himself due to self-reference. Researchers are also subject to social evolutions and conditions. As Horkheimer (2002) put it in his 1937 article *Traditional and Critical Theory*:

> "The traditional idea of theory is based on scientific activity as carried on within the division of labor at a particular stage in the latter's development. It corresponds to the activity of the scholar which takes place alongside all the other activities of a society but in no immediately clear connection with them. In this view of theory, therefore, the real social function of science is not made manifest; it speaks not of what theory means in human life, but only of what it means in the isolated sphere in which for historical reasons it comes into existence" (p. 197).

The above discussion on 'critical analysis' brings the need of incorporating Bourdieu's 'reflexivity' into the research methodology. Bourdieu's 'reflexivity' requires an examination of epistemological unconsciousness of the researcher as the result of being in the field of a given discipline (Kenway and McLeod, 2004). By bringing reflexivity into research, researchers need to assess how their habitus and class positions affect all stages of the research process (Mills, Durepos and Wiebe, 2012).

9.4 Limitations and Future Research

My thesis is a preliminary attempt to bring economic sociology into the sphere of social housing studies. However, it suffers from several limitations, which mainly arise from the immature approaches which aim to construct methodologies to bridge economics and sociology, as well as to bridge objectivity and subjectivity. Future research may consider addressing these limitations, and filling the research gap. In this section, I will discuss the potential directions that future research can take. The focus of the future research direction is to better understand how immateriality and subjectivism such as field, symbolic and cultural capital, social norms can be unveiled.

9.4.1 Constructing the housing field in the U.K.

The housing field and urban process follow the logic of capital (Harvey, 2002). The players with more capital can construct the norms and rules in the field, and hence reinforce the positions of the ‘winners’ and ‘losers’ within. The ‘winners’ in the field can also determine the use of urban space and consequently influence metropolitan habitus.

According to Bourdieu’s methodology, in order to identify habitus, the first step starts with the analysis of the position of the field. Mapping out the field, and the agents within, enables the identification of the social setting that agents operate within and form their habitus (Maton, 2012). However, due to the limited scale and scope of this thesis, it did not include a construction and analysis of the housing field in the U.K. Future research may use interviews, surveys, secondary data, and historical accounts of the development of housing policies to construct such fields, which will be a similar approach taken by Bourdieu when he constructed the housing field in France (see Bourdieu, 2005). Future studies may also use Multi-correspondence Analysis (MCA), which is a data analysis technique often adopted by Bourdieu. This method groups the data together based on the similarities of their corresponding characteristics, where the associations between the variables are calculated using chi-square distance (Crossley, 2008). MCA can be further used to organise the group of ‘housing consumers’ based on the forms of capital that they possess.

9.4.2 Defining cultural capital

Cultural capital, which manifests through space (Savage *et al.*, 2018), may also be reflected in housing choices. For example, the different degrees of possession of cultural capital may imply different choices of architectural styles and interior designs. Stately suburban homes within urban locations (e.g. Bloomsbury in London) are more likely to represent an old form of high-brow culture, and warehouse conversions within urban space (e.g. Shoreditch in London) represent a new form of cultural capital (Savage *et al.*, 2018). This thesis took a simplistic approach in defining ‘cultural capital’ by approximating it to the ‘level of education’. Despite Bourdieu himself using educational attainment or parents’ educational attainment as a proxy for cultural capital, it is insufficient to measure what constitutes as cultural capital. The causal relationship between cultural capital and educational attainment is not always clear. Alternative measures and proxies can be based on the engagement level with art, museums and galleries visits, heritage visits and archive visits, and linguistic abilities (Sullivan, 2001). Defining cultural capital is also much more complex in modern society than Bourdieu's time. This is because Bourdieu's discussion on cultural capital is formed based on Kantian aesthetics, of which he argued that aesthetic excellence moved away from the worldly everydayness towards the appreciation of culture in itself. However, Kantian aesthetics was derived from religious practices which deviated from the context of modern society and the urban experience (Savage *et al.*, 2018). Savage *et al.* (2018, p. 145) also found significant roles that new forms of cultural capital, such as "enthusiasm for sport", "contemporary music" and "digital communications and games", play in London. These emerging forms of culture are often more cosmopolitan and Americanised. Finally, given the important role of aesthetics in forming cultural capital, future research can incorporate images and photographs of different architectural and interior styles into surveys.

9.4.3 Psychoanalysis and the understanding of symbolic value

One of the difficulties that I faced during the research was how to determine the symbolic value of dwellings, since it was highly subjective. My approach in this thesis was engaging in phenomenological discussion on the symbolic value of dwellings through referencing literature in philosophy.

At theoretical level, given the unconscious and embedded nature of habitus, there is also potential of bringing psychoanalysis, especially the work of French psychoanalyst Jacques Lacan, into the study of habitus. Much of Bourdieu's theories connect with Lacan's work on the 'big Other' and the symbolic (Steinmetz, 2006). Not only the idea of 'otherness' connects with Bourdieu's work on habitus and field, Lacan's work on the symbolic also offers insights to Bourdieu's interpretation on symbolic capital and symbolic violence. Regarding the concept of 'otherness', Lacan distinguishes between the 'big Other' and the 'little other'. The 'big Other' refers to symbolic order, which can refer to the ideas of anonymous authoritative power. On the other hand, the ‘little other’ refers to the personal counterpart – In other words, it is the counterparty whom ‘I’ am in an inter-subjective dialogue with (Bailly, 2009). The overarching ‘big Other’, which forms a trans-individual symbolic order and structure, relates to Bourdieu’s discussion on field, the rules in the field, and the separation between the dominant and the dominated based on such rules. There have been previous attempts in linking psychoanalysis with the study of habitus, attempting to theorise the relation between objectivity and subjectivity. Examples include Silva (2016), who pointed out the extensive references that Bourdieu made to psychoanalysis, including, but not limited to, concepts such as unconsciousness and misrecognition.

Future research may bridge the gap between analyses of revealed preferences versus stated preferences. In contrast to revealed preference theory, stated preference can uncover individuals’ preference based on what they state. Collecting data on state preference can be achieved through surveys and interviews. The purpose of such primary research is to establish indicators of preferences that can be quantified and generalised. Furthermore, using interviews may help better understand the decision-making processes of social tenants. In particular, these interviews can help researchers better establish the habitus of social tenants. Psychoanalysis, which can be used to uncover symbolic meaning, can also be extended into methodology; it can be regarded as a more in-depth method for uncovering stated preference. Future research may also incorporate Lacanian psychoanalysis into the interview process. During a Lacanian psychoanalysis session, the focus of the analyst is listening, instead of trying to fit the analysand into a specific theoretical model or category. Interpretation plays an important role too, however, needs to be in relation to the ‘listening rule’ (Thompson, 1998). The incorporation of psychoanalysis into the interview process can connect with methods such as Biographical Narrative Interview Method (BNIM), which is a type of biographical research. Wengraf (2001) argued that BNIM not only enabled self-understanding of the interviewees, but also allowed the unconsciousness to resurface. The method consists of three stages through interviews. The focus of the first stage is the initial narration, where the interviewees provide their life stories. The second stage focuses on the clarification of certain points and questions raised from the first session. Finally, the third session focuses on the reflection of the initial conclusions and the rising themes. Such method allows the researcher to capture repeated patterns of behaviour, and possibly connect such behaviour to the interviewees' personal background and upbringing. The researcher can form a better understanding of habitus as a result.

To conclude, this thesis has sought to address the social housing issues beyond 'bricks and mortar' by placing Bourdieusian theories at the centre of the paper's theoretical framework. The interdisciplinary perspectives applied are not only relevant for the study of Bourdieusian theories, but are also shown to be highly relevant in the discussion of social housing studies and policies. As such, the research on social housing should seek to move beyond the technological aspects and supply units of dwellings, beyond the attempt to align social tenants with market logics; and bring in greater focus towards social, political and welfare dimensions. To achieve these aims, insights should be actively drawn from wide ranging disciplines including philosophy, politics, economics, sociology, psychology, social policies, planning and architecture. To quote Bourdieu (2014), "the social sciences have played a very important role in the construction of the state of mind and philosophy that led to the welfare state" (p. 364). As such, a cross-disciplinary collaboration of social sciences may be the most effective tool to address the social housing crises, as they fundamentally form the building blocks of the welfare state.

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Appendix

Chapter 2

Table 0.1 Local Authority Average Weekly Rents[116]

Area	2009/10	2010/11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-2018	2018-2019
Barking and Dagenham	72,70	73,97	79,30	88,10	90,39	90,82	98,58	.	97,27	94,89
Barnet	81,77	83,17	95,75	98,46	98,62	103,27	103,36	102,34	102,75	102,52
Brent	87,48	88,35	95,08	106,33	112,81	114,53	113,62	112,51	113,66	113,25
Camden	84,51	85,64	91,54	103,96	103,96	109,79	114,72	113,57	113,03	112,59
Croydon	84,33	85,12	95,81	100,13	104,99	107,31	106,64	105,45	104,42	103,40
Ealing	82,02	82,02	86,14	91,98	91,95	95,21	97,45	96,47	95,81	95,83
Enfield	81,06	81,27	86,30	92,44	96,10	102,75	101,78	100,97	100,38	101,06
Greenwich	80,58	81,55	87,07	93,52	97,46	102,18	104,62	103,58	90,71	89,90
Hackney	78,84	79,31	88,83	94,42	99,45	99,53	102,57	101,55	100,55	99,97
Hammersmith and Fulham	85,30	86,42	92,19	92,60	99,31	105,92	109,44	108,34	107,94	107,48
Haringey	82,53	83,43	87,50	94,01	98,28	103,27	107,12	106,44	105,56	104,63
Harrow	84,00	86,60	95,70	102,08	108,79	112,48	114,99	113,80	113,08	112,13
Havering	68,45	69,73	75,03	81,20	85,72	91,49	90,64	97,29	98,15	.
Hillingdon	88,71	89,98	95,22	101,40	104,53	110,62	109,99	108,95	108,05	109,02
Hounslow	77,42	78,73	84,35	91,36	95,92	101,45	105,22	104,60	106,50	.
Islington	84,42	85,86	92,07	100,49	105,84	111,85	115,91	116,45	116,55	117,30
Kensington and Chelsea	89,79	90,86	96,99	106,77	111,87	118,83	123,91	123,06	122,15	121,14
Kingston upon Thames	89,23	90,14	96,62	104,15	107,60	113,79	116,94	116,42	116,13	113,10
Lambeth	82,22	85,18	98,18	98,12	102,12	107,06	110,18	108,06	107,73	106,93
Lewisham	76,67	77,01	81,67	91,23	95,91	98,45	98,12	96,34	95,53	94,63
Newham	73,18	74,29	98,24	105,82	100,04	96,08	100,84	103,13	99,69	99,17
Redbridge	83,60	83,79	89,25	98,72	102,82	105,11	104,70	104,80	104,76	105,26
Southwark	79,54	80,60	85,20	91,98	96,46	99,11	103,90	100,76	100,13	98,75
Sutton	79,95	81,31	87,20	94,51	99,41	108,82	108,86	107,74	107,06	107,49
Tower Hamlets	83,86	86,46	92,23	99,16	103,56	108,65	112,07	113,90	110,81	109,96
Waltham Forest	80,41	80,95	86,51	92,74	96,47	100,80	104,60	104,86	104,69	104,69
Wandsworth	108,07	104,64	112,49	121,36	130,83	125,59	128,45	128,63	128,14	126,35
Westminster	96,61	98,03	106,03	111,43	117,92	122,19	126,14	131,87	129,98	127,09

Source: Ministry of Housing, Communities &Local Government (2020)

[116] Due to data limitation, there is no data for Bexley, Bromley, Lewisham, Merton and Richmond-upon-Thames. There are missing data for Barking and Dagenham (2016-2017), Havering (2018-2019) and Hounslow (2018-2019).

Table 0.2 Private rental market rent ratio based on the number of bedrooms (using two-bedroom flat as a benchmark)

Area	Studio	1-bed	2-bed	3-bed	4+bed
Barking and Dagenham	0.6	0.8	1.0	1.2	1.4
Barnet	0.6	0.8	1.0	1.3	1.8
Bexley	0.6	0.8	1.0	1.2	1.4
Brent	0.6	0.8	1.0	1.3	1.6
Bromley	0.6	0.8	1.0	1.3	1.9
Camden	0.5	0.8	1.0	1.3	1.8
Croydon	0.6	0.8	1.0	1.2	2.0
Ealing	0.6	0.8	1.0	1.2	1.8
Enfield	0.6	0.8	1.0	1.3	1.7
Greenwich	0.7	0.8	1.0	1.2	1.5
Hackney	0.7	0.8	1.0	1.4	1.7
Hammersmith and Fulham	0.6	0.8	1.0	1.3	2.4
Haringey	0.6	0.8	1.0	1.3	1.6
Harrow	0.7	0.8	1.0	1.2	1.6
Havering	0.6	0.8	1.0	1.2	1.6
Hillingdon	0.6	0.8	1.0	1.1	1.7
Hounslow	0.6	0.8	1.0	1.2	2.1
Islington	0.5	0.8	1.0	1.2	1.5
Kensington and Chelsea	0.4	0.6	1.0	1.5	2.5
Kingston upon Thames	0.6	0.8	1.0	1.2	2.0
Lambeth	0.6	0.9	1.0	1.3	1.7
Lewisham	0.7	0.8	1.0	1.2	1.8
Merton	0.6	0.8	1.0	1.2	1.8
Newham	0.7	0.8	1.0	1.2	1.4
Redbridge	0.6	0.8	1.0	1.2	1.7
Richmond-upon-Thames	0.6	0.7	1.0	1.4	2.3
Southwark	0.6	0.8	1.0	1.3	1.7
Sutton	0.6	0.8	1.0	1.3	1.7
Tower Hamlets	0.7	0.8	1.0	1.2	1.5
Waltham Forest	0.6	0.8	1.0	1.2	1.6
Wandsworth	0.6	0.8	1.0	1.3	1.8
Westminster	0.5	0.7	1.0	1.6	2.9
Average	0.6	0.8	1.0	1.3	1.8

Source: Office for National Statistics (2020)

Chapter 3

Table 0.3 Empirical test results

The dependent variable of the empirical model is RENTAL PRICE (natural log), whereas the independent variables are DISTANCE TO SCHOOL (natural log), LOCAL EDUCATION QUALITY (natural log), GARDEN (dummy variable). The control variables are DISTANCE TO NEAREST TRAIN/UNDERGROUND STATION (natural log), LOCAL ENVIRONMENTAL SCORE (natural log) and NEIGHBOURHOOD-FIXED EFFECT (dummy variable). The interaction terms for model (2) – (4) take the interaction between FAM and the independent variables, where FAM is a dummy variable indicating whether the dwelling is a family household. The interaction terms for model (5) – (7) take the interaction between TREAT and the independent variables, where TREAT is a dummy variable indicating whether the dwelling has 3 bedrooms. The estimation technique is OLS with interaction terms.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\boldsymbol{ln\_sch\_dist}$	**-0.916*** **	**-0.887*** **	**-0.916*** **	**-0.916*** **	**-0.906*** **	**-0.920*** **	**-0.920*** **
	(0.00264)	**(0.00415)**	**(0.00263)**	**(0.00263)**	**(0.00265)**	**(0.00240)**	**(0.00240)**
$\boldsymbol{ln\_quality}$	**0.00444*** **	**0.00424*** **	-0.00178	**0.00429*** **	**0.00355*** **	**0.00184** **	**0.00328*** **
	(0.000694)	**(0.000693)**	(0.00108)	**(0.000693)**	**(0.000654)**	**(0.000707)**	**(0.000656)**
$\boldsymbol{garden}$	**0.107*** **	**0.104*** **	0.105***	**-0.0920** **	**0.0769*** **	**0.0767*** **	**0.0459* **
	(0.0200)	**(0.0199)**	(0.0200)	**(0.0318)**	**(0.0190)**	**(0.0190)**	**(0.0204)**
ln_subway	-0.841***	-0.840***	-0.841***	-0.841***	-0.854***	-0.855***	-0.854***
	(0.00435)	(0.00434)	(0.00435)	(0.00434)	(0.00409)	(0.00410)	(0.00410)
ln_env	0.00585***	0.00581***	0.00583***	0.00585***	0.00869***	0.00898***	0.00887***
	(0.000672)	(0.000670)	(0.000670)	(0.000670)	(0.000636)	(0.000638)	(0.000638)
Neighbourhood-FE	YES	YES	YES	YES	YES	YES	YES
$\boldsymbol{fam * ln\_sch\_dist}$		**-0.0432*** **					
		(0.00484)					
$\boldsymbol{fam * ln\_sch\_qua}$			**0.0100*** **				
			(0.00134)				
$\boldsymbol{fam * garden}$				**0.314*** **			
				(0.0391)			
$treat * school$					-0.0640***		
					(0.00548)		
$treat * quality$						0.00961***	
						(0.00175)	
$treat * garden$							0.224***
							(0.0511)
Cons	4.633***	4.639***	4.628***	4.632***	4.691***	4.686***	4.686***
	(0.0150)	(0.0150)	(0.0150)	(0.0150)	(0.0143)	(0.0143)	(0.0143)
adj. R^2	0.904	0.905	0.905	0.905	0.907	0.907	0.907

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.4 Robustness test results

In the robustness test, the dependent variable of the empirical model is RENTAL PRICE (natural log), whereas the independent variables are DISTANCE TO SCHOOL (natural log), LOCAL EDUCATION QUALITY (natural log), GARDEN (dummy variable). The control variables are PUBLIC TRANSPORT ACCESSIBILITY SCORE (natural log), LOCAL ENVIRONMENTAL SCORE (natural log), LOCAL SAFETY SCORE (natural log) and NEIGHBOURHOOD FIXED EFFECT (dummy variable). The interaction terms for model (8) – (10) take the interaction between FAM and the independent variables, where FAM is a dummy variable indicating whether the dwelling is a family household. The estimation technique is OLS with interaction terms.

	(8)	(9)	(10)
$\boldsymbol{ln\_sch\_dist}$	**-0.811*****	**-0.849*****	**-0.849*****
	(0.00761)	**(0.00483)**	**(0.00483)**
$\boldsymbol{ln\_sch\_qua}$	**0.00652*****	**0.000922**	**0.00664*****
	(0.00141)	**(0.00209)**	**(0.00141)**
$\boldsymbol{garden}$	**0.0566**	**0.0589**	**-0.146***
	(0.0367)	**(0.0368)**	**(0.0586)**
ln_access	0.00415***	0.00414***	0.00413***
	(0.00110)	(0.00110)	(0.00110)
ln_env	**0.00493*****	**0.00496*****	**0.00498*****
	(0.00123)	**(0.00123)**	**(0.00123)**
ln_safety	0.0314***	0.0317***	0.0314***
	(0.00181)	(0.00181)	(0.00181)
Neighbourhood-FE	YES	YES	YES
$\boldsymbol{fam * ln\_sch\_dist}$	-0.0574***		
	(0.00890)		
$\boldsymbol{fam * ln\_sch\_qua}$		0.00934***	
		(0.00247)	
$\boldsymbol{fam * garden}$			0.326***
			(0.0719)
Cons	5.723***	5.711***	5.714***
	(0.0278)	(0.0279)	(0.0278)
N	15264	15264	15264
adj. R^2	0.678	0.677	0.677

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.5 Empirical test results appendix (without neighbourhood fixed effect)

The dependent variable of the empirical model is RENTAL PRICE (natural log), whereas the independent variables are DISTANCE TO SCHOOL (natural log), LOCAL EDUCATION QUALITY (natural log), GARDEN (dummy variable). The control variables are DISTANCE TO NEAREST TRAIN/UNDERGROUND STATION (natural log) and LOCAL ENVIRONMENTAL SCORE (natural log). The interaction terms for model (12) – (14) take the interaction between FAM and the independent variables, where FAM is a dummy variable indicating whether the dwelling is a family household. The interaction terms for model (15) – (17) take the interaction between TREAT and the independent variables, where TREAT is a dummy variable indicating whether the dwelling has 3 bedrooms. The estimation technique is OLS with interaction terms.

	(11)	(12)	(13)	(14)	(15)	(16)	(17)
$\boldsymbol{ln\_school}$	-0.917^{***}	**-0.889^{***}**	-0.917^{***}	-0.917^{***}	-0.908^{***}	-0.922^{***}	-0.921^{***}
	(0.00263)	**(0.00415)**	(0.00263)	(0.00263)	(0.00265)	(0.00240)	(0.00240)
$\boldsymbol{ln\_quality}$	0.00466^{***}	0.00445^{***}	**-0.00174**	0.00450^{***}	0.00377^{***}	0.00208^{**}	0.00350^{***}
	(0.000694)	(0.000693)	**(0.00108)**	(0.000693)	(0.000654)	(0.000707)	(0.000656)
$\boldsymbol{garden}$	0.108^{***}	0.104^{***}	0.105^{***}	**-0.0941^{**}**	0.0771^{***}	0.0768^{***}	0.0466^{*}
	(0.0200)	(0.0200)	(0.0200)	**(0.0319)**	(0.0190)	(0.0191)	(0.0204)
ln_subway	-0.841^{***}	-0.840^{***}	-0.841^{***}	-0.841^{***}	-0.854^{***}	-0.855^{***}	-0.854^{***}
	(0.00436)	(0.00435)	(0.00435)	(0.00435)	(0.00409)	(0.00411)	(0.00411)
ln_env	0.00577^{***}	0.00573^{***}	0.00575^{***}	0.00577^{***}	0.00860^{***}	0.00888^{***}	0.00878^{***}
	(0.000672)	(0.000671)	(0.000671)	(0.000671)	(0.000637)	(0.000639)	(0.000639)
Neighbourhood-FE	No	No	No	No	No	No	No
$\boldsymbol{fam * ln\_sch\_dist}$		**-0.0431^{***}**					
		(0.00485)					
$\boldsymbol{fam * ln\_sch\_qua}$			**0.0103^{***}**				
			(0.00134)				
$\boldsymbol{fam * garden}$				**0.318^{***}**			
				(0.0391)			
$treat * school$					-0.0644^{***}		
					(0.00548)		
$treat * quality$						0.00951^{***}	
						(0.00176)	
$treat * garden$							0.220^{***}
							(0.0511)
Cons	4.561^{***}	4.567^{***}	4.558^{***}	4.561^{***}	4.616^{***}	4.609^{***}	4.608^{***}
	(0.00933)	(0.00933)	(0.00932)	(0.00931)	(0.00879)	(0.00880)	(0.00880)
N	15264	15264	15264	15264	17788	17788	17788
adj. R^2	0.904	0.905	0.904	0.904	0.907	0.907	0.907

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.6 Robustness test (without neighbourhood fixed effect)

In the robustness test, the dependent variable of the empirical model is RENTAL PRICE (natural log), whereas the independent variables are DISTANCE TO SCHOOL (natural log), LOCAL EDUCATION QUALITY (natural log), GARDEN (dummy variable). The control variables are PUBLIC TRANSPORT ACCESSIBILITY SCORE (natural log), LOCAL ENVIRONMENTAL SCORE (natural log) and LOCAL SAFETY SCORE (natural log). The interaction terms for model (18) – (20) take the interaction between FAM and the independent variables, where FAM is a dummy variable indicating whether the dwelling is a family household. The estimation technique is OLS with interaction terms.

	(18)	(19)	(20)
$\boldsymbol{ln\_sch\_dist}$	**-0.812*****	**-0.850*****	**-0.850*****
	(0.00761)	**(0.00482)**	**(0.00482)**
$\boldsymbol{ln\_sch\_qua}$	**0.00668*****	**0.000951**	**0.00679*****
	(0.00141)	**(0.00209)**	**(0.00141)**
$\boldsymbol{garden}$	**0.0578**	**0.0600**	**-0.146***
	(0.0367)	**(0.0368)**	**(0.0586)**
ln_access	0.00466***	0.00462***	0.00462***
	(0.00108)	(0.00108)	(0.00108)
ln_env	0.00484***	0.00488***	0.00490***
	(0.00123)	(0.00123)	(0.00123)
ln_safety	0.0315***	0.0318***	0.0316***
	(0.00181)	(0.00181)	(0.00181)
Neighbourhood-FE	No	No	No
$\boldsymbol{fam * ln\_sch\_dist}$	**-0.0574*****		
	(0.00890)		
$\boldsymbol{fam * ln\_sch\_qua}$		**0.00952*****	
		(0.00247)	
$\boldsymbol{fam * garden}$			**0.329*****
			(0.0719)
Cons	5.669***	5.661***	5.663***
	(0.0157)	(0.0157)	(0.0156)
N	15264	15264	15264
adj. R^2	0.678	0.677	0.677

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 4

Table 0.7 List of 60 variables used to construct output area classification

Variable Number	Variable Description	Domain
1	% Persons aged 0– 4	Demographic structure
2	% Persons aged 5–14	
3	% Persons aged 25–44	
4	% Persons aged 45–64	
5	% Persons aged 65–89	
6	% Persons aged 90+	
7	Number of persons per hectare	
8	% Persons living in a communal establishment	
9	% Persons aged over 16 who are single	
10	% Persons aged over 16 who are married or in a registered same-sex civil partnership	
11	% Persons aged over 16 who are divorced or separated	
12	% Persons who are white	
13	% Persons who have mixed ethnicity or are from multiple ethnic groups	
14	% Persons who are Asian/Asian British: Indian	
15	% Persons who are Asian/Asian British: Pakistani	
16	% Persons who are Asian/Asian British: Bangladeshi	
17	% Persons who are Asian/Asian British: Chinese and Other	
18	% Persons who are Black/African/Caribbean/Black British	
19	% Persons who are Arab or from other ethnic groups	
20	% Persons whose country of birth is the United Kingdom or Ireland	
21	% Persons whose country of birth is in the old EU (pre 2004 accession countries)	
22	% Persons whose country of birth is in the new EU (post 2004 accession countries)	
23	% Persons whose main language is not English and they cannot speak English well or at all	
24	% Households with no children	Household composition
25	% Households with non-dependent children	
26	% Households with full-time students	
27	% Households who live in a detached house or bungalow	Housing
28	% Households who live in a semi-detached house or bungalow	
29	% Households who live in a terrace or end-terrace house	
30	% Households who live in a flat	
31	% Households who own or have shared ownership of property	
32	% Households who are social renting	
33	% Households who are private renting	
34	% Households who have one fewer or less rooms than required	
35	Individuals day-to-day activities limited a lot or a little (Standardised Illness Ratio)	Socio-Economic
36	% Persons providing unpaid care	
37	% Persons aged over 16 whose highest level of qualification is Level 1, Level 2 or Apprenticeship	
38	% Persons aged over 16 whose highest level of qualification is Level 3 qualifications	
39	% Persons aged over 16 whose highest level of qualification is Level 4 qualifications and above	
40	% Persons aged over 16 who are schoolchildren or full-time students	
41	% Households with two or more cars or vans	
42	% Persons aged 16–74 who use public transport to get to work	
43	% Persons aged 16–74 who use private transport to get to work	
44	% Persons aged 16–74 who walk, cycle or use an alternative method to get to work	

Variable Number	Variable Description	Domain
45	% Persons aged 16–74 who are unemployed	Employment
46	% Employed persons aged 16–74 who work part-time	
47	% Employed persons aged 16–74 who work full-time	
48	% Employed persons aged 16–74 who work in the agriculture, forestry or fishing industries	
49	% Employed persons aged 16–74 who work in the mining, quarrying or construction industries	
50	% Employed persons aged 16–74 who work in the manufacturing industry	
51	% Employed persons aged 16–74 who work in the energy, water or air conditioning supply industries	
52	% Employed persons aged 16–74 who work in the wholesale and retail trade; repair of motor vehicles and motor cycles industries	
53	% Employed persons aged 16–74 who work in the transport or storage industries	
54	% Employed persons aged 16–74 who work in the accommodation or food service activities industries	
55	% Employed persons aged 16–74 who work in the information and communication or professional, scientific and technical activities industries	
56	% Employed persons aged 16–74 who work in the financial, insurance or real estate industries	
57	% Employed persons aged 16–74 who work in the administrative or support service activities industries	
58	% Employed persons aged 16–74 who work in the in public administration or defence; compulsory social security industries	
59	% Employed persons aged 16–74 who work in the education sector	
60	% Employed persons aged 16–74 who work in the human health and social work activities industries	

Source: Office for National Statistics (2015)

Table 0.8 Empirical test results (including interaction terms between socio-economic groups and independent variables)

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BEDROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** TYPES OF FURNISHING (dummy variable), GARDEN OR NO GARDEN (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variables are DISTANCE TO NEAREST SCHOOL (natural log) and EDUCATION QUALITY SCORE (natural log). The interaction terms take the interaction between CLASS and the different categories of independent variables. The estimation technique is OLS with interaction terms.

	(1)	(2)	(3)	(4)	(5)
Physiological needs					
$beds$	**0.250*****	**0.213*****	**0.214*****	**0.212*****	**0.212*****
	(0.00988)	**(0.00807)**	**(0.00797)**	**(0.00806)**	**(0.00803)**
Safety and security					
$house$	**0.323*****	**0.421*****	**0.314*****	**0.321*****	**0.322*****
	(0.0188)	**(0.0345)**	**(0.0187)**	**(0.0188)**	**(0.0188)**
ln_safety	**0.00924*****	**0.0221*****	**0.00828*****	**0.00872*****	**0.00924*****
	(0.00118)	**(0.00254)**	**(0.00113)**	**(0.00117)**	**(0.00119)**
Love and belonging					
ln_subway	**-0.772*****	**-0.768*****	**-0.922*****	**-0.768*****	**-0.772*****
	(0.0116)	**(0.0115)**	**(0.0158)**	**(0.0115)**	**(0.0116)**
ln_econ	**0.0138*****	**0.0147*****	**0.0136*****	**0.0262*****	**0.0140*****
	(0.000984)	**(0.000987)**	**(0.000970)**	**(0.00222)**	**(0.000987)**
Aesthetic needs					
$furnishing$	**-0.0262*****	**-0.0264*****	**-0.0243*****	**-0.0253*****	0.0242*
	(0.00695)	**(0.00694)**	**(0.00686)**	**(0.00695)**	(0.00980)
$garden$	**0.0773*****	**0.0773*****	**0.0732*****	**0.0773*****	0.0618
	(0.0160)	**(0.0160)**	**(0.0159)**	**(0.0160)**	(0.0395)
ln_env	0.00150*	0.00131*	0.00164**	0.00137*	0.0110***
	(0.000632)	(0.000634)	(0.000635)	(0.000633)	(0.00160)
Control variables					
ln_school	-0.911***	-0.914***	-0.901***	-0.912***	-0.910***
	(0.00356)	(0.00356)	(0.00368)	(0.00356)	(0.00354)
ln_edu	-0.00529***	-0.00553***	-0.00405***	-0.00611***	-0.00568***
	(0.000896)	(0.000894)	(0.000876)	(0.000902)	(0.000896)
Physiological needs					
$class \times beds$	**-0.0165*****				
	(0.00242)				
Safety and security					
$class \times house$		**-0.0444*****			
		(0.0122)			
$class \times safe$		**-0.00611*****			
		(0.000921)			
Love and belonging					
$class \times subway$			**0.0747*****		
			(0.00625)		
$class \times econ$				**-0.00479*****	
				(0.000770)	
Aesthetic needs					
$class \times fur$					**-0.0218*****
					(0.00288)
$class \times garden$					0.00589
					(0.0153)
$class \times env$					**-0.00409*****
					(0.000615)
Cons	4.383***	4.383***	4.413***	4.387***	4.385***
	(0.0280)	(0.0280)	(0.0282)	(0.0280)	(0.0279)
N	14112	14112	14112	14112	14112
adj. R^2	0.878	0.878	0.881	0.878	0.878

Table 0.9 Empirical test results (class specific)

Physiological needs: NUMBER OF BEDROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** TYPES OF FURNISHING (dummy variable), GARDEN OR NO GARDEN (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variables are DISTANCE TO NEAREST SCHOOL (natural log) and EDUCATION QUALITY SCORE (natural log). The estimation technique is OLS. Model (6) – (9) represent the respective test results for SES-1, SES-2, SES-3 and SES-4.

	(6) SES-1	(7) SES-2	(8) SES-3	(9) SES-4
Physiological needs				
$beds$	**0.248*****	**0.228*****	**0.192*****	**0.249*****
	(0.0165)	**(0.0142)**	**(0.0136)**	**(0.0152)**
Safety and security				
$house$	**0.260*****	**0.313*****	**0.318*****	**0.0721***
	(0.0385)	**(0.0328)**	**(0.0335)**	**(0.0337)**
ln_safety	**0.0158*****	**0.00457***	0.00107	0.00406
	(0.00221)	**(0.00224)**	(0.00173)	(0.00219)
Love and belonging				
ln_subway	**-0.812*****	**-0.815*****	**-0.717*****	0.0124
	(0.0171)	**(0.0160)**	**(0.0248)**	(0.0184)
ln_econ	**0.0174*****	**0.00852*****	**0.0160*****	0.0159***
	(0.00253)	**(0.00174)**	**(0.00152)**	(0.00164)
Aesthetic needs				
$furnishing$	0.0139	-0.0537***	-0.0112	-0.00166
	(0.0143)	(0.0122)	(0.0121)	(0.0124)
$garden$	0.0632	**0.0759****	**0.0728***	-0.0324
	(0.0328)	**(0.0279)**	**(0.0289)**	(0.0282)
ln_env	**0.00650*****	**0.00448*****	-0.00176	-0.00170
	(0.00136)	**(0.00115)**	(0.00117)	(0.00113)
Control variables				
ln_school	-0.806***	-0.874***	-0.894***	-0.905***
	(0.0246)	(0.00844)	(0.00671)	(0.00416)
ln_edu	-0.0103***	0.00543**	-0.00404**	-0.00822***
	(0.00191)	(0.00174)	(0.00155)	(0.00161)
Cons	4.429***	4.404***	4.442***	5.256***
	(0.0625)	(0.0497)	(0.0499)	(0.0480)
N	3335	4875	4145	1757
adj. R^2	0.815	0.853	0.883	0.977

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.10 Empirical test results (the 'worst-off' vs. the 'best-off')

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BEDROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** TYPES OF FURNISHING (dummy variable), GARDEN OR NO GARDEN (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variables are DISTANCE TO NEAREST SCHOOL (natural log) and EDUCATION QUALITY SCORE (natural log). The estimation technique is OLS. Model (10) – (11) represent the respective test results for the worst-off of the underclass and the best-off of SES-4 based on income/rental ratios.

	(10) worst-off of SES-1	(11) best-off of SES-4
Physiological needs		
$beds$	**0.568*****	**0.240*****
	(0.0286)	**(0.0171)**
Safety and security		
$house$	0.0676	**0.0778***
	(0.112)	**(0.0347)**
ln_safety	**0.0241*****	0.00403
	(0.00271)	(0.00253)
Love and belonging		
ln_subway	**-0.907*****	0.0336
	(0.0162)	(0.0194)
ln_econ	**0.0105****	**0.0151*****
	(0.00398)	**(0.00180)**
Aesthetic needs		
$furnishing$	0.0408	-0.000142
	(0.0266)	(0.0137)
$garden$	-0.00970	-0.0326
	(0.0495)	(0.0290)
ln_env	**0.0102****	**-0.00346****
	(0.00328)	**(0.00124)**
Control variables		
ln_school	-0.876***	-0.877***
	(0.0269)	(0.00736)
ln_edu	-0.0259***	-0.00754***
	(0.00326)	(0.00192)
Cons	3.909***	5.315***
	(0.0992)	(0.0539)
N	1498	1377
adj. R^2	0.903	0.956

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.11 Robustness test (SES specific)

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BATHROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** MODERN/NEWLY RENOVATED OR NOT (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variable is DISTANCE TO NEAREST SCHOOL (natural log). The estimation technique is OLS. Model (12) – (15) represent the respective test results for SES-1, SES-2, SES-3 and SES-4 respectively.

	(12) SES-1	(13) SES-2	(14) SES-3	(15) SES-4
Physiological needs				
$baths$	**0.207*****	**0.217*****	**0.207*****	**0.257*****
	(0.0228)	**(0.0186)**	**(0.0197)**	**(0.0208)**
Safety and security				
$house$	**0.550*****	**0.590*****	**0.529*****	**0.305*****
	(0.0310)	**(0.0260)**	**(0.0275)**	**(0.0281)**
ln_safety	**0.0137*****	**0.00834*****	0.000281	0.00405
	(0.00226)	**(0.00213)**	(0.00152)	(0.00221)
Love and belonging				
ln_subway	**-0.812*****	**-0.806*****	**-0.713*****	0.0198
	(0.0175)	**(0.0161)**	**(0.0247)**	(0.0180)
ln_econ	**0.00796*****	**0.00976*****	**0.0113*****	0.00839***
	(0.00195)	**(0.00153)**	**(0.00131)**	(0.00140)
Aesthetic needs				
$modern$	-0.0941	0.00530	**0.131***	-0.00452
	(0.0845)	(0.0681)	**(0.0662)**	(0.0666)
ln_env	**0.00594*****	**0.00534*****	-0.00136	-0.00192
	(0.00136)	**(0.00117)**	(0.00117)	(0.00117)
Control variables				
ln_school	-0.801***	-0.880***	-0.893***	-0.901***
	(0.0243)	(0.00852)	(0.00673)	(0.00434)
Cons	4.671***	4.515***	4.541***	5.405***
	(0.0573)	(0.0357)	(0.0443)	(0.0399)
N	3335	4875	4145	1757
adj. R^2	0.805	0.848	0.881	0.975

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.12 Robustness test (the 'worst-off' vs. the 'best-off')

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Physiological needs:** NUMBER OF BATHROOMS; 2) **Safety and security:** HOUSE OR NON-HOUSE (dummy variable) and SAFETY SCORE (natural log); 3) **Love and belonging:** DISTANCE TO THE NEAREST STATION (natural log) and LOCAL ECONOMY SCORE (natural log); 4) **Aesthetic needs:** MODERN/NEWLY RENOVATED OR NOT (dummy variable) and LOCAL ENVIRONMENT SCORE (natural log). The control variable is DISTANCE TO NEAREST SCHOOL (natural log). The estimation technique is OLS. Model (16) – (17) represent the respective test results for the worst-off of SES-1 and the best-off of SES-4 based on income/rental ratios.

	(16) worst-off of SES-1	(17) best-off of SES-4
Physiological needs		
$baths$	**0.549^{***}**	**0.257^{***}**
	(0.0385)	**(0.0208)**
Safety and security		
$house$	**0.459^{***}**	**0.305^{***}**
	(0.0963)	**(0.0281)**
ln_safety	**0.0187^{***}**	0.00405
	(0.00273)	(0.00221)
Love and belonging		
ln_subway	**-0.926^{***}**	0.0198
	(0.0163)	(0.0180)
ln_econ	-0.00531	0.00839^{***}
	(0.00386)	(0.00140)
Aesthetic needs		
$modern$	-0.163	-0.00452
	(0.0880)	(0.0666)
ln_env	0.00166	-0.00192
	(0.00296)	(0.00117)
Control variables		
ln_school	-0.867^{***}	-0.901^{***}
	(0.0290)	(0.00434)
Cons	4.004^{***}	5.405^{***}
	(0.0778)	(0.0399)
N	1498	1757
adj. R^2	0.889	0.975

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 5

Table 0.13 Hedonic modelling

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is OLS. Model (1) – (5) represent the respective test results for Central, East, West, North and South London.

	(1) CENTRAL	(2) EAST	(3) WEST	(4) NORTH	(5) SOUTH
Quality of housing					
$house$	-0.026	**0.235*** **	-0.002	**0.027** **	0.022
	(0.018)	**(0.031)**	(0.026)	**(0.014)**	(0.016)
$modern$	0.032	-0.090	0.070	-0.006	0.002
	(0.031)	(0.088)	(0.049)	(0.034)	(0.032)
$furnishing$	**0.015*** **	-0.059***	0.014	0.008	0.006
	(0.006)	(0.010)	(0.009)	(0.005)	(0.005)
$beds$	**0.028*** **	**0.160*** **	**0.181*** **	**0.093*** **	**0.035** **
	(0.007)	**(0.017)**	**(0.014)**	**(0.008)**	**(0.009)**
$baths$	**0.273*** **	**0.052* **	**0.111*** **	**0.140*** **	**0.151*** **
	(0.009)	**(0.024)**	**(0.016)**	**(0.008)**	**(0.010)**
$reception$	**0.128*** **	0.019	**0.052** **	**0.056*** **	**0.028*** **
	(0.015)	(0.028)	**(0.024)**	**(0.011)**	**(0.009)**
$garden$	**0.039** **	**0.077*** **	-0.005	-0.031***	0.013
	(0.015)	**(0.028)**	(0.020)	(0.011)	(0.014)
Quality of area					
ln_env	**0.033*** **	0.020	0.019	**0.020*** **	-0.009
	(0.008)	(0.019)	(0.022)	**(0.006)**	(0.012)
ln_safety	**0.034*** **	-0.103***	0.073	0.010	-0.079***
	(0.010)	(0.026)	(0.028)	(0.012)	(0.013)
ln_school_dist	0.003	0.066***	-0.883	0.015*	-0.015
	(0.011)	(0.022)	(0.003)	(0.008)	(0.009)
ln_school_qua	-0.033***	**0.072*** **	-0.014	**0.020** **	0.013
	(0.007)	**(0.024)**	(0.020)	**(0.008)**	(0.016)
ln_access	**0.084*** **	-0.300***	-0.112	**0.015* **	-0.034*
	(0.010)	(0.019)	(0.020)	**(0.009)**	(0.015)
ln_subway	0.0002	**-0.915*** **	0.004	0.002	**-0.091*** **
	(0.008)	**(0.004)**	(0.013)	(0.007)	**(0.008)**
Quality of life					
ln_econ	**0.059*** **	-0.150***	-0.013	-0.023	**0.163*** **
	(0.016)	(0.027)	(0.022)	(0.014)	**(0.017)**
ln_health	**0.055*** **	**0.090*** **	**0.105*** **	**0.036** **	-0.090***
	(0.013)	**(0.030)**	**(0.018)**	**(0.017)**	(0.015)
Avg price controlled	YES	YES	YES	YES	YES
Cons	2.591***	6.311	3.853	3.872***	2.308***
	(0.087)	(0.357)	(0.256)	(0.130)	(0.126)
N	3,625	3,133	3,857	1,846	2,564
adj. R^2	0.800	0.952	0.974	0.808	0.878

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.14 Spatial Error Model

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is Spatial Error Model. Model (6) – (10) represent the respective test results for Central, East, West, North and South London.

	(6) CENTRAL	(7) EAST	(8) WEST	(9) NORTH	(10) SOUTH
Quality of housing					
house	-0.025*	**0.138*** **	0.006	**0.023***	**0.027** **
	(0.018)	**(0.018)**	(0.020)	**(0.013)**	**(0.012)**
modern	0.042	−0.105**	0.084	0.001	0.016
	(0.030)	(0.051)	(0.037)	(0.033)	(0.025)
furnishing	**0.012** **	−0.017***	0.019	0.005	−0.003
	(0.006)	(0.006)	(0.007)	(0.004)	(0.004)
beds	**0.060*** **	**0.098*** **	**0.145*** **	**0.106*** **	**0.112*** **
	(0.007)	**(0.010)**	**(0.011)**	**(0.008)**	**(0.007)**
baths	**0.263*** **	**0.032** **	**0.095*** **	**0.135*** **	**0.141*** **
	(0.009)	**(0.014)**	**(0.012)**	**(0.008)**	**(0.008)**
reception	**0.142*** **	0.010	**0.058*** **	**0.054*** **	**0.042*** **
	(0.014)	(0.016)	**(0.018)**	**(0.011)**	**(0.007)**
garden	**0.038*** **	**0.032***	−0.002	-0.031***	0.006
	(0.015)	**(0.016)**	(0.015)	(0.011)	(0.011)
Quality of area					
ln_env	**0.014***	0.015	0.007	**0.017*** **	−0.018**
	(0.008)	(0.011)	(0.016)	**(0.006)**	(0.009)
ln_safety	**0.021** **	−0.078***	0.018	0.008	−0.043***
	(0.010)	(0.015)	(0.021)	(0.011)	(0.010)
ln_school_dist	0.005	0.028**	**−0.464*** **	0.013*	−0.007
	(0.011)	(0.013)	**(0.008)**	(0.008)	(0.007)
ln_school_qua	−0.041***	**0.029** **	0.008	0.009**	−0.003
	(0.007)	**(0.014)**	(0.015)	(0.008)	(0.013)
ln_access	**0.064*** **	−0.038***	−0.032**	0.013	−0.002
	(0.010)	(0.012)	(0.015)	(0.008)	(0.012)
ln_subway	−0.003	**−0.289*** **	−0.004	−0.002	**−0.043*** **
	(0.008)	**(0.008)**	(0.010)	(0.007)	**(0.006)**
Quality of life					
ln_econ	**0.046*** **	−0.056***	−0.045***	-0.015	**0.063*** **
	(0.015)	(0.016)	(0.017)	(0.014)	**(0.013)**
ln_health	**0.037*** **	**0.151*** **	**0.108*** **	**0.028***	−0.037***
	(0.012)	**(0.017)**	**(0.014)**	**(0.016)**	(0.011)
Avg price controlled	YES	YES	YES	YES	YES
Cons	1.651	-0.841***	0.232	2.126	0.187
	(0.112)	(0.218)	(0.205)	(0.192)	(0.109)
Akaike Inf. Crit	73.593	2,209.483	3,085.274	−1,350.236	−1,095.783
Wald Test (df=1)	165.966	8,845.149***	3,027.409	148.027	1,469.072
LR Test (df=1)	169.517	3,091.911***	1,999.210	117.469	1,136.577

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.15 Spatial Lag Model

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is Spatial Lag Model. Model (11) – (15) represent the respective test results for Central, East, West, North and South London.

	(11) CENTRAL	(12) EAST	(13) WEST	(14) NORTH	(15) SOUTH
Quality of housing					
$house$	-0.021*	**0.121*****	0.019	**0.031***	**0.042*****
	(0.018)	**(0.018)**	(0.018)	**(0.014)**	**(0.011)**
$modern$	0.042	−0.081*	0.046	0.008	0.017
	(0.030)	(0.047)	(0.033)	(0.032)	(0.022)
$furnishing$	**0.014****	−0.017**	0.017	0.003	0.0003
	(0.006)	(0.007)	(0.006)	(0.005)	(0.004)
$beds$	**0.045*****	**0.120*****	**0.164*****	**0.102*****	**0.092*****
	(0.007)	**(0.011)**	**(0.011)**	**(0.008)**	**(0.008)**
$baths$	**0.260*****	**0.034****	**0.074*****	**0.134*****	**0.124*****
	(0.009)	**(0.013)**	**(0.011)**	**(0.008)**	**(0.007)**
$reception$	**0.126*****	**0.050*****	**0.083*****	**0.055*****	**0.028*****
	(0.014)	**(0.015)**	**(0.016)**	**(0.011)**	**(0.006)**
$garden$	**0.039****	**0.034****	0.007	-0.029***	0.011
	(0.015)	**(0.015)**	(0.014)	(0.011)	(0.010)
Quality of area					
ln_env	**0.034*****	**0.035***	0.016	**0.023*****	**0.032****
	(0.009)	**(0.020)**	(0.025)	**(0.008)**	**(0.014)**
ln_safety	**0.037****	−0.090***	−0.057**	0.002	−0.006
	(0.011)	(0.028)	(0.028)	(0.014)	(0.021)
ln_school_dist	0.004	0.032**	**−0.601*****	0.016*	0.008
	(0.012)	(0.016)	**(0.008)**	(0.009)	(0.009)
ln_school_qua	−0.031***	0.035	0.016	**0.023****	**0.031***
	(0.007)	(0.025)	(0.019)	**(0.011)**	**(0.017)**
ln_access	**0.086*****	−0.146***	−0.061***	0.004	**0.028***
	(0.011)	(0.021)	(0.022)	(0.011)	**(0.016)**
ln_subway	−0.001	**−0.549*****	0.015	0.004	**−0.017***
	(0.009)	**(0.010)**	(0.011)	(0.008)	**(0.009)**
Quality of life					
ln_econ	**0.061*****	−0.037	0.023	-0.025	**0.036***
	(0.018)	(0.028)	(0.035)	(0.017)	**(0.020)**
ln_health	**0.061*****	**0.188*****	**0.160*****	**0.041***	0.010
	(0.014)	**(0.029)**	**(0.018)**	**(0.021)**	(0.016)
Avg price controlled	YES	YES	YES	YES	YES
Cons	2.804	17.427	0.232	4.185	3.458
	(0.107)	(5.644)	(0.205)	(0.148)	(0.192)
Akaike Inf. Crit	130.442	2,280.967	3,035.476	−1,316.413	−1,350.389
Wald Test (df=1)	125.564	47,832,761.000	5,906,476.000	118.055	2,493.168
LR Test (df=1)	112.668	3,020.426	2,049.008	83.646	1,391.184

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.16 Spatial Durbin Model

The dependent variable of the empirical model is RENTAL PRICE (natural log). The independent variables are: 1) **Quality of housing:** HOUSE OR NON-HOUSE (dummy variable), MODERN/NEWLY RENOVATED OR NOT (dummy variable), TYPES OF FURNISHING (dummy variable), NUMBER OF BEDROOMS, NUMBER OF BATHROOMS, NUMBER OF RECEPTION ROOMS and GARDEN OR NO GARDEN (dummy variable); 2) **Quality of area:** LOCAL ENVIRONMENT SCORE (natural log), NEIGHBOURHOOD SAFETY SCORE (dummy variable), DISTANCE TO NEAREST SCHOOL (natural log), EDUCATION QUALITY SCORE (natural log), TRANSPORT ACCESSIBILITY SCORE (natural log), DISTANCE TO THE NEAREST STATION (natural log); 3) **Quality of life:** LOCAL ECONOMY SCORE (natural log), LOCAL HEALTH SCORE (natural log). The control variables include the average price for the neighbouring properties of a given property. The estimation technique is Spatial Durbin Model. Model (16) – (20) represent the respective test results for Central, East, West, North and South London.

	(16) CENTRAL	(17) EAST	(18) WEST	(19) NORTH	(20) SOUTH
Quality of housing					
house	-0.024*	**0.130*** **	0.019	**0.036*** **	**0.041*** **
	(0.018)	**(0.017)**	(0.017)	**(0.013)**	**(0.012)**
modern	**0.055***	−0.108**	**0.070****	−0.002	0.007
	(0.030)	(0.046)	**(0.034)**	(0.006)	(0.023)
furnishing	**0.012****	−0.012**	**0.019*** **	0.001	−0.001
	(0.006)	(0.008)	**(0.006)**		(0.002)
beds	**0.076*** **	**0.110*** **	**0.166*** **	**0.122*** **	**0.102*** **
	(0.008)	**(0.010)**	**(0.011)**	**(0.008)**	**(0.009)**
baths	**0.262*** **	**0.037****	**0.088*** **	**0.134*** **	**0.131*** **
	(0.009)	**(0.013)**	**(0.011)**	**(0.007)**	**(0.008)**
reception	**0.139*** **	**0.036*** **	**0.070*** **	**0.057*** **	**0.035*** **
	(0.014)	**(0.016)**	**(0.017)**	**(0.010)**	**(0.007)**
garden	**0.039*** **	**0.034****	0.004	-0.030***	0.011
	(0.015)	**(0.015)**	(0.014)	(0.011)	(0.010)
Quality of area					
ln_env	0.017	**0.033***	0.029	0.017	**0.036****
	(0.012)	**(0.019)**			**(0.021)**
ln_safety	**0.029***	−0.062***	−0.066***	−0.014	0.018
	(0.015)	(0.021)	(0.025)		(0.020)
ln_school_dist	0.010	0.027	**−0.547*** **	0.008	0.010
	(0.014)	(0.021)	**(0.009)**	(0.006)	(0.008)
ln_school_qua	−0.043***	0.010	0.023	0.016	0.024
	(0.009)		(0.022)		(0.015)
ln_access	**0.072*** **	−0.105***	−0.041***	−0.062	**0.030***
	(0.013)	(0.020)	(0.016)		**(0.015)**
ln_subway	−0.008	**−0.426*** **	0.010**	0.010	0.007
	(0.012)	**(0.011)**	(0.005)	(0.007)	(0.040)
Quality of life					
ln_econ	**0.046***	−0.001	0.057	-0.022**	−0.031
	(0.026)			(0.011)	(0.023)
ln_health	**0.052*** **	**0.151*** **	**0.146*** **	**0.049****	**0.048*** **
	(0.018)	**(0.014)**	**(0.003)**	**(0.020)**	**(0.016)**
Avg price controlled	YES	YES	YES	YES	YES
Cons	−692.143	−418.645	2,381.042	3,431.805	−937.089
	(1,113.026)	(0.292)	(0.160)	(0.081)	(0.076)
Akaike Inf. Crit	41.967	1,823.798	2,681.140	−1,398.353	−1,448.839
Wald Test (df=1)	79.022	9,950.771	1,843.485	90.307	1,421.790
LR Test (df=1)	77.859	2,371.528	1,499.816	79.800	1,042.342

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 6

Table 0.17 Waiting list length as a percentage of all local authority waiting list in Greater London (2015-2016)

Borough	Waiting list length (% of total waiting list lengths in Greater London)
Barking and Dagenham	2.95%
Barnet	1.41%
Bexley	2.20%
Brent	1.60%
Bromley	1.23%
Camden	1.29%
Croydon	1.99%
Ealing	5.03%
Enfield	0.81%
Greenwich	5.08%
Hackney	4.94%
Hammersmith and Fulham	0.62%
Haringey	3.64%
Harrow	0.46%
Havering	1.15%
Hillingdon	1.02%
Hounslow	1.38%
Islington	9.11%
Kensington and Chelsea	1.21%
Kingston upon Thames	3.75%
Lambeth	8.26%
Lewisham	3.98%
Merton	3.93%
Newham	7.67%
Redbridge	3.47%
Richmond-upon-Thames	2.16%
Southwark	3.12%
Sutton	0.51%
Tower Hamlets	8.40%
Waltham Forest	3.65%
Wandsworth	1.69%
Westminster	1.96%

Source: Adapted from Local Authority Housing Statistics data return, England 2015-2016 (Ministry of Housing Communities & Local Government, 2017b)

Table 0.18 Determinants of local authority waiting list length

The dependent variable of the empirical model is POPULATION ON THE WAITING LIST (natural log). The independent variables are POPULATION OF BENEFIT CLAIMANTS (natural log), BOROUGH-LEVEL POPULATION (natural log), MEAN RENT (natural log), LOCAL AUTHORITY EFFICIENCY (first difference of natural log), SOCIAL HOUSING STOCK LEVEL (first difference of natural log). The pooled OLS and the sys-GMM also include a lagged variable POPULATION ON THE WAITING LIST FROM LAST YEAR (natural log). Model (1) – (6) represent the respective test results of pooled OLS, Random Effect Model (RE), Time-Fixed Effect Model (time-FE), Entity-Fixed Effect Model (entity-FE), Two-way Fixed Effect Model (2way-FE) and System-GMM Model.

	(1) **pooled OLS**	**(2)** **RE**	**(3)** **time-FE**	**(4)** **entity-FE**	**(5)** **2way-FE**	**(6)** **sys-GMM**
$ln\_benefits$	**0.897*****	**2.145*****	**2.673*****	**2.926*****	**2.673*****	**2.531*****
	(0.125)	**(0.153)**	**(0.351)**	**(0.312)**	**(0.224)**	**(0.195)**
$ln\_population$	-0.291	-0.603	2.451	-2.444	2.451	0.202
	(0.192)	(0.451)	(3.447)	(1.459)	(2.314)	(0.957)
ln_rent	**-0.694*****	**-0.624****	0.551	0.286	0.551	-0.217
	(0.181)	**(0.216)**	(0.284)	(0.183)	(0.314)	(0.521)
$\Delta ln\_efficiency$	0.0630	-0.218	-0.165	-0.198	-0.165	0.170
	(0.363)	(0.281)	(0.315)	(0.275)	(0.268)	(0.374)
Δln_stock	0.209	1.248	2.524	1.935	2.524	4.222
	(3.138)	(2.448)	(1.580)	(1.220)	(2.298)	(2.565)
$ln\_waiting\_lag$	**0.524*****					0.0378
	(0.0637)					(0.0777)
year1			0.466		0	
			(0.269)		(.)	
year2			0.327		-0.139	
			(0.207)		(0.0931)	
year3			0.186		-0.280*	
			(0.122)		(0.117)	
year4			0.0733		-0.393**	
			(0.0707)		(0.146)	
year5			0		-0.466**	
			(.)		(0.177)	
Cons	3.440	-1.392	-53.60	6.987	-53.14	-18.67*
	(2.742)	(5.775)	(42.81)	(18.87)	(28.17)	(9.045)
N	140	140	140	140	140	112
adj. R^2	0.758		0.707	0.694	0.630	
LM-test		0.0000				
F-test			0.0000	0.0000	0.0000	
Hausman test			0.0000	0.0000	0.0000	
Sargan test						0.0969

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.19 Determinants of benefit claimants

The dependent variable of the empirical model is POPULATION OF BENEFIT CLAIMANTS (natural log). The independent variables are NATIVE WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), IMMIGRANT ECONOMIC INACTIVITY LEVEL (natural log), UK-BORN NON-WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), NATIVE WHITE POPULATION UNEMPLOYMENT LEVEL (natural log), IMMIGRANT UNEMPLOYMENT LEVEL (natural log), UK-BORN NON-WHITE POPULATION UNEMPLOYMENT LEVEL (natural log). The control variables include BOROUGH-LEVEL POPULATION (natural log), BOROUGH-LEVEL MEAN RENT (natural log), BOROUGH-LEVEL MEAN INCOME (natural log), POPULATION PAID BELOW LONDON LIVING WAGE (natural log), POPULATION ON THE WAITING LIST (natural log). The pooled OLS and the sys-GMM also include a lagged variable POPULATION OF BENEFIT CLAIMANTS FROM LAST YEAR (natural log). Model (7) – (12) represent the respective test results of pooled OLS, Random Effect Model (RE), Time-Fixed Effect Model (time-FE), Entity-Fixed Effect Model (entity-FE), Two-way Fixed Effect Model (2way-FE) and System-GMM Model.

	(7) **pooled**	(8) **RE**	(9) **time-FE**	(10) **entity-FE**	(11) **2way-FE**	(12) **sys-GMM**
$\boldsymbol{ln\_UKWminin}$	**0.250*****	**0.150***	**0.120***	0.106	**0.120***	**0.159***
	(0.0566)	**(0.0612)**	**(0.0582)**	(0.0622)	**(0.0582)**	**(0.0666)**
ln_migin	0.0564	0.0561	-0.0576	-0.0547	-0.0576	-0.127
	(0.0509)	(0.0580)	(0.0577)	(0.0724)	(0.0577)	(0.0784)
$ln\_UKminin$	0.0378	**0.104***	0.0411	0.0381	0.0411	0.0164
	(0.0470)	**(0.0405)**	(0.0353)	(0.0432)	(0.0353)	(0.0504)
$ln\_UKWminum$	-0.00365	-0.00452	0.00170	-0.000777	0.00170	-0.0109
	(0.0369)	(0.0257)	(0.0215)	(0.0186)	(0.0215)	(0.0270)
ln_migum	-0.0244	0.0222	-0.0163	-0.0225	-0.0163	-0.0337
	(0.0479)	(0.0366)	(0.0353)	(0.0371)	(0.0353)	(0.0412)
$ln\_UKminum$	0.0506	0.0282	0.0106	0.0107	0.0106	0.0130
	(0.0328)	(0.0269)	(0.0223)	(0.0207)	(0.0223)	(0.0286)
$ln\_population$	-0.141	-0.0232	-0.0447	0.0786	-0.0447	-0.113
	(0.132)	(0.210)	(0.682)	(0.433)	(0.682)	(0.509)
ln_rent	0.363***	0.0389	-0.190*	-0.164*	-0.190*	0.0786
	(0.102)	(0.0882)	(0.0894)	(0.0650)	(0.0894)	(0.212)
ln_income	-0.0954	0.210	-0.450	-0.308	-0.450	0.270
	(0.175)	(0.256)	(0.273)	(0.339)	(0.273)	(0.387)
$ln\_belowllw$	0.00143	0.0230	0.0611	0.0374	0.0611	0.160*
	(0.0442)	(0.0630)	(0.0658)	(0.0449)	(0.0658)	(0.0815)
$ln\_waiting$	0.164***	0.239***	0.204***	0.215***	0.204***	0.263***
	(0.0213)	(0.0199)	(0.0185)	(0.0231)	(0.0185)	(0.0231)
$ln\_benefits\_lag$	0.0000191***					0.267***
	(0.0000014					(0.0692)
Cons	4.542**	3.462	11.80	9.532	11.80	2.691
	(1.667)	(3.135)	(8.513)	(5.728)	(8.469)	(5.449)
N	140	140	140	140	140	112
adj. R^2	0.898		0.637	0.710	0.637	
LM-test		0.0000				
F-test (df=27)			0.0000	0.0000	0.0000	
Hausman test			0.0000	0.0000	0.0000	
Sargan test						0.2713

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.20 2way-FE robustness test for test on local authority waiting list length determinants

The dependent variable of the empirical model is POPULATION ON THE WAITING LIST (natural log). The independent variables are POPULATION OF BENEFIT CLAIMANTS (natural log), BOROUGH-LEVEL POPULATION (natural log), MEAN RENT (natural log), LOCAL AUTHORITY EFFICIENCY (first difference of natural log), SOCIAL HOUSING STOCK LEVEL (first difference of natural log), POPULATION OF THE PRIVATE RENTERS (natural log) or POPULATION OF OUTRIGHT OWNERS (natural log). The estimation method is Two-way Fixed Effect Model. Model (13) – (15) represent the respective test results of three robustness tests. (13) does not include POPULATION OF THE PRIVATE RENTERS or POPULATION OF OUTRIGHT OWNERS, and (14) does not include POPULATION OF OUTRIGHT OWNERS.

	(13)	(14)	(15)
$\boldsymbol{ln\_benefits}$	**2.673*****	**2.724*****	**2.705*****
	(0.224)	**(0.231)**	**(0.227)**
$ln\_population$	2.451	2.329	2.114
	(2.314)	(2.319)	(2.283)
ln_rent	0.551	0.628	0.671*
	(0.314)	(0.325)	(0.321)
$\Delta ln\_efficiency$	-0.165	-0.145	-0.153
	(0.268)	(0.269)	(0.265)
Δln_stock	2.524	2.471	1.895
	(2.298)	(2.301)	(2.279)
$ln\_privaterenters$		0.314	0.588
		(0.343)	(0.361)
$ln\_outrightowners$			0.641*
			(0.303)
Cons	-53.14	-55.85	-62.44*
	(28.17)	(28.34)	(28.04)
N	140	140	140
R^2	0.726	0.728	0.739

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.21 sys-GMM robustness test for test on local authority waiting list length determinants

The dependent variable of the empirical model is POPULATION ON THE WAITING LIST (natural log). The independent variables are POPULATION OF BENEFIT CLAIMANTS (natural log), BOROUGH-LEVEL POPULATION (natural log), MEAN RENT (natural log), LOCAL AUTHORITY EFFICIENCY (first difference of natural log), SOCIAL HOUSING STOCK LEVEL (first difference of natural log), POPULATION OF THE PRIVATE RENTERS (natural log) or POPULATION OF OUTRIGHT OWNERS (natural log). The estimation method is sys-GMM Model. Model (16) – (18) represent the respective test results of three robustness tests. (16) does not include POPULATION OF THE PRIVATE RENTERS or POPULATION OF OUTRIGHT OWNERS, and (17) does not include POPULATION OF OUTRIGHT OWNERS.

	(16)	(17)	(18)
$ln\_waiting\_lag$	0.153	0.144	0.135
	(0.103)	(0.100)	(0.0997)
$\boldsymbol{ln\_benefits}$	**2.603*****	**2.703*****	**2.729*****
	(0.223)	**(0.223)**	**(0.222)**
$ln\_population$	-0.642	-1.444	-2.320
	(1.125)	(1.240)	(1.363)
ln_rent	0.237	0.288	0.387
	(0.638)	(0.631)	(0.630)
$ln\_efficiency$	0.0490	0.121	0.189
	(0.341)	(0.334)	(0.336)
ln_stock	-0.521	-0.779	-0.661
	(0.525)	(0.559)	(0.563)
$ln\_privaterenters$		0.609	0.794*
		(0.345)	(0.366)
$ln\_outrightowners$			0.427
			(0.290)
Cons	-8.714	-4.372	-2.156
	(12.14)	(12.59)	(12.55)
N	112	112	112

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.22 2-way FE model robustness test for test on benefit claimants

The dependent variable of the empirical model is POPULATION OF BENEFIT CLAIMANTS (natural log). The independent variables are NATIVE WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), IMMIGRANT ECONOMIC INACTIVITY LEVEL (natural log), UK-BORN NON-WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), NATIVE WHITE POPULATION UNEMPLOYMENT LEVEL (natural log), IMMIGRANT UNEMPLOYMENT LEVEL (natural log), UK-BORN NON-WHITE POPULATION UNEMPLOYMENT LEVEL (natural log). The control variables include BOROUGH-LEVEL POPULATION (natural log), BOROUGH-LEVEL MEAN RENT (natural log), BOROUGH-LEVEL MEAN INCOME (natural log), POPULATION ON THE WAITING LIST (natural log) and POPULATION PAID BELOW LONDON LIVING WAGE (natural log). The estimation method is Two-way Fixed Effect Model. Model (19) – (21) represent the respective test results of three robustness tests. (19) does not include POPULATION PAID BELOW LONDON LIVING WAGE, (20) does not include BOROUGH-LEVEL MEAN INCOME, and (21) does not include BOROUGH-LEVEL MEAN INCOME or POPULATION PAID BELOW LONDON LIVING WAGE.

	(19)	(20)	(21)
$\boldsymbol{ln\_UKWminin}$	**0.122***	**0.130***	**0.131***
	(0.0581)	**(0.0584)**	**(0.0584)**
ln_migin	-0.0522	-0.0659	-0.0603
	(0.0574)	(0.0580)	(0.0577)
$ln\_UKminin$	0.0397	0.0447	0.0433
	(0.0352)	(0.0355)	(0.0355)
$ln\_UKWminum$	0.000224	-0.00324	-0.00505
	(0.0215)	(0.0215)	(0.0214)
ln_migum	-0.0126	-0.00666	-0.00222
	(0.0350)	(0.0351)	(0.0348)
$ln\_UKminum$	0.0104	0.00892	0.00856
	(0.0222)	(0.0224)	(0.0224)
$ln\_population$	0.0433	-0.0198	0.0785
	(0.675)	(0.688)	(0.681)
ln_rent	-0.183*	-0.193*	-0.185*
	(0.0890)	(0.0902)	(0.0899)
ln_income	-0.465		
	(0.273)		
$ln\_waiting$	0.205***	0.211***	0.212***
	(0.0185)	(0.0183)	(0.0183)
$ln\_belowllw$		0.0674	
		(0.0662)	
Cons	11.26	8.504	7.788
	(8.443)	(8.302)	(8.273)
N	140	140	140
adj. R^2	0.638	0.631	0.631

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.23 sys-GMM model robustness test for test on benefit claimants

The dependent variable of the empirical model is POPULATION OF BENEFIT CLAIMANTS (natural log). The independent variables are NATIVE WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), IMMIGRANT ECONOMIC INACTIVITY LEVEL (natural log), UK-BORN NON-WHITE POPULATION ECONOMIC INACTIVITY LEVEL (natural log), NATIVE WHITE POPULATION UNEMPLOYMENT LEVEL (natural log), IMMIGRANT UNEMPLOYMENT LEVEL (natural log), UK-BORN NON-WHITE POPULATION UNEMPLOYMENT LEVEL (natural log). The control variables include BOROUGH-LEVEL POPULATION (natural log), BOROUGH-LEVEL MEAN RENT (natural log), BOROUGH-LEVEL MEAN INCOME (natural log), POPULATION ON THE WAITING LIST (natural log) and POPULATION PAID BELOW LONDON LIVING WAGE (natural log). The estimation method is sys-GMM Model. Model (22) – (24) represent the respective test results of three robustness tests. (19) does not include POPULATION PAID BELOW LONDON LIVING WAGE, (20) does not include BOROUGH-LEVEL MEAN INCOME, and (21) does not include BOROUGH-LEVEL MEAN INCOME or POPULATION PAID BELOW LONDON LIVING WAGE.

	(22)	(23)	(24)
$\boldsymbol{ln\_benefits\_lag}$	**0.267*****	**0.281*****	**0.262*****
	(0.0692)	**(0.0676)**	**(0.0661)**
$\boldsymbol{ln\_UKWminin}$	**0.159***	**0.153***	**0.147***
	(0.0666)	**(0.0665)**	**(0.0655)**
ln_migin	-0.127	-0.126	-0.0924
	(0.0784)	(0.0789)	(0.0778)
$ln\_UKminin$	0.0164	0.0134	0.0258
	(0.0504)	(0.0507)	(0.0505)
$ln\_UKWminum$	-0.0109	-0.0109	-0.0211
	(0.0270)	(0.0273)	(0.0267)
ln_migum	-0.0337	-0.0361	-0.0426
	(0.0412)	(0.0413)	(0.0402)
$ln\_UKminum$	0.0130	0.0156	0.00754
	(0.0286)	(0.0287)	(0.0281)
$ln\_population$	-0.113	-0.120	0.459
	(0.509)	(0.512)	(0.339)
ln_rent	0.0786	0.140	
	(0.212)	(0.194)	
$ln\_waiting$	0.263***	0.262***	0.259***
	(0.0231)	(0.0233)	(0.0232)
ln_income	0.270		
	(0.387)		
$ln\_belowllw$	0.160*	0.156	
	(0.0815)	(0.0822)	
Cons	2.691	4.016	-0.620
	(5.449)	(5.135)	(4.115)
N	112	112	112

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 7

Table 0.24 Empirical test results of the gravity model: All age group

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN *i* AND *j* (natural log). The independent variables are respective POPULATION IN *i* and *j* (natural log), MEDIAN HOUSING SALES PRICE IN *i* and *j* (natural log), MEDIAN INCOME LEVEL IN *i* and *j* (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j* (natural log), ENVIRONMENT SCORE IN *i* and *j* (natural log) and WHETHER OR NOT *i* and *j* ARE ADJACENT (dummy variable). The estimation method is OLS based on Gravity Model. Model (1) – (7) represent the respective test results on the entire population of all years, and individual years between 2012 and 2017.

	(1) All	(2) 2012	(3) 2013	(4) 2014	(5) 2015	(6) 2016	(7) 2017
$Dist_{ij}$	**-0.861*****	**-0.933*****	**-0.892*****	**-0.877*****	**-0.853*****	**-0.895*****	**-0.851*****
	(0.0143)	**(0.0356)**	**(0.0355)**	**(0.0349)**	**(0.0337)**	**(0.0356)**	**(0.0322)**
$Population_i$	-0.104	0.105	-0.507**	-0.143	-0.293	-0.522**	2.924***
	(0.0755)	(0.182)	(0.173)	(0.173)	(0.176)	(0.174)	(0.561)
$Population_j$	0.0969	0.138	0.148	0.172	0.00282	0.00522	-0.0101
	(0.0716)	(0.179)	(0.176)	(0.172)	(0.168)	(0.178)	(0.159)
$Sale\_median_i$	**0.679*****	**0.549*****	**0.502*****	**0.547*****	**0.515*****	**0.635*****	**0.401*****
	(0.0296)	**(0.0808)**	**(0.0801)**	**(0.0787)**	**(0.0822)**	**(0.0882)**	**(0.0698)**
$Sale\_median_j$	0.0523	0.0283	-0.108	-0.0723	-0.167*	-0.267**	-0.0983
	(0.0296)	(0.0806)	(0.0800)	(0.0787)	(0.0807)	(0.0881)	(0.0695)
$Income\_median_i$	**-2.268*****	**-2.207*****	**-1.905*****	**-2.352*****	**-1.886*****	**-1.987*****	**-1.843*****
	(0.0926)	**(0.219)**	**(0.235)**	**(0.259)**	**(0.240)**	**(0.252)**	**(0.204)**
$Income\_median_j$	**0.493*****	**0.521*****	**0.387***	**0.437***	**0.266**	**0.222**	**0.383****
	(0.0654)	**(0.152)**	**(0.163)**	**(0.179)**	**(0.165)**	**(0.175)**	**(0.140)**
$London\_pub_i$	**-0.109*****	**-0.118***	**-0.175*****	**-0.211*****	**-0.167*****	**-0.153****	**-0.140*****
	(0.0182)	**(0.0464)**	**(0.0462)**	**(0.0453)**	**(0.0446)**	**(0.0465)**	**(0.0422)**
$London\_pub_j$	0.0807***	0.0501	0.0114	-0.00103	0.0261	0.0480	0.0314
	(0.0182)	(0.0455)	(0.0461)	(0.0453)	(0.0438)	(0.0465)	(0.0419)
$Green_i$	0.148***	0.0550	0.126*	0.196***	0.164***	0.140**	0.0422
	(0.0192)	(0.0464)	(0.0492)	(0.0506)	(0.0470)	(0.0483)	(0.0427)
$Green_j$	**0.260*****	**0.274*****	**0.235*****	**0.265*****	**0.236*****	**0.196*****	**0.202*****
	(0.0192)	**(0.0457)**	**(0.0492)**	**(0.0505)**	**(0.0468)**	**(0.0482)**	**(0.0412)**
Adj_{ij}	0.0315	0.00914	0.0353	0.0181	0.0356	-0.000519	-0.0216
	(0.0185)	(0.0460)	(0.0459)	(0.0449)	(0.0434)	(0.0458)	(0.0415)
Cons	18.88***	20.13***	21.11***	23.46***	21.07***	22.67***	13.68***
	(0.616)	(1.418)	(1.502)	(1.720)	(1.508)	(1.672)	(2.146)
N	5952	992	992	992	992	992	992
adj. R^2	0.655	0.680	0.665	0.659	0.666	0.657	0.669

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.25 Robustness test: All age groups

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN *i* AND *j* (natural log). The independent variables are respective POPULATION IN *i* and *j* (natural log), MEDIAN HOUSING SALES PRICE IN *i* and *j* (natural log), GEOGRAPHIC SIZES IN *i* and *j* (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j* (natural log), DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j* (natural log) , DISTANCE TO CENTRAL LONDON FROM *i* and *j* (natural log) and WHETHER OR NOT *i* and *j* ARE ADJACENT (dummy variable). The estimation method is OLS based on gravity model. Model (8) – (11) represent the respective robustness test results on the entire population of all years. Model (8) excludes GEOGRAPHIC SIZES IN *i* and *j*, DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j*, and DISTANCE TO CENTRAL LONDON FROM *i* and *j*. Model (9) excludes POPULATION IN *i* and *j*, DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j*, and DISTANCE TO CENTRAL LONDON FROM *i* and *j*. Model (10) excludes GEOGRAPHIC SIZES IN *i* and *j*, PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j*, and DISTANCE TO CENTRAL LONDON FROM *i* and *j*. Model (11) excludes GEOGRAPHIC SIZES IN *i* and *j*, PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j*, and DRIVING ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j*.

	(8)	(9)	(10)	(11)
$Dist_{ij}$	**-0.859***** **(0.0151)**	**-0.859***** **(0.0151)**	**-0.879***** **(0.0150)**	**-0.876***** **(0.0155)**
$Population_i$	**-0.168*** **(0.0793)**		**-0.165*** **(0.0791)**	**-0.166*** **(0.0792)**
$Population_j$	0.108 (0.0753)		0.105 (0.0751)	0.103 (0.0753)
$Area_i$		-0.0330 (0.0177)		
$Area_j$		0.0284 (0.0172)		
$Sale\_mean_i$	-0.0261* (0.0124)	-0.0269* (0.0124)	-0.00492 (0.0127)	-0.0124 (0.0124)
$Sale\_mean_j$	**-0.189***** **(0.0141)**	**-0.189***** **(0.0141)**	**-0.166***** **(0.0146)**	**-0.180***** **(0.0143)**
$London\_pub_i$	**-0.0390*** **(0.0188)**	**-0.0392*** **(0.0188)**		
$London\_pub_j$	**0.0609**** **(0.0188)**	**0.0610**** **(0.0188)**		
$London\_dri_i$			**0.0392*** **(0.0197)**	
$London\_dri_j$			**0.128***** **(0.0199)**	
$London_i$				0.0110 (0.0145)
$London_j$				**0.0709***** **(0.0147)**
$Green_i$	**-0.0819***** **(0.0181)**	**-0.0808***** **(0.0181)**	**-0.123***** **(0.0219)**	**-0.105***** **(0.0222)**
$Green_j$	**0.218***** **(0.0180)**	**0.218***** **(0.0180)**	**0.148***** **(0.0223)**	**0.171***** **(0.0225)**
Adj_{ij}	0.0539** (0.0194)	0.0533** (0.0194)	0.0347 (0.0194)	0.0367 (0.0198)
Cons	8.459*** (0.384)	8.321*** (0.275)	7.800*** (0.381)	8.346*** (0.362)
N	5952	5952	5952	5952
adj. R^2	0.618	0.618	0.620	0.619

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.26 Empirical test results of the Gravity Model: All age group (including education)

	All	2012	2013	2014	2015	2016	2017
$Dist_{ij}$	**-0.856*** **	**-0.856*** **	**-0.856*** **	**-0.856*** **	**-0.856*** **	**-0.856*** **	**-0.856*** **
	(0.0143)	**(0.0143)**	**(0.0143)**	**(0.0143)**	**(0.0143)**	**(0.0143)**	**(0.0143)**
$Population_i$	-0.139	-0.139	-0.139	-0.139	-0.139	-0.139	-0.139
	(0.0754)	(0.0754)	(0.0754)	(0.0754)	(0.0754)	(0.0754)	(0.0754)
$Population_j$	0.0957	0.0957	0.0957	0.0957	0.0957	0.0957	0.0957
	(0.0713)	(0.0713)	(0.0713)	(0.0713)	(0.0713)	(0.0713)	(0.0713)
$Sale\_median_i$	**0.686*** **	**0.686*** **	**0.686*** **	**0.686*** **	**0.686*** **	**0.686*** **	**0.686*** **
	(0.0295)	**(0.0295)**	**(0.0295)**	**(0.0295)**	**(0.0295)**	**(0.0295)**	**(0.0295)**
$Sale\_median_j$	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427
	(0.0295)	(0.0295)	(0.0295)	(0.0295)	(0.0295)	(0.0295)	(0.0295)
$Income\_median_i$	**-2.158*** **	**-2.158*** **	**-2.158*** **	**-2.158*** **	**-2.158*** **	**-2.158*** **	**-2.158*** **
	(0.0941)	**(0.0941)**	**(0.0941)**	**(0.0941)**	**(0.0941)**	**(0.0941)**	**(0.0941)**
$Income\_median_j$	**0.467*** **	**0.467*** **	**0.467*** **	**0.467*** **	**0.467*** **	**0.467*** **	**0.467*** **
	(0.0664)	**(0.0664)**	**(0.0664)**	**(0.0664)**	**(0.0664)**	**(0.0664)**	**(0.0664)**
$London\_pub_i$	**-0.102*** **	**-0.102*** **	**-0.102*** **	**-0.102*** **	**-0.102*** **	**-0.102*** **	**-0.102*** **
	(0.0181)	**(0.0181)**	**(0.0181)**	**(0.0181)**	**(0.0181)**	**(0.0181)**	**(0.0181)**
$London\_pub_j$	**0.0779*** **	**0.0779*** **	**0.0779*** **	**0.0779*** **	**0.0779*** **	**0.0779*** **	**0.0779*** **
	(0.0182)	**(0.0182)**	**(0.0182)**	**(0.0182)**	**(0.0182)**	**(0.0182)**	**(0.0182)**
$Green_i$	**0.175*** **	**0.175*** **	**0.175*** **	**0.175*** **	**0.175*** **	**0.175*** **	**0.175*** **
	(0.0195)	**(0.0195)**	**(0.0195)**	**(0.0195)**	**(0.0195)**	**(0.0195)**	**(0.0195)**
$Green_j$	**0.261*** **	**0.261*** **	**0.261*** **	**0.261*** **	**0.261*** **	**0.261*** **	**0.261*** **
	(0.0194)	**(0.0194)**	**(0.0194)**	**(0.0194)**	**(0.0194)**	**(0.0194)**	**(0.0194)**
Edu_i	**-0.0514*** **	**-0.0514*** **	**-0.0514*** **	**-0.0514*** **	**-0.0514*** **	**-0.0514*** **	**-0.0514*** **
	(0.00708)	**(0.00708)**	**(0.00708)**	**(0.00708)**	**(0.00708)**	**(0.00708)**	**(0.00708)**
Edu_j	-0.00875	-0.00875	-0.00875	-0.00875	-0.00875	-0.00875	-0.00875
	(0.00720)	(0.00720)	(0.00720)	(0.00720)	(0.00720)	(0.00720)	(0.00720)
Adj_{ij}	0.0358	0.0358	0.0358	0.0358	0.0358	0.0358	0.0358
	(0.0184)	(0.0184)	(0.0184)	(0.0184)	(0.0184)	(0.0184)	(0.0184)
Cons	17.90***	17.90***	17.90***	17.90***	17.90***	17.90***	17.90***
	(0.636)	(0.636)	(0.636)	(0.636)	(0.636)	(0.636)	(0.636)
N	5952	992	992	992	992	992	992
adj. R^2	0.658	0.658	0.658	0.658	0.658	0.658	0.658

Standard errors in parentheses
* *p < 0.05*, ** *p < 0.01*, *** *p < 0.001*

Table 0.27 Empirical test results of the gravity model: Age group between 20 and 29 (only use distance as an independent variable)

	All	2012	2013	2014	2015	2016	2017
$\boldsymbol{Dist_{ij}}$	**-0.423*****	**-0.423*****	**-0.423*****	**-0.423*****	**-0.423*****	**-0.423*****	**-0.423*****
	(0.00814)	**(0.00814)**	**(0.00814)**	**(0.00814)**	**(0.00814)**	**(0.00814)**	**(0.00814)**
Cons	3.838***	3.838***	3.838***	3.838***	3.838***	3.838***	3.838***
	(0.0229)	(0.0229)	(0.0229)	(0.0229)	(0.0229)	(0.0229)	(0.0229)
N	5952	992	992	992	992	992	992
adj. R^2	0.313	0.313	0.313	0.313	0.313	0.313	0.313

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 0.28 Empirical test results of the gravity model: Age group 20 – 29

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN *i* AND *j* (natural log). The independent variables are respective POPULATION IN *i* and *j* (natural log), MEDIAN HOUSING SALES PRICE IN *i* and *j* (natural log), MEDIAN INCOME LEVEL IN *i* and *j* (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j* (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j* (natural log), ENVIRONMENT SCORE IN *i* and *j* (natural log) and WHETHER OR NOT *i* and *j* ARE ADJACENT (dummy variable). The estimation method is OLS. Model (12) – (18) represent the respective test results on the 20-29 population of all years, as well as individual years between 2012 and 2017.

	(12) All	(13) 2012	(14) 2013	(15) 2014	(16) 2015	(17) 2016	(18) 2017
$Dist_{ij}$	**-0.427*****	**-0.450*****	**-0.440*****	**-0.433*****	**-0.403*****	**-0.441*****	**-0.410*****
	(0.0141)	**(0.0360)**	**(0.0355)**	**(0.0359)**	**(0.0333)**	**(0.0341)**	**(0.0312)**
$Population_i$	-0.0896	0.0699	-0.157	-0.272	-0.107	-0.477**	0.822
	(0.0711)	(0.180)	(0.166)	(0.171)	(0.171)	(0.165)	(0.521)
$Population_j$	-0.00416	-0.0114	0.0473	0.0689	-0.172	0.0717	-0.103
	(0.0674)	(0.173)	(0.168)	(0.170)	(0.159)	(0.164)	(0.147)
$Sale\_median_i$	**0.349*****	**0.320*****	**0.257****	**0.377*****	**0.190***	**0.251****	**0.141***
	(0.0286)	**(0.0810)**	**(0.0784)**	**(0.0791)**	**(0.0856)**	**(0.0852)**	**(0.0675)**
$Sale\_median_j$	0.0840**	0.0346	0.0422	0.0985	-0.0411	-0.243**	-0.0908
	(0.0286)	(0.0804)	(0.0784)	(0.0789)	(0.0826)	(0.0851)	(0.0673)
$Income\_median_i$	**-1.524*****	**-1.667*****	**-1.649*****	**-2.076*****	**-1.075*****	**-1.023*****	**-0.929*****
	(0.0872)	**(0.212)**	**(0.225)**	**(0.255)**	**(0.233)**	**(0.232)**	**(0.189)**
$Income\_median_j$	**0.545*****	**0.564*****	**0.670*****	**0.678*****	**0.369***	**0.185**	**0.324***
	(0.0616)	**(0.147)**	**(0.156)**	**(0.177)**	**(0.159)**	**(0.161)**	**(0.130)**
$London\_pub_i$	-0.0228	-0.0259	-0.0664	-0.0795	-0.00776	0.00771	-0.0362
	(0.0198)	(0.0505)	(0.0503)	(0.0506)	(0.0475)	(0.0482)	(0.0442)
$London\_pub_j$	-0.0131	-0.0135	-0.0586	-0.0388	-0.0229	-0.0224	-0.0145
	(0.0198)	(0.0505)	(0.0501)	(0.0505)	(0.0474)	(0.0479)	(0.0440)
$PTAL_i$	**0.0774*****	**0.102***	**0.129****	**0.120****	**0.0832***	**0.141*****	**0.0878***
	(0.0162)	**(0.0423)**	**(0.0413)**	**(0.0424)**	**(0.0411)**	**(0.0424)**	**(0.0366)**
$PTAL_j$	**0.112*****	**0.155*****	**0.150*****	**0.142*****	**0.141*****	**0.146*****	**0.128*****
	(0.0162)	**(0.0411)**	**(0.0411)**	**(0.0420)**	**(0.0399)**	**(0.0412)**	**(0.0365)**
$Green_i$	**0.133*****	**0.109**	**0.209****	**0.280*****	**0.0894**	**0.153***	**0.0937**
	(0.0249)	**(0.0642)**	**(0.0638)**	**(0.0672)**	**(0.0595)**	**(0.0620)**	**(0.0551)**
$Green_j$	**0.143*****	**0.195****	**0.221*****	**0.174****	**0.164****	**0.0952**	**0.120***
	(0.0249)	**(0.0614)**	**(0.0637)**	**(0.0672)**	**(0.0580)**	**(0.0616)**	**(0.0542)**
Adj_{ij}	**-0.113*****	**-0.121****	**-0.121****	**-0.118****	**-0.0920***	**-0.103***	**-0.132*****
	(0.0178)	**(0.0453)**	**(0.0446)**	**(0.0450)**	**(0.0419)**	**(0.0428)**	**(0.0393)**
Cons	12.79***	14.64***	15.42***	17.64***	12.25***	13.85***	9.893***
	(0.595)	(1.413)	(1.457)	(1.710)	(1.458)	(1.541)	(1.998)
N	5950	992	992	991	991	992	992
adj. R^2	0.371	0.393	0.383	0.374	0.359	0.396	0.370

Table 0.29 Empirical test results of the gravity model: Age group 20 – 29 (Using median rent levels as proxies for housing costs)

The dependent variable of the empirical model is RELOCATION POPULATION BETWEEN *i* AND *j* (natural log). The independent variables are respective POPULATION IN *i* and *j* (natural log), MEDIAN RENTAL COST IN *i* and *j* (natural log), MEDIAN INCOME LEVEL IN *i* and *j* (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j* (natural log), PUBLIC TRANSPORT ACCESSIBILITY TO CENTRAL LONDON FROM *i* and *j* (natural log), ENVIRONMENT SCORE IN *i* and *j* (natural log) and WHETHER OR NOT *i* and *j* ARE ADJACENT (dummy variable). The estimation method is OLS. Model (19) – (25) represent the respective test results on the 20-29 population of all years, as well as individual years between 2012 and 2017.

	(19)	(20)	(21)	(22)	(23)	(24)	(25)
	All	2012	2013	2014	2015	2016	2017
$Dist_{ij}$	**-0.424*****	**-0.448*****	**-0.434*****	**-0.434*****	**-0.400*****	**-0.443*****	**-0.415*****
	(0.0143)	**(0.0363)**	**(0.0353)**	**(0.0362)**	**(0.0332)**	**(0.0343)**	**(0.0310)**
$Population_i$	-0.0810	0.145	-0.225	-0.237	-0.276	-0.529**	0.951
	(0.0721)	(0.184)	(0.165)	(0.174)	(0.168)	(0.169)	(0.516)
$Population_j$	-0.000268	-0.0139	0.0443	0.0703	-0.165	0.0742	-0.105
	(0.0683)	(0.174)	(0.167)	(0.172)	(0.159)	(0.165)	(0.146)
$Rent\_median_i$	0.136***	0.0386	-0.358***	-0.110	-0.264*	-0.0955	-0.280**
	(0.0387)	(0.138)	(0.101)	(0.104)	(0.133)	(0.122)	(0.100)
$Rent\_median_j$	0.0599	**-0.0959**	**-0.313****	**-0.208***	**-0.413****	**-0.310****	**-0.332*****
	(0.0387)	**(0.135)**	**(0.101)**	**(0.104)**	**(0.130)**	**(0.120)**	**(0.100)**
$Income\_median_i$	**-0.795*****	**-1.111*****	**-0.904*****	**-0.925*****	**-0.393***	**-0.826*****	**-0.671*****
	(0.0600)	**(0.144)**	**(0.131)**	**(0.179)**	**(0.172)**	**(0.157)**	**(0.130)**
$Income\_median_j$	**0.377*****	**0.471*****	**0.487*****	**0.329****	**0.174**	**0.416*****	**0.359*****
	(0.0419)	**(0.0994)**	**(0.0909)**	**(0.124)**	**(0.118)**	**(0.109)**	**(0.0893)**
$London\_pub_i$	-0.0139	-0.0445	-0.0835	-0.0821	-0.00999	0.00407	-0.0370
	(0.0201)	(0.0511)	(0.0502)	(0.0516)	(0.0474)	(0.0485)	(0.0440)
$London\_pub_j$	-0.00391	-0.0201	-0.0707	-0.0525	-0.0304	-0.0291	-0.0115
	(0.0201)	(0.0510)	(0.0499)	(0.0515)	(0.0472)	(0.0483)	(0.0437)
$PTAL_i$	**0.104*****	**0.143****	**0.190*****	**0.161*****	**0.159*****	**0.191*****	**0.143*****
	(0.0164)	**(0.0438)**	**(0.0410)**	**(0.0422)**	**(0.0417)**	**(0.0436)**	**(0.0370)**
$PTAL_j$	**0.109*****	**0.169*****	**0.183*****	**0.160*****	**0.189*****	**0.146*****	**0.155*****
	(0.0164)	**(0.0422)**	**(0.0408)**	**(0.0420)**	**(0.0407)**	**(0.0418)**	**(0.0370)**
$Green_i$	0.0940***	0.102	0.123	0.176**	0.0845	0.131*	0.0802
	(0.0253)	(0.0648)	(0.0636)	(0.0675)	(0.0592)	(0.0624)	(0.0548)
$Green_j$	0.124***	0.188**	0.176**	0.117	0.157**	0.0903	0.113*
	(0.0253)	(0.0622)	(0.0635)	(0.0674)	(0.0575)	(0.0622)	(0.0539)
Adj_{ij}	**-0.103*****	**-0.113***	**-0.104***	**-0.110***	**-0.0851***	**-0.104***	**-0.133*****
	(0.0180)	**(0.0456)**	**(0.0444)**	**(0.0454)**	**(0.0417)**	**(0.0430)**	**(0.0390)**
Cons	9.766***	13.69***	16.34***	14.44***	11.69***	14.66***	11.39***
	(0.535)	(1.427)	(1.452)	(1.579)	(1.390)	(1.556)	(2.010)
N	5950	992	992	991	991	992	992
adj. R^2	0.354	0.383	0.389	0.362	0.364	0.390	0.377

Chapter 8

Figure 0.1 Model 1 pseudo-code

Step 1: Generate agents
Generate agent population
Each agent *i* is assigned with characteristics $\{\mathrm{inc}_i, \mathrm{edu}_i, \mathrm{religion\ belief}_i, \mathrm{eth}_i\}$

Step 2: Generate neighbourhoods
Generate 32 London neighbourhoods
Each neighbourhood *j* is assigned with characteristics distributions $\{\mathrm{inc}_i, \mathrm{edu}_i, \mathrm{religion\ belief}_i, \mathrm{eth}_i\}$
For each neighbourhood *j*
  Dominant neighbourhood characteristics = {the features with the highest population proportion}

Step 3: Define weighting
Input subjectivity weighting, endowment factor, public information weighting, friends' information weighting
$\mathrm{objectivity\ weighting} = 1 - \mathrm{subjectivity\ weighting}$
$\mathrm{private\ information\ weighting} = 1 - \mathrm{friends'information\ weighting} - \mathrm{public\ informaiton\ weighting}$

Step 4: Defining social group
Social groups = {Total high -economic high, Total high-cultural high, Total low -economic low, Total low-cultural low}
For each agent *i*
  $\mathrm{Total\ Capital}_i = \mathrm{education\ band}_i + \mathrm{income\ band}_i$
For each agent *i*
  If Total $\mathrm{Capital}_i \in$ Top 50% of $\mathrm{Capital}_j\ \forall j$
    If $\frac{\mathrm{Income}_i}{\mathrm{Capital}_i} \geq 0.5$
      $\mathrm{Social\ Group}_i = \mathrm{Economic\ high}$
    Else
      $\mathrm{Social\ Group}_i = \mathrm{Cultural\ high}$
    Else
    If $\frac{\mathrm{Income}_i}{\mathrm{Capital}_i} \geq 0.5$
      $\mathrm{Social\ Group}_i = \mathrm{Economic\ low}$
    Else
      $\mathrm{Social\ Group}_i = \mathrm{Cultural\ low}$

Step 5: Define objective preference and affordability
For each borough *j*
  X_j ={education, transport, jobs, environment}
  $\mathrm{objective\ score}_j = \sum X_j$
For each agent i
  m=the borough that the agent is initially assigned to
  For each borough *j*
    If $\mathrm{rent}_j \leq 2.5 \times \mathrm{income}_i$
      $\mathrm{affordability}_i^j = 1$
    Else
      $\mathrm{affordability}_i^j = 0$

Step 6: Determine distance between the origin and destination locations
For each agent *i*
  For each borough *j*
    $\mathrm{Distance}_i^j = \mathrm{distance\ between\ where}\ i\ \mathrm{is\ and}\ j$

Step 7: Define total preference
For each agent i
  For each borough *j*
    $\mathrm{score}_i^j = \mathrm{objectivity\ weighting} \times \mathrm{objective\ score}_i^j + \mathrm{distance\ weighting} \times \mathrm{distance\ score}_i^j$
    If *j*= m
      $\mathrm{score}_i^j = [\mathrm{private\ information\ weighting} \times \mathrm{score}_i^j + \gamma \times \mathrm{public\ score}_j] \times \mathrm{affordability}_i^j$
    Else
      $\mathrm{score}_i^j = \{[\mathrm{private\ information\ weighting} \times \mathrm{score}_i^j + \mathrm{public\ information\ weighting} \times \mathrm{public\ score}_j] \times \mathrm{affordability}_i^j\} \times \mathrm{endowment\ factor}$

Step 8: Moving decision for one round
Ranks of all borough
Move to borough with the highest rank
End

Step 9: Calculate public decision
Calculate average score for all agents in the previous round
Repeat **Step 8 - 9**

Figure 0.2 Model 2 pseudo-code

Step 1: Generate agents
Generate agent population
Each agent *i* is assigned with characteristics $\{\mathrm{inc}_i, \mathrm{edu}_i, \mathrm{religion\ belief}_i, \mathrm{eth}_i\}$

Step 2: Generate neighbourhoods
Generate 32 London neighbourhoods
Each neighbourhood *j* is assigned with characteristics distributions $\{\mathrm{inc}_i, \mathrm{edu}_i, \mathrm{religion\ belief}_i, \mathrm{eth}_i\}$
For each neighbourhood *j*
  Dominant neighbourhood characteristics = {the features with the highest population proportion}

Step 3: Define weighting
Input subjectivity weighting, endowment factor, public information weighting, friends' information weighting
$\mathrm{objectivity\ weighting} = 1 - \mathrm{subjectivity\ weighting}$
$\mathrm{private\ information\ weighting} = 1 - \mathrm{friends'information\ weighting} - \mathrm{public\ informaiton\ weighting}$

Step 4: Defining social group
Social groups = {Total high -economic high, Total high-cultural high, Total low -economic low, Total low-cultural low}
For each agent *i*
  $\mathrm{Total\ Capital}_i = \mathrm{education\ band}_i + \mathrm{income\ band}_i$
For each agent *i*
  If Total $\mathrm{Capital}_i \in$ Top 50% of $\mathrm{Capital}_j\ \forall j$
    If $\frac{\mathrm{Income}_i}{\mathrm{Capital}_i} \geq 0.5$
      $\mathrm{Social\ Group}_i = \mathrm{Economic\ high}$
    Else
      $\mathrm{Social\ Group}_i = \mathrm{Cultural\ high}$
    Else
      If $\frac{\mathrm{Income}_i}{\mathrm{Capital}_i} \geq 0.5$
        $\mathrm{Social\ Group}_i = \mathrm{Economic\ low}$
      Else
        $\mathrm{Social\ Group}_i = \mathrm{Cultural\ low}$

Step 5: Defining subjective preference
For each agent *i*
  For each borough *j*
    $\mathrm{subjective\ score}_i^j$ = number of features that the agent *i* overlap with the dominant neighbourhood characteristics of neighbourhood *j*

Step 6: Define objective preference and affordability
For each borough *j*
  X_j ={education, transport, jobs, environment}
  $\mathrm{objective\ score}_j = \sum X_j$
For each agent i
  m=the borough that the agent is initially assigned to
  For each borough *j*
    If $\mathrm{rent}_j \leq 2.5 \times \mathrm{income}_i$
      $\mathrm{affordability}_i^j = 1$
    Else
      $\mathrm{affordability}_i^j = 0$

Step 7: Determine distance between the origin and destination locations
For each agent *i*
  For each borough *j*
    $\mathrm{Distance}_i^j = \mathrm{distance\ between\ where}\ i\ \mathrm{is\ and}\ j$

Step 8: Define total preference
For each agent i
  For each borough *j*
    $\mathrm{score}_i^j = \mathrm{objectivity\ weighting} \times \mathrm{objective\ score}_i^j + \mathrm{subjectivity\ weighting} \times \mathrm{subjective\ score}_i^j + \mathrm{distance\ weighting} \times \mathrm{distance\ score}_i^j$
    If *j*= m
      $\mathrm{score}_i^j = [\mathrm{private\ information\ weighting} \times \mathrm{score}_i^j + \gamma \times \mathrm{public\ score}_j] \times \mathrm{affordability}_i^j$
    Else
      $\mathrm{score}_i^j = \{[\mathrm{private\ information\ weighting} \times \mathrm{score}_i^j + \mathrm{public\ information\ weighting} \times \mathrm{public\ score}_j] \times \mathrm{affordability}_i^j\} \times \mathrm{endowment\ factor}$

Step 9: Moving decision for one round
Ranks of all borough
Move to borough with the highest rank
End

Step 10: Calculate public decision
Calculate average score for all agents in the previous round
Repeat **Step 9 - 10**

Figure 0.3 Model 3 pseudo-code

Step 1: Generate agents
Generate agent population
Each agent *i* is assigned with characteristics $\{\text{inc}_i, \text{edu}_i, \text{religion belief}_i, \text{eth}_i\}$

Step 2: Generate neighbourhoods
Generate 32 London neighbourhoods
Each neighbourhood *j* is assigned with characteristics distributions $\{\text{inc}_i, \text{edu}_i, \text{religion belief}_i, \text{eth}_i\}$
For each neighbourhood *j*
  Dominant neighbourhood characteristics = {the features with the highest population proportion}

Step 3: Define weighting
Input subjectivity weighting, endowment factor, public information weighting, friends' information weighting
$\text{objectivity weighting} = 1 - \text{subjectivity weighting}$
$\text{private information weighting} = 1 - \text{friends'information weighting} - \text{public informaiton weighting}$

Step 4: Defining social group
Social groups = {Total high -economic high, Total high-cultural high, Total low -economic low, Total low-cultural low}
For each agent *i*
  $\text{Total Capital}_i = \text{education band}_i + \text{income band}_i$
For each agent *i*
  If Total $\text{Capital}_i \in$ Top 50% of $\text{Capital}_j\ \forall j$
    If $\frac{\text{Income}_i}{\text{Capital}_i} \geq 0.5$
      $\text{Social Group}_i = \text{Economic high}$
    Else
      $\text{Social Group}_i = \text{Cultural high}$
    Else
      If $\frac{\text{Income}_i}{\text{Capital}_i} \geq 0.5$
        $\text{Social Group}_i = \text{Economic low}$
      Else
        $\text{Social Group}_i = \text{Cultural low}$

Step 5: Defining closeness with friends
For each agent *i*
  Friends = {Agents belonging to the same social group}
  For each agent *j*
    If $(\text{religion belief}_i = \text{religion belief}_j)$ and $(\text{eth}_i = \text{eth}_j)$
      $\text{closeness}_i^j = 3$
    Else $(\text{religion belief}_i = \text{religion belief}_j)$ or $(\text{eth}_i = \text{eth}_j)$
      $\text{closeness}_i^j = 2$
    Else $\text{closeness}_i^j = 1$

Step 6: Defining subjective preference
For each agent *i*
  For each borough *j*
    $\text{subjective score}_i^j$ = number of features that the agent *i* overlapping with the dominant neighbourhood characteristics of neighbourhood *j*

Step 7: Define objective preference and affordability
For each borough *j*
  X_j ={education, transport, jobs, environment}
  $\text{objective score}_j = \sum X_j$
For each agent i
  m=the borough that the agent is initially assigned to
  For each borough *j*
    If $\text{rent}_j \leq 2.5 \times \text{inc}_i$
      $\text{affordability}_i^j = 1$
    Else
      $\text{affordability}_i^j = 0$

Step 8: Determine distance between the origin and destination locations
For each agent *i*
  For each borough *j*
    $\text{Distance}_i^j = \text{distance between where } i \text{ is and } j$

Step 9: Define total preference
For each agent i
  For each borough *j*
    $\text{score}_i^j = \text{objectivity weighting } \times \text{objective score}_i^j + \text{subjectivity weighting } \times \text{subjective score}_i^j + \text{distance weighting } \times \text{distance score}_i^j$
    If *j*$= m$
      $\text{score}_i^j = [\text{private information weighting} \times \text{score}_i^j + \text{friends'information weighting} \times \text{public information weighting score}_i^j + \gamma \times \text{public score}_j] \times \text{affordability}_i^j$
    Else
      $\text{score}_i^j = \{[\text{private information weighting} \times \text{score}_i^j + \text{friends'information weighting} \times \text{friends score}_i^j + \text{public information weighting} \times \text{public score}_j] \times \text{affordability}_i^j\} \times \text{endowment factor}$