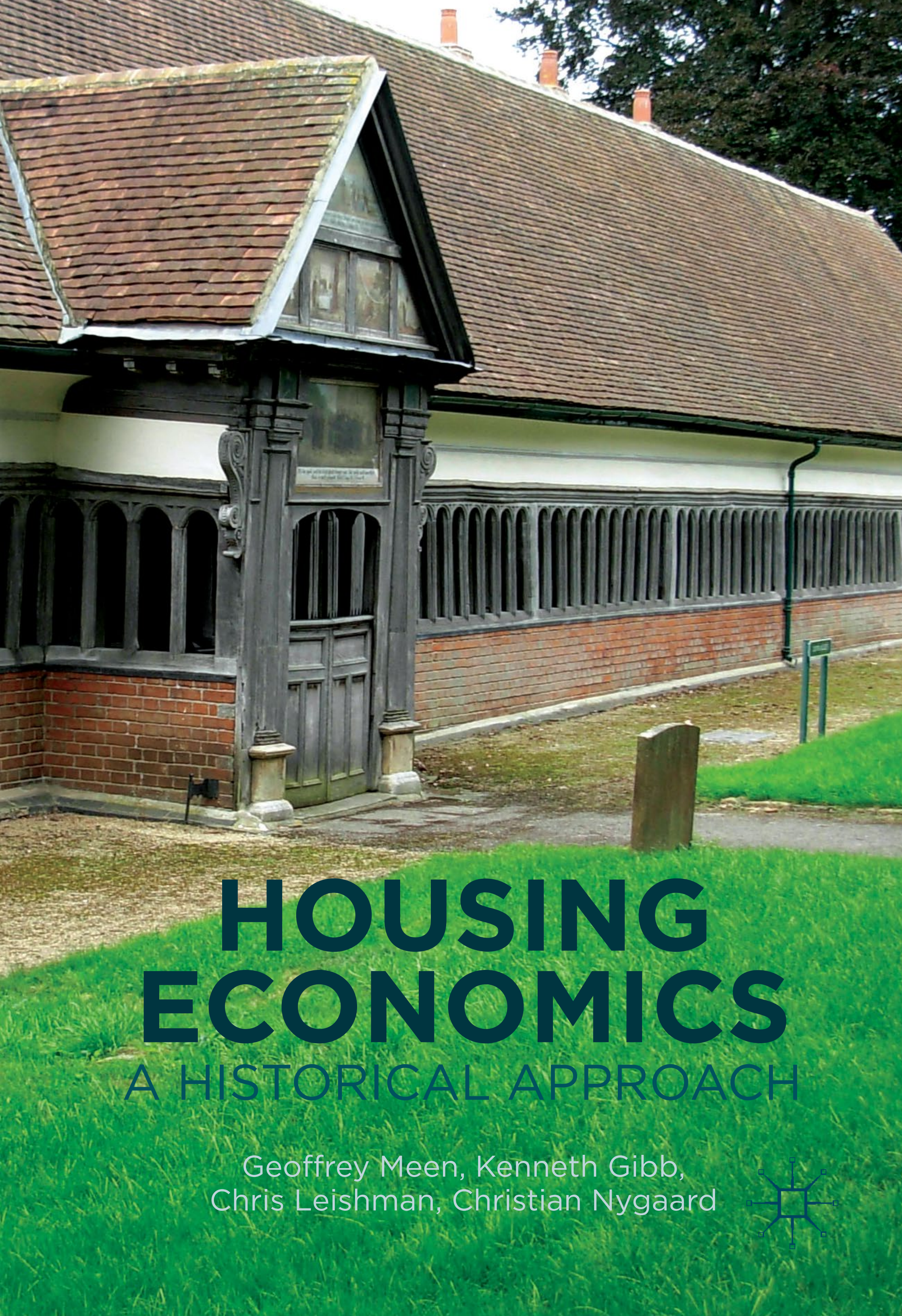

HOUSING ECONOMICS

A HISTORICAL APPROACH

Geoffrey Meen, Kenneth Gibb,
Chris Leishman, Christian Nygaard

Housing Economics

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Preface

The cover illustration[1] depicts the Long Alley almshouses in what is now the Oxfordshire town of Abingdon; the almshouses were first built in 1446 by two medieval guilds, the Fraternity of the Holy Cross and the Guild of Our Lady.[2] The former received a Royal Charter in 1441, although it appears to have been in existence as a voluntary organisation for much longer, whereas records of the latter date back to 1247. The Fraternity operated as a mutual self-help society with assistance provided to its members suffering sickness or poverty; its objectives were partly religious, but also secular with an involvement in major civic infrastructure projects. A part of its Royal Charter mandate was to make provision for 'thirteen poor sick and impotent men and women' and Long Alley was built to meet the requirement. The Fraternity thrived through the fifteenth century, but both Guilds were suppressed and the assets seized shortly after the Reformation and Henry VIII's Dissolution of the Monasteries. Nevertheless, only a few years later, in 1553, the lands were restored under a new Royal Charter to a secular governing body Christ's Hospital, which took responsibility for the provision of relief to the poor

[1] Produced with the permission of the Governors of Christ's Hospital of Abingdon.

[2] See Preston (1929) *Christ's Hospital Abingdon*, Oxford University Press, for a more detailed description of the history of the Abingdon Almshouses.

in the town more generally in addition to those located within Long Alley. Christ's Hospital remains the governing body today.

The provision of social housing support therefore has a very long history. The first almshouses in Britain date to the tenth century, although by no means all provided the beautiful accommodation of Long Alley. Today, almshouses only account for a very small proportion of the total social housing stock, catering mainly for the elderly, but they illustrate that a duty to provide basic accommodation for the poor has been accepted throughout history, although not always with good grace.

Next to Long Alley stands St Helen's church, the earliest parts of which date to the thirteenth century and was originally the site of a Saxon church. Its Lady Chapel possesses a beautiful medieval painted ceiling. A few metres away lie East and West St Helen Streets; the former is made up of a very expensive, diverse mixture of primarily residential properties built between the fifteenth and twentieth centuries. A plaque on number 28 denotes that William III stayed there in 1688 and the street also claims involvement in the English Civil War. The western branch, however, is made up of late-twentieth century residential and retail properties built on the site of a former clothing factory.

This example is, of course, not unique and countless other cases could have been chosen from across Britain but, within approximately 50m of the church, three housing submarkets exist, based on tenure and dwelling type. The question arises therefore whether mainstream urban economics alone can fully explain the richness and diversity of the urban environment, and particularly the dynamics of change, or whether it needs to be augmented by other disciplines, notably urban history, geography and social policy.

This book has had a long gestation period and was originally driven by the simple observation of different housing markets existing very close together more generally with no obvious reasons for the boundaries. Our thinking was, first, heavily influenced by research on social interactions modelling and, then, by recent tests of path dependent outcomes using long-run historical data sets. This literature implies that the ability to provide accommodation today and the overall urban structure are constrained by the decisions of earlier generations; even very large external events may not necessarily change the nature of housing markets. In the case of Long Alley, the Dissolution did not produce fundamental long-run change; since the poor remained and the state did not want to take on the responsibility, the re-establishment of a similar form of governance was the easiest option. Many of the Governors of Christ's Hospital were dignitaries from the earlier Guilds.

An analytical problem is that long-run, intra-urban data rarely exist in the form necessary for empirical research and it takes a lot of resources to put them together. Over the years, a large number of friends, relatives and students have helped to compile the data sets used here. The starting point was the development of case studies, typically, small streets in major cities. These turned out to be interesting in their own right and our admiration for the painstaking work of local historians grew. It was easy to become fascinated by the lives of individual families from the nineteenth and early twentieth centuries. Some of the most poignant information came from Australian First World War records. However, the case studies showed what could be compiled on a city-wide scale, given sufficient resources.

Finally, the finest of British economists/economic statisticians working in the field of housing, Alan Holmans, died earlier this year. Alan's work placed a strong emphasis on historical analysis in explaining housing markets and as an aid to good policy. He was right.

October 2015

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Introduction: Why a Historical Approach?

1.1 History and Modern Housing Problems

At the time of writing in the second half of 2015, the world has still to emerge fully from the housing-triggered Global Financial Crisis (GFC). However, housing crises are not new—nor, arguably, is the post-2007 crash the worst. The history of housing might be described as a process of long-run social progress, littered with regular crises, not all of which have been financial in origin. Given short-term memories and the nature of policy, the progress is often forgotten, whilst the problems hit the headlines.

The short-term volatility of housing markets should not be underplayed, but this book adopts a longer-term perspective than most texts on housing economics. The emphasis is on the dynamics of long-term change, particularly in major cities. We believe that long-term analysis still provides lessons for the short term, but leads to a shift in emphasis in terms of technique and focus. This book is not a chronological history of housing since there are plenty of excellent texts that fill this role. Rather, it attempts to apply economic principles to a selection of key issues in housing, set in a long-run context. The analysis concentrates primarily

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on British markets, although other parts of the world are also brought into the story.

History can shed light on modern problems, notably the constraints on what can be achieved and possible alternative options. As a first example, in Britain and many other countries, almost all economists believe that higher levels of house building are an essential element in solving long-standing affordability problems. The mainstream view in Britain is that restrictive post-Second World War planning regulations led to a long-run increase in real house and land prices (and there is evidence to support this). However, this presumes that consistently higher levels of construction are feasible in the absence of restrictions. Even before the 1947 Town and Country Planning Act, Britain, typically, failed to build sufficient homes to match population growth. The rapid expansion in house building in the 1930s and after the Second World War was an exception rather than the historical norm. From the mid-nineteenth century until the First World War, Britain only invested between 1 % and 2 % of GDP in housing (Holmans 2005). Housing investment experienced a step-change after the Great War, but it never permanently continued to rise thereafter. Large increases in housing have, generally, been associated with temporary events, such as wars, slum clearance programmes or recessions.

History shows that low levels of construction do not only lead to house price inflation and worsening affordability, but there are also other market outcomes. In terms of nineteenth century housing, this was partly in terms of changes in density—the number of individuals living in each dwelling. In 1851, on average across England and Wales, density stood at 5.2; at the start of the First World War, this had fallen modestly to 4.8 (figures were much higher in major cities). But by 2001, density stood at only 2.3 and this is one indicator of the long-run improvement in housing conditions. Greater densities in the nineteenth century may reflect a high income elasticity of demand for space—since incomes were lower, living at higher densities was more acceptable to the population—or housing supply shortages or, indeed, both. But history teaches us that there is a market outcome in which other factors, in addition to changing real prices, have a role. In recent years it has been the case that household representative rates (the proportion of any age or gender group who are household heads) have fallen for some younger age groups, so a higher incidence of sharing or staying with parents for longer has, to some extent, already occurred. Nevertheless, if further rises in densities in the direction of those in the early twentieth century are considered to be unacceptable, it must be because incomes have risen, the income distribution has widened, social norms have changed or because there are externalities, such as labour market performance, education or health. Even by the mid-nineteenth century, the relationship between overcrowding, sanitation and the transmission of disease was beginning to be understood: for example, in Robert Perry's 1844 study of epidemics in Glasgow and John Snow's isolation of the source of cholera in the London water supply in 1854. But history demonstrates that there are alternative policies to new building; the question is whether these are acceptable to modern societies. Densities are considerably higher for some ethnic groups than others, partly because of social norms. Furthermore, all generations, particularly at the early stages of their life cycles, face housing difficulties and despite the very real problems for the current generation of younger households, they are not unique.

A second example comes from international migration. Domestic mobility is quantitatively more important to the structure of local housing markets, but international migrants continue to attract policy and public attention. The effects of migrants on local housing and labour markets were also of concern in the eighteenth and nineteenth centuries and both the House of Commons and House of Lords established enquiries in the late nineteenth century (see Fishman 1988). One of the most striking features of migrant populations is their spatial concentration and the persistence of patterns over long time periods. The break-up of local migrant densities, typically, only takes place in response to large shocks; the Second World War is one case, but history demonstrates the difficulty of producing more integrated communities. Local migrant densities in England can be traced in some detail from the 1850s.

Long-term analysis inevitably gives rise to data problems and historians rightly urge caution in the use of data for the nineteenth and earlier centuries. Arguably, similar caution should be exercised using modern data. Nevertheless, the quality of information improved significantly over the course of the nineteenth century and a variety of rich sources have been under-utilised for formal time-series analysis. On-line access to information has helped considerably, but much still needs to be gleaned directly from public records. Few modern econometricians, used to electronic data retrieval, have the patience or resources for such labour-intensive work. However, in some cases, nineteenth and twentieth century data are more detailed than for the twenty-first century and we show how micro household panel data sets, used to study mobility patterns, can be constructed from the mid-nineteenth century. The study considers three major cities in detail; London, Glasgow and Melbourne. These were three of the largest cities at the height of the British Empire and this provides one reason for their choice.[1] Given that London was so much larger than the others, it receives particular attention. A second reason for the choice of cities is that, in different ways, they have detailed longitudinal micro data sets that have never been fully explored. In the case of London, this comes primarily from census material. Melbourne is unusual in that detailed records have been kept from first European colonisation in 1835; electoral rolls, rate books and migration records are particularly useful. These long-run records allow us to delve into the nature of change in a new manner, concentrating on individuals at small spatial scales.

There is an increased acceptance in economics generally that, faced with large shocks, historical experience provides a useful guide for modern policy. For example, Eichengreen (2015) discusses the parallels between the Great Depression and the Global Financial Crisis; Piketty (2014) draws out the implications of very long-run international trends in inequality for policy, including the effects of structural breaks caused by war; Button et al. (2015) examine the implications for regulation of the biggest banking collapse in the UK before the GFC, which was the failure of the City of Glasgow bank in 1878. A conference volume edited by White et al. (2014) adopts a historical approach to US housing and mortgage markets. Nevertheless, historical analyses by economists of housing systems remain scarce. The work of Alan Holmans provides an invaluable exception for the UK and we fully acknowledge our debt to

[1] For a more recent period (1960–2008), a special issue of *Urban Policy Research* (O'Hanlon and Hamnett 2009) compares processes of de-industrialisation and gentrification in London and Melbourne.

his path-breaking work; Holmans (1986) considers the history of housing policy; Holmans (2005) provides the seminal compilation of historical housing statistics, whereas Holmans (2012) examines the history of household projections.

1.2 A Brief Overview of the Central Issues

At one level, all housing is historical; observation of most cities reveals a rich mixture of architectural styles and property ages. With notable exceptions, the structures of cities are gradually built up over centuries rather than regularly rebuilt from scratch. There is opposition to wholesale change. City dynamics are sometimes characterised by long periods when change is modest, interspersed by infrequent periods when change is rapid and dramatic. In some instances this may be a response to deliberate government policy or technological improvements, in others it may result from major unplanned events, such as wars or natural catastrophes.

Conventional housing economics stresses the importance of spatial and physical characteristics, for example in hedonic analysis, but the role of history in their development is under-explored in the housing literature. An aim of this book is to begin to fill this gap, which leads to an emphasis on different concepts from standard housing models, such as path dependence and phase transitions. Since the focus of the study is on large urban housing systems, with exceptions, the starting point is the beginning of the nineteenth century. England was still primarily a rural economy and, at the time of the first census in 1801, only London had a population in excess of 100,000. But this was the beginning of the century in which both population and mobility expanded enormously. Around the start of the sixteenth century, the capital had a population of approximately 50,000; by 1650, it was the second largest city in Europe (after Paris) with a population of 350,000. But by 1800, London had outstripped Paris with approximately 1 million residents. By contrast, Britain's next largest cities were Dublin (200,000) and Manchester (84,000) (De Long and Shleifer 1993).

This starting date also has the advantage that, as noted above, the quantity of statistical information increased rapidly. This is sufficient to examine the effects of the sequence of dramatic changes cities subsequently faced. The study does not throw away traditional neo-classical approaches, but integrates these into the historical analysis, also applying modern models of self-organisation. All three provide important insights into the dynamics of housing systems, but the emphasis here is on the historical. As McDonald and McMillen (2007) argue:

> Economic history is an important tool for understanding urban economies. The best modern economic historians combine analyses of the institutions and historical context of the urban area and its region, economic analysis, and political economy to provide a convincing narrative of what happened and why. This explanation may also have considerable relevance for current economic development policy. (p. 485)

This book inter-weaves local case studies with city-wide and aggregate analysis. There is some danger with using local case studies, but there are also considerable benefits, by showing how economic concepts relate to identifiable ordinary individuals and places in history. The use of historical case studies is certainly not unprecedented. York et al. (2011) discuss segregation and clustering in a long-run historical context and argue that their work 'combines elements of systematic and intensive strategies of comparison', where 'systematic comparisons typically involve large-number random sample strategies and the statistical analysis of many variables' and 'intensive comparisons employ fewer cases and greater social and historical contextualisation' (p. 2401). They consider three case studies: ninth to tenth century China, nineteenth century Algiers and late twentieth century Prague. The long-run historical perspective suggests that segregation has not necessarily always been an inevitable process, but changes in spatial patterns typically emerge in response to large shocks—dynastic change in China, the transition from Ottoman to French rule in Algiers, and the fall of the socialist government in Prague.

Local case studies rarely provide general proofs, but they still give insights that aggregate analysis hides and the accumulation of detailed evidence helps to clarify more general propositions. Geology provides a further example: locations only a few hundred metres apart may have different elevations and underlying rock formations, leading to the development of different property types and classes of households in each location. It is also feasible to use local studies as the foundation for wider city analysis, consistently moving from the micro to the macro. Studies of mobility patterns based on constructed long-run household panel data sets are particularly useful for studying the dynamics of change.

The 2006 UK Government *State of English Cities* report states:

> Cities are complex, self-organising market driven systems of economic, social, technological and social relationships. They differ in their economic, social and institutional structures. Each is the product of a unique history of development. These differences persist over time, so there are strong tendencies making for 'path dependence' in the patterns of size, function, and specialisation among cities. There are corresponding differences between cities in their capacity to adapt to changing technological, economic and market conditions and opportunities. (ODPM 2006, p. 66)
>
> … our evolutionary approach to the analysis of city economies has emphasised the significance of their long-term historical trajectories. They have arrived where they are today as a result of the long-term interactions between their particular circumstances and the external forces that have impacted on them. This approach shows not only that history matters, but that it takes a long time to develop along a particular path. It also shows that policy-makers and policies need similar long-term perspectives to achieve changes in those paths. There are no quick fixes that will turn around lagging city economies. (ODPM 2006, p. 108)

In line with these quotations, paying due attention to history is important for *current* housing and urban policy. Therefore, this book examines the nature of change—the extent of persistence and path dependence in residential structures, the drivers of change and whether change is a gradual or discrete process. Although housing history is of considerable interest in its own right, the focus is on how history can contribute to an explanation of modern housing problems. Our team consists of economists and, therefore, we use the techniques of economics (although not always mainstream economic analysis), but we value the additional insights from economic history and the evolution of institutional structures. Runciman (2015), for example, argues that Daniel Defoe, writing *Robinson Crusoe* in the early eighteenth century, would still largely recognise the institutional structures and the distribution of power in place today, despite the changes in technology and social norms that have taken place over three centuries. Institutional structures are highly persistent unless disturbed by radical changes. Furthermore, Eichengreen (2015, p. 247) contrasts the successful reforms to financial institutions in the US after the Great Depression in the 1930s with the far less radical changes that have taken place after the GFC. Some would suggest that, in the later episode, little has fundamentally changed. He suggests that the difference between the two events was the greater severity of the Great Depression, both in length and depth, which 'brought the financial system and the economy to their knees', whereas the relative success of policy after 2008 mitigated the momentum for major reform. A theme of this book is that only infrequently occurring major shocks promote fundamental permanent changes.

Even if cities evolve, as neo-classical economic models suggest, from optimal decision-making by households, companies and governments, decisions are constrained by the inherited structure of the built environment and the underlying technology available. The distribution of households in any city arises from the demographic trends and from moving/migration decisions, both of which are influenced by the built environment and by policy. Path dependence occurs because households, across generations, may become locked-in to a given spatial structure, arising from the non-malleability of the built environment and the nature of property rights. The physical structure of cities—the buildings, (particularly residential), road networks and infrastructure—may remain unchanged for decades, if not centuries, and provide constraints on the current decisions of households, so that household mobility is not fully responsive to current market opportunities. Lock-in to existing spatial residential patterns may also arise because of the nature of networks (potentially particularly important for migrants), which generate forms of increasing returns from the spatial concentration of socio-ethnic groups.

A central theme is that residential neighbourhood structures change only slowly, because of inertia, increasing returns and transactions costs, but there may be defining periods that produce major changes. North (2005) argues that constraints make change incremental, although 'the occasional radical and abrupt institutional change suggests that something akin to the punctuated equilibrium change in evolutionary biology can occur in economic change as well' (pp. 2–3). Nevertheless, the view that neighbourhoods undergo large dramatic transformations is, by no means, uncontroversial and Malpass (2013) stresses the gradual nature of change in housing systems. Both are possible at different points in time and in different places.

Punctuated equilibrium change can, in principle, occur through the accumulation of unpredictable random shocks. But structural change is more likely to result from exposure to major events, notably natural disasters, wars, technology or economic crises. An important recent literature has developed on the factors affecting long-run city growth, in one case dating back eight millennia. For example, Davis and Weinstein (2002, 2008), Nitsch (2003) and Bosker et al. (2007) examine the impact of the First and Second World Wars; Dincecco and Onorato (2013) look, more generally, at the effects of military conflicts on city population growth between 1000 and 1800; Skidmore and Toya (2002), Odell and Weidenmier (2004) and Pereira (2009) consider the effects of natural disasters; Voigtländer and Voth (2013) discuss the impact of the Black Death on incomes and urbanisation; Dittmar (2011) examines the impact of the invention and spatial diffusion of the printing press in the mid-fifteenth century on subsequent city population growth; Michaels and Rauch (2013) compare the effects of the break-up of the Roman empire on the subsequent spatial distribution of towns in England and France. Whereas the latter exhibits a high degree of path dependence—the locations of modern major towns in France are still closely related to their Roman antecedents—this is not the case in the former. None of these studies is concerned with long-run change and the distribution of populations *within* cities or use micro data sets, but they provide useful insights on key influences and techniques. For example, issues of mean reversion and multiple equilibria are raised, which are particularly important for explaining persistence in patterns of intra-city segregation.

There are three broad sets of issues that need to be addressed: first, the underlying reasons for the initial establishment of the residential structure of neighbourhoods within cities; second, the processes that generate growth and decline and patterns of integration/segregation; third, the impact of historical development on the current status and problems of urban areas.

1.3 Initial Development

The literature highlights two main sets of influences as causes for the initial establishment of cities and the residential neighbourhoods within them; these explanations are not necessarily mutually exclusive. The first stresses natural advantages, for example the geology, soil fertility, water quality, access to markets, administrative benefits and the availability of safe harbours. Glaeser (2005a, b) discusses the historical natural advantages of New York and Boston, whereas Barr et al. (2011) examine the impact of the bedrock on the development of skyscrapers in the business districts of Manhattan in the late nineteenth century. The hypothesis is that building in the downtown and midtown areas was due to lower construction costs resulting from the closeness to the surface of the bedrock in these locations.[2]

The establishment of Roman London also fits within this categorisation. At the micro scale, Saffron Hill—a small central London street near Clerkenwell and one of the case studies to be examined in detail in Chap. 2—had initial advantages. Figure 1.1 shows the limits of urban London in the mid-sixteenth century (the City lies in the south east corner). At that time, Saffron Hill was outside the city walls with available land; it also lay in the valley of the Fleet River, providing plentiful, good quality water supplies, including a number of local springs. Clerkenwell derives its name from Clerks' Well, which is still visible through an office window in Farringdon Lane. As the name suggests, nearby Turnmill Street contained a number of water mills by the river. Furthermore, the area had a concentration of major medieval monastic orders, perhaps an early example of agglomeration economies.

It would be hard to dismiss the importance of such advantages, but a second strand of the literature stresses the impact of random shocks or unexpected events that lead to initial advantages for a location, which are subsequently reinforced by processes of increasing returns to scale. For example, MacCulloch (2009, pp. 290–291) suggests that the establishment of Rome as the centre of western Christianity was, by no means, a foregone conclusion and arose from a combination of unpredictable

[2] In fact, they find that the reduction in building costs was not large in these areas and agglomeration benefits were more important in explaining location.

Fig. 1.1 London and Saffron Hill from the Agas Map, circa 1562 (*Source*: © London Metropolitan Archives)

events. These included official status for the religion granted by Constantine I, aided by the construction of new church buildings, which set the standard for architecture in other locations; the re-organisation of the Empire by Diocletian, which opened up a power vacuum that could be exploited by the Pope; the charismatic power of St Peter (and St Paul) both buried in Rome; and the more limited ability of Islam to affect the expansion of the western as opposed to the eastern Church.

After the initial establishment, transactions costs, including those associated with property rights, can lock in existing spatial structures, unless large shocks occur, which are sufficient to overcome the transactions costs. As noted above, these may occur through wars or civil unrest, major technological developments (such as those associated with the Industrial Revolution), disease, natural disasters, economic crises and, in some cases, through policy innovations. Therefore, this alternative view sees initial location as determined by chance, but increasing returns ensure that the advantages are maintained over time, leading to a form of historical dependence. In terms of residential neighbourhoods outcomes are not pre-determined, but, once established, are preserved even though the structures may not necessarily be optimal in terms of meeting the needs of modern living. The approach can be explored through models of self-organisation, which exhibit features of complex systems, notably phase transitions and tipping points; gentrification and urban decline may be explained in these terms. The literature also stresses the importance of social interactions amongst households, which can lead to highly segregated communities.

1.4 The Dynamics of Growth, Decline and Segregation

By the mid-nineteenth century, segregation had already become a feature of the major British cities. As Cannadine (1977) discusses, this was not the case in modestly-sized 'walkable' British towns where social classes were more mixed; nor, at that stage, did US cities exhibit the same degree of segregation. Therefore, although our case studies are all large cities, we do not necessarily expect to observe the same patterns of segregation; they depend partly on the relative speeds of population and transport infrastructure growth. Cannadine points to three factors in explaining nineteenth century British patterns: first, strong population growth in the first half of the century; second, concentrated land rights allowed owners to enforce a form of land-use planning, even in the absence of formal government regulations. Loosely, on the major city estates under development in the eighteenth and nineteenth centuries, wealthy land owners wanted only middle-class tenants and an absence of industrial or commercial construction. Although rigid social structures gradually broke down over time, the freeholder rights, at least initially, allowed owners to plan developments, which were uniform in architectural style and encouraged social segregation. Third, the tastes of middle-class households for suburban living also promoted segregation, because cheap rail fares for the working classes were not established until later; poorer households still had to rely on walking to walk.

There is a popular tendency to identify the nineteenth century poor with segregation in London's East End, but this is an over-simplification. Some of the most deprived parts of London were at its centre and lay only modest distances from wealthier areas. Saffron Hill falls into this category; urban sprawl had already overtaken Saffron Hill by the mid-eighteenth century as London's population expanded. By contrast, in Fig. 1.1, the area around sixteenth century Saffron Hill was open fields. Even before the eighteenth century, Saffron Hill had become one of the most deprived areas in London. The question arises, however, whether the dynamics are gradual or subject to discrete changes (or both) and the nature of the adjustment mechanisms. As discussed in Chap. 2, over its history, Saffron Hill faced war; natural disasters; domestic and international migration; policy innovations including major infrastructure changes, such as new road networks, social housing estates, slum clearance and regeneration schemes; technology innovations and medical advances, for example, the effects of the Industrial Revolution, extensions in international trade, motorised transport, and isolation of the causes of cholera in the water supply.

Property rights raise particular issues; persistence is a feature of buildings, but street layouts change even less markedly than individual buildings. Saffron Hill today is still narrow and most of the major thoroughfares and many of the smaller streets that appear on nineteenth century maps of the area remain. More widely, even Sir Christopher Wren's ambitious plans for redesigning London following the Great Fire, in classical style with broad avenues replacing the twisting lanes, were never implemented. Ball and Sunderland (2001) chronicle the major developments to the inner London street structure in the second half of the nineteenth century in response to the severe traffic congestion and increasing commercialisation of the city. However, they also point out that there was no overall street plan and there was a tendency to purchase the minimum amount of land for each scheme. Therefore, London never experienced the same transformation undergone by Paris under Baron Haussmann's designs. Similarly, proposed slum demolition schemes in London were placed in the hands of local officials rather than a central agency and, so, attention was focused on discrete sites rather than a general plan. Sites were not necessarily physically adjacent nor involved a re-shaping of the city. This continued into the twentieth century and there appears to have been a deliberate attempt to avoid Haussmann-style grand designs as an unacceptable concentration of power and an assault on private property.

Furthermore, failure to agree compensation payments in slum clearance programmes across a wide ownership of property rights contributed to a lock-in of spatial structures.

1.5 The Relationship Between Modern Housing Problems, Policy and the History of Development

Table 1.1 shows that 21 % of current English dwellings were built before 1919, although a high proportion is likely to have undergone major regeneration. A further 16 % were built between 1919 and 1944 and only 12 % have been built since 1990. This is a much older distribution than in the US or Australia for example. The oldest parts of the housing stock are in the private sector, notably in renting, whereas the rather younger public sector distribution reflects the post-war local authority building expansion. Therefore, the longevity of the housing stock is striking and is, typically, older than for industrial or commercial properties. Longevity, in itself, is neither good nor bad, since much of the remaining nineteenth century housing stock is of high quality, whereas the worst nineteenth century slums have been long-demolished. However, longevity implies that current housing policy decisions are made conditional upon the age and spatial distribution of the housing stock, which generate both constraints and externalities. As an extreme example, modern residential property prices in Melbourne are still significantly affected by

Table 1.1 The age distribution of the English Housing Stock, 2008 (% of dwellings in each tenure)

Dwelling age	Owner-occupation	Private renting	Local authorities	Housing association	Total
Pre-1919	21.3	39.7	4.3	8.7	21.4
1919–1944	17.9	13.1	16.9	9.6	16.4
1945–1964	18.0	11.6	38.3	26.2	19.6
1965–1980	21.0	16.2	33.5	23.9	21.6
1981–1990	9.3	6.7	5.4	11.4	8.8
Post-1990	12.5	12.6	1.5	20.2	12.2

Source: English Housing Survey; Housing Stock Report, 2008, Table 1.1

the underlying rock types; these were understandably important in the nineteenth century, but should have less relevance today. Nevertheless, the distribution still contributes to the patterns of relative spatial poverty, which, in many cases, have been in place since the nineteenth century.

Figure 1.2, using historic Ordnance Survey maps, demonstrates a further feature of longevity, taking as an example one postcode in the East London district of Tower Hamlets, tracing its development over the last 100 years or more. Tower Hamlets is one of the most deprived areas of England and was one of the districts used as a location for the 2012

Fig. 1.2 The development of Tower Hamlets. *Upper left*: 1854–1901; *upper right*: 1906–1939; *lower left*: 1949–1992; *lower right*: contemporaneous (*Source*: Edina Historic Maps. © Crown Copyright and Landmark Information Group Limited (2010), all rights reserved)

Olympic Games. The first two frames, which show differences between the mid- to late-nineteenth century and the Second World War, indicate little change and the area continued to be dominated by closely-packed terraced housing. The open spaces in the third frame indicate the destruction of properties arising from the heavy bombing of the docks in the war, set out in graphic detail in the maps of the London Topographical Society (2005), but the street layouts remained broadly the same until the early nineties. It was not until the major redevelopments associated with the docks that the structure fundamentally altered; large shocks—war and policy in this instance—were necessary for major change. The London Docklands Development Corporation fulfilled the latter role between 1981 and 1998.

1.6 Chapter Contents

The three themes—initial development, the dynamics of change, and current problems and history—are explored in detail in the remaining chapters. Chapter 2 introduces the local case studies, taken from areas of London, Glasgow and Melbourne, which, as noted above, were amongst the largest cities in the British Empire. Perhaps surprisingly (to non-Melburnians), Melbourne had the second highest rateable value in the Empire, after London, towards the end of the nineteenth century, due to two spectacular eras of property speculation and building activity. Small, insignificant streets are chosen that few readers will recognise, but they are still able to demonstrate a number of important features, which are explored on a larger spatial scale in subsequent chapters.

Chapter 3 develops the more technical concepts that are necessary to formalise the analysis in the later chapters. It concentrates on three strands of the literature, beginning with elements of standard neo-classical residential location theory including an allowance for the durability of the housing stock. The chapter, then, discusses models of neighbourhoods and social interactions and how spatial residential structure is an emergent property of the interdependent decisions of heterogeneous agents. In addition, the chapter discusses path dependency and the role of historical development caused by the nature of institutions.

Chapter 4 is concerned with the initial development of cities and neighbourhoods. The descriptive case studies from Chap. 2 provide insights, but the analysis is widened here to consider the extent to which modern distributions of property values still reflect the underlying geology and topography. Both London and Melbourne are analysed and empirical estimates are also made for England as a whole. Unsurprisingly, given the major changes in industrial structure and technology over the last 2000 years, modern price distributions cannot be fully understood in geological terms alone, but differences in rock formations are still capitalised into property prices.

Chapter 5 considers urban dynamics in response to exogenous disturbances (notably wars and epidemics) and the contribution of early policy development, related to sanitation and slum clearance. Wars, although temporary, are found to have permanent effects on local population distributions, although the nineteenth century cholera and 1918 influenza outbreaks did not. The expansion of the armaments factory in Woolwich during the First World War provides one example, but the Second World War had much larger effects. However, adjusting for age, the spatial distribution of health outcomes across London has changed little since the mid-nineteenth century, despite the large London-wide fall in death rates over this period. The most likely cause is residential sorting of the population, rather than intrinsic features of the areas.

Chapter 6 is concerned with both the nineteenth and twentieth centuries, but, in this case, for Glasgow, a city that had worse health outcomes than even the poorest parts of London. The chapter demonstrates the key characteristics of the medieval-based property law system in operation in Scotland, which differed from the rest of the UK. It also discusses the collapse of the City of Glasgow bank in 1878 and its impact. Subsequently, no other major bank failures occurred in the UK until the Northern Rock failure during the GFC. This introduces the issue of housing volatility, a theme which is developed further in later chapters. In addition, Chap. 6 considers the development of social housing in twentieth century Glasgow. Finally, the chapter discusses the extent to which distinct submarkets have persisted across Glasgow, by modelling the relationship between modern local house prices and rental values in the late nineteenth and early twentieth centuries.

Chapter 7 turns to an issue that remains at the forefront of policy today—housing supply—but set in a long-run framework. For Britain, this requires a consideration of public sector involvement in the provision of housing, which expanded after the Great War. But the proportion of gross domestic product (GDP) devoted to housing investment and housing completions have exhibited little evidence of upward trends since then. High levels of building rarely consistently took place, except following times of national emergency or when the wider economy was in recession. Controversially, this raises the question of whether the industry would respond fully to the commonly-acknowledged current major housing shortages, even if planning controls were to be relaxed. This national level analysis is complemented by local London analysis and considers the relationship between building and rail and underground developments. The first London underground route, the Metropolitan line between Paddington and Farringdon Street, which lies next to Saffron Hill, was not completed until 1863, but subsequent rail construction had a major impact on population distributions (and still has an effect on property prices). For example, Fulham, now considered as part of central London, was still on the western outskirts of London in 1881, with an unsavoury reputation. It was not until the late nineteenth century that the area began to be redeveloped, benefitting from the establishment of underground railway links to the area. Censuses provide information on local house building and show that building was concentrated on the, then, outer fringes, whereas the already-developed inner areas received little new housing.

Chapter 8 returns to the issue of residential sorting and attempts to go behind the aggregate spatial population distributions, revealed by residential density functions first estimated by Colin Clark in 1951; the chapter models the moving decisions of individuals in London and Melbourne since the nineteenth century. Newly-constructed panels for the two cities are central and allow the chapter to reveal some of the influences on mobility. In both cities, most moves were short distance, a feature that remains in place today. Again, in line with the modern era, socio-economic and demographic factors affect mobility and the chapter shows some evidence that social interactions between individuals, in terms of social classes, were important contributors to the persistence of segregation patterns in London. However, the chapter also argues that, over long periods, conventional variables cannot fully explain mobility or the places where people choose to live. This suggests that more attention has to be paid to structural changes to the neighbourhood, including the development of transport networks and housing.

Chapter 9 turns to the role of international migration, which continues to be controversial. The themes are: first, the reasons why migrant groups choose certain locations in which to live; second, the extent to which migrant groups are concentrated; third, the extent to which groupings persist and the factors that bring about change. The chapter provides insights into the relative roles of conventional economic variables—employment opportunities or housing costs—and networks, which are particularly important for new arrivals. This is aided by the availability of country-of-birth data in the UK population censuses from 1861 to the current day on a broadly comparable basis. The location and persistence of local migrants matter because of their potential effects on domestic population displacements and on housing costs, which the international literature suggests are significant.

Chapter 10 concentrates on tenure and, particularly, on the changing long-run trends in home ownership and the associated measures of affordability in the UK. Although affordability had been an issue for working-class households from the nineteenth century and before, two issues receive particular attention since they represent two of the most important structural changes of the twentieth century. These are the 1947 Town and Country Planning Act (linking to Chap. 7) and the deregulation of mortgage markets that occurred primarily in the 1980s. In contrast to the emphasis in previous chapters, a national rather than local perspective provides the focus of attention; this is because these were national policy changes, having effects across the country. The regions of England experienced related rises and falls in home ownership and affordability, because housing markets are spatially linked, partly reflecting the displacement activities discussed in the previous chapter.

The mortgage market changes of the 1980s represented a major structural change with far-reaching consequences that are still being experienced today. Whereas households previously faced mortgage rationing, liberalisation led to an explosion of credit, such that the ratio of mortgage debt to household income is, today, approximately four times higher than in the 1970s. Analysing the impact on affordability of mortgage liberalisation is not straightforward; as the chapter shows, it depends on changes in the user cost of capital. The chapter also reconsiders the causes of the long-run rise in real house prices in the UK and attempts to decompose the trend into demand and supply-side causes. Visually, there is a strong relationship between the rise in planning constraints and prices (see Cheshire et al. 2014), but it is possible that other factors are at work as well, including the role of the tax system and mortgage finance. Our own econometric research on UK house prices which has taken place over the past 25 years is employed.

Chapter 11 is concerned with long-run changes in poverty and segregation, starting with the pioneering work of Charles Booth in the late nineteenth century. Despite the major overall reductions in poverty since then, the relative spatial distributions have been remarkably persistent, at least in London, consistent with some of the theories explored in Chap. 3. Models of social interactions, for example, indicate the importance of non-linearity; this, in turn, implies that only large policy interventions are sufficient to bring the most deprived areas to self-sustaining take-off points. As an example, the chapter looks at the influence of one particularly large change, the London Olympic Games. Although it is too early to assess fully the legacy, so far, there appears to have been little effect on relative property prices in the districts where the Games took place. This leads on to a wider discussion of area regeneration, including the outcomes from selected evaluation exercises.

The final, short Chap. 12 is more reflective. Since this book is concerned with the long term, the chapter comments on one of the key issues for the future—the sustainability of housing and how economists may make a positive contribution to the debate, rather than being seen as the enemy. Housing faces a set of possibly irreconcilable choices between the need for large numbers of new homes, particularly for the young and for future generations, and the need to protect the environment. Neither side is wrong, but a longer-term perspective than is the norm can help to inform the debate.

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2

A Tale of Three Victorian Cities: Exploring Local Case Studies

Richard, Duke of Gloucester: *My Lord of Ely, when I was last in Holborn,*
I saw good strawberries in your garden there:
I do beseech you send for some of them.
Bishop of Ely: *Marry, and will, my Lord, with all my heart.*
(Richard the Third, Act 3 Scene 3, William Shakespeare c1592, describing events c1485)

… it was nearly eleven o'clock when they reached the turnpike at Islington. They crossed from the Angel into St. John's Road; struck down the small street which terminates at Saddler's Wells Theatre; through Exmouth Street and Coppice Row; down the little court by the side of the workhouse; across the classic ground which once bore the name Hockley-in-the Hole; thence into Little Saffron Hill; and so into Saffron Hill the Great… a dirtier or more wretched place he had never seen. The street was very narrow and muddy, and the air was impregnated with filthy odours.
(Oliver Twist, Chapter VIII, Charles Dickens 1837)

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2.1 Introduction

In 1963, Asa Briggs published his classic study of Victorian cities, covering London, Melbourne, Manchester, Leeds, Birmingham and Middlesbrough. The rapid expansion in these cities took place at similar periods, but they had major distinguishing features; it was not the case that each was an identical product of the Industrial Revolution. Perhaps, the distinctions were most evident between London and Melbourne, which, with Glasgow, are the focus of attention in this chapter. London was already well developed by the nineteenth century. Melbourne, by contrast, with much easier access to cheaper land and natural resources, began with a blank canvas in terms of European settlement in the 1830s; its history is, then, well-documented from this period. Melbourne experienced major shocks, notably in the 1850s and 1880s (a gold rush in the former and a speculative boom in the latter—the period known as 'Marvellous Melbourne'), which led, in 1891, to Melbourne having the second highest rateable value (after London) of any city in the British Empire and just ahead of Glasgow (Briggs 1963, p. 278). Following the credit-fuelled speculative boom, property prices peaked in 1891, but were then hit by a banking crisis with values falling to a trough in 1903, when prices were only 63 % of the peak. Prices did not return to the previous peak until 1917 (see Stapledon 2007, quoted in Merrett 2013).[1] Glasgow was also hit by a major banking crisis in this period, with the collapse of the City of Glasgow bank in 1878. London was a city where the majority of residents were born and bred, whereas growth in Melbourne arose from migrants; Glasgow also had a high percentage of migrants, particularly from Ireland. Inequality levels were high in 1880s London, but relatively low in Melbourne (Davison 2004); Glasgow had much higher death rates than the other two cities, reflecting the level of poverty.

This chapter starts from two observations; first, an empirical study of neighbourhood housing dynamics needs neighbourhood-level data. In practice, such data sets are limited and many local housing studies employ proxies, based on administrative boundaries, most frequently

[1] The US did not experience its first residential property crash until the early 1920s, which took place in Florida. The events are described in Eichengreen (2015).

local authority districts in England, but also postcodes and Census Output Areas. None of these is satisfactory and Meen (2009) shows how the larger administrative areas are typically averages across both 'good' and 'bad' locations. An important feature of cities is that neighbourhoods of differing qualities can be physically located close together. Fuller analysis requires individual or household data in which neighbourhoods can be constructed on the basis of area/housing/individual characteristics. This becomes particularly important if the objective is to study dynamic features of cities such as possible self-organisation, where neighbourhoods have to reach a critical mass before phase transitions take place (Meen and Meen 2003). Second, because of the persistence of the physical structure, neighbourhoods undergo fundamental change infrequently. Therefore, consistent data sets over long periods of time are required, ideally from the Victorian era until today, if evidence of change is to be found. However, data sets which are consistently available over approaching 200 years at fine spatial or individual levels rarely, if ever, exist for any country.

An exception arises with local case studies, where data can be constructed over long time periods from a combination of sources, such as, censuses, electoral rolls and rate books. Descriptions of the development of small areas of cities have often been the preserve of local historians, but have increasingly attracted the attention of popular writers, urban historians, the media and, to some extent, economists. For example, Lichtenstein (2007, 2012) describes Brick Lane and Hatton Garden, whereas Tindall (2007) examines Bankside on the Thames; all these are in London. A recent BBC series *The Secret History of Our Streets* follows the development of six London roads in addition to streets in Glasgow, Edinburgh and Aberdeen. For academic research, such studies are primarily of interest if they give rise to messages that can be generalised to wider communities; this chapter is primarily about what can be learnt from such case studies as a way of analysing spatial change and shows how data sets can be constructed, to which more formal empirical analysis is applied in later chapters. The chapter is, therefore, concerned with what is achievable. Perhaps the closest research to our own is the study of one street block in New York since the seventeenth century by Easterly et al. (2015). Although our results are provided for a limited number of neighbourhoods, the methods are applicable to other areas and can be generalised to larger spatial scales (and this is carried out in later chapters). The only constraint is the required resources, which are considerable.

2.2 Case Study 1: Saffron Hill in London

The thread uniting the literary quotations at the beginning of this chapter, from two of the greatest writers in the English language, is that they are describing the same location, Saffron Hill, but in periods approximately 350 years apart, although they appear to be very different places. In the late fifteenth century, Holborn (which includes Saffron Hill) was capable of growing strawberries. Saffron Hill in the mid-nineteenth century was the fictional site of Fagin's den; in reality, it was an area of high crime, disease, overcrowding and slums. Saffron Hill is now an unexceptional, small, north/south-running street in the district of Camden (see Fig. 1.1). It looks little different from thousands of others—indeed it has few distinguishing features. Its history is related to the development of the Fleet River and its valley; Saffron Hill lies on the west side of the river and, although now heavily built up, the slope of Saffron Hill and the surrounding streets down to the river is still clearly visible.

Its history can be traced back to Roman times; excavations indicate that the predominant form of land use in the Holborn area was as a cemetery (it lies just outside the original city walls). However, settlement appears to have disappeared after the Roman period, as Anglo-Saxon developments moved approximately a mile westward, establishing the settlement of Lundenwic by the seventh century. The mouth of the Fleet River may have been used as a trading base, but a trial trench dug in Saffron Hill by the Inner London Archaeological Unit in 1978 found no evidence of early medieval settlement in the Fleet Valley at this point. However, later settlement in Holborn may first have grown up at the point where a bridge crossed the Fleet River. A ribbon development then extended westwards along the main road.

More importantly, major ecclesiastical orders were established to the east of the river from the late eleventh century, notably the priory of St John of Jerusalem and the nunnery of St Mary; the river was central to their development, providing high-quality water supplies with wells and water mills along its banks and also providing fertile alluvial soils for horticulture. The Fleet River is now covered by Farringdon Road, built in the 1860s and had been little more than a contaminated sewer for well over a century, following industrialisation and population growth, but this was not the case for most of its history and provided a stimulus for the initial establishment of the communities and subsequent growth. English Heritage (2008) provides detailed commentary on this area, which covers modern Clerkenwell.

Ecclesiastical development of the west bank took place 200 years later. In 1200, Saffron Hill was known as Golde Lane, but, in 1272, John Kirkby, Treasurer of the Realm, acquired land in the area and founded an estate which eventually included a great hall, chapel, gardens and a vineyard. The hall lay in what is now Ely Place, close to Holborn Circus. He was made Bishop of Ely by Edward I in 1286 and, on his death, he bequeathed the estate to the diocese of Ely as a London palace. At the time, it was the duty of bishops to be at the call of the King and Parliament and, so, they required a London home. The current church, St Etheldreda's, was built about 1290 and is one of only two surviving London buildings from the period of Edward I. St Etheldreda (or Aethelthryth) was a seventh century Anglo-Saxon princess from the East Anglian royal family and founded an abbey on the island of Ely, of which she became the first abbess (MacCulloch 2009, p. 358).

The fertile lands of the Fleet Valley allowed the development of luxurious gardens, for which the estate became famous, growing fruits and possibly saffron. The lands and possessions belonging to the priory and nunnery to the east of the river were broken up during the Dissolution; a similar fate was avoided on the Ely estate, but, in 1575, Elizabeth 1 forced Bishop Cox to lease the gardens to her favourite and Chancellor, Sir Christopher Hatton. The following bishop was required to grant the freehold to Hatton. Legal disputes over the ownership of the estate continued after Hatton's death in 1591, but Lichtenstein finds that the courts, in 1654, ruled in favour of Hatton's heirs, although by this stage the buildings and estate were decaying. During the civil war the buildings had been used as a prison. The third Baron Hatton leased the estate to a developer, Robert Smith, who sub-let it to Robert Johnson (Lichtenstein

2012, p. 101). Johnson proposed to construct a purpose-built estate for upper middle-class residents; despite delays, by 1665, all the estate's buildings had been demolished with the exception of St Etheldreda's and rebuilding had begun. By 1676, Hatton Garden and associated neighbouring streets had been constructed, including the development of Saffron Hill. Whereas Hatton Garden, which lies on relatively high ground, was spacious and was aimed at the gentry, Saffron Hill, in the valley, was more down-market. Figure 2.1 shows a watercolour by the Victorian artist, James Lawson Stewart, of buildings in Field Lane (the southern end of Saffron Hill at the time) and illustrates Field Lane backing on to the Fleet River. It was painted circa 1890, but since the Fleet River had been covered over, it cannot be an accurate representation of that period. The Museum of London holds a collection of Stewart's watercolours and finds that he was employed to copy earlier prints of London and, therefore, the painting may represent an earlier date.

By the mid-seventeenth century, the Saffron Hill area had become notorious; in the eighteenth century, nearby Chick Lane on the east bank, which led into Saffron Hill, was considered one of the most dangerous streets in London. In 1772, an Act of Parliament allowed the bishop to sell the estate to the Crown, which, in turn, sold the freehold to developer and architect, Charles Cole, who built the high-quality Georgian residences of Ely Place.

By the first half of the nineteenth century, this street of 'filthy odours' had become the site of Fagin's den and, at the time Dickens was writing, Saffron Hill was a haunt of pickpockets and thieves. Field Lane was described as a steep, narrow, undrained way, comprising rotting Jacobean, Stuart and early Georgian tenements. The Fleet River had declined in quality in line with the area as a whole and was a potential source of disease. Field Lane traded mainly in second-hand clothes, but, arguably, Saffron Hill was improving by this date because of social reform. Charles Barry's Church, St Peter's Saffron Hill, opened in 1832 and a Catholic mission opened in the 1840s. Dickens was a supporter of the Field Lane Ragged School,[2] which opened in 1841 and, by 1860, was

[2] A letter by Dickens to the *Daily News* in 1846 describes a visit, which is said to have provided inspiration for *A Christmas Carol*.

Fig. 2.1 Field Lane
(*Source*: Copyright, Museum of London)

teaching over 500 children in one large classroom. The Ragged School developed into the Field Lane Christian social care charity, which still exists today.

Much of the Saffron Hill area was torn down as part of major improvement schemes in Clerkenwell; English Heritage (2008, illustration 508) shows the destruction of the area with the Field Lane Ragged School in the background. The Farringdon Road scheme was started in 1841 (as an extension of earlier city improvements to Farringdon Street). The scheme was not completed until the 1860s and the development was closely tied up with the construction of the Metropolitan Line—London's first underground railway with Farringdon as its terminus—which opened in 1863. The line ran below and alongside the new road and the railway and new road transformed the character of the area. Much of the Saffron Hill area was swept away: contemporary reports suggested that 1600 dwellings were demolished, displacing a population of approximately 16,000. Since few of the residents moved far, the scheme added to the overcrowding in neighbouring streets.

The second improvement scheme—the construction of the Clerkenwell Road between 1874 and 1878—removed much of what was left. This east-west project linked Shoreditch to Oxford Street; much of its course followed existing streets and the only major new stretch cut through the slums between Holborn and Farringdon Road and between Little and Great Saffron Hill. The new stretch was lined with factories and warehouses and several large firms specialising in precision engineering moved to the area. In general, slums were cleared away to be replaced with warehouses and commercial developments.

The Clerkenwell improvement schemes, however, did little to alleviate poverty. Writing in the 1850s and 1860s, Henry Mayhew refers to Saffron Hill as a street of costermongers, containing Irish settlements; Mayhew also highlights Greater Saffron Hill as an area of low lodging houses. In an era of rapid railway expansion, transport innovations were ultimately responsible for a significant reduction in population densities, but, between 1841 and 1871, the demolitions associated with clearance schemes for new rail operations had the initial effect of increasing overcrowding at the centre.

The 1881 Census provides more direct evidence of the status of Great Saffron Hill. At that time, there were 59 occupied dwellings (and numerous workshops and warehouses), housing 805 individuals—an average of 13.6 persons per dwelling. Few of the dwellings were occupied by single households, a notable outlier being Number 81, where William Rendell and his wife Harriet lived, a shop fitter employing 10 men and boys. Number 2 housed the Central Shoeblack Society, where 46 poor, young men lived. The Society was formed by John MacGregor and Lord Shaftesbury in 1851 and provided uniforms, equipment, shoe-cleaning pitches and moral instruction, whilst encouraging church attendance. Each brigade had its own coloured uniform and the Central brigade was known as 'the Reds'; this was the oldest and largest branch and continued until around the First World War.

By 1881 the Irish-born population was declining, but the Saffron Hill parish was still internationally orientated. The parish (rather than the street) contained 3972 residents in total at the time, of whom 123 were Irish-born and 255 came from Italy. Parts of Saffron Hill were known as Little Italy, and the eminent Victorian photographer John Thomson (1994) described the conditions facing children in the area. Although often associated with the ice cream trade, in the census, only six recorded their occupations as ice cream sellers or makers. Some residents, but by no means all, were earning sufficient to winter back in Italy. Those who could not afford to over-winter in Italy generally found local employment, notably as asphalters (25 were recorded in the census). The dominant occupation, according to the census, was as musicians (mainly itinerant) and related occupations (114). Most of these were relatively low paid, although precision instrument makers also existed, such as, optician, jeweller and barometer maker. Little Italy also included its own school for the children of poor Italian immigrants. The Italian community in the area persisted until well after the Second World War.

In the late nineteenth century, Charles Booth describes the Saffron Hill area in his diaries as a combination of residential dwellings and small manufacturing workshops, factories and warehouses.[3] As noted above, immigrant populations were important to the area; in addition to the resident Italian and Irish communities, Jewish immigrants were working in gold and jewellery manufacturing in Hatton Garden, which was London's centre for the trade (although many lived in the East End and commuted and, so, do not appear in census records for the area). One of the attractions for skilled craftsmen was the fact that the area lay outside the city walls and, so, industry was not subject to the restrictions of the

[3] In the nineteenth century, London rather than the industrial north was the largest manufacturing centre in England, although much of the industry was relatively small scale.

guilds. Booth portrays neighbouring Cross Street as 'a street humming, scraping, puffing', but, according to Booth's classification, the residents of Great Saffron Hill were, by no means, the poorest in the immediate area. By this stage, the population of the parish was declining; the population reached its peak around 1830, but by the end of the century, the population was under half of that a hundred years earlier. Figure 2.2 shows conditions at the turn of the century in Little Saffron Hill (mentioned in the quotation at the start of the chapter and now known as Herbal Hill). The narrowness of the street is evident.

A glimpse into the life of Saffron Hill in the 1920s can be seen in the films of Harry B. Parkinson and Frank Miller. Their series of short documentaries looking into the working lives of often unfashionable parts of London preceded the main films at cinemas and have recently been re-released by the British Film Institute (2012). But today, Saffron Hill shows little evidence of its heritage (Fig. 2.3). During the Second World War, Saffron Hill lay in the Metropolitan Borough of Holborn, which was very heavily hit during the Blitz in 1940–1941. Of the 28 boroughs, Holborn had the highest weight of bombs (56 kilos per hectare), the fourth highest rate of residential destruction (197 houses demolished and seriously damaged) and the fifth highest casualty rate (25 causalities

Fig. 2.2 Little Saffron Hill, circa 1903 (*Source*: Copyright, Camden Local Studies and Archives Centre)

Fig. 2.3 **(a)** Saffron Hill looking north. **(b)** Saffron Hill looking south (*Source*: Authors' photographs)

per 1000 population), as shown in Table 4 of London Topographical Society (2005). Detailed coloured maps in this publication show that large parts of Saffron Hill were almost completely destroyed or damaged beyond repair in the Blitz. It was also hit by a V1 attack in the last year of the war; Lichtenstein (2012, p. 178) provides a photograph of the street's destruction.[4] Therefore, although the street remains narrow, it is unsurprising that few of the original buildings still exist. Only the eighteenth century public house described by Dickens still exists in recognisable form—its true name is the One Tun, but is caricatured as the Three Cripples in the book. The bottom of the hill where Fagin's den was located has undergone the most marked transformation, now consisting of new, prime office space (Fig. 2.3b). In the 2001 Census, the Census Output Area that includes Saffron Hill had only 240 residents[5] (1.6 per dwelling). It was not one of the most desirable locations in London in 2010, but the Lower Layer Super Output Area (LSOA) in which Saffron Hill lies[6] is only the 10,337th most deprived out of 32,482 in England as a whole. Therefore, over very long periods of time, Saffron Hill's status

[4] A wider selection of bomb damage photographs for Saffron Hill is held at the Camden Local Studies and Archives Centre.

[5] COA reference 00AGGP0032.

[6] Camden 027B.

and environment have clearly changed—from sweet-smelling fields in the fourteenth century, through filth and crime in the eighteenth and nineteenth centuries, to a central business area today. But anachronisms remain—Ely Place is a privately-owned gated road, governed by its own commissioners and beadles, reflecting its original medieval status and ownership by the Bishop of Ely.

In this extended description, Saffron Hill is just a case study, but, given sufficient resources, similar descriptions and data sets could be compiled for local areas of most UK cities. In the case of Saffron Hill, over the centuries, evidence of the effects of wars, geology, government policy, migration, and changes in technology are all evident, which still have effects on the current structure of the area. In some cases, outcomes were due to natural advantages or disadvantages; other changes arose from chance events, such as where a bomb fell. Some processes of change were gradual, whereas others occurred quickly.

2.3 Case Study 2: North Melbourne

The Fleet River was important to the status of Saffron Hill; similarly, the modern structure of Melbourne still reflects its physical geography, notably, the distribution of soil types and rivers. Original development took place just upstream from the Yarra Falls (Melbourne's main river), which provided a natural divide between the tidal brackish water downstream and the upstream freshwater. Until the destruction of the falls in the 1880s, the lower level provided a basin for shipping; trade expanded rapidly, particularly after the discovery of the Victorian goldfields in the 1850s. Excise duties provided an important revenue source for the colony and the (third) Customs House on the banks of the pool, which still stands as a museum, was completed in 1876 and remains one of Melbourne's most elegant buildings, reflecting its importance. By contrast, the original development around the Maribyrnong River (the second river) was primarily working class and industrial, since it consisted of salt water and early graziers favoured the upper reaches with freshwater tributaries. Higher status residential areas were primarily established on fertile alluvial flats and mudstones/sandstones, which now form the Central Business District (CBD) and parts of the Eastern suburbs, despite soil fertility now being less of an advantage to the dominant service industry base. By contrast, lower value areas and industrial development originally took place on basalt rock. Along the western bank of the Yarra River, the originally working class districts of Fitzroy, Collingwood and Richmond are all based on basalt and this bank provided a social divide; the wealthy districts of Hawthorn and Kew on the eastern bank lie on mudstone/sandstone and also have a higher elevation. More generally, higher elevations attracted the wealthy.

Geology, and particularly elevation, are important for explaining the social structure of the second case study, Harris Street in North Melbourne, a (now gentrified) suburb, which developed outside Hoddle's original grid pattern for the CBD. North Melbourne was originally created as the Municipality of Hotham in 1859; in 1862, Hotham as a whole had a population of 7057, with 1740 houses (351 stone or brick; 1277 wood; 112 iron) (Mattingley 1917). Hotham's name was changed to North Melbourne in 1887 as it expanded and was incorporated back into the City of Melbourne in 1905. Harris Street is not chosen randomly, but is designed to meet a set of criteria: (1) it has a local history society in the Hotham History Project, see Roberts (2002), Murphy (2004), Siska and Ashley (2004); (2) the street is small and manageable in terms of data; (3) the street was working class for most of its life; (4) there is a contrasting physical geography to nearby areas, lying at the bottom of a hill; (5) it was developed by the start of the twentieth century; (6) it is a residential district located close to the CBD (less than a 10 minute tram ride).

The history of this small road began in the early 1850s in response to the call for a new township to accommodate the gold-rush population influx. In 1852 alone, approximately 100,000 people arrived in Melbourne and no available accommodation remained (Mattingley 1916). The first land subdivision in North Melbourne consisted of quarter acre lots and took place south of Arden Street. A second subdivision to the north of Arden Street took place in 1855, but lots were not sold until 1865 and succeeding dates. The area of this second subdivision is our primary concern and is set out in Fig. 2.4 with Arden Street at the southern boundary; a stream ran through the area from Royal Park in the north to the West Melbourne swamp and is clearly visible on the figure, running between O'Shannassy and Haines Streets, which still exist. Note that, at the time of these initial plans, all the dwellings are spacious and of approximately equal lot sizes, despite the fact that Chapman Street, to the north, lies at the top of the hill, whereas O'Shannassy and Haines Streets lie at the bottom of the valley and were prone to regular flooding.

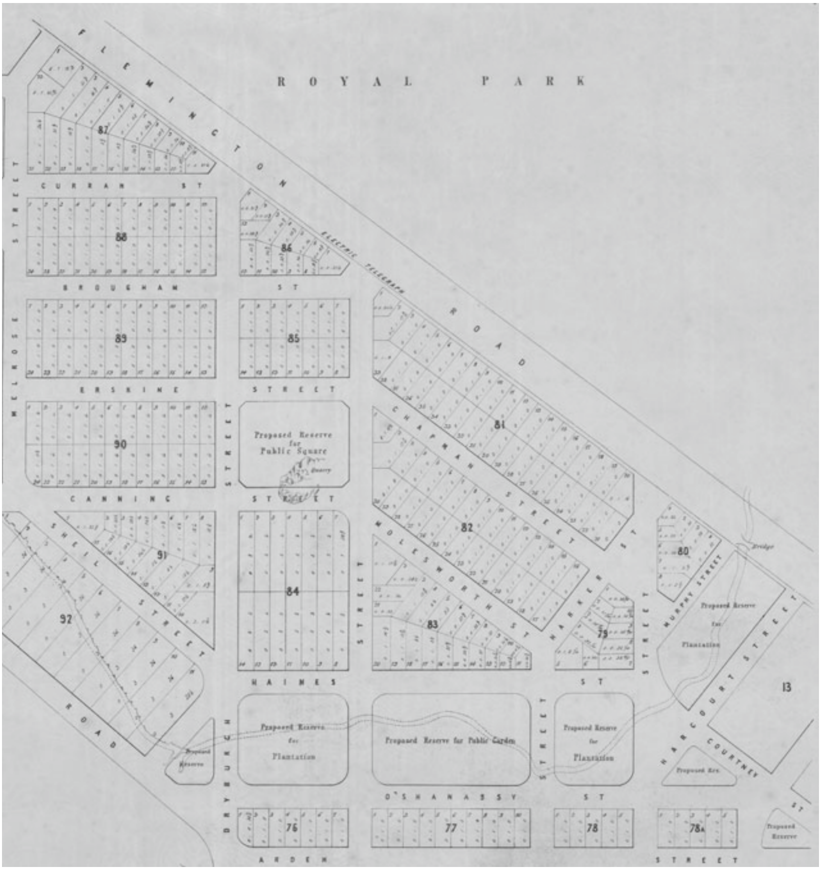

Fig. 2.4 North Melbourne, 1858
(*Source*: Victoria Public Lands Office, accessed from State Library of Victoria)

At these initial stages, the area surrounding the stream was designated as a reserve for public gardens and plantations. The original intention, therefore, was the construction of a high-quality neighbourhood; furthermore, there is no sign of Harris Street. Mattingley (1916) states, 'The site of the future town was an ideal one, consisting of undulating land richly carpeted with grass and studded with noble redgum trees, which gave it a beautiful park-like appearance.'

In practice, these plans were never implemented. The need for revenue from land sales by the colonial government led to fuller development and further subdivision of the lots (Roberts 2002). Figure 2.5 indicates the position in 1875; this now shows the stream to have been diverted through a blue-stone storm drain. Although not mentioned, this is the location of Harris Street and is named on the plans for sale of freehold properties in 1881. All indications of parkland have been replaced by dense housing on small plots. According to Roberts (2002), plot sizes at the top of the hill were approximately 2.6 times larger than in the valley, but, even on the hill, there were gradations in social status, with Chapman Street typically containing better quality dwellings than Molesworth Street (see Fig. 2.6a for an example of the former). Building in Harris Street had begun by 1880 and, as an indication of status, all 17 houses built that year were timber and even by 1890 only 13 % were brick (Roberts 2002). The areas between the south side of Molesworth and Haines Streets were designated for slum reclamation in 1940, although, in practice, little work was undertaken until the 1960s. Furthermore, the valley area had been seen as an area of special need since 1911, consisting of small, flood-prone cottages. Nevertheless, its proximity to the CBD made it a candidate for gentrification. Whereas many of the good-quality original nineteenth century properties on the higher ground remain in place, most of the lower ground properties have been replaced by apartments and social housing. The valley was still experiencing flooding in 2010. Figure 2.6b shows one of the few remaining gentrified original cottages in Harris Street, with a modern apartment block in the background. Earlier photographs of pre-gentrified cottages in Harris Street, prior to demolition, can be found in Siska and Ashley (2004). Today, large parts of Harris Street have disappeared and the current version (the original eastern end) is only approximately 120 m in length.

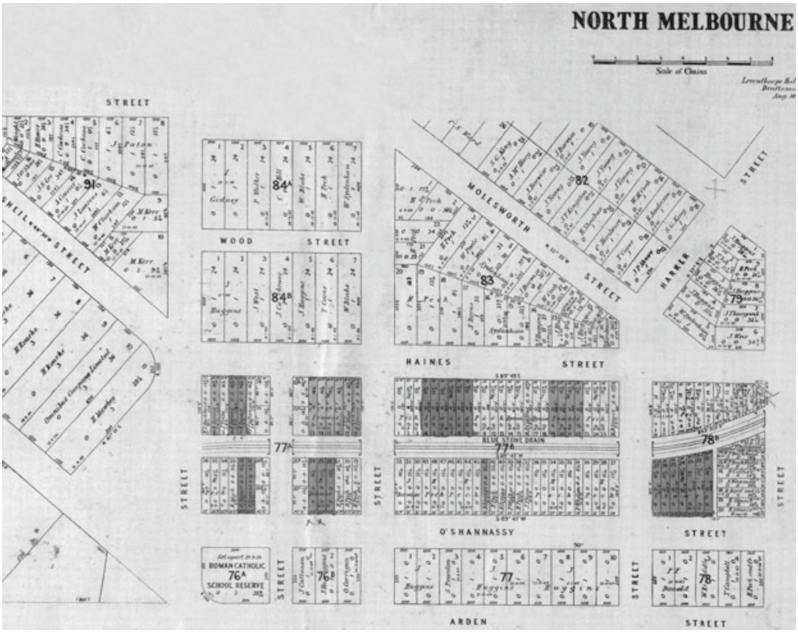

Fig. 2.5 North Melbourne, 1875
(*Source*: Department of Lands and Survey, accessed from State Library of Victoria)

Fig. 2.6 (**a**) Chapman Street. (**b**) Harris Street
(*Source*: Authors' photographs)

The western end is now a private road, with the centre subsumed by apartments.

The electoral rolls over the period 1903–1980 provide valuable information on the changing social status of Harris Street; similar analyses can be carried out for any street in Melbourne (and indeed nationally). The Commonwealth Franchise Act of 1902 established a uniform franchise law for federal elections where all British subjects over the age of 21—both male and female—living in Australia for more than six months were entitled to vote in federal elections. Consequently, the 1903 electoral roll was the first with fairly comprehensive coverage. Nevertheless, the indigenous population was disqualified and did not obtain full voting rights until the 1960s. The voting age for all was reduced to 18 in 1973 and women were not granted voting rights in Victorian state elections until 1908.

The value of the historical electoral roll lies in its ability to trace the changing social status of streets, because, in contrast to England, the register recorded the occupations of all residents until 1983. Furthermore, since the individual records are available, it is possible to construct a panel of individuals to trace mobility over most of the twentieth century. Table 2.1 shows the total number of adult residents living in Harris Street in a sample of nine years. In 1903, 171 residents were present at the time of the roll, numbers which remained fairly stable until 1954, after which date they declined dramatically; change was certainly not gradual. By 1913, 82 properties had been constructed and remained in place until

Table 2.1 Dwellings, population and mobility: Harris Street

	1903	1913	1922	1934	1949	1954	1963	1972	1980
Total dwellings	74	82	82	82	82	82	23	7	8
Total population	171	185	168	185	189	154	38	12	15
Adults per occupied dwelling	2.3	2.3	2.1	2.3	2.3	1.9	1.7	1.7	1.9
Nos. in same location in (*t*) and (*t*–1)	–	25	37	24	40	93	15	6	3
% of population in same location	–	13.5	22.0	13.0	21.2	60.4	39.5	50.0	20.0

Source: Melbourne Electoral Rolls

the early 1960s, when clearance programmes reduced the total. All the remaining dwellings lie at the eastern end, which has a slightly higher elevation. Until the 1950s, average adult occupancy was approximately 2.3, but began to decline subsequently.

Given the magnitude of the Great War, it might be expected that social change would be evident, although Melbourne never faced bombing in either World War in the manner that devastated Saffron Hill. However, Table 2.1 shows little change in the total numbers living in Harris Street between 1913 and 1922. The direct population effects can also be measured from First World War records, notably the Roll of Honour compiled for the Australian War Memorial, which gives the details of all Australians dying in conflict. The raw data for the Roll are taken from circulars sent to the next of kin, seeking further information. As an example, Thomas McKinley lived at Number 64 in 1913 with his wife and son Thomas (junior); he was killed in action at Ypres on 11th September 1916, aged 34. The electoral roll for 1913 records his occupation as a labourer, although the circular also notes his 'other training' as footballer. His son, Thomas junior, was still living at number 64 in 1922, although his wife had moved by that stage. In total five residents of Harris Street can be identified as having definitely died in the conflict; in addition to Thomas McKinley, Samuel Andrew (number 62, killed at Passchendaele October 1917), Phillip Kirkpatrick (number 56—where he was also born—killed in France March 1918), Frederick McCaughey (number 70, died 5th Australian General Hospital, Melbourne), Edward Moran (number 25, killed in France, May 1917).

Table 2.2 sets out the occupations of the residents and distinguishes all those recorded more than three times, except for the later years when the total population had fallen and so more detail is noted. By far the most frequent occupation was 'home duties'. Despite the fact that North Melbourne was a low income area for most of its history, very few married women were in paid employment until the latest years. Almost all the male residents were in manual occupations with 'labourer' the most common classification; drivers, machinists and railway employees are also well represented. Numbers are low, but the beginnings of gentrification are revealed in 1980; almost all residents were then in white-collar occupations.

Table 2.2 Occupational distribution of Harris Street, 1903–1980 (nos.)

1903	1913	1922	1934	1949	1954	1963	1972	1980
House duties: 72	Home duties: 76	Home duties: 72	Home duties: 77	Home duties: 62	House duties: 57	Home duties: 14	Home duties: 6	Home duties: 3
Labourer: 24	Labourer: 20	Labourer: 16	Labourer: 34	Labourer: 22	Labourer: 21	Labourer: 4	Clerk: 2	Social worker: 2
Dressmaker: 5	Driver: 7	Driver: 9	Driver: 9	Driver: 6	Bookbinder: 6	Driver: 7		Consultant: 1
Driver: 4	Bookbinder: 4	Railway empl.: 5	Bookbinder: 5	Bookbinder: 6	Machinist: 4	Assistant: 2		Contractor: 1
Machinist: 4	Machinist: 4	Bookbinder: 4	Tobacco worker: 4	Machinist: 6				Draftsman: 1
Railway empl.: 4	Postal empl.: 4			Process worker: 4				Lecturer: 1
								Medical pract.: 1

Source: Melbourne Electoral Rolls

Table 2.1 also shows turnover rates; these are calculated as the proportion of individuals who remained in the same dwelling between two dates. Note that the sample years are not equally interspersed and this is reflected in the rates. Nevertheless, it is evident that a significant percentage of individuals were immobile over five to ten year periods. In the post-Second World War era, approximately 60 % of residents remained in place between 1949 and 1954. Amongst the most immobile of residents in Harris Street was Thomas Egan (boot maker) who lived at number 15 from 1903 until 1934 and members of his family continued to live in the dwelling through to 1954. But the longest-serving resident was Annie Mitchell (home duties), who lived at number 7 from 1913 to 1972. Further long-residing families included the Keenans (number 19, 1903–1934), the Keaneys (number 71, 1903–1954) and the Laffys (number 18, 1913–1954). These three cases indicate that, although individuals may leave or die, residences were passed on to other family members. For families as a whole, immobility rates were noticeably higher than those shown in Table 2.1. Also, using information from the Melbourne rate books, these individuals or families were owners in 1949, whereas approximately 75 % were renters in Harris Street as a whole. As in modern data, renters were typically more mobile than owners. In addition to those who remained in place, the electoral rolls allow the movements of the residents to be traced over time. Discussion of these moves is reserved until Chap. 8 when mobility and residential sorting for larger samples of Melbourne residents are discussed. However, anticipating the findings, most moves were over fairly short distances.

The occupational distributions can be compared with the more upmarket Chapman Street, in this case, over the post-Second World War period (Table 2.3). The advantage of the comparison is that the two streets are close together, are on the same transport network and, at least initially, differed only in terms of their elevation. Nevertheless, this is sufficient to reveal significant differences between the streets. First, the major reduction, by 1980, in the proportion of women undertaking home duties in Chapman Street is evident. Second, the rise in the number of students in 1980 reflects the lowering of the voting age. Third, the large number of retirees in 1980 arises from the establishment of the St Vincent de Paul home for the elderly. Fourth, although not evident from

Table 2.3 Occupational distribution of Chapman Street, 1954–1980 (nos.)

1954	1972	1980
House duties: 91	Home duties: 36	Retired: 29
Clerk: 14	Teacher: 12	Student: 24
Labourer: 13	Clerk: 10	Home duties: 23
Driver: 4	Student: 8	Clerk: 20
Munition worker: 4	Engineer: 5	Teacher/tutor: 14
Box maker: 3	Driver: 4	Nurse: 6
Carpenter: 3	Nurse: 4	Labourer: 5
Metal worker: 3	Sales: 4	Machinist: 4
Sales: 3	Storeman: 4	Admin. officer: 3
Storeman: 3	Box maker: 3	Box maker: 3
	Cleaner: 3	Librarian: 3
	Public servant: 3	Manager: 3
		Med. pract/vet: 3
		Pharmacist: 3
		Public servant: 3
		Secretary: 3

Source: Melbourne Electoral Rolls

Table 2.3, higher proportions of residents were living in apartments by the last year. Finally, it is clear that the social status of the street rose over time (and was of higher status than Harris Street even in 1954). Clerks were the most numerous in 1954, although there were also a significant number of labourers and other manual occupations, but white collar workers, notably clerks and teachers dominated by 1980.

2.4 Case Study 3: Anderston in Glasgow

Anderston sits on the north side of Glasgow's main river, the Clyde, due west of the city centre into which it merges. Those new to Glasgow would not know that, prior to the comprehensive redevelopment of the district, Anderston, which is approximately one square mile in size, was within walking distance of Kelvingrove Park in the west and reached as far as Glasgow central train station. The district was brutally cut in two by the M8 motorway and Kingston Bridge, which, infamously, were constructed through the city centre in the late 1960s. Further road-based damage was inflicted by the Clydeside expressway—a dual carriageway that runs from the Clyde tunnel to the city centre—and again effectively dissected Anderston, running west to east several hundred yards north of the river.

Anderston's housing and streetscape were also radically redesigned by comprehensive redevelopment; tenements were removed and post-war social housing, consisting of non-traditional flats and multi-storey blocks, took their place. A large part of the neighbourhood remained mixed land use industrial and warehousing property and one warehouse in Cheapside Street, a whisky bonding plant, blew up in the early 1960s during a fire, killing 19 firemen. Arguably, this tragedy sped up the redevelopment of Anderston (Cooper 2004, p. 71). Much later, in the 2000s, a stock transfer ballot led to much of the 1960s and 1970s redevelopment housing being taken over by a housing association which, with the consent of its new tenants, agreed to transform the area, demolishing and rebuilding at more human levels in excess of 400 homes. The work, by Sanctuary Scotland Housing Association continues to reintroduce the original streetscape.[7]

However, these post-Second World War developments hide the history of Anderston, which dates to the eighteenth century. According to Cooper (2004),

> It is approaching three hundred years since the village of Anderston was first proposed and feuing-off land for cottages was begun in 1725. By the mid-nineteenth century the village had emerged from a small weaving and farming community into a highly industrialised part of Glasgow. In many respects, Anderston was the cradle of industrial enterprise and innovation during the eighteenth and nineteenth centuries. (Cooper 2004, foreword)

Cooper (2004) reports that the population of Anderston grew from 4000 in 1790 to more than 12,000 in 1820, chiefly as a result of economic growth, steam power and attendant jobs bringing people into the

[7] One of the authors, Gibb, has close personal attachment to what is happening in Anderston. Both Gibb's parents grew up there and, in both cases, their family homes were destroyed by the comprehensive redevelopment. Gibb sits on the board of the Sanctuary Scotland Housing Association and was able to invite his mother to one of the demolitions, which was a highly poignant moment.

district to work and live. In addition to weaving and textiles, new jobs were emerging in iron foundries, shipbuilding and marine engineering. A concentration on the key industries that brought Glasgow's rapid growth and industrial domination in the nineteenth century helped fuel the growth of Anderston as a classic mixed area of industry and residential housing; most of Anderston's tenements were built between the 1850s and 1880s and replaced weavers' cottages and limited model housing from earlier periods. However, these same industries produced highly volatile local economies, which saw rapid growth, immigration and inflating costs of living followed by joblessness, out-migration and destitution in the bad times. In the long term, it also left Glasgow heavily exposed to the risks of shifting international terms of trade, especially in shipbuilding, engineering and associated industries.

Anderston was, in many ways, representative of the high density, overcrowded and unhealthy nineteenth century Glasgow (Worsdall 1989; Maver 2000). Anderston and its contiguous, more affluent western districts of Kelvinhaugh and Sandyford represented vastly diverging levels of social stress during this period. Andy Gibb (1983, Table 5, reprinted in Chap. 6), found that, in 1881, Kelvinhaugh and Sandyford had low population density rates per acre compared to Anderston (43 against 229), death rates per 1000 were, respectively, 17.2 and 28.4; infant mortality rates were nearly double in Anderston (54 against 101 per 1000 for children under-five). The table also suggests that, while only 7.5 % of properties in Kelvinhaugh were one apartment flats, fully 33 % were in Anderston.

Arguably, the best single account of the long-term vulnerability experienced by Glasgow and districts such as Anderston is *The Upas Tree* by Checkland (1976). This tree, native to Java, entered legend (according to the book's preface) because its poisonous roots could spread for miles and kill everything in its radius; this was a metaphor for the decline of Glasgow and the Clydeside region as a result of its dependence on shipbuilding and associated trades and the undiversified nature of the economy, leaving it excessively vulnerable to later deindustrialisation. This, however, was compounded by serial policy errors in response to the cumulative problems facing Glasgow from, at least, 1945 to the mid- to late-1980s.

Checkland argues that the city grew too big and too fast on a narrow economic base, which was particularly prone to boom and bust. It then declined rapidly and successive generations saw further negative patterns of employment loss, dereliction, unemployment and the attendant problems that led to Scotland's highest levels of multiple deprivation, exemplified by what is now often called the Glasgow Effect—the difficult to explain poor morbidity and mortality records of Glaswegians compared to other post-industrial cities in the UK. Glasgow contracted rapidly and lost population on an unprecedented scale (but in a way similar to several rust belt cities in North America). National and regional policies, both for the built environment and for economic development, failed to counter these big trends until quite different policies started to emerge in the 1990s, eventually reversing population decline and ushering in a period of jobs growth until the downturn after 2008.

2.5 To Conclude

This chapter is concerned with exploring what is achievable from historical micro data sources, which are non-standard for most economists. There is nothing unique about the chosen case studies—although small streets and areas are sometimes more interesting than larger thoroughfares and have rich histories—and the exercise could be repeated for most streets in the three cities. In fact, the adopted procedures lie behind the construction of long-run longitudinal data sets for wider areas, which form the basis of empirical modelling work in later chapters. The fine spatial level reveals important features of the physical environment, such as elevation or liability to flooding, which affect population distributions and the social statuses of areas; these are often overlooked, but still have implications for modern policies. As Chap. 4 will demonstrate, current house price distributions are still influenced by geology. Furthermore, the long-run perspective allows the impact of infrequent major events and path dependence to be explored. The case study for Glasgow illustrates the importance of industrial structure for local volatility, an issue explored further in Chap. 6.

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3

Key Concepts from the Literature

3.1 Introduction

A set of general concepts is relevant to the three local case studies in Chap. 2; these include residential density, segregation, agglomeration, social interactions, random walks, path dependence, mean reversion and institutions. However, their relevance needs to be drawn out and formalised through reference to the relevant literatures. The monocentric model provides a standard introduction to residential density, but it can be extended in a number of directions, such as the introduction of durable housing as a way of adding dynamics to an otherwise comparative static model and the addition of neighbourhood amenities to relax some of the assumptions of the basic model. Other issues are better discussed employing the literature on self-organising systems, notably segregation and social interactions. Path dependence, increasing returns, random walks and mean reversion are discussed in the context of history and institutions, including recent models of long-run growth, but there are overlaps in each case.

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3.2 Issues from the Monocentric Model

In his review of the history of urban economics, Alan Evans (2003) attributes the foundation of the subject to two approaches developed in the US in the late 1950s.[1] One approach concentrated on the detailed workings of major urban economies. By contrast, the second, associated with Alonso (1964), Mills (1972), Muth (1969) and Wingo (1961) formulated a theory of the relationship between commuting costs and urban land values and how these determined spatial household residential patterns. The development of this monocentric model represented the birth of the subject because of its integration, into a coherent theoretical framework, of previously diverse and uncoordinated topics. However, the urban monocentric model had been preceded more than a century earlier by the work of Ricardo (1821) and von Thünen (1826) and, arguably, the monocentric model primarily transposed the models to an urban setting and so was not a scientific revolution or paradigm shift, as defined by Kuhn, but it has certainly been the strongest influence on the programme for subsequent urban theoretical and empirical research in economics, including the fields of housing, segregation, crime, education and the environment.

The neo-classical monocentric model, elegantly based on clear assumptions, derives precise and testable predictions. Important results are that rents, land values, population and building densities all decline as the distance from the city centre increases. For our purposes, population densities and the spatial distribution of different household types are of particular relevance and can be compared and contrasted with other approaches based on theories of self-organisation and institutional economics. Since these are slightly less well-known than the monocentric model, particular attention is paid to them below. Nevertheless, a starting point is the classic paper on urban population densities published by Colin Clark in 1951. Clark's tests are based on the negative exponential function, (3.1):

$$D_i = Ae^{-bx_i} \tag{3.1}$$

[1] Evans also briefly discusses earlier research on cities in the classics, notably, by Adam Smith on the role of towns in the *Wealth of Nations*, agglomeration economies in Marshall's *Principles of Economics* and Tiebout's work on local public goods.

where D_i = density of the residential population (thousands per square mile in Clark's study) at location (i); x_i = distance in miles from the city centre. Since the Central Business District (CBD) is typically dominated by commercial rather than residential properties, (3.1) can be modified to exclude this initial distance between the commercial centre and the start of the residential area (see McDonald and McMillen 2007, Chap. 7). For example, the City of London (the Square Mile) had under 0.1 % of the total Greater London population in 2011. In (3.1), (A) measures population density at the core, and (b) the speed at which density decays away from the centre; compact cities are expected to have high values of (b). Furthermore, the development of cheap mass transport systems lowered its value over time. Clark's study covered cities in the US, Britain, mainland Europe and Australia; in 1841, density at the core, (A), in London was the highest in the sampled world—800,000 people per square mile—but had fallen tenfold by 1939. Additionally, the value of (b) fell over the same period from 1.4 to 0.2. The largest changes were between 1841 and 1871, when the boom in railway building was at its peak. Clark's analysis also shows that core density in New York had overtaken London by 1900, but Paris and Berlin had become the cities with the highest central densities. In Paris, in contrast to all the other cities, central density rose between 1817 and 1931. Of the Australian cities, at 100,000, Melbourne had the highest core density, but Sydney was the least compact by 1947.

Since Clark's original work, density gradients have been studied extensively for later periods and include refinements to the methodology, but the basic conclusions still generally hold. As an example, McDonald and McMillen (2007, Table 7.1) show density gradients for 25 US cities in 2000, based on census tracts. The highest value of (b) is for New York, but density declines by 12.4 % for each additional mile from its centre. However, the authors show that the model does not necessarily fit in all cases; those areas that grew by joining together formerly distinct cities need to be modelled as polycentric cities. McDonald and McMillen also show that a decline in the density gradient continued through the twentieth century in US cities, with particularly rapid declines between 1880 and 1900 and 1950 and 1970, again coinciding with an expansion of mass transport systems and, therefore, reducing the necessity to walk to work.

Three issues arise for our purposes. First, a standard criticism of the monocentric model is that the urban centre is exogenously determined (Baumont and Huriot 1998), rather than being part of a general equilibrium solution. Alternatively, the model does not explain why centres arise in the first place. By contrast, New Economic Geography models endogenise city formation through agglomeration economies. These take three forms: (1) non-market interactions, such as social or business interactions for the exchange of knowledge; (2) monopolistic competition where firms produce differentiated products and consumers wish for diversity; (3) strategic externalities that arise from co-location of competing firms. The first is central in the discussion of the next section, but, although agglomeration economies show how endogenous processes generate centres, they do not necessarily show *where* these centres will arise, since, in uniform space, all locations are identical. The determination of location can be tied down by 'first nature causes' (Baumont and Huriot 1998), related to geographical advantages. Alternatively, following Arthur (1994), location may arise from a series of random shocks. Chapter 2 provided indications that the modern urban structure of Melbourne partly reflects underlying rock formations and this is developed further in Chap. 4. The relationship between agglomeration and randomness is explored in the next section.

A second issue relates to the dynamics of change. Chapter 2 suggested that, in some instances, urban change might be gradual, but in other cases occurs in discrete jumps. Dynamics can be added to the monocentric model by recognising the longevity of the housing stock. Brueckner (2000) provides a useful survey of models where the malleability assumption of the standard model, (in which the housing stock can be rebuilt in each period), is replaced with either the assumption that housing is irreversible, so that the stock is entirely determined by history, or can be redeveloped according to obsolescence conditions. In contrast to the static model where building heights decline smoothly and the location of new development can be predicted, longevity provides a richer characterisation more consistent with observed urban patterns, including the co-location of high and low height buildings, 'leapfrogging', where central locations are left vacant as outward development occurs, and increasing population densities with distance. The age of the stock is just as important as its location in determining density, which is, therefore, related not only to current economic conditions, but also to those prevailing at the time each unit was built. Brueckner (1986) shows that density exhibits a discontinuity at the time of area redevelopment. Harrison and Kain (1974) conducted the first empirical tests of the role of history and different models are nested in Yacovissi and Kern (1995). In a generalised version of (3.1), given by (3.2), the authors take into account the history of development—the percentage of properties in area (i) built in period (j), Y_{ij}—and an interaction term that allows density to vary both by age and distance from the centre, x_i.

$$D_i = A_0 e^{-bx_i + \sum_{j=1}^{n}\left(c_j Y_{ij} + d_j x_i Y_{ij}\right)} \tag{3.2}$$

where, A_0 is density at the centre in the base year and b, c, d are parameters to be estimated.

Empirical evidence finds that redevelopment occurs when the price of land for new development exceeds the price of land in its current use by the cost of demolition. The rule was originally developed in Brueckner (1980) and Wheaton (1982), but the first rigorous tests appear in Rosenthal and Helsley's (1994) work on Vancouver housing markets. Subsequently, Munneke (1996) applied the same model to industrial and commercial development in Chicago and Dye and McMillen (2007) extend it in the Chicago metropolitan housing market. All these studies provide support for the valuation rule.

Third, even within its own static structure, the central results of the monocentric model do not unambiguously determine the spatial distribution between rich and poor households. To illustrate, Eq. (3.3) is taken from Muth and Goodman (1989).

$$\frac{\mathrm{d}u}{\mathrm{d}y} = \frac{\left(\eta_{hy} - \eta_{\psi y}\right)\left(\psi / y\right)}{\delta^2 p / \delta u^2} \tag{3.3}$$

u = time spent commuting
y = income

$\left(\eta_{hy} - \eta_{\psi y}\right)$ = the difference between the income elasticity of housing demand and the income elasticity of the marginal valuation of commuting time

ψ = the marginal valuation of travel time

p = the price of housing services

Therefore, whether households move to the suburbs as their incomes rise (and increase their commuting time) depends on the difference between two elasticities. If the income elasticity of demand for space is high, this is consistent with a concentration of high income households away from the centre. But, if high income households respond strongly to higher travel times, then it is possible that the rich will be concentrated in the centre. The model predicts that segregation between household types is likely to be the norm, but does not necessarily predict the location of the rich, although, in principle, both key elasticities can be estimated. Extensions are necessary to tie down the theoretical spatial distributions. Note, however, that, consistent with (3.3), a possible interpretation of the squalid housing conditions of the poor in nineteenth century British urban areas is that, if the income elasticity of housing demand is high, then the *demand* for space by low income workers might have been weak, rather than representing a shortage of adequate housing *supply*. This, of course, is contentious and highlights the fact that the basic model concentrates on demand and neglects supply under its assumptions.

The ability of the monocentric model to explain the structure of modern polycentric cities, as opposed to its ability to explain the historical development of older cities, attracts differing views, but empirical studies suggest that additional factors help to explain the modern distribution of different types of households. Based on hedonic analysis of micro data, Cheshire and Shepherd (1995, 1998), show that for two British towns, Reading and Darlington, an extended form of the monocentric model still holds, allowing for differences in structural and locational characteristics. Therefore, distance from the centre still matters, despite long-run falling transport costs (and a flattening on the rent gradient), but more attention needs to be paid to the neighbourhood, including local crime rates (Gibbons 2004) and the quality of local education (Cheshire and Sheppard 2004).

Brueckner et al. (1999) use differences in urban amenities as a means of overcoming the potential indeterminacy of the location of the wealthy in the standard model. Using Paris and Detroit as examples, they assume that the marginal valuation of amenities rises with income. Urban amenities take three forms: *natural* amenities related to topography; *historical* amenities, such as the buildings; and *modern* amenities. The first two categories are exogenous, whereas the third is related to the location of the wealthy households, such as the provision of restaurants or theatres. Both natural and historical amenities exert a causal influence on location and, since they vary considerably across cities, are consistent with the international variation in the location of the rich between the centre and suburbs. The unusual densities found by Clark for Paris during the nineteenth and early twentieth centuries were noted above and (in contrast to Detroit) wealthy Parisians are concentrated in the centre, attracted by the high quality of the buildings and the environment, aided by Haussmann's nineteenth century public works programmes.

Three further features of household mobility are important for later chapters. First, most moves are short distance, which has been true in England since at least the nineteenth century. Ravenstein's (1885) First Law of Migration states that the great majority of internal migrants only move short distances and most moves are towards centres of absorption, such as centres of commerce and industry. On more modern data, National Health Service Central Register data for 2005 show that approximately 60 % of total migration flows took place between the four southern English regions (measured as the sum of inflows and outflows in the four regions as a proportion of total English inflows and outflows). Böheim and Taylor (2002) also find, using the British Household Panel Survey from 1991 to 1997, that 66 % of moves are within local authority districts, 16 % are between local authority districts, but within regions and only 18 % are between regions. The Survey of English Housing indicates that in 2005/06, 70 % of movers travelled under 10 miles and the same patterns emerge in other countries. Clark and Dieleman (1996), for example, reach similar conclusions for both the US and the Netherlands. A plausible hypothesis to explain short-distance moves is that households are unwilling to lose the ties with family and friends associated with long-distance moves; in other words, neighbourhood interactions matter. Second, in 2012–2013, 19 % of English moves took place for family reasons, 16 % of movers wanted a larger house, and 10 % wanted to move to a better neighbourhood; only 10 % wanted to move for labour market reasons (Department of Communities and Local Government 2014, Table 6.4). Third, most modern work on moving decisions, using both aggregate time-series and micro data sets, considers a large class of explanatory factors, in addition to labour market variables. Stylised facts include: private renters move more frequently than owners; social tenants have low rates of migration; negative equity reduces rates of mobility amongst owners; high relative house prices discourage migration into an area, but this may be offset by expectations of capital gains; migration into an area is deterred by housing shortages, but equally areas that experience excessive levels of vacancies are unattractive because they indicate decline; those in professional occupations have higher rates of mobility than the unskilled; migration is more difficult for dual income households because of the problems of job matching; migration falls sharply in middle age at least up to the age of retirement; migration is low for households with school aged children; aggregate rates of home-ownership are positively correlated with high rates of unemployment. The last of these is controversial, given its policy implication that encouraging high levels of owner occupation raises unemployment, despite the fact that higher income groups are more likely to be owners.

3.3 Neighbourhoods, Social Interactions, Randomness and Spatial Structure

Neighbourhoods are not made up only of their topography and history, although Chap. 2 hinted at the relevance of both in North Melbourne and they are drivers in the Brueckner et al. (1999) location model. In addition, neighbourhoods comprise the social interactions between local residents. The properties of systems exhibiting endogenous social interactions are not straightforward and, often, require numerical solutions, but they lead to important conclusions. First, integrated communities of rich and poor households are stochastically unstable—small shocks to an integrated neighbourhood cause it to break down. Second, neighbourhoods may undergo phase transitions; change takes place rarely but when it happens, it happens quickly. In some cases, it may occur in response to a series of random events. Third, in a similar manner to the monocentric model, spatial structure is not unique in homogenous space, but needs to be tied down by exogenous characteristics. Fourth, in contrast to the monocentric model, the dynamics of city change can be more interesting than the comparative statics. Each aspect is discussed in this section, although it is helpful to begin in an aspatial framework.

Manski (2000) points to a lack of clarity in what is meant by social interactions in economics and such terms as *peer influences*, *neighbourhood effects*, *herd behaviour* and *social capital* are often used imprecisely. Manski notes that agents affect the decisions of others through constraints, expectations and preferences. Here, our concern is with preferences, so that the utility an agent receives depends on the actions of others. In a spatial context, the Schelling (1971) model of residential segregation provides a classic example, where the utility of each individual is a function of the (racial) composition of others who decide to live in the area. We return to the Schelling model and its extensions below.

Preference interdependencies have been widely recognised in the literature, for example in Evans (1976), and modelling interdependencies in game theory is standard. However, interactions-based models of individual behaviour, adding externalities arising from groups, show how features of aggregate outcomes can be explained which standard individual agent models neglect. As Glaeser and Scheinkman (2001, p. 84) argue, social interactions generate strategic complementarities: 'even if changes in fundamentals create only a small change in the level of activity for each individual, each individual's small change will then raise the benefits for everyone else pursuing that activity. … Small changes in fundamental variables can set off a cascade'. The models also give rise to the possibility of non-linear behaviour and multiple equilibria. The greater is the weight attached to the actions of others, the more likely are multiple equilibria to occur.

Some of the insights arise in the biological sciences and it is useful to take examples in order to illustrate their relevance (or otherwise) to economics and housing, particularly how non-linearity arises in complex systems. However, they lead to radically different conclusions compared with standard economic models and care is needed. In particular, self-organisation in complex systems may lead to non-predictability or uncontrollability. Although this may be valid and is consistent with Taleb's (2007) idea of Black Swans, for example, this is very different from the neo-classical approach of the last section. Complex systems have large numbers of interacting parts where the behaviour of the system as a whole cannot be understood simply from a consideration of the individual agents. Again, this differs from the representative agent models of neo-classical theory. Self-organisation in the natural sciences is now well established and ant colonies, fish shoals, or flocks of birds form ordered communities without clear leaders. The interactions between agents, following low-level rules, create higher levels of order, known as emergence. In the case of ant colonies, aggregate outcomes arise from the reactions of individuals to pheromone trails left by others. No individual ant needs to understand the behaviour of the colony as a whole as each ant reacts only to the trails of neighbouring ants, but this is sufficient for ordered patterns to arise. The murmurations of starlings provide another example.

In neo-classical models all individuals are, typically, identical or representative, but complex systems stress the heterogeneity of agents and behaviour can be simulated through agent-based computation models.[2] In this case, even if equilibrium solutions exist, they may not be achievable or may be unstable; the system may remain out of equilibrium for very long periods of time. These models also exhibit 'tipping' or thresholds, generating highly non-linear behaviour. An example from Kauffman (1994) provides a useful starting point. One of the central themes of Kauffman's book is that self-organisation in biological systems is a pre-condition to evolution and 'only those systems that are able to organize themselves spontaneously may be able to evolve further' (p. 185). The origin of life, he argues, may have occurred as a phase transition in systems of chemical reactions, giving rise to emergent order.

In the models that follow, the featureless plain of the basic monocentric model is replaced with a cellular automaton (CA). The first frame of Fig. 3.1 randomly distributes a set of buttons; in this example there are 400 buttons, but the precise number is not important. The simulation

[2] The models below are constructed using the Ascape software for agent-based systems.

begins by taking two buttons randomly and joining them together with a thread; the process then continues with further threads and buttons. Initially, if one thread is picked up, the number of buttons that are joined together is likely to be two or a small number; this case is shown in Fig. 3.1a. However, Fig. 3.1b shows the position as the number of threads expands. Now, the maximum number of linked buttons increases in a non-linear fashion, summarised in Fig. 3.1c. This shows the maximum number of buttons on any string on the vertical axis against the number of threads on the horizontal axis; as the number of threads expands, the linked buttons reach a threshold or phase transition.

This simple example illustrates the importance of networks. Without stretching the imagination too far, the buttons might be considered as individuals or households and the threads the interactions between them. If the links are limited, then the agents act as individuals and society is simply the sum of the individual parts. But if interactions between like-minded agents reach a threshold then they create strong networks and societies that are difficult to break down. This provides initial insights into why neighbourhoods might arise in order to provide support groups. Other applications of these basic principles are in evolutionary economics, often set in the context of Schumpeterian models. Foster (1993) also discusses how the ideas can be related to Marshallian concepts of time irreversibility.

Adding an explicitly spatial dimension, human geographers and regional scientists have applied CA models to a wide range of urban

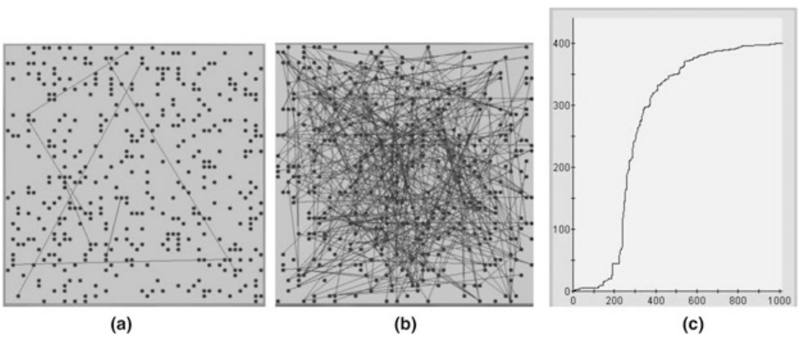

Fig. 3.1 The Kauffman buttons and threads model

problems (see, in particular, Batty 2005 or Portugali 2000 for overviews of the field) and provide valuable perspectives on cities as self-organising systems. However, the classic Schelling (1971) checkerboard model and its extensions to a stochastic framework remain a starting point. The model's central insight is to demonstrate that, even if everyone has only a weak preference that some of his/her neighbours should be of the same type, then the sum of individual free choices will generate segregated communities. Now consider the spatial configuration in Fig. 3.2a. In this case there are two types of agents (black and white) and assume that each agent wishes to live in a completely integrated neighbourhood where 50 % of neighbours are white and 50 % are black; the neighbourhood is assumed to constitute the surrounding eight locations for any individual. Therefore Fig. 3.2a meets the criterion. But, as Krugman (1996) points out, the problem is that such configurations are not stable. Changes to the locations of a few individual agents leads to a complete break-down of the integrated state because of the interdependence of preferences (Fig. 3.2b); by contrast segregated states are stable.

The stability of segregation can be shown using a stochastic version of the Schelling model developed by Young (1998, 2001).[3] Stochastic stability is related to the concept of evolutionary stable strategies adopted in biology. Formally a strategy is evolutionary stable 'if a population of individuals using that strategy cannot be invaded by a rare mutant adopting a different strategy' (Axelrod 1990, p. 93). To illustrate, in Fig. 3.3a, two groups of agents are randomly distributed around a circle. An individual is defined as discontent with his/her current location if the two immediate neighbours are of different colour, otherwise the agent is content. Two agents are randomly chosen and consider trading by changing places. The probability of trading is as follows.

(i) If both agents were previously discontent with their locations or one was discontent and trading would make both content, then trading takes place with probability $(1-\varepsilon)$.

[3] See also Zhang (2004a, b) where stochastic stability is demonstrated in the context of a discrete choice random utilities model. Figure 3.2 is derived from Zhang's work. The model is also used to demonstrate the causes of persistent suburbanisation of black households since the sixties, the expansion of black ghettos, and changes in racial house price and vacancy differentials.

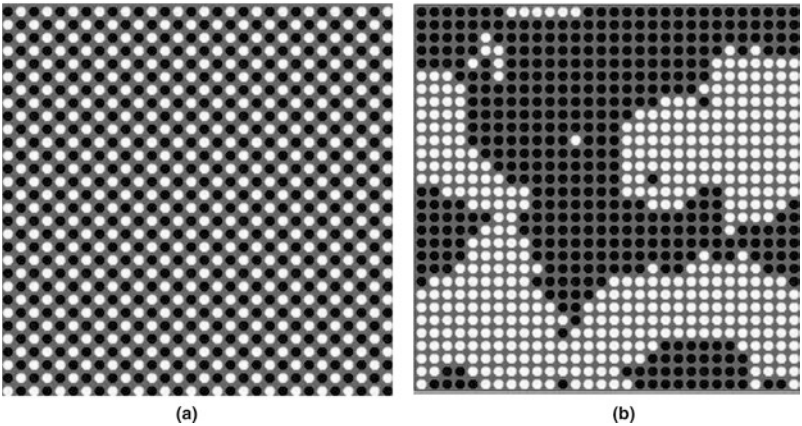

Fig. 3.2 The stability of segregation (Zhang 2004a, b)

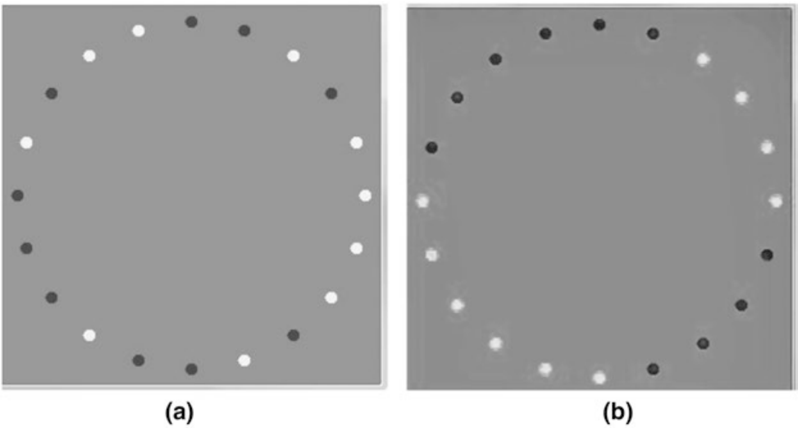

Fig. 3.3 Stochastic stability

(ii) If swapping does not change either's level of contentment, then the probability of trading is ε^a.
(iii) If both were previously content and, by trading, one becomes discontent, then the probability of trade is ε^b.
(iv) If both were content, and by trading both become discontent, then the probability of trading is ε^c.

Figure 3.3 is based on parameter values, $\varepsilon = 0.1$; $a = 1.0$; $b = 1.5$; $c = 2.0$. Therefore, there is a 10 % probability that agents will not move, even if it is in both their interests to do so and some (smaller) probability that a move will occur even if it is not in the interest of one or both agents. Repeating the process, these probabilities mean that the dynamics are permanently in a state of flux, but the second frame provides a snapshot where segregation occurs. Such states are stochastically stable, such that when 'an evolutionary process is subjected to small, persistent stochastic shocks, some states occur much more frequently than others over the long run' (Young 1998, p. 10). Note, however, that due to inertia in the system, it can take extremely long periods of time before the stochastically stable state is achieved. As such, the dynamics are often more interesting than the stable state. Systems of this form, subject to random trades, exhibit ergodicity—long-run behaviour, in this case segregation, is independent of the initial conditions. The outcome is not path dependent; although the path itself cannot be predicted, the long-run outcome is known. We return to path dependence and non-ergodicity below, including formal definitions.

Figures 3.1 and 3.3 can be extended to illustrate the importance of thresholds, tipping or phase transitions in economics. Young (1998) takes as a (non-spatial) example the adoption of currencies. In any period an individual must decide whether to carry gold or silver (assumed to be equally valuable) as a medium of exchange. Individuals meet, but can only trade if they both carry the same medium. Young shows that, in this case, the population will converge to carrying the same currency and this state will typically continue for long periods of time. But if there is some probability that individuals choose randomly, then an accumulation of random choices is capable of tipping the system to the alternative currency regime. The same processes can occur in neighbourhood models if there are pioneers who set out for a new neighbourhood even if moves are not utility-improving on the basis of the rules. The idea is explored in Meen and Meen (2003), who show how neighbourhoods can tip and gentrify. Neighbourhoods are not permanently stable, although they can exist in the same state for long periods, but when they change, they change suddenly. These models provide insights into the possible dynamics of cities, but the number of practical applications to housing markets is still limited. Yin (2009) is one of the few, in this case for the city of Buffalo, where simple rules for household location choices relate to both racial composition and housing sale prices.

3.4 Path Dependence, Non-ergodicity, Polya Processes and Poverty Traps

It is helpful to formalise the concept of path dependence and its relationship to the models of the last section. Sometimes loosely characterised as 'history matters', a path dependent process is described more fully as one whose evolution is determined by its own history. North (2005) points to 'constraints on the choice set of the present that are derived from historical experiences of the past' (p. 52). Formally, Arthur (1994) considers a process driven by a dynamic sequence $\{x_n\}$. This, for example, might be the share of population in a particular location at time (n). A process is ergodic if different sequences of historical events lead to the same market outcome and, so, an ergodic world is one which does not exhibit path dependent outcomes, an example of which was shown in Fig. 3.3. A path dependent (non-ergodic) stochastic process is, correspondingly, defined in terms of the limiting probability distribution which governs the system dynamics (David 2007). For many markets, an assumption of ergodicity is reasonable, but, arguably, this is not the case in urban systems.

A Polya process provides an example of a stochastic system, which exhibits non-ergodicity and is useful as a way of explaining how spatial agglomerations may arise. In Chap. 9, particular attention is paid to the local spatial distribution of migrant communities and is used as an example of the more general idea, although Arthur (1994) applies the model to industrial concentration. Because the model is used in Chap. 9, slightly more formal definitions are required here. From Arthur (1994), let the vectors $n_t = \left(n_t^1, n_t^2, \ldots, n_t^k\right)$ and $X_t = \left(X_t^1, X_t^2, \ldots, X_t^k\right)$ represent the numbers and proportions of immigrants of nationality types $1 \ldots k$ at period t in an area. If an additional person enters the area at time t, he/she is of nationality k with probability $q_t^k\left(X_t\right)$. In other words, the probability that he/she is of nationality k depends on the distribution of nationalities already in the area. If there is already a high proportion of migrants of type k this raises the probability that the next arrival will be of the same nationality. As time increases, the question is whether a structure, or fixed point, emerges.

Arthur shows that the shares will tend to a fixed distribution, but shocks at an early stage determine which fixed point emerges amongst the possible set of outcomes. In our example, the proportions of immigrants in an area may be volatile in early stages of development, but stabilise over time. The process is non-ergodic, but initial random chances determine which distribution is achieved. Consequently, small events in history matter to eventual spatial distributions, but, once determined, the patterns are persistent. In other words, the system converges to one of a number of possible equilibria, but which equilibrium is unpredictable in advance and is determined by a sequence of random events. A feature of the process is irreversibility—once the path is chosen, it is not possible to return to an alternative. However, the question arises how path dependent processes can be spotted, since only one outcome is observed in practice. One approach is through the identification of shocks or major policy changes and their effects on the properties of very long time series. This is discussed in Sect. 3.6.

In this model, the choice amongst multiple equilibria is determined only by a sequence of random events. Alternatively, but not necessarily, the equilibrium might be tied down by location fundamentals. Krugman (1991) discusses the further possibility that the outcome may be determined by self-fulfilling expectations. If agents move only slowly to their optimal locations, this must be because there are adjustment costs. Therefore, agents have to form expectations of, for example, future relative wages in different locations. In this case, if everyone believes a certain location is optimal, this may outweigh any advantage established in other areas by history.

3.5 Interactions and the Empirical Problems

The figures above show that thresholds and phase transitions are features of models with social interactions and, in some cases, outcomes follow S-shaped distributions. A further feature is that, once areas have undergone a phase transition, they are locked in to the new state, except in the presence of additional large shocks; the states are, therefore, persistent. Similarly, Durlauf (2006) defines poverty traps as limiting cases of economic immobility or are states in which the persistence of economic conditions is arbitrarily long. Based on Galster and Zobel (1998), Fig. 3.4 graphs a stylised representation of the relationship between local economic conditions, here measured by the level of house prices (scaled to unity) and neighbourhood poverty (expressed as the deviation from the mean). Therefore, positive values indicate higher than average levels. If social interactions are important, then local prices might not take off until poverty falls to a critical point (B). The areas that are most likely to gentrify or decline are those that lie around the thresholds and, for policy, the identification of these areas is critical. Relatively small government expenditures (or other changes) in areas that lie around points (A) and (B) have large effects on property values. By contrast, expenditure at locations well above (B) has little effect. Therefore, 'one size fits all' policies do not work in the presence of thresholds, leading to poverty traps.

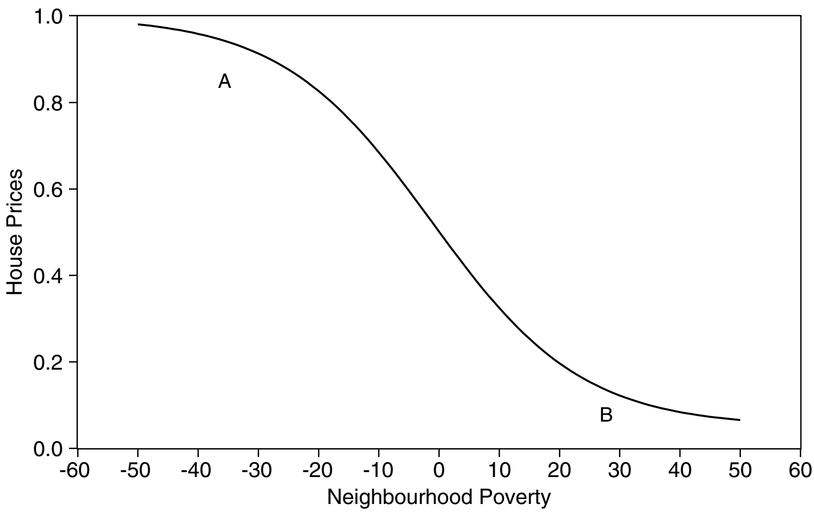

Fig. 3.4 Poverty traps

The empirical literature, which attempts to draw conclusions about the effects of neighbourhoods on economic outcomes for adults and children, is extensive, but remains controversial; Galster (2010) brings together the evidence on 15 possible causal pathways, classified under four broad headings: social interactive, environmental, geographical and institutional. Although all are relevant here, social interactive mechanisms are particularly closely related to the last section. They include, for example, the possibility of social contagion where aspirations and behaviour are affected by interactions with neighbours or peer groups; Galster draws an analogy to epidemics.

Other classifications are possible and Manski (1993, 2000) draws the distinction between endogenous interactions, contextual interactions and correlated effects. Under the first, the behaviour of an individual varies with that of a group; under the second, behaviour varies with the exogenous characteristics of the group; under the third, group members behave in a similar way because they have similar characteristics or similar institutional environments. To illustrate the differences, Manski (2000) gives the example of the performance of a high school student. Interactions are endogenous if his/her achievements vary with those of the student's reference group; the interactions are contextual if achievement varies with the social composition of the group. The effects are correlated if students achieve similar scores because they come from similar backgrounds or have the same teacher. The distinctions matter because they have different implications for policy. Later chapters are concerned with possible group effects on the decision where to live and similar issues arise. Do households move to a given area because they are copying the behaviour of others, or does their choice depend on the exogenous characteristics of others, or because they have been exposed to similar backgrounds, including parenting?

The problem is that the data cannot always distinguish between the three. Meen (2009) provides an example of the difficulties in the context of local house price modelling. More generally, an identification problem arises because mean group behaviour is determined by the behaviour of its members, as a simple aggregation, known as the Reflection Problem. 'Does the mirror image cause the person's movements or reflect them?' (Manski 2000, p. 128). Although methods are available to ensure identification (see Galster et al. 2010), none is without its drawbacks. Methods include the use of lagged grouped behaviour, the introduction of non-linear relationships between individual and group behaviour (thresholds are an example), or the use of an instrumental variable, which varies with some but not all individuals in the group. The difficulties have also led to recommendations for the use of pseudo-experimental data; the Moving to Opportunity programme, in particular, has generated a wide range of studies, designed to look at the effects on subsequent economic performance if residents are moved from areas of high poverty.

A further empirical problem noted by Manski concerns the appropriate definition of the group, which in our case is spatially determined. A priori, the limits of the neighbourhood are unknown, but choices are often determined by the availability of administrative data, not appropriate to the task. It is for this reason that some of the empirical analysis in subsequent chapters uses individual micro data, which do not require pre-specification of the neighbourhood. Considerable attention has been paid in the literature to testing the effects of social interactions on economic performance and health (see the extensive reference list in Galster 2010), but few attempts have been made to test econometrically the spatial structures that emerge from the issues discussed in Sect. 3.3. Models of complex systems for cities are more typically based on rules with imposed, rather than fully estimated, parameters (see, for example, Bossomaier et al. 2007; Gilbert et al. 2009; Yin 2009). Although the results that emerge from such models are indicative and avoid the difficult identification problems, there remains scope for the integration of these techniques with more standard econometric methods.

3.6 History, Institutions and Long-Run Change

There are many excellent historical accounts of the evolution of world cities. Glaeser (2005a, b) considers the development of New York and Boston; both cities had advantages, for example, New York's deep water port or Boston's religious foundations, which promoted social cohesion and stressed the value of education. However, their subsequent status has been strongly related to their ability to attract high-skilled workers and to act as information hubs. Long-run US studies by Simon and Nardinelli (2002) and Beeson et al. (2001) also stress the importance of human capital.

This section highlights empirical techniques and theoretical issues, relevant to subsequent chapters. The distinction is drawn between the effects of temporary shocks and permanent structural innovations. Examples of the former are wars, natural disasters and epidemics, although temporary shocks may still have long-lasting outcomes. Permanent structural innovations are associated with institutions, defined by North (1994) as 'formal constraints (e.g., rules, laws, constitutions), informal constraints (e.g., norms of behaviour, conventions, self-imposed codes of conduct) and their enforcement characteristics'. The roles of government, property rights, religion, universities, social capital, technological progress and trade have all received attention in the literature.

The extent to which spatial structures persist over long periods of time involves a discussion of the time-series properties of key variables and the extent to which they change in response to shocks. From the definition of path dependency above, even small temporary events can produce permanent effects on equilibrium outcomes. But it is important to stress that path dependence does not generally imply irrationality; the underlying paths which occur may arise from rational technological or policy choices. The potential problem is that once a decision is made to adopt a technology or policy, irreversibility implies that it is difficult to change the decision. David's (1985) QWERTY keyboard case is an example of a Polya process; if typists are heterogeneous in their preferences for keyboard layouts, each decision in favour of QWERTY raises the probability of a subsequent typist making the same choice and, so, the design becomes locked in and persists, even if better designs become available. Similarly, future political decisions are heavily constrained by the past, because the costs of change may be high.

Empirical analysis of persistence arising from temporary shocks benefits from long-run data sets, which can be tested for evidence of structural change. Recent studies have explored data for the last millennium or even longer, although, inevitably, the choice of variables available to be studied is limited and analysis relies heavily on extensions to the Bairoch et al.

(1988) city-level population data sets. It is helpful to begin with the study covering the longest time span; Davis and Weinstein (2002) consider Japanese regional population distributions from 6000 BC to the modern era, based on archaeological and census information (censuses in Japan began in the eighth century AD). The time span allows tests of three hypotheses concerning the drivers of the spatial distribution of economic activity: increasing returns, random growth and location fundamentals. Increasing returns include the class of approaches discussed in Sect. 3.4, including explanations in terms of path dependence. An advantage of the time period is that scale economies were unlikely to have been important in the hunter-gatherer Stone Age and, therefore, differential effects over time would be expected. Random growth models imply that city size distributions arise from stochastic processes and provide a possible explanation of Zipf's Law. Locational fundamentals are related to the natural advantages that any area might possess, such as access to ports and rivers.

Strikingly, Davis and Weinstein find a significant correlation between modern regional population distributions in 1998 and those 8000 years ago (a correlation coefficient of 0.53)—the spatial distribution of the population in Japan is highly persistent, suggesting that natural advantages are a major part of the story. Also, using the case of Second World War bombing of Japanese cities, they conclude that the population shares of bombed cities quickly recovered in the post-war period, despite the widespread destruction and, therefore, exhibit mean reversion. Tests are based on the random walk model set out in Appendix 1. If population shares exhibit a random walk, then temporary shocks, such as a war, have permanent effects. Finally, they also find that variations in population densities have existed in all periods, broadly supporting Zipf's Law.

As obvious examples of large temporary shocks, wars provide a fruitful line for research. Nitsch (2003) concentrates on changes in the population of Vienna following the break-up of the Austro-Hungarian Empire after the First World War, finding that the population initially declined but stabilised subsequently at a higher level than would have been expected from its underlying characteristics. He interprets this as evidence of spatial lock in. Bosker et al. (2007) examine the bombing of German cities in the Second World War and, in contrast to Davis and Weinstein for Japan, find that large shocks may be sufficient to shift city population distributions to a new equilibrium. Over a longer time scale, Dincecco and Onorato (2013) suggest that the prosperous urban belt in modern Europe that runs from the Low Countries to Northern Italy can be explained by a high level of exposure to wars over the pre-industrial period from 1000 to 1799. Since rural populations suffered most from conflict, they were incentivised to relocate behind urban fortifications, leading to higher rates of human capital formation and agglomeration, which persist today. Michaels and Rauch (2013) use the break-up of the Western Roman Empire in the fifth century as a form of natural experiment to investigate whether fundamentals, such as rivers and coastlines, determine the location of towns or whether history locks towns into unfavourable positions. Following the removal of Roman troops, urban structures in Britain were temporarily wiped out, whereas many towns in France were taken over by the Franks and a higher proportion of French towns still remain on former Roman sites than in Britain. Three residential patterns might have been re-established: first, if fundamentals continued to favour the former Roman locations, then these would still have been chosen by both countries; second, if the value of fundamentals shifted over time, town locations in both would move if the gains in productivity were greater than those obtained from a concentration of human activity; third, if the value of fundamentals changed, but the gains were fewer than from the population concentrations, then towns would be re-established in the best physical locations in Britain and were less likely to replicate Roman settlements, but patterns would be locked in France. Michaels and Rauch find support for the third, path dependent outcome and suggest that the losses in France from sub-optimal location away from rivers and ports were substantial and are still experienced today.

Epidemics and natural disasters provide further examples of large temporary shocks. Voigtländer and Voth (2013) suggest that the Black Death led to a permanent increase in urbanisation and real wages between the fourteenth and seventeenth centuries. Pereira (2009) considers the largest ever natural disaster in Europe—the 1755 Lisbon Earthquake—and, despite a direct loss of between 32 % and 48 % of Portuguese gross domestic product (GDP), he suggests that there may have been permanent beneficial effects resulting from the opportunity to reform the economy.

Even major institutional change can still be triggered by unexpected events. For example, Cantoni (2012) suggests that the adoption of Protestantism in the early sixteenth century in many parts of the Holy Roman Empire, following Martin Luther's defiance of Catholic authority, was aided by a combination of fortuitous events: the power struggle between the Pope, the Holy Roman Emperor and territorial lords; the support given by Frederick III of Saxony (where Wittenberg is located); the invention of the movable-type printing press, which aided the dissemination of the 95 Theses, because between 1450 and 1500 the price of books fell by two-thirds (Dittmar 2011); and the wars against the Ottoman Empire. Furthermore, areas close to Wittenberg were more likely to adopt Protestantism than remain Catholic, because of strategic complementarities; the same religious distribution largely remains in place today. By contrast, criticisms of the Catholic Church by the Hussites[4] in the previous century had little lasting effect outside Bohemia (and disappeared even here after 200 years). Indeed, Jan Hus was betrayed at the Council of Konstanz in 1415 and was burned at the stake (MacCulloch 2009, p. 572).

The role of institutions, notably government, as a contributor to growth is not a new theme. Both Smith in the *Wealth of Nations* and Montesquieu in *The Spirit of Laws* stressed the importance of property rights. In absolutist monarchies, property ownership is insecure and held at the discretion of the ruling elite. Under constitutional governments, where the power of the monarch is restricted, property rights are more secure. Consequently, economic growth is likely to be stronger in the latter. Montesquieu contrasted the booming economies of Britain and the Netherlands and the stagnant economy of France (see De Long and Shleifer 1993). North and Weingast (1989) discuss the evolution of successful parliamentary-based institutions in Britain following the seventeenth century Glorious Revolution and the removal of James II. They point to five key changes: the removal of an archaic fiscal system that had led to periodic financial crises; limitations on the Monarch's powers, which reduced the Crown's ability to introduce legislation without parliamentary assent; the removal of the power of

[4] Jan Hus' attacks were inspired by the English Lollard movement.

the Crown to set taxes unilaterally; the role of Parliament in prioritising and monitoring expenditures; the balance between the powers of Monarch and Parliament, which ensured limits on the actions of *both* parties. The outcome was a structure where both were limited in their ability to revise institutions further, so that the Monarch could not alter property rights for his own benefit. Ownership rights, thus, became credible and led to the rapid development of private capital markets, furthering economic growth. Parliament also had a commitment to uphold these rights because wealth holders had an input to the decisions through Parliament, so that only changes that were in their own interests were implemented.

Recent research has attempted to test empirically these ideas. Van Zanden et al. (2012) show that the earliest parliaments were in Spain in the twelfth century, but had gradually spread across the West by 1500. However, although parliamentary influence (and a corresponding reduction in the power of the monarch) expanded in Britain and the Netherlands between 1500 and 1800, parliaments declined in southern Europe, notably France, Spain and Portugal. Using data for the growth of city populations, they show evidence of an associated shift in economic activity towards north-western Europe. Acemoglu et al. (2005) also find that pre-Industrial Revolution European growth rate differentials, from 1500, were affected by the extent to which countries were involved in Atlantic trade. However, as in Van Zanden et al., the UK and the Netherlands gained relative to Spain and Portugal, who were also involved in the trade, because of their favourable institutional structure, again due to the absence of absolutist monarchies.

Cantoni and Yuchtman's (2014) research on the establishment of German universities, following the Papal Schism of 1378, demonstrates the importance of a strong judicial system for the promotion of economic activity. Following the Schism, universities were opened for the first time in Germany as faculty and students at French universities supporting the Holy Roman Emperor were expelled and those originally from Germany returned home, giving rise to an exogenous increase in human capital. Cantoni and Yuchtman suggest that the subsequent expansion in commercial activities in those areas with access to the new universities was associated with the improved knowledge of Roman law learnt at French universities, which was used to develop legal institutions in Germany. The importance of knowledge transfer is also demonstrated in Dittmar's (2011) study of the diffusion of the Gutenberg press invented in the mid-fifteenth century. He demonstrates that European cities where the press was established grew more strongly between 1500 and 1600 by promoting numeracy and good business practices.

Outside Europe, Acemoglu et al. (2001) demonstrate that, across a large range of countries with a colonial past, there is a strong relationship between *current* per capita GDP and the form of colonial institutions, which were originally established in past centuries. More precisely, permanent European settlement was more likely to take place in countries where mortality rates were low, for example Australia, New Zealand, the US and Canada, whereas more exploitative relationships without permanent settlement were likely to occur in countries with high death rates for European settlers. In the former, strong institutions, clearly defined property rights and democratic government were established, which persisted over time, because they remained in the best interests of the residents. By contrast, institutions were much weaker in the exploited countries, but still persisted after independence because the transactions costs associated with change were large. For example, small ruling elites may receive a large percentage of the countries' revenues and are incentivised to resist change. Additionally, if agents have made investments in a country related to the institution set, irreversibility suggests that they will again resist change. As a result, the current institutional structure, influenced by the past, affects the distribution of modern growth rates. Bosker et al. (2013) investigate the reasons for the decline in economic power of middle-eastern Islamic states between 800 and 1800 and the increasing strength of Europe. In the early period, the Islamic world was more advanced both economically and culturally, whereas Europe was a declining backwater, following the demise of the Roman and Carolingian Empires. The authors identify two key factors in the reversal of fortunes—relative independence from the state and greater local governance, coupled with the greater use of efficient water-based trade in Europe.

3.7 To Conclude

The central message that runs through most of the studies examined in this chapter is the importance of persistence; changes that took place hundreds of years ago still have an impact on modern economies and constrain policy decisions. None of the long-run studies in Sect. 3.6 are specifically concerned with housing and spatial structures within cities, but the remaining chapters develop some of these aspects. The different concepts introduced here all play a role.

For example, Chap. 4 is concerned with location fundamentals and the extent to which residential spatial distributions today still reflect past decisions, which are no longer strictly relevant. Chapter 7 discusses the long-run time-series properties of new building and the restrictions these place on modern policy. Chapter 8 considers household mobility patterns since the nineteenth century, allowing for the effects of social interactions and the distribution of the housing stock. Chapter 9 is concerned with path dependence, Polya processes and the implications for the spatial distribution of migrants. Chapter 11 is concerned with local poverty traps and the extent to which these can be explained by the characteristics of urban systems discussed in the previous sections.

3.8 Appendix 1: The Random Walk Model

Although random walks are a general concept, used widely in empirical economics and econometrics, this application to war-time bombing is taken from Davis and Weinstein (2002). Suppose there are observations on city populations for three time periods, (n_1, n_2, n_3). The first date relates to the pre-war period, the second to the immediate post-war aftermath and the third to a later post-war date, by which time areas may potentially have recovered to the pre-war position Let R_{b,n_1}denote the log share of the total population in city (b) in period (n_1). Similar definitions hold for the other time periods. The share is defined by (3.1a) for (n_2) in the aftermath of the war, which is composed of an equilibrium share and an error term. The error term in Eq. (3.2a) incorporates the effects of the one-off war-time bombing shock and pre-war errors that may be autocorrelated.

$$R_{b,n_2} = \Omega_b + \varepsilon_{b,n_2} \tag{3.1a}$$

$$\varepsilon_{b,n_2} = \delta\varepsilon_{b,n_1} + \nu_{b,n_2} \tag{3.2a}$$

Ω_b = equilibrium share
ε_{b,n_2} = city specific error term for each year
ν_{b,n_2} = war-time shock, i.e., the effects of bombing
δ = error autocorrelation coefficient

Defining similar relationships for the other time periods, by substitution, 3.3a can be derived.

$$R_{b,n_3} - R_{b,n_2} = (\delta - 1)\nu_{b,n_2} + \left[\nu_{b,n_3} + \delta(\delta - 1)\varepsilon_{b,n_1}\right] \tag{3.3a}$$

Since the term in square brackets is an error, which is uncorrelated with the war-time shock, ν_{b,n_2}, persistence tests concentrate on the first term. A measure of the war-time shock is the extent of bombing. If $\delta = 1$, population shares exhibit a unit root; temporary shocks have permanent effects. Values of $\delta < 1$ imply reversion towards the pre-war equilibrium. Davis and Weinstein find $(\delta - 1)$ approximately equal to 1 and, therefore, reject the random walk. In a subsequent paper by Davis and Weinstein (2008), the model is extended to allow for the possibility of multiple equilibria, which they reject.

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4

Geology and Cities

4.1 Introduction

Cities are central to the organisation of human and economic activity. Globally, cities have emerged and disappeared over the millennia with the evolution of technology, environmental change or degradation, geopolitical and administrative requirements and patterns of trade and commerce. Throughout history, cities have combined complex interplays of commercial, administrative and religious roles. Natural advantages, such as rivers, harbours, defences, soil fertility and access to resources, facilitated consumption, production and communication, giving rise to a concentration of people and economic activity.

Geological and physical conditions have been important to the location of cities (Marshall 1890; Ellison and Glaeser 1999; Roos 2005) and have also influenced the evolution of urban hierarchies with the economic potential of cities conditioned by access to agricultural surpluses and industrial geological resources. In some cases, the original agglomerations have survived until the present day and continue to thrive, even though the original geological advantages have become less important or irrelevant. Furthermore, geology and physical conditions also vary within

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cities. The built environment is located upon and anchored in the soil and bedrock that underlie urban development and may systematically affect the patterns of land use and neighbourhood characteristics, which, in turn, give rise to socio-economic micro geographies and stratification. For instance, low-value land within cities might be more likely to attract housing investment for low-income households and land-intensive industries. A number of studies have tested the impact of locational advantages and increasing returns on the evolution of urban hierarchies, but few studies directly control for underlying geological conditions.[1]

This chapter specifically examines the role of geology and topography in generating intra-urban differences. As discussed in Chap. 3, longevity of the built environment, property rights and social interactions can result in slow changes to the urban morphology. If geological conditions, historically, gave rise to systematic variation in land use, then modern property prices and urban social structures may continue to reflect the geological foundations. In order to test this view, we examine the relationship between modern property prices in England and Melbourne and a number of geographical determinants, including distances from centres, topographical and physical characteristics, hydrogeological features and, finally, soil characteristics, notably geology and fertility. The tests build on the ideas from the more descriptive case studies in Chap. 2.

4.2 A Brief History of Geology and Development

Urban form and location are frequently shaped by natural features and constraints. Legget (1973) argues that the location of most ancient settlements was related to topography, where rivers provided boundaries and protection as well as serving as a means of communication. On the one hand, access to clean and reliable supplies of water was central to the sustainability of settlements and features such as proximity to natural resources, minerals and fertile land, determined the economic potential

[1] Combes et al. (2010) is an exception by employing instruments, such as soil and hydrogeology, in addressing biases in productivity and agglomeration estimates.

and also shaped the urban environment and quality of life. On the other hand, proximity to natural barriers, such as mountains, deserts, oceans and swamps determined the limits for urban growth and planning.

Roman civil organisation tended to follow that of existing administrative structures, with a policy to locate most of the provincial capitals in close proximity, or simply replacing, existing tribal centres (Palliser 2000). Roman towns suggest a geographical pattern that spread across the south and east of Britain with no urban centres north of Hadrian's Wall and only two in Wales (Palliser 2000). Unlike modern cities and towns, Roman urban centres were primarily centres of consumption rather than production; the economic function of later medieval urban developments often evolved from the Roman military and political functions and remained as centres of authority into the medieval and later periods (Palliser 2000).

Fertility of the land remained, at this stage, an important determinant of urban development and production of an agricultural surplus would still have been vital to the maintenance of army and civil administrative functions. Land suitable for arable cultivation is more predominant in southern and eastern parts of the British Isles and that would also have been important to earlier tribal settlements. From the seventh century, agricultural surpluses, broadly defined to include livestock, could sustain larger populations and facilitated trade and the concentration of non-agricultural activities at permanent locations (Astill 2000). The commercialisation of British towns extended over several centuries, continuing as predominantly centres of consumption, whereas agricultural surpluses enabled occupational specialisation and urban services to emerge that broadened the economic base (Britnell 2000). Natural advantages, such as ports and navigable rivers, increased their importance over this period with particular growth in port cities during the thirteenth century (Hinton 2000).

Throughout the twelfth and thirteenth centuries, ports along the North Sea and Channel coast expanded as a result of growing long-distance trade, particularly in wool, hide and tin (Britnell 2000). Relative town sizes thus depended not only on the ability of the economic hinterland to sustain a growing population, but also on the range of skills, specialisations and production of services. The potential for such urban dimensions was greatest where a number of functions coexisted—seats of power, secular or religious, demand from surrounding regions, and centres of trade, including, increasingly, long-distance trade (Britnell 2000). Compared to their modern counterparts, commercial activities remained small scale, but, nevertheless, the emerging commercial role also meant that the fortunes and growth prospects of many towns extended beyond primary geological foundations or geopolitical determinants.

The late medieval era experienced a number of periods of export growth in wool and cloth and towns with stronger export growth tended to increase their rank size (Britnell 2000). However, periods of general or localised decline also resulted in a greater centralisation of commercial activity and credit networks in London and in a more general change in the distribution of leading commercial centres (Britnell 2000). Whereas the early Tudor period had enabled an export boom and promoted regional centres of manufacturing (especially in wool and cloth) across Devon, Wiltshire, Gloucestershire, Suffolk, Yorkshire and Westmoreland, the later medieval period witnessed an urban bias towards the south east. This was, in part, facilitated by geological conditions that sustained larger populations and produced agricultural surpluses (Langton 2000).

Urban development from the Reformation until the 1700s was characterised by considerable stability in the urban hierarchy and by growing commercialisation, regional and urban specialisation, economic integration and the development of communication and proto-industrialisation (Glennie and Whyte 2000). Compared to parts of Western Europe, the British urban hierarchy was polarised with a large number of small market centres, no large cities apart from London (de Vries 1984) and only a small number of regional centres with extensive trade connections (Clark 2000). While some aspects of urban life remained closely linked to the economic hinterland, improved national and international integration and emerging urban industrial, service and leisure specialisation towards the end of the pre-industrial era, also reduced the vulnerability of urban development to local agricultural conditions. Glennie and Whyte (2000, pp. 176–180) argue that, after 1590, crises in grain supplies in England were no longer associated with higher urban mortality rates and, by the late seventeenth century, a national market for wheat existed with common price fluctuations.

Throughout the eighteenth and nineteenth centuries, industrial geological resources laid the foundations for an energy-rich economy in parts of the country, transformed a number of existing towns to world-city status and led to the establishment of a series of new towns. By the mid-nineteenth century, Britain's urban hierarchy, below London, was, in large parts, turned upside down (Langton 2000); geology again played an important part. Coalfields are non-randomly distributed and, before the railways, coal was costly to transport and of low value relative to its weight. Proximity to coalfields and industrial geological resources facilitated rapid economic growth based on coal and power. Alternative interpretations of the eighteenth century, however, contest this view of 'revolutionary' industrialisation and emphasise a more evolutionary development, based on proto-industrialisation. However, whether revolutionary, evolutionary or commercial, geology continued to influence urban growth and development. London's population increased from 100,000 inhabitants in the seventeenth century to 2 million by 1840; Glasgow increased from 18,000 to 260,000 inhabitants, while Manchester and Liverpool increased from less than 2400 inhabitants to 311,000 and 286,000 respectively.

While industrial urban centres in the Midlands and North expanded at a faster rate than southern urban centres, urban growth was also rapid in areas not dominated by coal and power; Norwich increased from 14,000 to 61,800, and Oxford, Cambridge, Colchester and Canterbury all more than doubled in size. According to Langton (2000, p. 479) urban growth in less-industrial areas reflected 'a technologically innovative commercial agrarian economy, swollen by imports of goods and fortunes from the colonies'; geology (and geography) continued its pre-industrial relevance.

Over the eighteenth and nineteenth centuries, the role of geology became even more complex. Agricultural fertility, which in the Middle Ages provided a surplus for commercial and proto-industrial development, was eclipsed by industrial–geological resources as a basis for urban growth. Taking a longer view it is also evident that technological innovation and improvements to communications had reduced the immediate link between urban development and agricultural fertility. Urban innovations, such as the expansion of service trades in the Middle Ages and specialist manufacturing and leisure sectors in the seventeenth century, had made the urban hierarchy more complex by the start of the nineteenth century.

Large parts of the built-up environment *within* cities today remain conditioned by urban developments in Victorian and Edwardian Britain and soil conditions contributed to views of locational attractiveness and advantages. Different types of soil were classified as conducive to healthy living or otherwise, for example Woodward (1906), although it was recognised that economic imperatives may nevertheless result in their development. Since the demand for housing quality is generally found to be income elastic, different soil characteristics may result in systematically different patterns of land use and land rents. As discussed later, soil characteristics also affected the indoor quality of housing; industry and artisan/lower-income housing was, therefore, more likely to be constructed on marginal or low rent land. Similarly, a range of environmental characteristics, such as health, topographical features, and wooded or shaded surroundings, are conditioned by geological foundations. Since environmental amenities are likely to be superior goods, higher-income households may be expected to spend proportionally more on environmental and social amenities than lower-income households. To the extent that such characteristics are conditioned by non-random geological conditions, the distribution of property and neighbourhood characteristics and, by extension, social structures and property prices, may systematically be conditioned by geology.

4.3 Geology, Housing and Health

Geology also played an important part in the development of vernacular house building in England from the early Middle Ages until the Industrial Revolution since rock formations determined the availability of local building materials close to the surface. Johnson (2010, p. 44), for example, points to the similarity between local houses along a band from Hampshire to Norfolk, reflecting a layer of chalk and flint. The availability of local materials became less important with the development of improved and cheaper transport links from the nineteenth century. Furthermore, Johnson notes that from 1300 onwards, new houses were rarely built on previously undeveloped land and occupied sites of much older human habitation.

Concentrating on London, the Roman city was founded on river terrace deposits largely consisting of sand and gravel. As shown below, sand and gravel constitute the superficial geology (British Geological Society 2010) and the city rests upon a bed of London Clay, which further overlays a deep bed of chalk and flint (Legget 1973; Woodward 1906). The square mile around the original Roman settlement constituted London's initial urban footprint, but the sixteenth century Agas map in Chap. 1 shows urban development, by that stage, across the Fleet River to the west of the City. Like the area of the City itself, the geological foundations of this area were river terrace deposits consisting of sand and gravel.

By the Georgian period, London had expanded further west and in areas to the immediate north, where Moorfields had been drained, as well as to the east and south as shown in Blome's 1673 London map and Rocque's 1741/1745 map. During the Victorian era, as analysed further in Chap. 8, the urban footprint expanded dramatically, enclosing larger tracts of the southern shores of the Thames and growing in all directions. During this period the geological foundations of the capital also became more diverse as the high demand for land resulted in marginal land being converted to residential and industrial use. The south bank of the Thames largely consists of alluvium deposits made of up clay, silt and sand. The same geology is found along the River Lea and the Isle of Dogs in the east of the city. Similar rapid urban development and building on previously marginal land took place in a number of European cities in this period (Legget 1973). Figure 4.1 shows some of the key features of London's geology, taken from the British Geological Survey. The map indicates the ancient bedrock of London Clay, covered by superficial deposits of sand and gravel laid down during the last Ice Age. In addition, it shows the river terraces and flood plains around the Thames and River Lea, and the alluvial clay and silt deposits.

As cities expanded and population density increased, the effects on the quality of water supplies and health became a matter of public policy concern. Chapter 2 noted the decline of the Fleet River, whereas early legislation on sanitation is discussed in Chap. 5. Furthermore, improvements in building materials and construction technology, combined

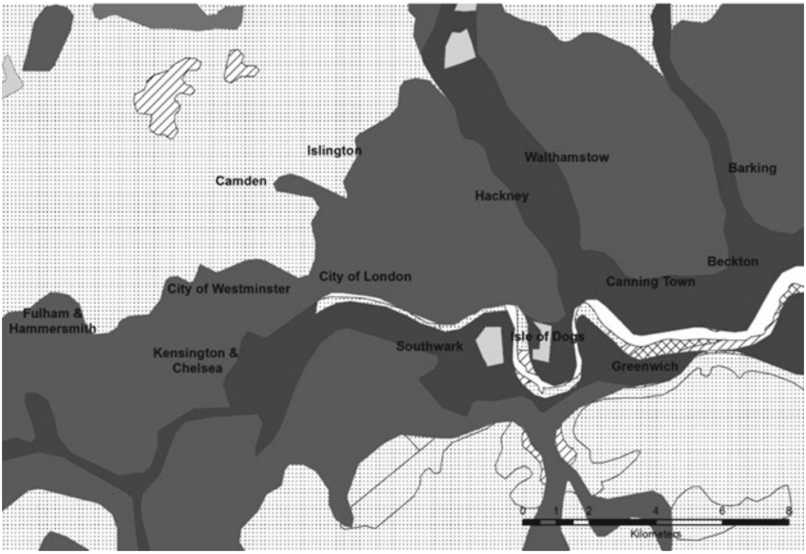

Fig. 4.1 The geology of London. *Note*: Hatched segments are bedrock formations; stipled areas are London Clay; lighter grey areas are superficial sand and gravel deposits; darker grey areas are alluvial clay, silt and sand deposits (*Source*: Based upon British Geological Survey 1:625,000, with the permission of the British Geological Map Data BGS © NERC 2015)

with increasing demand for land, intensified land use with taller residential buildings as well as subterranean construction. In 1843 the Royal Commission for 'Inquiry into the State of Large Towns and Populous Districts' was charged with examining the state of urban centres from a public health point of view. The Commission reported that some 10 % and 15 % of the population in Manchester and Liverpool, respectively, lived in cellars (reported in Culshaw and Price 2011).

As discussed in Chap. 5, a number of cholera epidemics hit British cities in the nineteenth century as a result of poor drainage and an absence of clean water supplies. The impact of poor water quality on public health was also a policy concern in other European countries. For example in the 1860s, Eduard Suess reported on Vienna's water supplies; following his study, long distance supplies were developed and the Danube was regulated to reduce concerns about the flood hazards and ensuing health impacts (Dorsch 2004). In Melbourne, miasmic air was an important determinant of home-seekers' valuations of different parts of the city (Hibbins 1997; Davison 2004).

In the mid-nineteenth century, damp living conditions, drainage/sewage and water quality were linked to the geological foundations of buildings and neighbourhoods. The effect of leakages from sewers or the direct disposal of refuse into pits on ground water quality is determined by the permeability of the soil and rocks and the volume of sewage. Increasing population densities in damp and unhygienic dwellings exacerbated public health concerns. A report by the Medical Officer of the Privy Council in 1867/1868 concluded that drainage and the permanent reduction of water in the urban soil reduced the death rate from tuberculosis (Woodward 1906). In London and other English cities, programmes of slum clearance were initiated from the 1860s onwards (see Chap. 5) and began to expand from the 1890s, particularly in the eastern and southern parts of London; these were frequently in areas dating from the Victorian urban expansion on to marginal lands.

Woodward's 1906 study *Soils and Subsoils from a Sanitary Point of View* discusses the geology of London and parts of the south east. The study classifies geological formations according to suitability for residential housing construction and healthy living. Soil is simplified and classified according to its geotechnical and hydrogeological properties rather than its age (Culshaw 2004). The classification of soils for residential construction purposes in Woodward is of particular interest to this chapter as it summarises the accumulated geological knowledge at the end of the Victorian era. As such, this can serve as a guide to understanding systematic variations in housing quality and the formation of neighbourhood characteristics.

Notwithstanding the significant slum clearances that have taken place in much of Victorian London, differences in geological conditions in the nineteenth century may still be capitalised in to contemporaneous house prices. Nygaard and Meen (2013) show how slum clearance programmes throughout the late nineteenth and twentieth centuries still failed to affect the fundamental perceived or actual social status of the areas, resulting in the spatial lock-in of nineteenth century social structures. To the extent that geology determined the nineteenth century distribution of housing for particular social classes, it may remain capitalised in contemporaneous property prices.

As noted above, Woodward (1906) classified London's soils according to their building suitability and divided the geology into made ground, natural ground and five types of subsoil. These are briefly described as follows.

- *Made soil*: like many other British cities, the surface soil of London is a mixture of mould, gravel, clay and the remnants of older buildings and rubbish. In parts of British cities, the layer of made soil is quite substantial and can, thus, alter the soil mechanics of superficial deposits. At the beginning of the twentieth century, the layer of made soil could vary from 1 to 25 ft and was characterised as 'not always an unsatisfactory foundation for a house' (Woodward 1906, p. 10). However, in pockets of London, such soil contained decaying organic matter where gravel and sand had been removed and filled in with rubbish. The decaying of organic matter could result in uneven settlement of the ground and the development of methane gas (Legget 1973).
- *Natural soil*: this is primarily derived from weathered strata of soil and rock and mixed with decaying organic matter. It was generally considered too thin to have an appreciable impact on residential suitability.
- *Alluvium/marshland*: within the London area, this was largely found in low-lying parts of the city, bordering the Thames and its tributaries (see Fig. 4.1). Alluvium was 'essentially the property of the river' (Woodward 1906, p. 11) and, since it was found on flood plains, such areas were prone to flooding and rising water in cellars. Within modern London, alluvium is particularly found in Enfield, Tottenham, Walthamstow, Hackney and West Ham, along the Lea River and lower reaches of the Thames. Woodward further remarked that 'while the necessity of livelihood and calling require residence in [East Ham, Plaistow, Canning Town, Beckton, Silverton and North Woolwich],[2] such areas are in general undesirable' (p. 13). According to Legget (1973), achieving strong foundations is often difficult on floodplains.

[2] See Fig. 4.1.

- *Gravel, sand and sandstone*: gravel on higher grounds (plateau gravel) was classified as conducive to healthy living, whereas gravel on lower ground (valley gravel) might contain water and cause dampness. Much of the London area is characterised by valley gravel and sand, but at different levels of elevation and thickness and is, therefore, not uniform in its health characteristics. In places where the layer is thin, residential construction rests on the underlying London Clay strata. In other parts, significant layers of artificial or man-made soil overlay gravel and sand beds and provide additional elevation and insulation. Layers of sand and gravel extend into the surrounding counties; a belt of hilly 'Lower Greensand' stretching through Surrey and Kent was characterised as 'admirably adapted for healthy residences' (Woodward 1906, p. 24). A key determinant of the suitability of these types of soil relates to elevation and the permeability of the soil.
- *Mixed subsoils*: a varied range of mixed sandy, loamy and clay formations are described. Suitability for residential living is, again, associated with elevation, permeability and the natural drainage capacity of the soil. Several parts of the South East are regarded as dry and healthy.
- *Clay*: different types of clay in London and the South East are described. Boulder clay (gritty clay with pebbles of chalk, flint, stones and fossils), lying to the north of London, was considered generally as providing a 'good firm foundation'; Letchworth Garden City was situated on a layer of boulder clay. London Clay, however, was considered less favourably, due to its lower elevation and greater water content leaving the ground prone to long spells of dampness and cracking in dry weather. The disadvantages of living on clay diminished with elevation and drainage. Furthermore, over large parts of London, the overlaying of clay strata with artificial soil and the reduced exposure to rainfall as the area was built up, for example from paving and roofing, contributed to the drying out of the ground.
- *Limestone/chalk*: limestone formations around London were considered porous and, except in very low-lying areas, good sites for building. Woodward (1906) observes that, due to low water supply in most of the layer, residential development had only commenced once public water services were provided to more elevated areas.

4.4 Geology and the Modern Distribution of House Prices

There are two main strands to the extensive empirical literature on house price formation. The first, macroeconomic perspective, attempts to explain aggregate movements in prices over time. This approach is explored further in Chap. 10. The second models the prices of individual dwellings through hedonic analysis, where the prices of properties are related to their structural characteristics and those of the local neighbourhood. The coefficients from regression analysis represent the implicit prices of each characteristic. Hedonic models are also used to evaluate the impact of major infrastructure projects, such as airports, on the local area.

The approach in this section is closer to the hedonic method, but there are important differences. First, the prices of individual properties are not used, rather average prices within small spatial units. Second, the current characteristics of individual properties are deliberately excluded. We are only concerned with variables related to geology, topography and hydrogeology and the extent to which they can explain modern price distributions; arguably, these are the only true exogenous variables. In addition we are concerned with the extent to which soil fertility remains a significant influence, even though this is now expected to be less important within cities. However, Sect. 4.2 showed that the role of geology and topography is complex and, given the evolving industrial structures over time, there is no necessary reason why soil fertility within cities, for example, should still exert an influence on property values. A finding that this is the case might support an extreme form of spatial lock-in, but a priori, this seems unlikely. Since the case study cities were either founded or expanded rapidly in the nineteenth century, it is more plausible that the geological conditions that were important in that era could still exert an influence.

The basic model takes the form of (4.1). Given the nature of the data and the time invariance of geology, lags are not necessary in the specification.

$$\ln \mathrm{PH}_i = \beta_0 + \beta_1 \mathrm{DIST}_i + \beta_2 \mathrm{GEO}_i + \beta_3 \mathrm{HYD}_i + \beta_4 \mathrm{GLGY}_i + \varepsilon_i \quad (4.1)$$

where PH_i is the purchase price of dwellings in location i, GEO is a set of geographic variables, HYD measures the hydrogeological influences, GLGY is a vector of geological and soil types, DIST controls for distances to major employment centres, ε is an error term, ln represents the natural logarithm of a variable and β_j, $j = 0, \ldots, 4$ are coefficients to be estimated. DIST is a way of including some of the insights of the space-access trade-off from the monocentric model discussed in Chap. 3. Property values decline with distance from central business districts (CBDs), but have to take into account the location of employment. GEO captures distances from the coast and the elevation (the height above sea level) of the area. We have already seen the importance of elevation in the North Melbourne case study, and, as above, Woodward (1906) and Davison (2004) detail the relevance of elevation to amenity and health and the willingness to pay for these advantages. The HYD variables control for ground water content, known as the aquifer productivity of the bedrock. Finally, GLGY directly estimates the impact of different soils on property prices. If $\beta_4 \neq 0$ then geological conditions are capitalised in property prices and increase or decrease the value of housing relative to the space-access location.

Equation (4.1) is estimated separately for two of the case study cities, London and Melbourne, although the variables included in the latter are more limited. As a further comparison, the former is expanded to England as a whole, which allows a wider range of rock types to be taken into account. For England and London, the dependent variable is the log of the average real median purchase price for the Middle Layer Super Output Areas (MSOA) over the period 2005–2011. For Melbourne, the dependent variable is the log of average house prices at postcode level in 2004. Some 983 observations are available for London and 449 for Melbourne.

Information on geology in England is derived from the British Geological Survey's (BGS) 1:625,000 geological map of Britain. London was discussed above, but, more widely, the surface geology of Britain consists of bedrock and superficial formations. The latter are the youngest geological deposits and vary in thickness from under a metre to over 200 m. While all of Britain is covered by bedrock, only part of the surface includes superficial deposits. In estimation, the two have been combined to provide a single geological dataset of the surface. The bedrock and superficial geology are divided into a large number of lithological types (rock types and soil composition), of which further details are given in Appendix 1.

The geology of Melbourne is divided into nine categories, based on the basic rock formations—igneous, sedimentary and metamorphic. These basic formations are further subdivided using additional information that enables marine, non-marine and alluvial sedimentary deposits to be identified, and intrusive and extrusive crystallisations of igneous rock. The western plains of Melbourne largely consist of igneous rock and are mapped in Fig. 4.2.

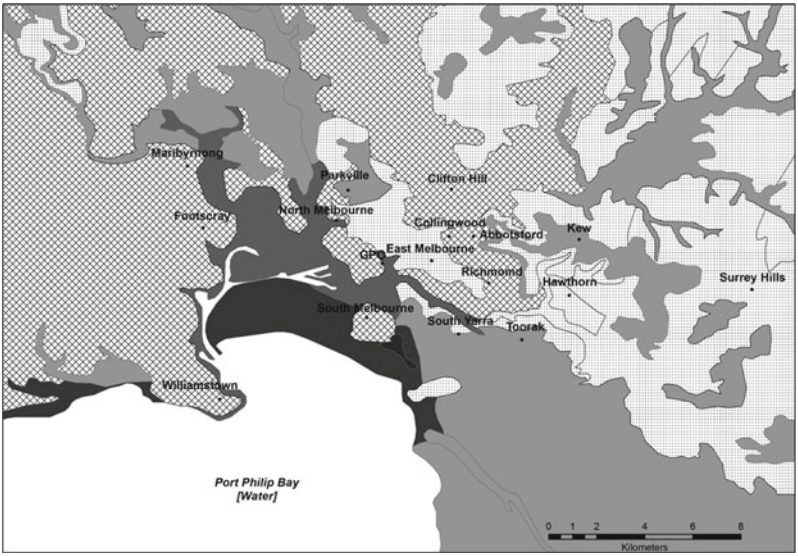

Fig. 4.2 The geology of Melbourne. *Note*: Cross-hatched segments are igneous (extrusive) rock formations; stipled areas are sedimentary marine formations; light grey are sedimentary non-marine deposits (*Source*: Australian Geological Provinces 1:1,000,000 (Bain et al. 2004). © Commonwealth of Australia (Geoscience Australia) 2015. This product is released under the Creative Commons Attribution 4.0 International Licence.)

London and England

In Victorian and Edwardian England, soil characteristics were reflected in housing quality, neighbourhood health and environmental amenities. In London, housing along the alluvial plains and lower lying eastern parts of the city contained housing adjacent to industry and was often intended for working-class and lower-income residents. Uniformity of housing construction lowered costs of production, but also ensured that many parts of the rapidly expanding urban sprawl was relatively homogeneous in character. As noted by Woodward, housing built on alluvial plains close to the Thames and its tributaries were more likely to experience flooding, general dampness and subsistence; in dry conditions the soil could shrink, damaging walls and brickwork.

In contrast, affluent households were located in the western parts of the city, which had long been the residential areas for wealthy households and were situated on drier gravel ground. Systematic differences in the housing stock and the ensuing socio-economic characteristics of neighbourhoods may have generated increasing returns through human capital accumulation and positive externalities in geologically preferred parts of the city, but over-crowding and ill health in geologically less desirable parts. However, technological change and altered economic geography may, over time, change the spatial dimensions of locational advantages. The Docklands area just to the east of the City of London was once a blue-collar and low-rent neighbourhood (see Chap. 5), related to the East End docks and shipping industry, but, as shown in Chap. 1, following publicly supported redevelopment, it is now part of London's prime real estate, housing large parts of the financial services industry.

The relationship between area elevation and prices is complex, which was a key issue in the Chapman Street and Harris Street comparisons in Chap. 2. Low lying areas are, typically, closer to the coast and, hence, benefit from improved trade and communications, although low-lying areas are more prone to flooding and water-logged ground after rain. The equation, therefore, includes variables not only for elevation, but also, as separate variables, the distance to the nearest coast and 'aquifer productivity'. The last of these is taken from the BGS hydrogeological map of Britain and is measured as the percentage of the area in each MSOA with soils of high, moderate, low and no ground water. Aquifer productivity measures the flow rate of water through the rock. A priori, the expectation is that higher flow rates may be negatively associated with house prices as this may cause foundation instability, but this effect will depend on the water level.

Section 4.2 summarised the relationship between urban development and soil fertility. A measure of 'natural fertility' is available from Cranfield University's 'Land Information System' based on natural lime status and acidity levels; soils with higher acidity levels are less productive. Naturally fertile soil is agriculturally more productive and is classified from 1 (very low) to 5 (very high) and a weighted average is calculated for each MSOA according to the proportion of soil within a particular fertility level. The expected effect of fertility on modern house prices is ambiguous. Geologically conditioned spatial lock-in would imply a positive and significant association between fertility and house prices, but soil fertility is of little significance to the current economic potential of urban areas in Britain.

As England's largest and economically most significant city, London's influence as an employment centre extends beyond its immediate built up area, to adjacent parts of the south and, so, Eq. (4.1) includes distance to the London CBD as an additional control variable. The regressions for England as a whole also include the distance to a second employment centre, derived from the 75 largest urban areas in 2001. These controls provide estimates of price-distance gradients.

Table 4.1 summarises the main results from the estimation of Eq. (4.1) for London and England. Full results for London are presented in Appendix 1. Some 32 % and 51 % of the variation in property prices in London and England, respectively, can be explained by the equation. In terms of explanatory power, the most important factor is distance; unsurprisingly in the light of the discussion of residential density in Chap. 3, those areas that lie closest to London have the highest prices, for given values of the other variables. Nevertheless, the overall R^2 for England is increased by approximately 20 % points by the inclusion of the remaining variables.

The equations show that elevation remains an important influence on property values. In estimation for England as a whole, a non-linear

Table 4.1 Geology and house prices in London and England

	London	England
Distance from London in kilometres	Yes, negative	Yes, negative
Distance in kilometres from secondary employment centre	–	Yes, negative
Elevation (height above sea level, metres)	Yes, positive	Yes, positive
Nearness to the coast (metres)	Yes, negative	Yes, negative
Fertility (1 very low, 5 very high)	No	No
Aquifer productivity	Yes, negative	Yes, negative
Alluvial clay (%)	Yes, negative	Yes, negative
Bedrock (London) clay (%)	No	Yes, negative
Limestone (%)	–	Yes, positive
Sandstone (%)	–	Yes, positive
Adjusted R^2	0.316	0.512

Note: Yes/no reflects significance at either 0.10/0.05/0.01 % levels

relationship appears to exist between elevation and modern house prices. Beyond immediate coastal locations, at low elevations, prices first decline, but increase again from about 2 to 3 m above sea level. Property prices are, then, positively related to elevation until about 130 m above sea level, before again declining. Since height is a desirable characteristic today, just as much as in the nineteenth century (although fears of miasmic diseases are no longer the main concern), this is not evidence of persistence and lock-in. Similarly, the quality of aquifers has a significant effect on property values. A higher likelihood of flooding reduces current prices, but, again, this is not evidence of persistence. The technology for dealing with flooding may have improved since the nineteenth century, but it remains a concern to households.

The distance to the nearest coast has a negative effect. Many of Britain cities are located on the coast so that a negative effect in part captures features of the price distance gradient. However, proximity to the coast also provides environmental, leisure and possibly health benefits separate from employment-access considerations. Distance to the coast is measured in metres to the nearest shoreline, where the shoreline also includes segments of navigable rivers, so that MSOAs along the Thames have distances around 200–300 metres from the coast.

The results also show that there is no simple relationship between rock formation and prices. Geological determinism clearly does not hold; in the case of London, where the formations are more limited, there is evidence that residential properties on alluvial clay have significantly lower prices than those on sand and gravel (the default category in Appendix 1). From Fig. 4.1, alluvial clay is predominantly found along the south and eastern banks of the Thames and along the Lea river valley. The median house price in an MSOA situated entirely on alluvial clay is some 13 % lower than properties built on sand and gravel, identified by Woodward as more conducive to healthy living. Properties built on bedrock London clay do not, however, trade at a discount. Nevertheless, much of the London Docklands area lies on alluvial clay, but is today prized real estate for non-residential development.

For England as a whole, alluvial clay also has a significant negative influence. The median property price on alluvial clay is approximately 22 % lower than properties built on sand and gravel; properties built on bedrock clay are priced some 11 % lower. Median property prices on limestone and sandstone, however, are 18 % and 4 %, respectively, higher than properties built on sand and gravel. Estimation for both London and England, therefore, find evidence in support for Woodward's classifications of soils and their relative demand characteristics. Geological conditions continue to be capitalised into modern property prices.

As Sect. 4.2 discusses, agricultural surpluses and trade in wool were related to the urban bias towards the south and east of England in the Roman and Medieval eras. However, the coefficient on fertility, while marginally positive, is not significant and is dropped in the equations in Appendix 1. The absence of an effect from fertility provides some evidence against very long-run, geologically-conditioned spatial lock-in, because the urban system has adjusted to changed economic determinants—the growth of cities during the Industrial Revolution is an example of this. Nevertheless, rock formations are found to remain important, as are hydrogeology and elevation, but, unlike fertility, these measures are still relevant today as environmental characteristics and freedom from flooding still matter to contemporaneous property buyers. Rock formations may also continue to exert an influence on property prices through behavioural and institutional drivers that preserve the built environment and neighbourhood characteristics of Victorian and Edwardian developments.

Melbourne

Chapter 2 provided an introduction to the establishment of Melbourne, including the importance of its rivers and rock formations. As noted there, Melbourne's history is well documented since its establishment by the Port Philip Bay Association in 1835. An alternative location for the Port Philip area capital, at Williamstown (today a Melbourne suburb), was discarded in favour of the present CBD location because of more abundant fresh water supplies (O'Callaghan 1927). A grid of east–west and north–south running streets was laid out by Robert Hoddle on the grassy north side of the Yarra River in 1837. The settlement was awarded city status in 1847 and became capital of the new colony of Victoria in 1851 (Lewis 1995).

Geology and topography played roles in the initial location of the settlement, but also affected its subsequent development and land use within the city. The location of infrastructure, industry and residential areas were, in many respects, determined by local geological conditions. The location of the settlement's first bridge across the Yarra River, Princes Bridge, was located at the end of the major thoroughfare, Swanston Street, due to the available gravel ground, rather than at the end of nearby Elizabeth Street, where the ground was muddy (City of Melbourne n.d.). Both streets, running north–south, were part of the original grid, but Elizabeth Street had a stream running underneath it and is still subject to flooding today. Residential areas were initially located along the grassy slopes of the present CBD and in nearby vicinities to the north and south east of the River Yarra. The latter was a result of the distinct differences in geological conditions between, on the one hand, areas to the west of the CBD and elements of the western shore of the Yarra and, on the other hand, what are today the affluent eastern suburbs. According to Davison, home-seekers placed a low value on the flat volcanic plains to the west of the CBD (Davison 2004, p. 57).

Lower land values to the west of the saltwater Maribyrnong (Melbourne's second river), with river access, attracted industrial development and Melbourne's north-western suburbs experienced rapid industrial development (Davison 2004). Similarly, the western shores of the Yarra in the present day areas of Collingwood, Abbotsford and Richmond became areas of industry and working class housing. The Collingwood Plain (see Fig. 4.2),[3] as it was known, is similarly volcanic and slowly rises up towards the west, where the underlying geology changes, and to Clifton Hill in the north. The Collingwood Plain was prone to flooding and was believed to be miasmic—giving the area a reputation as the least healthy part of Melbourne (Hibbins 1997). Due to flooding and poor air quality, the Collingwood Plain was low rent (Davison 2004), which, as Hibbins notes, attracted a range of industries. The riverside areas immediately to the south of the Yarra similarly suffered from swampy conditions and poor air quality.

The residentially affluent eastern suburbs were, by contrast, predominantly built on marine sedimentary bedrock. The area consisted of tree-covered hills, fine black soil and clay for brick making (McWilliam n.d.). Hills, vegetation and higher elevation than the western plains or the Collingwood Plain gave the area a healthy reputation. A number of more desirable residential suburbs were developed in a south-eastern arc from South Yarra to Kew. Closer to the CBD, affluent locations at Parkville and East Melbourne were also developed on marine sedimentary bedrock.

By 1891 the Yarra had become a socio-economic boundary between working-class inner Melbourne locations and middle/upper class residential areas. Across Melbourne, geological and geographic conditions were systematically reflected in the character of the built environment and were capitalised in rental values. For instance, the distribution of houses in 1891 with more than six rooms is concentrated in the south eastern suburbs. Under 10 % of the housing stock in working class districts, such as Collingwood and Abbotsford in the east, Footscray in the west and South Melbourne (all lying on volcanic rock) had more than six rooms (Davison 2004).

Today, inner Melbourne is a centre of finance and knowledge-based industries and a number of erstwhile working-class suburbs have substantially gentrified. Technology, planning and improved sanitation have eliminated some of the geological and geographical disadvantages. Planning regulations throughout the twentieth century and a shift to knowledge-based economic activity have further resulted in better air and

[3] The geological map also pinpoints North Melbourne, the case study from Chap. 2.

neighbourhood quality, so that much of the socio-economic character of inner Melbourne has fundamentally changed. Though more Victorian than Sydney, much of the Victorian-era working-class housing stock has been removed, while the remainder has become valued for its location and its character.

The question, however, is whether these changes have been sufficient to mitigate traditional price differentials.

Table 4.2 summarises the key results in which house prices are regressed on the percentage of each postcode area covered by the different rock formations—igneous, sedimentary and metamorphic; further details are shown in Appendix 1. As in the case of London, proximity to the CBD is a key determinant of prices. However, the relationship is non-linear; given the geologically-conditioned distribution of historic properties, the price-distance gradient for Melbourne initially rises with distance from the CBD before declining. This is consistent with the concentration of larger and less affordable housing stock in the eastern suburbs, but adding the geological variables significantly raises the explanatory power of the equation.

The table shows that Melbourne property prices are conditioned by the underlying geological foundations. Controlling for distance to the CBD, the average property price of postcodes entirely on basalt and lava bedrock (igneous extrusive) are some 26 % lower than postcodes on sedimentary (non-marine) ground. Furthermore, the average price for dwellings on sedimentary marine deposits is some 12–28 % greater than the average price of properties built on sedimentary (non-marine) ground. As above, igneous extrusive rock is predominantly found in the western

Table 4.2 Geology and house prices in Melbourne, Australia

Distance from CBD in kilometres	Yes, negative
Igneous (%)	Yes, negative
Sedimentary (marine) (%)	Yes, positive
Sedimentary (alluvial) (%)	Yes, negative*
Metamorphic (%)	Yes, positive
Adjusted R^2	0.369

Note: Yes/no reflects significance at either 0.10/0.05/0.01 levels.

*Coefficient only significant with the inclusion of *x* and *y* location coordinates in estimation. Omitted category Sedimentary (non-marine) parts of the city and pockets of the inner city, whereas the eastern suburbs mainly sit on sedimentary marine and non-marine deposits.

4.5 Conclusions

Some care is needed in the interpretation of the results. First, geological determinism would be a poor approach to explaining the spatial distribution of house prices in the two cities. Although geology, topography and hydrogeology were crucial in explaining the original sites for many major towns and cities, at best, only a half of the variation in modern prices within the case studies can be explained in these terms and this includes the important influence of distance from the CBD in the regressions. The analysis suggests that subsequent human geographic and economic processes dominate the price changes. Across England, many working-class areas have gentrified with the positive benefits from access to employment opportunities, leisure and amenities gradually balancing out any negative effects from soil conditions. Similarly, Collingwood, Abbotsford and Maribyrnong have gentrified to some extent due to their proximity to the inner city's job market and social amenities.

However, second, different rock formations do have a significant effect on modern prices. This is most evident in Melbourne, which possesses a variety of contrasting soil types, and the empirical evidence supports the view that those areas that were initially established as high-quality residential areas on fertile soils have maintained their ascendancy. Areas of volcanic rock were originally the locations of industry and working-class housing. In London, properties on alluvial clays are lower, although still high priced. Third, poor-quality soils do not now prevent new housing developments. The largest residential growth area in Melbourne is in the outer western districts and the cleaning up of the Maribyrnong has led to new high-quality homes along the river. As above, the historic disadvantages that these areas suffered as a result of poor soil fertility is now of less relevance to households, particularly in the light of the heavy development of the eastern suburbs.

Fourth, the significance of topographical variables, in itself, cannot be used as evidence of spatial lock-in. Elevation and freedom from flooding are now just as desirable as characteristics as they were to previous generations and households are willing to pay for these features. Lock-in implies that characteristics, which were historically important but no longer relevant, still have an impact. Soil fertility is the most obvious example. However, over time, the direct relationship in England with soil fertility has weakened and has largely disappeared today as the economic specialisation of urban systems became more complex. By the nineteenth century industrial–geological resources in England were key to rapid industrialisation and urban growth, rather than soil fertility. However, geological conditions affected the micro geographies of rapidly-expanding Victorian cities and the structure of the housing stock laid down in that era is still being felt today through the durability of the stock, land-use planning, property rights and social interactions amongst segregated households. These are amongst the themes of later chapters.

4.6 Appendix 1: House Prices and Geology (Tables. 4.3, 4.4, and 4.5)

Table 4.3 House prices and geology: London

	ln(PH)
ln(DIST)	–0.244*** (11.5)
ln(Coast)	–1.041*** (6.6)
ln(Elevation)	0.092*** (5.5)
Highly productive aquifer	–0.0016 (1.3)
Moderately productive aquifer	–0.0035*** (3.58)
Low productivity aquifer	–0.0012** (2.3)
Chalk	0.0024 (1.5)
London clay	0.0002 (0.9)
Alluvial clay	–0.0013*** (–2.9)
Diamicton	0.0021* (1.8)
Constant	15.288*** (89.1)
Number of observations	983
Adjusted R^2	0.3162

Note: Omitted categories 'sand and gravel' and 'no ground water'.
t-values in brackets (based on robust standard errors).
***/**/*significant at 0.01/0.05/0.1 level

Table 4.4 House prices and geology: Melbourne

	ln(PH)	ln(PH)
ln(DIST)	1.415*** (3.9)	0.983*** (2.7)
$\ln(DIST)^2$	–0.763*** (5.1)	–0.562*** (3.8)
$\ln(DIST)^3$	0.104*** (5.5)	0.076*** (3.9)
Igneous	–0.011*** (3.4)	–0.0030 (0.9)
Igneous (extrusive)	–0.0028*** (5.8)	–0.0026*** (4.3)
Igneous (intrusive)	–0.0004 (0.4)	0.0010 (1.0)
Metamorphic	0.0017 (0.6)	0.0053* (1.8)
Sedimentary (marine)	0.0012** (2.2)	0.0028*** (4.5)
Sedimentary (marine, non-marine, coastal)	0.0013 (1.0)	0.0005 (0.4)
Sedimentary (alluvial)	–0.0003 (0.3)	–0.0023** (2.2)
Not classified	–0.0064 (0.7)	–0.0033 (0.4)
X coordinate	–	–0.313** (3.0)
Y coordinate	–	–0.621*** (4.6)
Constant	12.571*** (43.9)	34.769* (2.1)
Number of observations	449	449
Adjusted R^2	0.319	0.369

Note: omitted category is 'Sedimentary (non-marine)'.
t-values in brackets.
***/**/*significant at 0.01/0.05/0.1 level

Table 4.5 Variable descriptions

Variable	Description
ln(DIST) (*Source*: authors' estimates)	For England/London this is the log of distance in kilometres from the centroid of the MSOA to the centroid of the City of London. For Melbourne this is the log of distance in kilometres for individual properties in each postcode to the CBD postcode.
Distance to second centre of employment (only used in England-wide equations) (*Source*: authors' estimates)	The log of distance in kilometres between the centroid of each MSOA and the centroid of the nearest built up area outside London, based on the 75 largest built up areas in England.
ln(Coast) (*Source*: Lindley et al. 2011)	The log of distance in metres from the nearest coast to centroid of each MSOA.
ln(Elevation) (*Source*: Lindley et al. 2011)	Height above sea level in metres for each MSOA.
Aquifer productivity (*Source*: BGS 1:625,000 hydrogeological map of Britain)	The percentage of the land area in each MSOA with high, moderate, low and no ground water in the soil.

(*continued*)

Table 4.5 (continued)

Variable	Description
Lithological classes: England (*Source*: BGS 1:625,000 geological map of Britain)	The percentage of the land area in each MSOA in lithological classes. The aggregated lithological classes used in estimation are based on the following bedrock and superficial rock groups: Breccia Chalk bedrock Clay, silt and sand Clay, silt, sand and gravel Superficial clay Alluvial Clay, silt, sand Dolerite Dolomite Felsic Sand and gravel Schist Lava Limestone bedrock Mafic Mudstone Siltstone Ultra bedrock Wacke bedrock Peat Silt Diamicton
Lithological classes Melbourne (*Source*: Bain et al. 2005)	The percentage of the land area in each postcode in lithological classes. The lithological classes used in estimation are based on the following bedrock and superficial rock groups: Igneous Igneous extrusive Igneous intrusive Metamorphic contact Sedimentary marine Sedimentary marine, non-marine, coastal Sedimentary non-marine alluvial Not classified
X and *Y* coordinates	*X* and *Y* coordinates of the centroid of each Melbourne postcode

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5

Wars, Epidemics and Early Housing Policy: The Long-Run Effects of Temporary Disturbances

I went into a low cellar [in Tyndall's-buildings] …. There were a woman and two children there; … from a hole in the ceiling there came a long open wooden tube supported by props, and from that flowed all the filth of the house above, right through the place where this woman was living, into the common sewer.

Evidence given in 1884 by the Earl of Shaftesbury before the Royal Commission on the Housing of the Working Classes, quoted in London County Council (1913)

The tenements in which I have visited are occupied from the cellars to the allies, and almost altogether kept for lodging houses, many of them being more fit for pig-styes than dwellings for human beings; and in not a few the donkeys and pigs rest at night in the same apartment with the family. The entrance to these abodes is generally through a close, not unfrequently some inches deep with water, or mud, or the fluid part of every kind of filth, carelessly thrown down, …

Report of the Glasgow Fourth District Surgeon, Perry (1844)

G. Meen et al., *Housing Economics*,
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5.1 Introduction

Chapter 2 showed that, at a local scale and over its long history, Saffron Hill faced a series of major disturbances arising from wars, technology and policy that fundamentally changed the characteristics of the area and its residents. Saffron Hill is not a special case, however, and the principles generalise to wider areas. In addition, Chap. 3 demonstrated, through the works, for example, of Dincecco and Onorato (2013), Michaels and Rauch (2013), Voigtländer and Voth (2013) and Cantoni (2012), that the effects of policy or institutional changes can be highly persistent. Cities sometimes still experience the effects of innovations and disasters that took place in the medieval era. This suggests that the nature of any housing market equilibrium is conditioned by past history as shown by the formal definition of path dependence.

Housing in Britain and Australia has always been provided primarily by the private sector as a market good. As noted in Chap. 1, since the market will always find some solution, the issue for governments and society more generally is whether the market outcome is acceptable in terms of efficiency and equity and judged against the increasing expectations and requirements of households over time. From the start of the study period in the nineteenth century, and indeed earlier, governments have been involved; as the first quotation above might suggest (Tyndall's Buildings lie slightly to the west of Saffron Hill) early legislation was concerned with the effects of poor sanitary conditions on health, which were worsened by rapid urban population growth. The second quotation for Glasgow indicates that conditions in the poorest areas were not limited to London but existed in most of the major metropolitan conurbations. It would be hard to argue that the health conditions discussed below did not produce major externalities at that time, justifying government action. At the opening of the nineteenth century, London had already overtaken Paris as the largest European city, when population stood at approximately one million, but this had risen to 4.5 million[1] at its end. Similarly, the population of Glasgow almost doubled between 1780 and 1801 from 42,800 to 83,800 and rose to 762,000 in 1901; Melbourne

[1] For Inner London.

had reached almost half a million by this date. The Registrar General's Report for 1881 found, in London, that only approximately 2 % of the population lived in healthy districts,[2] a position only worse in Lancashire. Approximately 27 % of male deaths under the age of 5 were attributable to miasmic and diarrhoeal diseases. These include smallpox, chicken pox, measles, scarlet fever, influenza, whooping cough, mumps, diphtheria, cholera and dysentery. Cholera is discussed in more detail below since it gave rise to the largest nineteenth century epidemics.

This chapter is concerned with the effects of both early legislation and exogenous shocks—notably wars and epidemics—on local area dynamics since the nineteenth century. Once again, the emphasis is on how historical events have shaped modern distributions and problems and whether change has been gradual or in discrete 'jumps'. Since major changes are infrequent, this requires the construction of data sets over long time periods. The effects of major epidemics (cholera outbreaks in the 1840s, 1850s and 1860s and influenza in 1918), two World Wars and policy legislation relating to slum clearance are reviewed. Discussion of later larger-scale public housing programmes and planning reforms are covered in later chapters. Although this chapter does not attempt a complete list of the numerous pieces of legislation that have affected housing over the last 200 years, there were major milestones. In line with the overall theme of the book, time-series statistical methods are employed to examine whether these changes had any permanent effect on the key variables of interest.

5.2 Pre-First World War Milestones in British Legislation

The 1977 Housing Policy Review (Department of the Environment 1977, Technical Volume 1) summarises the state of housing in the early years of the twentieth century and highlights three issues that remain at the heart of today's problems: first, a shortage of housing in quantitative terms; second, sub-standard conditions in the housing stock; third,

[2] Defined as districts where crude death rates were below 17.5 per 1000.

a gap between what many households could afford to pay in rent and the cost of providing housing to an adequate standard. For example, the Review indicated that, around 1907, a private return on working-class dwellings of 5 % would require on average across the country a rent, including rates, of between six and eight shillings per week, or approximately 23 % of average earnings. By contrast, at that time, rents and rates typically made up between one-sixth and one-fifth of earnings. Therefore substantial numbers of low-income households could not afford housing of a decent standard without subsidy and privately-constructed homes (or those built by philanthropic organisations) were not occupied by the lowest strata of society. Insufficient working-class homes were built by the private sector, because the returns were too low and, so, a high degree of sharing and overcrowding was commonplace. Housing legislation took two forms: the setting of minimum health standards for new properties, such as ventilation and sanitation or the width of streets, which raised their cost further, and the demolition of insanitary existing dwellings. Of the three proposed solutions concerning affordability for low-income households—construction (bricks and mortar) subsidies, income support for households and rent control—all were tried over the next hundred years.

These problems might be seen as leading to the beginning of large-scale government intervention in housing provision during the twentieth century, but the foundations of government involvement lie earlier. The 1834 Poor Law Amendment Act was introduced as a major reform to medieval assistance practices, originally codified in the Elizabethan Poor Law of 1601. The 1601 Act provided a parish-based relief system, financed by a charge on the local population (see Royle 2012 for further discussion). The old system had come under increasing pressure to reduce costs, following the Napoleonic Wars, due to rising unemployment and grain prices, which increased the relief payments imposed on local ratepayers. The 1832 Royal Commission into the Operation of the Poor Laws, with one of the nineteenth century's most important reformers, Edwin Chadwick, as Secretary, proposed that a new law should be established with two principles: first conditions within a workhouse should be worse than those achievable by a poor free labourer outside the workhouse; second, relief for paupers should only be available within a workhouse, where conditions should be so unpleasant that no-one would choose to be there if outside options were available. In practice, the second condition was never fully implemented and outdoor relief continued to be provided; for example, in 1856, 6.6 per 1000 persons in England received in-door relief, compared with 41.6 in receipt of out-door relief. By 1905, the relative values were 7.2 and 15.8 (1905 Registrar General's Report, p. 77). Although the workhouse movement had begun in the seventeenth century, under the 1834 Act, all parishes were now required to establish a workhouse, operated by Poor Law Unions, formed from groups of small parishes. The Unions were overseen by a national Poor Law Commission. The system gradually declined in the twentieth century, as a result of welfare reforms, but the Poor Laws were not formally abolished until 1948 with the implementation of the modern welfare state.

The stringent conditions of the 1834 Act contributed to driving the population towards the rapidly industrialising cities but, in the absence of adequate building regulations, overcrowded rookeries rarely contained sewers, toilets or fresh water supplies; the quotations above provide examples. The first case of cholera in Britain was discovered in Sunderland in 1831. Despite initial resistance, thanks to the work of John Snow in the 1850s, the medical profession came to accept that cholera was a waterborne disease, rather than transmitted through the miasma (see Johnson 2006). Whereas deaths from the main zymotic (infectious) diseases continued to increase in the second half of the nineteenth century, deaths from cholera fell sharply through improvements to the water supply, despite major outbreaks in 1849, 1854 and (to a lesser extent) in 1866.

In 1839, the Poor Law Commission was instructed to enquire into the health of the working population, leading to the publication of Edwin Chadwick's path-breaking 1842 Report on the Sanitary Conditions of the Labouring Classes of Great Britain. Chadwick's work was aided by the improved statistics on disease and death rates that became available from 1838 with the establishment of the General Registrar Office for England and Wales. For the first time, births, marriages and death records were centralised in one source, based on Registration Districts, whose boundaries generally conformed to those of the Poor Law Unions; from 1841 the Office also took on the running of the population census. The Annual Reports of the Registrar General are used extensively below. Chadwick's report showed that public health problems were primarily caused by the environment, including drainage, lack of water supplies, and ineffective means of removing dirt and rubbish (Fee and Brown 2005). Against the background of a new wave of cholera sweeping Europe, the critical 1848 Public Health Act was passed, establishing a General Board for Health. Fee and Brown describe the Act as 'one of the great milestones in public health history', with the state becoming a guarantor of health and environmental standards. The Act required local Boards to be established where the crude death rate exceeded 23 per 1000 over a seven-year period.

In the second half of the nineteenth and early twentieth centuries a series of acts were passed dealing directly with the housing conditions of the working classes.[3] The Earl of Shaftesbury was among the earliest campaigners and two Acts (known as the Shaftesbury Acts) in 1851 dealt with conditions in lodging houses, generally the poorest forms of housing. Perhaps of more long-term importance were the series of Torrens and Cross Acts. The first Torrens Act (more formally the 1868 Artizans and Labourers Dwellings Act and its amendment in 1879) applied to individual dwellings and required the owner to maintain the property in good condition. Medical Officers were required to report to the authorities whenever they found properties unfit for habitation. In the absence of action by the owner, the authorities could intervene, including the power to demolish with compensation, although limits were put on the total value of compensation payments in any year. By contrast, the Cross Acts dealt with whole areas that were insanitary and fit only for demolition and reconstruction; the terms differed over time but, for areas to be demolished, the authorities were required to produce plans for rehousing. In practice, neither Act produced major changes to housing conditions (see below) and the 1882 Artizans Dwellings Act relaxed the stringent conditions relating to the rehousing of displaced residents. In addition, the 1875 Public Health Act required all new houses to include internal drainage and running water in an attempt to prevent the worst building by contractors.

[3] See London County Council (1913) for a detailed account of the legislation up to this date.

The important 1884–1885 Royal Commission on the Housing of the Working Classes and the subsequent Acts of 1885, 1890 and extensions in 1894, 1900 and 1903 (along with the Housing, Town Planning, etc. Act 1909) recognised the lack of progress on overcrowding and sanitation. The 1890 Act consolidated and extended the Cross, Torrens and Shaftesbury Acts, including financial powers, and was the principal Act governing local authority action up to the First World War; compensation under the Act was based on 'fair market value'. London County Council (LCC 1913) provides details of all redevelopment schemes carried out in London between 1855 and 1912, including maps, numbers of displaced and rehoused residents and the costs of each scheme. Perhaps the best known project (and the first and largest under the 1890 Act) was the Boundary Street development in the East End district of Bethnal Green, which was one of the first social housing estates in London. The scheme displaced 5719 residents across an area of 14.85 acres at a net cost of £267,989 (LCC 1913, Appendix III). Originally constructed in the late eighteenth century, the area included the notorious 'Nichol' dramatised as 'the Jago' in Arthur Morrison's best-selling novel of East End poverty, *A Child of the Jago* (1896). The LCC reports that 'in one street alone there were at the same time no fewer than 64 persons who had served varying terms of penal servitude' (LCC 1913, p. 36). By March 1912, the LCC was responsible for 11,180 tenements, housing 53,487 individuals (LCC 1913, Appendix VII). In addition, 9317 working-class tenements were erected by philanthropic bodies of which the Peabody Fund provided 5756 and the Guinness Trust an additional 2574 (Appendix XII). The impact of the 1890 Act up to the Great War is evident in Fig. 5.1. The weekly rents on LCC housing were not, however, cheap. For example, the rent on a three-roomed tenement ranged between 4 shillings 9 pence and 11 shillings 6 pence and this was reflected in the occupations of residents. Labourer was the most frequently recorded occupation, but by no means all were in the lowest social classes.

Slum clearance legislation extended beyond the Great War and further enactments are discussed in Chap. 7, but it is helpful to provide context here. In fact, in terms of dwellings demolished, the later legislation had much greater impact. Valuable details are held at the London Metropolitan Archives, which retain copies of the majority of slum

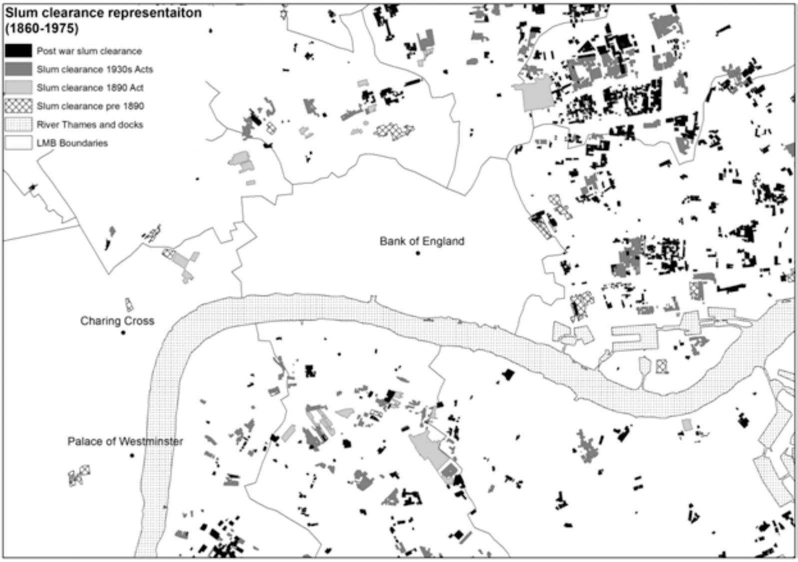

Fig. 5.1 Slum clearance programmes 1860–1975 (*Source*: Slum clearance representation maps (authors' calculations) are based on copies of LCC representation maps stored at the London Metropolitan Archives and are derived from Historic Ordnance Survey County Series 1:2500 1st revision (1893–1915) and 2nd revision (1906–1939) from EDINA Digimap and Landmark information Group. The 2001 MSOA boundaries are based on data provided through EDINA UKBORDERS with the support of the ESRC and JISC and use boundary material which is copyright of the Crown. © Crown Copyright and Landmark Information Group Limited (2010), all rights reserved)

clearance representations made by the LCC from the 1930s onwards and include detailed maps made by medical officers at the time. Maps of earlier slum clearance activity are also found in Stewart (1900) and Gomme (1913). However, not all slum clearance was carried out by the LCC—private landlords also undertook some demolition and a number of slum clearance schemes were carried out by the London boroughs. The data considered below only include LCC schemes.

Figure 5.1 and Table 5.1 are derived from the individual representation maps. Based on the original information, Historic Ordnance Survey maps were used to calculate the proportion of a Middle Layer Super Output Area (MSOA) that had been affected by LCC slum clearance.

Table 5.1 Slum clearance activity in London, 1860–1973

Period	Number	Average area (m²)	St. dev. (m²)	Total area (m²)
Pre-1890	31	7390	6993	229,090
1890s Acts	34	7942	13,830	270,028
1930s Acts	207	6890	7471	1,426,230
Post-war (1945–1954)	96	4634	7068	444,864
1955–1964	587	3482	4451	2,043,934
1965–1975	235	4118	5456	967,730
Total	1190	4523	6158	5,381,876

Source: Authors' calculations

Table 5.1 shows summary statistics for the three main legislative slum-clearance periods before the Second World War and the post-war period, divided into three, following Yelling (2000). The first two rows of the table emphasise the modest extent of the schemes conducted under pre-First World War legislation, compared with later activity. The 1190 schemes are mapped and Fig. 5.1 shows those in the Inner London area, demonstrating the concentration in the east and south. Although some MSOAs (particularly in the west) experienced no clearances under the different Acts, at the other extreme, 35 % of the land area in the East End MSOA of Tower Hamlets 009 was redeveloped under the different schemes.

5.3 Local Market Structure and Health

Early legislation was heavily concerned with improving sanitation and the living environment and an important issue is whether there is any evidence that policy affected spatial health outcomes. Since advances in medical knowledge are common to all areas, a priori, a general improvement in health over time might be expected. The question is whether there were improvements in the poorer areas relative to the London average, which reflected the emphasis of policy, shown in Fig. 5.1.

For context, Table 5.2 provides a starting point, showing deaths per 1000 of living population for England, London, Glasgow and for some of the British colonies in 1881 and 1905. Although not shown in the

Table 5.2 Death rates in the Empire (deaths per 1000 living residents)

Period	England and Wales	London	Glasgow	New South Wales	Victoria	Ceylon	Jamaica
1881	18.9	21.3	25.3	15.1	14.2	27.2	26.0
1905	15.2	15.7	19.8	10.1	12.1	27.7	21.9

Source: 1905 Registrar General's Report, for England and Wales, Table 44. Registrar General's Report for Scotland, 1881 and 1905 (Information from the Registrar General's Reports was derived from Histpop—The Online Historical Population Reports Website, University of Essex.)

table, English death rates in 1881 were noticeably lower than in almost all European countries. In the light of the discussion in Sect. 3.6, the lower death rates in the two Australian states than in England, but the higher rates in Ceylon (Sri Lanka) and Jamaica, are particularly noticeable. Death rates in London and Glasgow were, unsurprisingly, higher than the English average, but, with the exception of Ceylon, there was a reduction in death rates in all the countries over this fairly short 25 year period.

Advances in medical knowledge were influential in the fall in death rates, although the role of vaccination at this period can be over-estimated. A successful smallpox vaccine was introduced in 1796 by Edward Jenner, although coverage was still by no means complete in the late nineteenth century. Furthermore, although smallpox was the single most lethal disease in the eighteenth century, Davenport et al. (2011) show that deaths from smallpox in London were already falling from around the 1770s and were relatively unimportant in the nineteenth century. The first vaccine for diphtheria was not developed until the 1920s and widely introduced in the 1930s, whereas a measles vaccine was not introduced until the 1960s.

Over a longer time scale, Fig. 5.2 sets out the crude death rates in London per 1000 of the population between 1838 and 1910. Deaths have been compiled from the individual reports of the Registrar General for Births, Deaths and Marriages for England in each year. Deaths are, then, divided by the population given in the decennial censuses, interpolated between census years. The long-run decline clearly stands out along with the spikes in the cholera years. For our purposes, however, the issue is the trend in *local* deaths rates relative to the London average.

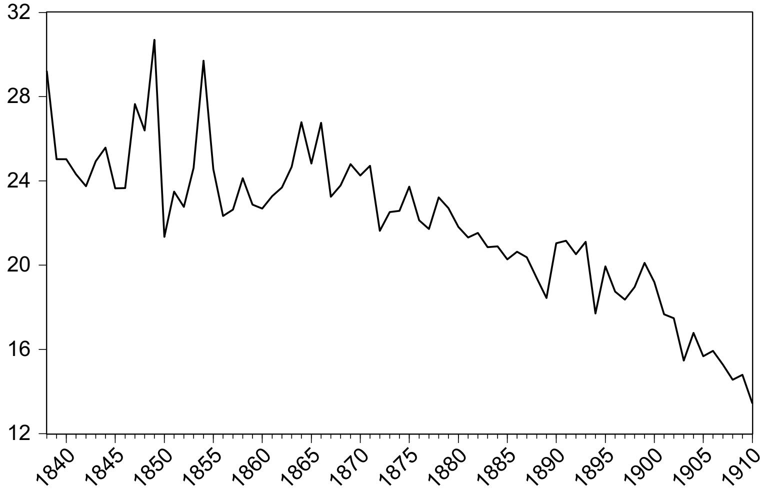

Fig. 5.2 London-wide death rates, 1838–1910 (Nos. per thousand living residents)
(*Source*: Registrar General's Reports for England and Wales)

Table 5.3 and Fig. 5.3 are based on death rates in the Registration Districts. As noted above, Registration Districts were based on the Poor Law Unions, but boundary changes occurred over the 70-year period. The estimates are therefore standardised on the 1901 classification, generating the separate districts for (Inner) London, set out in Table 5.3. Appendix 1 (Fig. 5.6) maps the districts across London; for presentational purposes, in the table, these are grouped further into nine geographical entities, although the more detailed information is also used below. The second column shows that the annual percentage decline between 1838 and 1910 in death rates is fairly similar to the London average value of −0.86 % in most areas; however even small differences have large cumulative effects over long periods and the falls in the East End, East Central, North East and West London were smaller than elsewhere. The first three of these were poorer areas and, in the case of richer West London, death rates remained low compared with the city as a whole. From the above, since the eastern districts contained most of the areas of policy action, it might have been expected that death rates would fall *faster* than the average. There are a number of possible explanations, some of which are explored

Table 5.3 Death rates in the London Registration Districts

	Annual average % change, 1838–1910	Registration Districts
East End	–0.68	Shoreditch, Bethnal Green, Whitechapel, St. George in the East, Stepney, Mile End Old Town, Poplar
East Central	–0.63	St. Giles, Holborn, City
Inner South East	–0.95	St. Olave, St. Saviour
West Central	–0.75	St. George Hannover Sq., Westminster, Strand
West London	–0.68	Paddington, Kensington, Fulham, Chelsea
North East	–0.63	Hackney
North	–0.79	Marylebone, Hampstead, Pancras, Islington
South	–0.82	Lambeth, Wandsworth, Camberwell
Outer South East	–1.24	Greenwich, Lewisham, Woolwich
Total (Inner London)	–0.86	

Source: Registrar General's Report, for England and Wales, various issues

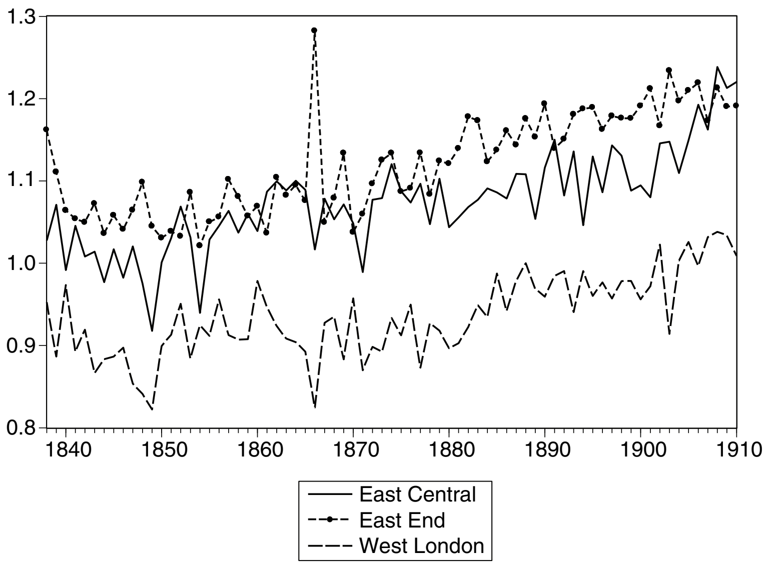

Fig. 5.3 Local death rates relative to the London average, 1838–1910 (*Source*: Registrar General's Reports for England and Wales)

in more detail below and in the following chapters. First, a definition of 'successful' policy needs to define a counterfactual; likely death rates in the absence of the housing policy actions are unknown. Second, crude death rates take no account of the age structure of the population. Poorer areas may have contained higher proportions of the elderly and young, who experience higher mortality. Third, policy might reinforce patterns of social disadvantage through the public housing programmes which replaced the slum clearances. Fourth, death rates may remain high because of (non-housing) area characteristics, such as high levels of pollution or the underlying industrial structure. The Bryant and May East End match factory perhaps provides the most extreme example of industrial illness in the late nineteenth and early twentieth centuries, arising from the use of cheap white phosphorus, causing widespread incidence of 'phossy jaw' (formally phosphorous necrosis of the jaw) amongst the workers. More widely, the industrial structure of the East End contained highly polluting industries, partly arising from prohibitions on such industries within the City. Fifth, as Cheshire et al. (2014) emphasise, local areas within cities are subject to residential sorting. Therefore, poorer Registration Districts may continue to experience higher death rates simply because low-income and low-skilled households are forced or choose to live in the areas with the worst conditions. If the health of some residents improves due to policy, they may leave those areas, increasing the death rates of those left behind. Additionally, there may be new inflows of poorer domestic or international migrants over time. In this case, time series of crude death rates understate the possible successes of policy.

Death rates across London began to fall at a faster rate subsequently, although affected in the short run by the 1918 influenza epidemic. However, later comparisons are hampered by the presentation of statistics on the basis of Metropolitan Boroughs until the mid-1960s, rather than Registration Districts and, then, local authority districts after local government reform. After the 1960s, we use information on the Tower Hamlets district to measure the East End, whereas East Central is proxied by Camden (and includes Saffron Hill). Both lie at the heart of the earlier Registration Districts and Tower Hamlets, in fact, includes all the East End Registration Districts from Table 5.3.

Despite the data problems, the key features are still clear; in particular, death rates in the East End and East Central areas had become similar to the London average by the mid-1960s and a decline in crude death rates in the East End was particularly strong from the mid-1990s; by the standards of the previous 150 years, the change took place over a relatively short period of time. There is *prima facie* evidence for the impact of the London Docklands Development Corporation in operation between 1981 and 1998 (see Chap. 1). Given the dynamism of the area from this period and the importance of the financial services industry, an inflow of young, skilled workers with lower death rates occurred. In the 2011 census, Tower Hamlets had the youngest age profile in the capital, with a mean age of 30.9 and 30.7 % of the population were aged between 18 and 29. To demonstrate the effect, the crude death rates for Tower Hamlets can be compared with mortality rates, standardised for the population age distribution, since 2001. Standardised values are useful for comparison purposes, but some care is needed with their interpretation, since the age distribution reflects endogenous mobility decisions.

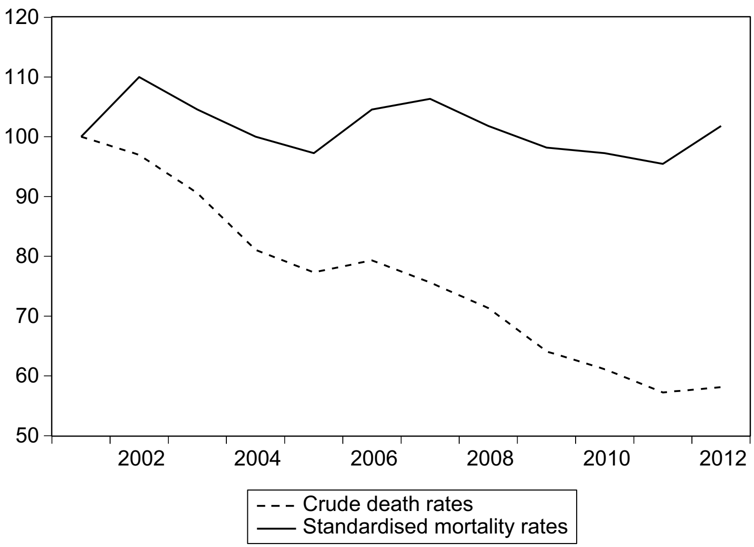

Fig. 5.4 Crude and standardised death rates in Tower Hamlets (2001 = 100) (*Source*: ONS)

Figure 5.4 shows that there was no change in the standardised rate—all the improvement occurs as a result of the changing population age distribution. Although not shown in the chart, the standardised rates in the poorer areas of Greenwich, Hackney and Newham also remain well above the London average. The differences between the crude and standardised rates provide some evidence of the importance of residential sorting as a major determinant of spatial restructuring, although, in this case, aided by large-scale policy innovations.

The changes in population distributions and the housing stock have implications for levels of overcrowding. Information for the London Metropolitan Boroughs (excluding the City) is summarised in Fig. 5.5; data for the changes in the number of rooms per person are shown for

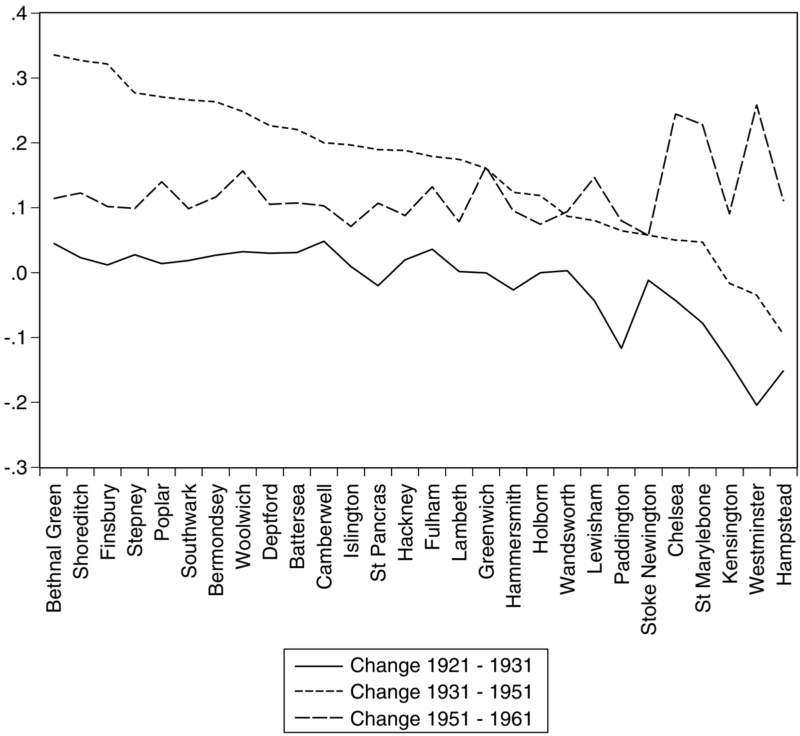

Fig. 5.5 Overcrowding (change in rooms per person), 1921–1961 (*Source*: Censuses of Population, various years)

sub-periods between 1921 and 1961, which are the most important periods for the next section. These are ranked according to the boroughs that showed the largest changes between 1931 and 1951, in other words, either side of the Second World War. Broadly, few boroughs underwent major changes in overcrowding between 1921 and 1931; all boroughs lie close to the zero axis, with the exception of Kensington, Westminster and Hampstead, which experienced some reduction in rooms per person. However, even allowing for the longer 20-year period, the fall in overcrowding is much more noticeable between 1931 and 1951. Nor were the declines equally distributed. Whereas, the areas around the docks (Bethnal Green, Shoreditch, Poplar and Stepney) experienced large improvements (Finsbury is a spatial outlier), Kensington, Westminster and Hampstead felt no improvement. Since the population decline was greater than the loss of dwellings in the East End, war-induced improvements to overcrowding were permanent. We return to this issue more formally in the next section and in Chap. 9. By contrast, although further reductions in overcrowding took place between 1951 and 1961, the changes were more broadly based.

5.4 Epidemics and Wars

The previous section demonstrates the persistence of death rates across London. A further question is whether large temporary exogenous disturbances have permanent effects on local population distributions. Chapter 3 showed that wars and epidemics have been a fruitful line of enquiry internationally and Davis and Weinstein (2002) provide an appropriate methodology for testing the long-run effects of short-term changes.

Population movements in Woolwich[4] in south-east London provide a simple initial example. Between 1914 and 1920, the total civilian population of the London metropolitan boroughs fell by 0.9 %, but the decline was not equally distributed across the boroughs. In particular, the population share of Woolwich rose by an exceptional 0.4 percentage points, from a modest 2.7 % in 1914. The surrounding boroughs south

[4] Appendix 1 shows the location of Woolwich.

of the Thames also typically grew, although at a slower rate. By contrast, the population share of Stepney in the East End fell by 0.5 percentage points from 6.1 %. The loss of East End population around the docks in the Second World War is well known; less-well appreciated is the loss there in the Great War. Woolwich was the site of Royal Arsenal and had its roots in the naval dockyard established by Henry VIII.[5] The armaments factories on the site expanded dramatically in the First World War, employing approximately 80,000 workers, partly housed in a new, high-quality, government-built housing estate of 1298 dwellings (the Well Hall Estate), constructed along Garden City lines. However, although the munitions factory was reduced in size after the War, the population of Woolwich never declined in line with the general reduction of the Inner London population. It continued to increase its population share up to and beyond the Second World War. Woolwich, Lewisham and Hampstead were the only inner boroughs to increase population between 1931 and 1951. In this case, a large temporary shock to the area produced long-lasting effects to the population distribution, because of the induced permanent increase in the local housing stock.

During the nineteenth century, London faced three significant cholera outbreaks, in 1849, 1854 and 1866, which were the largest epidemics of the era until the influenza outbreak of 1918. In 1849, for example, there were more than 14,000 cholera deaths in London, accounting for approximately 20 % of the total in that year (9 % and 2 % in 1854 and 1866 respectively). Table 5.4 suggests that the spatial patterns of the epidemics were not the same in each period. Remembering that the water-borne sources of cholera did not begin to be understood until the mid-century, the 1849 outbreak was heavily concentrated south of the river, deaths from the 1854 outbreak were based in the northern and western districts, including Soho where John Snow was carrying out his research, and the smaller 1866 outbreak was based on the central districts around Holborn. Interestingly, the East End was never disproportionally affected.

[5] Woolwich was the original location of Arsenal Football Club until it moved to north London in 1913; hence the nickname of the Gunners.

Table 5.4 Distribution of deaths from cholera in the London Registration Districts (% of total)

	1849	1854	1866
Paddington, Kensington, Fulham, Chelsea	3.59	11.80	5.54
St Georges Hannover Sq., Westminster, Strand	6.17	8.89	2.07
Marylebone	1.85	10.72	3.16
Hampstead	0.06	7.18	2.75
Pancras	2.55	8.11	1.19
Islington	1.32	12.43	3.47
Hackney	0.98	5.39	2.90
St Giles	2.02	3.91	7.25
Holborn	3.29	5.15	13.37
City	5.79	2.54	11.55
Shoreditch	5.58	2.81	7.88
Bethnal Green	5.58	3.38	4.04
Whitechapel	3.58	2.03	2.64
St George in the East	1.41	1.25	3.47
Stepney, Mile End	3.54	1.66	4.72
Poplar	2.21	2.05	5.44
St Saviour, St Olave, Rotherhithe	26.29	3.15	6.17
Lambeth, Wandsworth, Camberwell	18.43	2.94	4.15
Greenwich, Lewisham, Woolwich	5.76	4.60	8.24

Source: Report of the Cholera Epidemic of 1866 in England: Supplement to the 29th Annual Report of the Registrar General

In order to test whether the epidemics had even temporary effects on the population distributions, analogous to the appendix in Chap. 3, the change in the population shares between 1851 and 1871 in each Registration District is regressed on the cholera death shares from Table 5.4, but, in fact, there is no significant effect. None of the epidemics, despite their size, resulted in changing population distributions. Three potential reasons might be identified; first, the general view was that cholera was miasmic—if the disease is air-borne, it cannot be fully avoided by moving. Second, before the advent of cheap working-class fares, the population was still largely walking to work and therefore could not move long distances. Third, as noted, there were no common spatial patterns in the epidemics or safe locations to which the population could move. This was also true of the 1918 influenza epidemic, which killed approximately 13,000 Londoners, where the disease was widespread across the capital. In summary, even the largest epidemics did not affect the population distribution through mobility.

The Second World War, however, tells a different story. Whereas, the Great War had important effects on Woolwich, the Second World War produced more general permanent as well as temporary outcomes. Table 5.5 sets out some of the key indicators for selected boroughs; it shows strong reductions in population in all tabled boroughs (except Hampstead) between 1939 and 1951—the short-term losses between 1939 and 1941 during the Blitz were, in fact, much larger. The declines were particularly heavy in the East End dock areas, where Stepney lost approximately 50 % of its population. In addition, Stepney lost around a quarter of its housing stock and nearby Poplar and Shoreditch approximately 20 %, but, as a percentage of the population, deaths and serious injuries were not disproportionately concentrated on the East End and V1 rocket attacks were widespread.

Since the population and dwelling losses were not equally distributed, the question is whether the post-war shares recovered to the pre-war

Table 5.5 The London Registration Districts and the Second World War

	Houses destroyed[a] (%)	Killed/seriously wounded[b]	V1 rockets[c]	Population change 1939–1951 (%)
City of London	38	6.21	25.6	−41.5
Bethnal Green	12	0.45	1.8	−35.3
Chelsea	6	1.58	1.0	−8.0
Finsbury	12	0.81	1.1	−35.8
Hackney	14	0.32	2.5	−16.5
Hampstead	1	0.33	1.1	5.5
Holborn	17	1.52	2.2	−25.7
Islington	6	0.60	0.7	−18.2
Kensington	7	0.43	1.8	−2.29
Lambeth	18	1.01	4.1	−15.0
Poplar	21	1.16	7.0	−43.9
St Pancras	7	0.84	1.7	−22.2
Shoreditch	21	1.47	1.9	−41.9
Southwark	11	1.17	2.0	−31.1
Stepney	26	0.66	4.0	−49.9
Westminster	17	1.74	4.4	−19.5

Source: London Topographical Society (2005)
[a]Houses destroyed, demolished and damaged as % of 1939 total
[b]Residents killed and seriously wounded as % of 1939 population
[c]V1 rockets per 10,000 of 1944 population

position or whether the war had permanent effects on the distributions. To anticipate Chap. 9, this issue is also important for the spatial distribution of international migrants. Permanent changes in population shares can be tested using the random walk model in the appendix to Chap. 3. Using the notation of that Appendix, now, R_b is the logarithm of the population shares in each borough and v_{b,n_2} refers to the wartime population shock, arising from the London bombings. Given the available data for each borough, n_3 is chosen as 1961, n_2 (the immediate aftermath of the wartime shock) is taken as 1951 and n_1 is the pre-war period.

The test implies regressing the change in population between 1961 and 1951 on the change in population between 1939 and 1951 as a measure of v_{b,n_2}. As a slight complication, since v_{b,n_2} may also contain information of past population growth rates as well as the effects of the war, it has to be instrumented to avoid bias to the estimated coefficients (see Davis and Weinstein 2002). From Table 5.5, the chosen instruments are the percentage of houses destroyed, V1 attacks and the civilian population killed or seriously wounded. The second column in Table 5.6 shows that, of these three variables, only the number of houses destroyed has any significant effect on population movements between 1939 and 1951[6] and therefore the insignificant variables are dropped in the third column. Nevertheless, approximately 60 % of the change in population can be explained by the loss of homes alone, although by concentrating on the boroughs, the number of observations is modest. The results from regressing the change in population between 1951 and 1961 on the instrumented value of v_{b,n_2} are shown in the final column of Table 5.6; the equation also adds the change in population between 1931 and 1941 as a further general test of dynamic changes in population shares. The central finding from the coefficient on $\hat{v}_{b,n_2}$, however, is that, at least up to 1961, there was no recovery towards the pre-war shares, although it is still possible that a longer period beyond 1961 might reveal evidence of reversion, but tests are hindered by absence of data on the same spatial definitions for later periods. Nevertheless, Chap. 9, in the context of immigration, finds further support for the view that the changes were permanent.

[6] V1 is, in fact, borderline significant at the 5 % level, but with an unexpected positive coefficient.

Table 5.6 Population change and the Second World War (dependent variables: change in population shares in the Metropolitan Boroughs 1939–1951, v_{b,n_2} (Columns 2, 3) and change in population shares between 1951 and 1961, Δpop_{51-61} (Column 4))

	v_{b,n_2}	v_{b,n_2}	Δpop_{51-61}
Constant	0.0793 (5.1)	0.0785 (4.5)	−0.0058 (1.3)
Houses	−0.0115 (7.0)	−0.0086 (6.8)	–
Killed	0.0052 (0.3)	–	–
V1	0.0066 (1.9)	–	–
$\hat{v}_{b,n_2}$	–	–	0.0293 (0.4)
Δpop_{31-41}	–	–	0.1486 (2.9)
Adjusted R^2	0.70	0.62	0.31
Number of observations	29	29	29

Houses: houses destroyed, demolished and damaged as % of the 1939 total
Killed: residents killed and seriously wounded as % of the 1939 population
V1: V1 rockets per 10,000 of the 1944 population
$\hat{v}_{b,n_2}$: estimated value of the dependent variable in column 3
Δpop_{31-41}: change in population shares between 1931 and 1941
t-values in brackets

5.5 To Conclude

The chapter illustrates the spatial persistence of death rates over long periods of time. Despite the fact that housing policies were spatially differentiated, notably in terms of slum clearance, death rates did not converge towards the London average in the worst areas until recently. There is *prima facie* evidence that residential sorting is part of the explanation. Low-quality areas may experience persistently higher death rates because low-income and low-skilled households are more likely to move into those areas and healthier households will move if their economic circumstances improve. Unsurprisingly events, such as epidemics, whose causes and spatial distribution were not fully understood at the time, had little effect on population distributions. Nevertheless, major events did induce change; the simplest example was Woolwich, where large population inflows as a result of the Great War and the accompanying construction of a major housing estate, produced permanent results. Furthermore, since bombings in the Blitz were not equally distributed across London, the chapter finds some evidence that this major temporary shock had permanent population effects. Since the outflows of population from the East End were greater than the loss of dwellings, the Second World War permanently reduced overcrowding on a greater scale than had been achieved by slum clearances. Further evidence of residential sorting was found in the East End in the 1990s as policy initiatives under the London Docklands Development Corporation took effect. Crude death rates fell sharply, because of the influx of young workers, although age-standardised death rates changed much less.

5.6 Appendix 1: London Registration Districts, Metropolitan Boroughs and Local Authority Districts (Fig. 5.6)

Fig. 5.6 London boundaries, 1881, 1951 and 1971. (**a**) Registration District Boundaries 1881. (**b**) Metropolitan Borough Boundaries 1951. (**c**) Local Authority District Boundaries 1971 (*Source*: This work is based on data provided through www.VisionofBritain.org.uk and uses historical material which is copyright of Humphrey Southall/Great Britain Historical GIS/University of Portsmouth)

(b)

(c)

Fig. 5.6 (continued)

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6

Speculation, Sub-division, Banking Fraud and Enlightened Self-interest: The Making of the Contemporary Glasgow Housing System[1]

6.1 Introduction

For most of the nineteenth and twentieth centuries, Glasgow's reputation was associated with poor housing conditions and economic deprivation. The city has been subject to among the most pronounced state interventions seen in the UK, but resisted the transition to a predominately owner-occupied housing system longer than most other UK towns and cities. Indeed, the rate of owner occupation still sits noticeably below the Scottish and English averages (43 % compared to 58 % and 63 % respectively) and even below London (49 %). This chapter is concerned with how the origins and development of the city's housing stock and its spatial structure helped to shape its modern housing market. Particularly important is the nineteenth century institutional structure, which, in turn, was heavily influenced by the medieval roots of Scottish property rights and differed from the rest of Britain. The chapter also shows how

[1] This chapter is written in memory of former colleague and historian of Glasgow, Andy Gibb.

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the nature of the institutions contributed to nineteenth century housing volatility and describes the failure of the City of Glasgow bank in 1878 and the problems engendered by the legal framework on which it was founded, leading to profound changes for the banking system as a whole; it was to be another 130 years before Britain saw a bank run again.

This chapter looks at the private sector origins of the distinctive twentieth century municipal approach to council housing in Glasgow. The origins arose from long-term economic and demographic growth pressures, exacerbated by economic volatility and speculative behaviour, for example, the sub-division of tenements by builders and landlords, culminating in 'altruistic' redevelopment of major parts of the centre by city leaders operating through a charitable improvement trust. As the quotation at the start of Chap. 5 indicates, in the second half of the nineteenth century, Glasgow was prone to massive housing and public health problems of overcrowding, high densities and often squalid and inadequate market accommodation. The difficulties encountered by the private market, made worse by specific disastrous episodes such as the collapse of the City of Glasgow bank, paved the way for a more radical approach to housing, which casts a legacy, both positive and negative, to the present day in shaping the built form and characteristic neighbourhoods found across the city.

These developments help us explain Glasgow's experiments with municipal socialism and council housing that provide a direct link to post-war slum clearance, comprehensive redevelopment and the city becoming the home of high-rise flats. Thereafter, there were top-down and bottom-up policy reversals against municipalism, and the return to the neighbourhood through successful community-based housing associations and ultimately the expansion of home ownership in the city and the sale of council housing en masse to the Glasgow Housing Association. The case study of Anderston, discussed in Chap. 2, located in the central western part of the city, in many ways characterises the dynamic path and endless changes and shocks that typify large tracts of Glasgow.

Following a description of the development of the Glasgow housing system from the mid-nineteenth century, the chapter explores four key themes: the distinctive nature of Scottish property law and the implications for housing; building volatility; the 1878 City of Glasgow bank collapse; and the spatial persistence of housing market structure since the nineteenth century to the current time.

6.2 Glasgow in the Late Nineteenth and Twentieth Centuries

Maclennan and Gibb (1988), Worsdall (1989) and Maver (2000) outline the rapid transformation and enlargement of the city in the nineteenth century. In each decade after 1840 until the First World War, population grew rapidly though unevenly (Table 6.1). In-migration, first from Ireland and, then, from the Scottish Highlands, came to supply labour for the growing economy, initially for spinning and textile weaving in districts like Anderston. The city expanded to more than a million by 1914 as a result of internal growth and annexing neighbouring parishes like Govan and Partick (see Tables 6.2 and 6.3, noting that the latter captures the economic-induced volatility in migration, which turned negative in the 1880s). After the initial growth, based on trade in textiles, tobacco

Table 6.1 Glasgow population change, 1780–1912

Year	Population	Percentage growth on previous date
1780	42,832	
1791	66,578	55.4
1801	83,767	25.8
1811	110,460	31.8
1821	147,043	33.1
1831	202,426	37.6
1841	274,324	35.5
1851	329,097	19.9
1861	395,503	20.1
1871	477,732	20.8
1881	511,415	7.0
1891	565,839	18.4
1901	761,709	34.6
1911	784,496	3.0
1912[a]	1,008,487	28.6

Source: Gibb (1983, Table 5.iii and Table 6 ii)
[a]1912 Boundaries Act annexed Partick and Govan

Table 6.2 Birthplace of migrants to Glasgow, 1851–1911 (% of city population)

Year	Scotland (excluding Glasgow)	Ireland	England and Wales	Other	Total as % of city population
1851	34.7	18.2	2.5	0.5	55.9
1861	30.0	15.7	2.6	0.9	49.2
1871	34.5	14.3	3.1	0.7	52.6
1881	31.6	13.1	3.2	0.9	48.7
1891	29.9	10.6	3.4	1.0	44.8
1901	27.0[a]	8.9	3.7	1.7	41.3[a]
1911	26.2	6.7	3.8	1.7	38.5

Source: Gibb (1983, Table 6 iii)
[a]Lanarkshire-born residents estimated at 20,000

Table 6.3 Population and migration change, Glasgow (nos.)

Period	Net increase in population	Immigration
1861–1871	87,532	+41,010
1871–1881	19,674	–37,976
1881–1891	54,295	–11,026
1891–1901	103,639	+28,344
1901–1911	22,787	–82,638

Source: Cairncross (1934, Table B)

processing and then chemicals, the economy exploited its regional coal and iron ore resources for steel making and vertical integration into shipbuilding and engineering. As Maclennan and Gibb (1988) emphasise, the city benefited from its ability to trade with North America and equally from its canal links to the east coast and Europe.

Glasgow, like most cities in this period prior to the internal combustion engine and horseless trams, was a place where employment had to be close to worker accommodation (Maclennan and Gibb 1988, p. 6). The regional economy grew rapidly, but was also prone to volatility and severe downturns. Latterly this became associated with trade volatility in the Empire and violent swings in the demand for shipbuilding, but it was also transmitted into the local economy and the house building sector. Rodger (1979, p. 226) notes that, in depression years, output could fall to just 10 % (or less) of its peak value years. He argues that house building output was more volatile than other forms of investment and

Table 6.4 Building cycles, Glasgow 1873–1914

Period	Number of years	Houses built (numbers)	Houses demolished (numbers)	Annual demolitions as % of stock
1873–1883	10	27,100	15,200	1.3
1883–1890	7	6800	2500	0.3
1890–1900	10	32,000	12,300	0.8
1900–1910	10	26,700	7700	0.4
1910–1914	4	2200	7200	1.0

Source: Cairncross (1934, Table A)

experienced several 20 year-long cycles in production across Scotland. This instability helped fuel wider housing problems that led to a series of market and policy responses. Cairncross (1934, p. 2) identifies five building cycles between 1873 and 1914 in Glasgow specifically of four to ten years in duration (see Table 6.4).

The housing market in operation in the city was characteristically designed and operated to support low-income migrant workers with few resources (Maclennan and Gibb 1988, p. 6). Private landlords housed these workers in high-density three or four-floor tenements: for the period around 1860 'residential densities in the central city were of the order of 330 persons per acre' (Maclennan and Gibb 1988). Poorer quality properties could house 20 families without washing facilities or an internal toilet. The public health concerns and the subsistence existence of many unregulated workers meant that there was a market for single night or lodging accommodation; consequently there was much destitution, homelessness and movement to and from the countryside depending on the state of the economy.

The public health outcomes were notorious and highly unequal. Table 6.5 sets out the density levels by city sanitary district in 1881, suggesting considerable variation; on the one hand, the city/east core, Anderston to the west of the city centre, and the northern industrial centres, for example St Rollox, all had density levels in excess of 200 per acre. On the other hand, the outlying west end (Kelvinhaugh and Sandyford) and even further out in the east (Bellgrove and Dennistoun) had much lower density levels. Standardised death rates and those for children under five years old also displayed this spatial variation. Furthermore, the table

Table 6.5 Density and death rates, Glasgow, 1881

City sanitary district	Density per acre	Total death rate/1000	Death rates, under 5 years/1000	% of one apartment dwellings
Blythswood	101	16.1	52.9	9.0
Kelvinhaugh & Sandyford	43	17.2	54.0	7.5
Woodside	134	20.9	64.2	20.0
Monteith Row	42	21.0	70.1	15.5
Exchange	96	21.7	67.4	18.0
Kingston	97	21.8	73.4	18.0
St Rollox	316	21.8	69.0	27.0
Springburn & Maryhill	26	22.4	68.6	31.0
Bellgrove & Dennistoun	47	23.1	72.3	32.0
St Enoch Sq.	44	24.4	87.7	24.0
Hutcheson Sq.	121	24.9	79.3	31.0
Greenhead & London Rd.	52	26.7	87.5	43.5
Laurieston	186	27.2	88.5	30.0
Port Dundas	64	27.3	83.5	28.5
Anderston	229	28.4	101.7	33.0
St Andrews Sq.	189	28.7	93.1	29.0
Gorbals	274	29.0	103.8	29.0
High St. & Closes West	239	29.9	95.6	46.5
Barrowfield	233	30.3	103.3	47.5
Brownfield	348	30.7	99.3	24.0
Calton	335	30.9	108.4	43.0
Cowcaddens	249	32.0	116.6	45.0
High St. & Closes East	155	37.8	128.5	53.0
Bridgegate & Wynds	223	38.3	138.7	49.0

Source: Gibb (1983, Table 6 v)

shows that, in several of the high-density areas, overcrowding must have been extreme given the higher proportions of one-apartment dwellings. These figures were higher or as high as anywhere in the UK, even the East End of London. As Chap. 5 showed, death rates in Glasgow were also greater than in London and similar to those in some of the British colonies. Worsdall (1989) notes that the 'Rookery' in Drygate, claimed 500 people living from one close entry (p. 7).

Figure 6.1 shows how the unequal conditions were reflected in 1881 rental values, employing information from the historic valuation rolls used for local property taxation purposes. By 1881, the property hot

Fig. 6.1 The distribution of Glasgow rental values in 1881 (*Source*: Glasgow valuation rolls)

spots (marked in darker colours) on the north side of the River Clyde were in the areas now generally recognised as Glasgow's west end. On the south side of the river, the development of the city had expanded on a south west path, establishing the Shawlands and Queen's Park areas of the city, set in the context of a large Victorian park. Worsdall sums up the emerging situation for many thousands of Glaswegian immigrants living in the worst areas:

> To take advantage of this wretched market and the lack of legislation to safeguard health, tenements of the poorest description were built in what had been garden ground belonging to street buildings. These *back-lands*—*land* being an old synonym for *tenement*—were reached only by narrow lanes [*wynds*] or closes, which meant that they were deficient in both light and ventilation. Needless to say, the poverty-stricken inhabitants contributed nothing in the way of care or maintenance of these buildings and they quickly deteriorated into the most wretched slums. (p. 6)

Rodger (1999, p. 203) notes that many lodging houses, planned for short-term, single-person overnight use, were converted over time to family housing through subdivision and crude overcrowding. He also found that eviction was common despite typically 12-month leases. The use of legal proceedings was 30 times greater in Glasgow than London between 1866 and 1890.

Figure 6.1 suggests the existence of housing submarkets. The concept of housing submarkets is closely related to the issue of path dependency. Maclennan and Tu (1996) argue that some housing attributes are almost impossible to replicate; for example, locations nearby or visible to large, Victorian public parks are very difficult to create anew. Similarly, many hedonic studies of British housing markets reveal significant positive effects associated with built environment heritage, such as the premia attached to historic, stone-built properties. The value of the built heritage is important in a city such as Glasgow with Victorian (and earlier) quarters consisting of sought after stone-built or finished properties and a mix of other vintages, with varying designs and qualities. It is also almost certainly the case that a finite supply of non-replicable, attractive housing attributes will have a greater impact on price differentials if the urban growth rate has been strong since the original production of the attributes.

Thus, difficulties in replicating housing attributes that were created in the past may contribute to path dependency. As Leishman (2009) argues, although the housing submarkets literature is now well developed, there have been far fewer studies exploring the nature of spatial change within urban housing markets. Instead, most are concerned with identification of, and statistically testing for, submarkets. Grigsby (1963) argued that the boundaries between submarkets may be in a 'constant state of flux' and that migration between higher and lower priced submarkets, and differential rates of construction between areas, act to break down submarket boundaries. Nevertheless, Jones et al. (2004) tested the possibility of evolving boundaries in Glasgow, but generally found migration patterns to be reinforcing existing submarket boundaries. They also pointed out that levels of construction activity in higher-priced or more valued submarkets tend to be lower than in the lower-priced areas of the city. Of course, this partly reflects public sector efforts to facilitate urban renewal through the promotion of development opportunities in more deprived and less popular parts. In Glasgow, hedonic studies from the 1980s onwards indicate distinct west end, north west, east end, and south west submarkets, but these patterns can be traced back further and a similar distinction, or perhaps simply the preconditions, appears to be supported by Fig. 6.1 in 1881. This is explored further below.

A number of forces led to pressure for change in the nineteenth century. First (in a similar manner to England as discussed in the last chapter), there was a growing understanding of the public health externalities associated with overcrowding and poor sanitation, reflected in the response to cholera and typhus outbreaks in the 1850s and the public works project that led to the critical development of safe public water from Loch Catrine from 1860. The Corporation attempted to reduce overcrowding by affixing metal tickets to properties limiting the maximum number of people who could live in them. At the same time, a succession of legislative Acts, both national and local, attempted to alleviate different problems essentially derived from the housing pressures. Worsdall (1989) summarises various Police Acts and other enabling powers that gave the Dean of Guild Court much stronger powers, *inter alia*. However, he contends that these efforts to reduce overcrowding and to take over the worst housing were, in the first half of the nineteenth century, woefully inadequate and this led in 1866 to the establishment of the City Improvement Trust, followed in the next year by the first of several public health reforms and further building control acts for Glasgow in 1892 and 1900.

By 1897, the Liberal leadership of the Corporation secured Parliamentary approval to purchase land and build municipal housing for the 'poorer classes' (Maver 2000, p. 159) as well as encouraging non-excessive rents from private landlords in an early form of non-profit housing (Maclennan and Gibb 1988). This first trickle of council housing (more than 2000 units eventually) was small in comparison to the private building levels in the 1890s and the first decade of the twentieth century. However thereafter, from 1910 to 1914, building collapsed prior to the Great War, helping to create the tight market conditions that prefigured the rent strikes to come in 1915.[2]

[2] Maclennan and Gibb (1988), estimate that real rents grew by 25 % between 1914 and 1915 while restrictions precluded new supply at the same time as an influx of people to the city occurred.

The Civic Improvement Trust remains controversial, although it was supported by the Corporation, the voluntary sector, church and business leaders. The Trust purchased land, cleared swathes of poor-quality housing and developed new housing and business space, in some cases working closely with the burgeoning and land-hungry railway sector. This long-term project was both a slum clearance programme and one of 'profitable speculation' (Maver 2000, pp. 172–176). Mainly operating on the medieval city core and to its east and south, Maver notes many sceptical critics of the motives of the programme. This was, in part, the result of local political disputes. The Trust delivered new family housing on previously overcrowded sites on a fairly modest scale, at relatively high rents, and freed up space for major railway infrastructure developments, such as that on the former grounds of Glasgow University, but it was bedevilled by financial shortages and the impact of the 1878 bank failure. The immediate closure of substandard housing and its slow, only partial, replacement made things considerably worse in the short term before eventually helping to alleviate the problems. Maver argues that, while the Trust lost its controversial status over time, it did not really make a sufficient dent in the housing problem; this continued to ratchet up towards its watershed in 1914 and immediately thereafter in the rent strikes of the following year.

Post-First World War construction levels in Scotland, both private and public sector, are graphed in Fig. 6.2. As the figure shows, the major council house building programmes, that took place in several waves until the mid-1970s, were not unique to Glasgow. Yet the dominance of the public sector in housing and urban renewal was, perhaps, stronger in Glasgow than in other Scottish towns and cities. In Glasgow between 1960 and 1975, 95 % of all homes built were council houses and only 3.8 % were privately constructed dwellings for sale.

Rosenburg and Watkins (1999) argued that the mid-1970s was a watershed in terms of housing policy in Glasgow. In addition to policies designed to promote owner occupation, there were significant investments in tenement improvements, facilitated through community-based housing associations. The Glasgow Eastern Area Renewal (GEAR) project was one of the first comprehensive area-based urban development programmes, combining housing renewal and development with physical

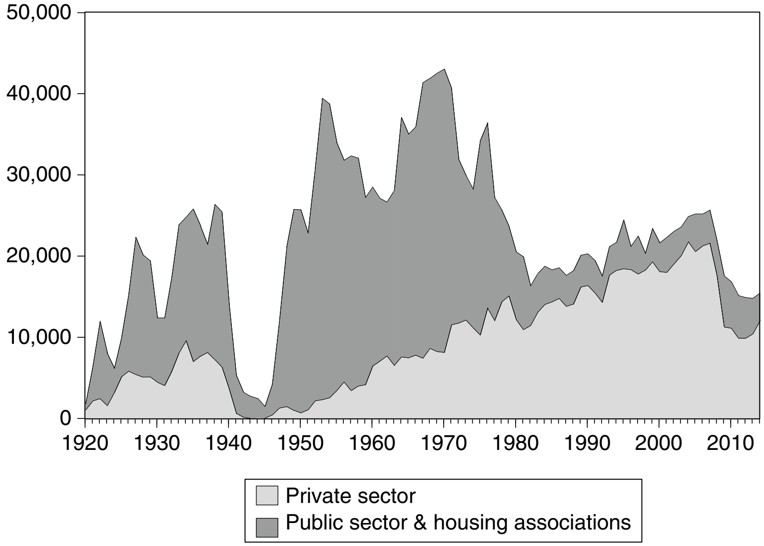

Fig. 6.2 Private and public housing completions in Scotland from 1920 (nos.)

and environmental improvements and had an explicit objective to lever in private investment to improve public sector value for money. While it is widely felt that GEAR failed to deliver on its long-term objectives, it is interesting to note that the same locations within the East End are now the beneficiaries of the large-scale Clyde Gateway urban regeneration company, the motorway extension of the M74 into the city centre and the 2014 Commonwealth Games site, notably the residential athletes' village, injecting new private and social housing into Dalmarnock.

In the late 1970s, the Council began actively to encourage owner occupation by promoting the sale of Council-owned land to builders as a policy lever. The first land sales that occurred as part of this policy had originally been intended for further council housing development, but, by the mid-1980s, the Council had moved to an ongoing forum with the city's house builders, designed to encourage the identification of sites (particularly urban renewal land) suitable for housing development. By the early 1990s, Scottish Homes—the country's housing regulator, public sector landlord and renewal agency—was routinely investing substantial sums for the remediation of brownfield land and to facilitate the supply of units of housing for low-cost owner occupation. The change has been dramatic from virtually no family housing being built in the city to significant volumes of new building on predominantly brownfield sites, reversing the outflow of families from the city. Between 1992 and 1997, more than 2200 units were constructed under the 'GRO' grants scheme (grants for residential occupation, Gibb et al. 1995). Rosenburg (1995) argued that a relatively high proportion of properties (10–15 %) were eventually repossessed by their mortgage lenders, and dwellings also recorded very modest rates of house price growth in subsequent transactions. Nevertheless, it was recognised that the scheme was designed for marginal, problem areas and was expected to have a higher failure rate.

Rosenburg and Watkins (1999) found that a combination of pro-home ownership policies, housing improvement programmes and urban renewal policies came together to help create a new market for private flats in the city. The public sector stance was also critical to the success of urban initiatives such as the Merchant City regeneration. The central location was an area comprising many vacant, derelict and obsolete buildings that were nevertheless recognised in city plans as an important part of the city's townscape and heritage. The buildings dated to the peak of the city's eighteenth century tobacco and sugar trades, but by the 1960s had been converted to wholesale distribution uses before becoming derelict altogether. Rosenburg and Watkins note that the package of regeneration measures included the development of an important leisure and recreational quarter as well as commercial developments and grants to rehabilitate and convert warehouses as small flats for owner occupation aimed primarily at a young, middle-class clientele. By the early 1990s, over 1000 units of housing had been developed, facilitated by both public and private investment money.

6.3 Key Theme 1: Tenement Development and the Feudal Pyramid

The nineteenth century housing system was market based, co-locating housing and industry and maximising the use of scarce urban land, with the tenement built form as the most effective means of achieving high-density supply within the confines of Scottish property law and the feudal system on which it was based. In turn, these long-established institutional constraints created the building system and landlordism that characterised the city in the nineteenth century. Ultimately, the logic of the system and its public health externalities led to an unravelling, but to understand how it operated and had such a huge influence on the building sector, we need to look at the law and practice of the Scottish tenement.

Tenement law managed the property rights associated with living in communal property and defined, for example, responsibilities for common areas, gardens, closes, roof repairs and how the internal courtyard or backyard space might be allocated for other economic uses. In Glasgow, it was the merchants through the Burgh Guilds (specifically, the Dean of the Guild Courts) who organised the practice of property law and looked to a combination of Roman and feudal law to establish its underlying principles (Worsdall 1989). In so doing they created the economic incentives to over build at high density, arguably exacerbating building sector cyclical volatility as well as controlling the built form and look of the tenements that would be constructed.

The feudal system was essentially a succession of superior-vassal relationships: from the Crown to the Burgh, from the Burgh to economic land-owners and then on to final users. 'Each superior, on *feuing* some of his land, granted a charter to his new vassal, who in return agreed to render certain services, or to pay in money or in kind, what was known as *feu duty*' (Worsdall 1989, p. 17). Rather than a *feu* superior selling land at a market price, a ground annual payment was agreed. As Worsdall argues, this led to specific rules written into the title deed by *feu* superiors, setting out the legitimate uses and built form allowed on the site transferred.

In urban Scotland it was common to see newspapers advertising the purchase of existing feus and was a measure of property market conditions. As Wightman (2011) notes, a conveyance at property sale may substitute a new owner for an old one but the feudal relationship remains in place. He also notes that it was common to find insurance companies holding portfolios of *feu* superiorities as relatively secure income streams in the form of the implied fees. Furthermore:

> Feuing was an important mechanism for the development of Scotland's villages, towns and cities in the days before planning and it allowed for the

> orderly development of houses and streets by imposing conditions on feuars, such as the obligation to maintain part of the street and not to use the land for … undesirable urban activities. (Wightman 2011, p. 8)

There were a number of critical implications of this set of institutional arrangements. First, it made subsequent land assembly for redevelopment very difficult and created a need for centralised local government control and compulsory purchase powers. It also created much resistance and antipathy towards property law in Scotland, eventually modernised only in the 1970s with further land reform in the early 2000s.[3] Second, *feu* superiors in new developments would, by laying down infrastructure, also establish the materials, shape and forbidden land uses, for example the types of shop on the ground floor, in order to maximise the numbers of rent-paying tenants and *feu*-paying investors for the land (Roger 1979, 1999).

Third, it created an ability to use the ground annual payment as the basis for financing building projects and, indeed, property purchase once the development was ready for sale. Feuing was a first charge on estates so it, as a form of future income, made for excellent loan security (Rodger 1999; Wightman 2011). Finally, Rodger (1979) notes that, 'the habit of subinfeudation or "feu-farming", by which the vassal sold part of the land to a number of sub-vassals at an increased feu-duty, inflated Scottish land prices. The result was to constrict further the volume of effective demand notably in the lower echelons of income stratification and normally the forte of the speculative builder' (p. 234). This only encouraged landowners to withhold land and thereby promote asset values, which led to further subdivision and intensive use of land.

6.4 Key Theme 2: Building Volatility

House building in the nineteenth century was an atomistic competitive affair of small builders struggling to find development finance and working capital, exposed to high business failure levels and to the risks

[3] Wightman's book is a reasoned account of the need for further and more comprehensive land reform. The Scottish Parliament is currently (February 2016) legislating further land reform.

associated with oscillating economic conditions. Cairncross produced a remarkable piece of applied economics in 1934 to unpick the building sector in Glasgow and this detective analysis is supported by the more nuanced historical analysis of Rodger (1979, 1999) to give us a sense of the key drivers of the volatility we see clearly from Table 6.4.

Worsdall (1989, p. 10) argues that city expansion reached its building zenith in the boom years of the 1870s prior to the City of Glasgow bank collapse in 1878. The Corporation through the Dean of Guilds Court approved more than 21,000 tenement houses between 1872 and 1876. Rodger (1999) concludes that the primitive and often naïve, amateurish nature of the sector made its precariousness inevitable:

> Together, these factors—small firm size, limited capitalisation, imprecise market analysis, lack of barriers to entry, limited book keeping, and cash flow problems strongly associated with a product normally saleable only on completion—meant that builders were particularly vulnerable to bankruptcy should their sources of finance dry up. Collectively, these features of the Scottish building industry produced boom-to-bust cyclical fluctuations of unprecedented severity—at least 70 per cent more pronounced than in the manufacturing sector generally. (p. 200)

Critical to this inherent weakness were finance and occupier demand. Rodger (1999) accounts for the major sources of finance, some of which at least did reduce risk. Builders produced tied accommodation and offices for specific institutions and businesses where the funding came directly from the client, for example churches, schools and other public sector bodies. Most working capital, however, came from investing individuals and businesses, often organised by local solicitors to support the development of tenement projects. Conventional lending from banks and other mutual lenders only appeared towards the end of the nineteenth century, although this was the specialist financing role played by the ill-fated City of Glasgow bank in the 1870s. So, finance for tenement building, neighbourhood creation and renewal and the subsequent building of the better, middle-class housing later in the century relied on a complex network of sources (including borrowing on the security of *feu* duties and their 'farming').

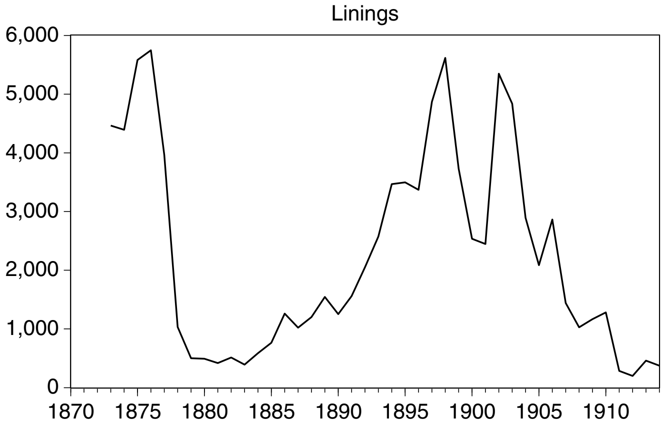

Fig. 6.3 Housing permits in Glasgow, 1873–1914 (nos.) (*Source*: Cairncross (1934, Table I))

Cairncross's analysis draws on records from planning permissions (known as linings, shown in Fig. 6.3), historical rental, vacancy rates and demolition data. His evidence supports the thesis of excessive market volatility; in particular, he links rents to vacancies and to building levels. He also makes the point that, increasingly, municipal policies and non-building institutions involved in the built environment further exacerbated building capacity and cyclical volatility.

Cairncross's data allow the estimation of an equation for linings, using similar explanatory variables to those employed in modern studies of housing construction in order to quantify the effects of the key factors. Modern approaches are discussed in more detail in Chap. 7. Linings are regressed on market rents, construction costs and borrowing costs, measured by the interest rate on long-run government bonds. The latter is taken from the Bank of England's data base and the results are set out in Appendix 1. The key findings are that, first, the *level* of rents had no significant effect. In other words, even in nineteenth century Glasgow, the price elasticity of housing supply was low or even zero[4]; second, the *growth* in rents had a major significant effect on linings; third, increases in interest rates reduced construction. As we shall see in the next chapter,

[4] We return to this key elasticity for later time periods in the next chapter.

although not identical, the results bear a similarity to those found on modern data, not only for the UK, but also for other countries. However, although variations in rents and monetary policy are capable of explaining a large part of the construction volatility, they cannot fully explain the major slumps, such as that in the late 1870s and 1880s.

6.5 Key Theme 3: The 1878 Banking Disaster

The 1878 collapse of the City of Glasgow bank was the last major bank failure to occur in Britain until Northern Rock in 2007. The bank had 133 branches and was heavily exposed to speculative investment in North America, India and Australasia. When it collapsed it had liabilities of £12.4 million and assets of only £7.4 million. The bank's owners had unlimited liability and 1500 customers were bankrupted including families, businesses and specific ventures associated with borrowing from the bank. There was no formal statutory external audit of banks in those days and, according to Rosenblum (1933), it later transpired that there had been gross management errors, large loans made on questionable security and that speculative investments had been made in order to make up for bank losses already incurred, with falsified balance sheets and profit and loss accounts. Its failure had both local and global consequences.

> The opinion expressed by bank managers is that a more reckless course of gambling with other people's money was never pursued by any body of managers or Directors and that such engagements as these could never have been entered into had there not been either the weakest or most wilful sanction […], coupled with a negligent system of supervision which is hardly short of criminal. (Quoted from the *New York Times* (October 3, 1878), reprinted in Rosenblum 1933)

Cairncross estimates that the Bank collapse had a major impact on Glasgow building, leading to a severe depression (see Fig. 6.3). In addition, Worsdall (1989) reports that the bank failure:

> was a disastrous event for the building industry as the bank's special interest had been the financing of builders and the encouragement of speculative

> development. In the winter following the collapse, 14,000 people applied for poor relief, which, taking dependants into account, meant that the number of destitute had reached the appalling figure of about 40,000. Architecturally, the results of the failure could long be seen in the form of many unfinished housing developments. (p. 10)

The Scottish Register of Sasines can be used to identify the occupations of borrowers from the bank. The Register, a historic and publicly accessible record of deeds, includes information on transactions governing land marked for development, the registration of ground rents, the registration of bonds (mortgages) and conveyances or acquisitions of land with buildings. The National Records of Scotland maintains Register of Sasines minute books, many of which have been scanned and digitised, stretching back to the 1600s. Searching the records is time consuming, but Table 6.6 supports Worsdall's finding that the majority of money loaned by the bank was to builders. Other borrowers were described in the Sasines data as engineers, ironmongers, manufacturers, merchants or smiths, and presumably therefore closely linked with building trades. A 10-year search window was used both before and after the collapse of the bank, revealing a quite significant concentration of activity in the period 1858 through to 1860, during which nearly £70,000 of bonds were registered. Although the bank collapsed in 1878, records mentioning the institution continue to appear for some time thereafter, sometimes referring to the Trustees of the City of Glasgow bank, sometimes

Table 6.6 The occupations of City of Glasgow bank borrowers (£)

	1856	1857	1858	1859	1860	1874–1880
Builder	–	–	39,500	10,000	18,460	7800
Clerk	150	–	–	–	–	–
Engineer	–	–	–	–	–	3600
Furnishing Ironmonger	6000	–	–	–	–	–
Manufacturer	–	–	–	–	1200	4300
Merchant	–	4000	–	–	–	10,050
Portioner	–	–	–	–	–	310
Smith	–	–	–	460	–	–
Storekeeper	–	600	–	400	–	–
Trustees	–	–	–	–	–	700

Source: Register of Sasines

to the City of Glasgow bank, and in some cases to the bank as one of a number of parties with an interest in the transaction.

These events and their consequences were also fictionalised in a series of successful novels (*Wax Fruit*) about a middle class Glaswegian family (McCrone 1947). The bank collapse had a series of enduring repercussions and the banking sector moved rapidly to limited liability as the predominant form of corporate governance. It led to the adoption of the convention for commercial banks to apply prudent capital ratios to underpin the sector's viability and to law requiring external auditing of statutory accounts. Button et al. (2015) argue that a case can be made that the City of Glasgow bank experience also contributed to the wave of mergers that went on until the First World War and resulted in a highly concentrated UK banking system.

The directors, contemporaneously described both as 'adventurers' and mediocre 'straw men', were tried in the High Court in Edinburgh (Button et al. 2015). They were found guilty: two served full 18-month sentences and five other directors served 8-month sentences (without any remission). The media and the chattering classes had a field day as several of the directors were worthies in the 'wee Free' Church, but the real damage was visited on those made destitute and the indirect impacts on the Glasgow housing system.

6.6 Key Theme 4: Long-Run Persistence in Property Values

Chapter 4 established that, in England and Australia, geology, hydrology and elevation all contribute to persistence in property values over time. The related question in this chapter is whether local spatial patterns of value established in nineteenth and early twentieth century Glasgow have any statistical modern day legacy. To answer this question, we re-examine a dataset used in Leishman (2009). The Leishman analysis was based on information provided by the Glasgow Solicitors' Property Centre, whose transactions data spanned a period from 2002 to 2006 and were suitable for traditional hedonic estimation of property values. Each data point included locational and physical attribute information for properties marketed and subsequently sold through an estate agency. By combining the transactions data with GIS (geographic information system) information and census variables, a fuller set of variables or predictors was assembled. In Leishman (2009) the estimated models were used to cluster small areas (Census Output Areas) in terms of similar hedonic coefficients, revealing housing submarket boundaries. The question we now ask is whether historic information on residential price premia has any additional value in helping to explain the contemporary spatial distribution of prices.

Figure 6.1 showed the spatial distribution of local rental values in 1881, revealed by the valuation rolls. Similar calculations were carried out for 1861 and 1911 and new variables were constructed, each consisting of small-area, mean rental values, expressed as a ratio to the city-wide mean for the three years. Therefore, three spatial indices of historic relative value are compiled and were tested as explanatory variables in a re-estimation of the 2002–2006 hedonic models reported by Leishman. The results using the 1861 and 1911 rental values are shown in Appendix 2.[5]

As the appendix indicates, individual dwelling characteristics are captured by the property type, the number of rooms, the presence of a garage and a garden. Area features include the level of poverty, captured by the Index of Multiple Deprivation and the proportion of different types of properties in each area. These location variables also capture the history of an area's development and, therefore, the extent of persistence; poverty, for example, is highly persistent as explored fully in Chap. 11. The findings are generally consistent with the wider literature; prices are, unsurprisingly, higher in the areas that are *today* classified as better-quality. More interesting, however, is the direct additional effect of relative quality a hundred years ago, although a consequence of combining recent housing transaction data with historic information on the spatial distribution of values is that many observations are lost from the modern hedonic dataset. Transactions occurring in areas undeveloped in 1861 or 1911 drop out of the analysis and, so, the results for 1861 include only

[5] The results using 1881 rental values were broadly consistent, standardising for the available observations.

2431 observations, whereas there are 9237 for 1911. Nevertheless, the results are broadly consistent and show that the historic variables have strongly significant positive effects, although the influences should not be over-stated and there is only a modest improvement in terms of equation fit. The modern characteristics remain more important, although to re-emphasise the point, historical rental values are only a partial measure of persistence, since the local area housing stocks and measures of poverty also capture path dependence. Indeed, the path dependencies expressed in terms of housing stock type, design and quality are more important in terms of explanatory power in the models summarised here, yet it is remarkable that, after accounting for these housing stock and socio-economic differences, historic patterns in property value retain some explanatory power in terms of a modern hedonic model.

6.7 In Conclusion

The economic incentives created by property law, the urban land economics of a rapidly growing city and an inherently volatile building industry laid the city's housing market open to exogenous shocks, such as the 1878 bank collapse, and to market failures as regulation and public health law struggled to keep pace with the depth of housing problems in the later nineteenth century. Moreover, several of the interventions such as redevelopment by the City Improvement Trust may have worsened the situation by removing land from housing use and by reducing the supply of available lower cost housing.

While these market conditions may have created the circumstances that, allied to the urban impacts of war in 1914, ended with the rent strikes and their legacy, it is a bigger stretch to argue that the precise form of municipal large scale council housing that came to dominate the city arose from these configurations of circumstances. Nonetheless, economic arguments can be deployed to help us explain how this constellation of forces came about, that it had perverse and unintended consequences and led a confident municipal Corporation to confront its housing problems with laws and regulations, followed up by innovative housing experiments.

Central to the story are the economics of property rights and the land economics of the tenement. This suggests a fascinating combination of institutional economics and spatial analysis of urban land. Political and business networks and the way they organise and evolve are also critical variables, as is clear from the discussion both of the building sector and the City Improvement Trust. The non-profit interplay between the business, voluntary and state sectors around the Trust underscores the economics of philanthropy and self-interested altruism. The dysfunctional market and repeated attempts to regulate and mitigate various problems of market failure (most obviously public health externalities), require a consideration of the efficiency of state responses and the utility of the original diagnoses on which policies were based, including ideological and moral attitudes to the nature of intervention.

The analysis of Sasines data confirms the role of banks in the construction boom, which showed the rapid expansion of activity by the City of Glasgow bank in the decade leading up to its collapse. Cairncross (1934) emphasised the collapse in contributing to the construction slump that followed the boom of the 1860s. Using Cairncross's data, the chapter showed that similar variables to those used in modern models can explain much of the building volatility in the second half of the nineteenth century. Furthermore, the impact of the bank collapse had consequences far beyond Glasgow in terms of long-lasting changes to bank regulation and structure.

One must be careful not to seek out simple or reduced form explanations of a set of developments viewed from our present time perspective; this basic error of history is all too easily adopted. Our evidence is patchy and one imagines politicians, bureaucrats and business people struggling with the wicked problems of the city, seeking out ways to make small and larger improvements in the name of progress, religion and economy. One major contrast with similar challenges facing the council post-1945, for instance, was that the scale of resources, the planning powers and the will to redevelop was so much greater in the more recent period. While our Victorian and Edwardian counterparts might have confronted seemingly intractable problems, they did not have the wherewithal or the political imperative to address them on the scale that followed in the 1950s and 1960s.

Fundamental to the chapter is the notion of path dependency—that earlier decisions lock in future possibilities and constrain options. Clearly, earlier development decisions continue to constrain choices, in some cases, to the present day. This has, partly, been examined through the modern lens of housing submarkets as a key concept from the housing economics literature. It is generally accepted in the literature that submarket boundaries change over time, but when a number of studies of Glasgow spanning several recent decades are considered together, the suggestion is that while boundaries move back and forth, there remain persistent submarket effects. Furthermore, this chapter finds that, over a longer time span, submarket effects or path dependencies stretch even further back into Britain's urban past than previously thought. It is clear that the spatial patterns of value evident in the late nineteenth and early twentieth centuries retain some predictive power in statistical models of house prices based on recently collected data.

6.8 Appendix 1: Modelling Linings 1874–1914

The data provided in Cairncross (1934, Tables 1 and 5), supplemented by information from the Bank of England on interest rates, provide the basis for a simple model of 'linings' (house building permits) for the period prior to the First World War. The basic dynamic model is given by (6.1a), which allows for both levels and difference effects:

$$\begin{aligned}\ln(\text{LININGS})_t &= b_1 + b_2\ln(\text{LININGS})_{t-1} + b_3\ln(\text{RENT})_{t-1} + \\ &\quad b_4\Delta\ln(\text{RENT})_t + b_5\ln(\text{COST})_{t-1} + b_6\Delta\ln(\text{COST})_t + \\ &\quad b_7(R)_{t-1} + b_8\Delta(R)_t + \varepsilon_t \end{aligned} \tag{6.1a}$$

LININGS = number of linings
RENT = average rent of houses (£)
COST = masons' wages per hour (pence) or average cost per room (£)
R = yield on long-term government bonds (%)
ε = error term

Δ = first difference operator
t = time subscript
ln = natural logarithm

RENTS are taken from Table 5 of the Cairncross paper and we splice the data for average rents on *occupied* houses (1873–1890) and *all* houses (1891–1914). Missing data mean that observations for 1891–1894 and 1896–1900 have to be interpolated.

Final results, excluding insignificant variables, are given in the second column of Table 6.7. In fact, both measures of costs, in levels and differences, are insignificant, possibly reflecting the fact that general inflation was modest over this period. Importantly, the *level* of rents is also insignificant, so that the price elasticity of supply in levels is equal to zero, but the *growth* in rents has a strong effect with an elasticity of more than eight. Interest rates also have a significant effect. The high coefficient on the lagged dependent variable indicates slow adjustment to the long-run state, but is also likely to be indicative of missing variables in this simple specification.

Although the equation appears to explain a high percentage of the volatility of construction, based on the R^2, the equation standard error is high at around 40 %. As a modern comparison, the standard errors in Ball et al. (2010) are approximately 10 %. The second equation in Table 6.7 uses the percentage of houses that are vacant (VAC) as a regressor. Its inclusion reduces the significance of rents because of a strong negative relationship between rents and vacancies. Note, however, that data gaps reduce the estimation period. Finally, unsurprisingly, neither equation can fully explain the post-1878 slump associated with the City of Glasgow bank collapse.

Table 6.7 Modelling the number of linings

	$\ln(\text{LININGS})_t$	
	1874–1914	1874–1914 ex. 1891–1899
Constant	3.132 (3.0)	4.355 (4.3)
$\ln(\text{LININGS})_{t-1}$	0.737 (8.4)	0.535 (4.9)
R_{t-1}	−0.474 (2.2)	–
$\Delta\ln(\text{RENT})_t$	8.819 (2.2)	–
VAC_{t-1}	–	−0.160 (4.0)
R^2 (adjusted)	0.80	0.82
Equation standard error	0.43	0.40

t-values are in brackets

6.9 Appendix 2: Hedonic House Price Equations (Table 6.8)

Table 6.8 Modelling house prices in Glasgow

	Dependent variable = ln(house price)	Coefficient	*t*-value	Coefficient	*t*-value
	Constant	11.104	134.3	10.884	239.7
Rental values	ln(rental value 1861)	0.056	6.5		
	ln(rental value 1911)			0.035	4.8
Property types	Conversion (dummy)	0.313	6.0	0.384	13.4
	Terrace (dummy)	0.188	3.0		
	Flat (dummy)			0.081	4.2
	House (dummy)			0.211	9.1
	Bungalow (dummy)			0.487	5.7
No. of rooms	Number of bedrooms	0.417	12.1	0.315	20.6
	Squared number of bedrooms	–0.047	–6.1	–0.023	–7.4
	Squared number of public rooms	0.067	6.8	0.058	16.6
Property characteristics	Garden (dummy)	–0.059	–3.0	–0.024	–2.5
	Garage (dummy)	0.207	5.9	0.083	5.0
	Central heating (dummy)	0.110	5.8	0.126	12.4
	Double glazing (dummy)			–0.032	–3.5
Area characteristics	% properties in output area with 1 room	–0.006	–3.1	–0.005	–4.3
(2011 census)	% properties in output area with 2 rooms	–0.003	–3.3	–0.003	–6.8
	% properties in output area with 5 or 6 rooms	0.002	2.8	0.001	2.2
	% properties in output area with 7+ rooms			0.006	10.7
	% properties in output area that are privately rented	0.003	6.1	0.005	15.2
	% properties in output area that are detached	0.021	3.9		

(continued)

Table 6.8 (continued)

	Dependent variable = ln(house price)	Coefficient	*t*-value	Coefficient	*t*-value
	% properties in output area that are terraced			0.002	5.8
	% properties in output area that are flats	0.003	5.5	0.004	10.6
Index of Multiple Deprivation	IMD score	−0.011	−24.3	−0.009	−35.0
	IMD housing domain score	−0.004	−5.6	−0.002	−9.0
	Number of observations (*N*)	2431		9237	
	Adjusted R^2	0.699		0.677	
	Equation standard error	0.351		0.354	

Equations include yearly dummy variables for 2001–2005

The default category for property type is semi-detached houses. Of the census variables, the proportion of properties that are semi-detached is omitted

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7

Building Our Way Out of Trouble

The First World War rather than the Second marked a watershed in housing policy in terms of the increase in the resources going into housing, in public expenditure, and in progress in improving housing conditions. The low level of house building in the years before 1914 at a time when large numbers of households did not have a separate dwelling is strong evidence that a combination of socially determined minimum standards and a near exclusive reliance on private enterprise, unaided by subsidy, was unworkable with the level and distribution of incomes at that time, and the housing standards that were set.

Department of the Environment (1977, p. 45)[1]

7.1 Introduction

Economists almost unanimously agree that increasing housing supply should be a fundamental part of policies to improve affordability and to reduce housing market volatility. However, attempts to raise construction

[1] The Department of the Environment's 1977 Housing Policy Review provides valuable information on the development of housing policy up to the date of its publication and is particularly used in Sects. 7.2 and 7.3.

G. Meen et al., *Housing Economics*,
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through public intervention are not new and date back to at least the late nineteenth century. As the opening quotation suggests, construction underwent a step change after the First World War; despite boosts to housing in the 1870s and between 1896 and 1908, in general, the country only invested between 1 % and 2 % of GDP in housing prior to the war. Furthermore, from the post-Great War period onwards, despite major fluctuations over the cycle, Britain has never *permanently* raised output beyond the step change. The absence of an upward trend in construction appears to be a feature of other countries as well and raises questions about the feasibility of increasing supply and the wider macroeconomic consequences should an increase be achieved. Is increasing supply a pipe-dream or a target that can be realistically achieved?

Chapter 5 showed that local authorities had powers to undertake building prior to the First World War, although, at that stage, numbers were modest and only approximately 20,000 homes were built before the war, heavily concentrated in London. Most homes were therefore constructed by the private sector for rent, but unsubsidised rents were beyond the means of many working-class households, whereas affordable rents did not produce sufficient returns to encourage housing shortages to be eliminated. Between 1911 and 1921, the number of households relative to the number of dwellings rose by approximately half a million (Department of the Environment 1977, Table I.11). Rent controls and security of tenure were introduced in 1915, originally as a temporary war-time measure to prevent spiralling rents caused by the housing shortage, but, despite subsequent variations in the conditions, were not finally abolished until the 1980s, with long-lasting consequences for the rental sector.

The provision of central government building subsidies for the first time, for both local authorities and the private sector after the Great War, recognised the fundamental problem and, in different forms, the principle that subsidies should be provided to meet sufficient of the expenditures not covered by rents, without imposing a heavy burden on the rates, guided policy through to the early 1970s. The inter-war period also saw a rapid expansion in suburban building in England and higher accommodation standards (typically in the suburban semi-detached home and influenced by the Tudor Walters construction standards), accompanied by population outflows from the inner cities, housed both in the municipal sector and through growth in owner occupation. The early 1930s saw a higher level of private construction than has ever taken place since and house building played a major role in leading Britain out of the Great Depression. In addition, slum clearance took on a new momentum during the 1930s with the provision of subsidies. Although suspended during the Second World War, slum clearance expanded rapidly between the 1950s and 1970s. Later, improvement grants were introduced for sub-standard homes. Even in 1947, it was still the case that only 50 % of households had sole use of a fixed bath and only 36 % had piped hot water to a bath, sink and hand basin (Department of the Environment 1977, p. 32).

The first part of the chapter is primarily descriptive, including a summary of the policies and legislation that affected building at both national and local levels, following on from the early legislation described in Chap. 5. This includes the development of town and country planning, which was linked to the post-First World War suburban expansion, leading to a series of Acts and eventually to the 1947 Town and Country Planning Act. The Green Belt and the 1947 Act were still important influences on more recent legislation in 2011 and 2012.

The second part of the chapter provides an introduction to segregation, using the New Towns as examples; the discussion is widened in later chapters. The third part is concerned with analysis of the long-run trends and volatility in construction revealed by the data. The analysis has two main dimensions: first, from the above, the discussion is couched in terms of whether higher levels of building, consistent with modern targets, are ever likely to be achieved over long periods, given the evidence of history. The second deals with volatility, booms and busts; the crash in Glasgow in the late nineteenth century, following on from the collapse of the City of Glasgow bank, was discussed in the last chapter, but the broader national and local pictures are considered here over longer time periods.

7.2 Key Tends in Construction and Post-First World War Legislation

The 1919 Housing, Town Planning, &c. Act, known as the Addison Act, aimed to address the severe housing shortage immediately after the Great War and to provide 'Homes Fit for Heroes', also stimulated by the poor physical condition of working-class soldiers observed during the war. The

Act provided government subsidies for local authorities to build 500,000 homes over a three-year period and marked the beginnings of the expansion in council housing that was to take place over the twentieth century. In practice, the impact of the early 1920s recession led to cuts in funding and only 213,000 homes were completed under the Act. A series of further Acts extended government involvement in the 1920s: the 1923 Chamberlain Housing Act provided subsidies to private builders; in fact 43 % of new private sector homes built between the end of the war and 1930 attracted subsidy, mainly in the form of a £75 capital subsidy per dwelling (reduced to £50 in 1927). This may now seem small, but it amounted to between one-sixth and one-seventh of the cost (Department of the Environment 1977, p. 8). In the 1930s, the volume of private construction heavily outweighed that produced by local authorities and is widely regarded as a key factor in bringing the country out of the Great Depression, peaking at 287,000[2] units in 1934/1935; this level has never been achieved since. Broadberry (1987) discusses the influences of demographic changes, rising real incomes for those in employment, falling land and building costs, and the availability of cheap money. He argues that cheap finance, associated with the fall in government long-term bond yields between 1932 and 1935, accounted for approximately 50 % of the investment growth, transmitted through finance provided by building societies. Under this view, building societies largely played a facilitating role; since their own deposit rates were 'sticky', falling bond yields led to strong deposit inflows, to an excess supply of funds, and to reduced mortgage rates and easier terms in order to encourage mortgage demand and owner occupation. Humphries (1987), however, argues that societies were not passive actors and in fact adopted an aggressive stance to mortgage provision and to the expansion of owner occupation. Scott (2013, p. 17) notes that societies and speculative builders had particularly close relationships. Humphries points out that the increased inflow of building society deposits preceded the cheap money era and was especially strong during the 1920s, aided by beneficial tax advantages under the composite tax rate arrangements and its predecessors.

[2] The figure is for England and Wales. See Holmans (2005), Table B.6.

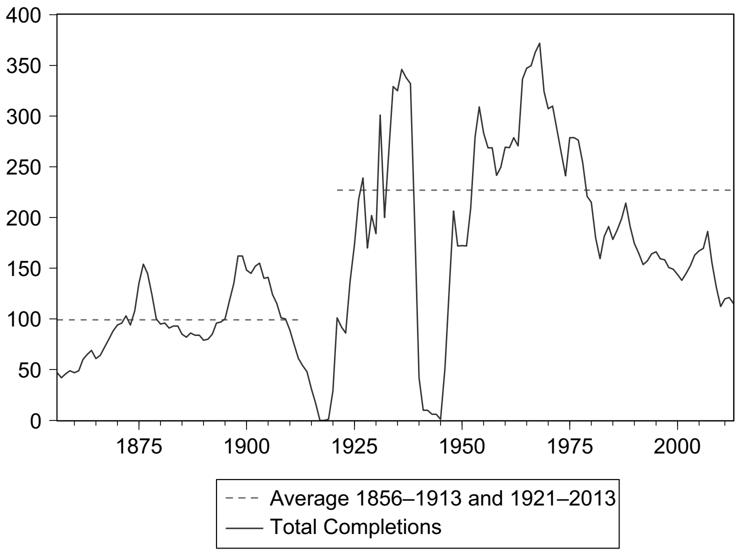

Fig. 7.1 Total housing completions (England and Wales (000s), 1856–2013) (*Source*: Holmans (2005) and Department of Communities and Local Government for later years)

Between 1925/1926 and 1938/1939, total housing completions (both private and public sector) averaged approximately 260,000 per annum (England and Wales) and UK housing investment accounted for 3.5 % of gross domestic product (GDP) (Figs. 7.1 and 7.2). It is sometimes argued that modern housing programmes need to be of a similar order of magnitude to improve affordability (see, for example, National Housing and Planning Advice Unit 2008), but the special circumstances of the 1920s and 1930s need to be borne in mind. There is a difference between the achievement of high levels of construction in periods of recession with spare capacity and the maintenance of permanently high levels of construction covering periods of full employment. We return to this theme below.

The 1924 (Wheatley) Housing Act gave further subsidies to local authorities, which were to continue through to the 1972 Housing Finance Act[3]; the 1930 (Greenwood) Act allocated grants to local authorities to

[3] Building subsidies for private construction were not made available after the Second World War.

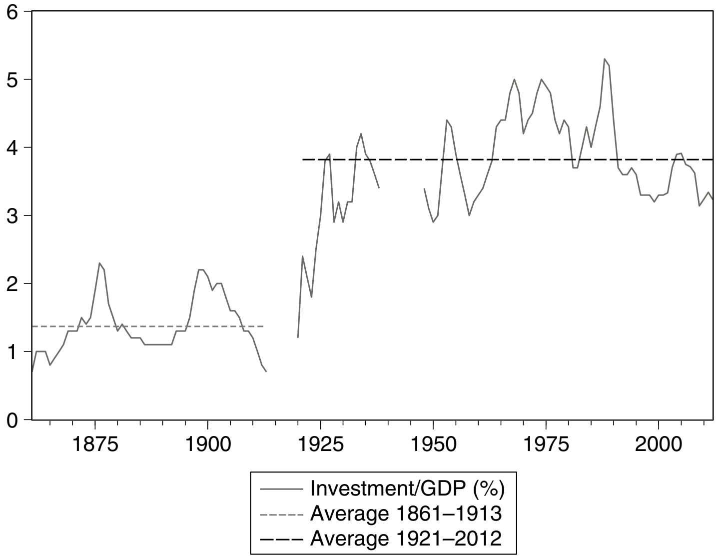

Fig. 7.2 Housing investment as a percentage of GDP (UK, 1861–2012) (*Source*: Holmans 2005)

demolish all remaining slums and rehouse the inhabitants. As illustrated in Fig. 5.1, demolitions were much larger than under the nineteenth century Acts and were only exceeded by those after the Second World War. The overall effect of the different pieces of legislation is evident in the sharp rise in completions in Fig. 7.1, made up not only of council building, which expanded by more than a million homes in the inter-war period, but, as noted above, also through an expansion of private building particularly concentrated on the suburbs.

7.3 Post-Second World War Building

Britain emerged from the Second World War with further housing shortages; in the Inner London boroughs alone, 10.5 % of the housing stock was destroyed or damaged by bombings in the Blitz (London Topographical Society 2005, Table 5) and the pre-war slum clearance programmes were far from complete. Although controls on private building were to remain in place until 1954, public housing programmes expanded rapidly, with public construction averaging 176,000 dwellings per annum between 1948 and 1955. The role of New Towns, following the 1946 New Towns Act, is discussed below. Furthermore, due to the subsequent increase in private construction, total completions in England and Wales averaged 300,000 per annum between 1954 and 1970. Figure 7.1 shows that construction reached a peak of 372,000 in 1968, the highest on record, with strong contributions from both the public and private sectors. It might appear that, since the country was able to construct at these levels in the 1950s and 1960s, there is no reason why current housing shortages should not be eliminated. However, some care is needed in reaching this conclusion. First, the 1960s coincided with the peak of the slum clearance programme, so that the net increase in the housing stock was considerably lower than completions, rising approximately at an annual average of 220,000 per annum between 1951 and 1970 (Holmans 2005, Table B.17). Second, between 1954 and 1970, public construction added, on average, 140,000 dwellings per annum in England and Wales, backed by strong capital expenditure programmes. Similarly, the sharp fall in construction since the 1980s has been associated with a fall in pubic programmes. Housing construction in recent years has been at its lowest level since before the Second World War, but this is a result primarily of the public sector decline, not the private sector; cuts in local authority programmes were not compensated by a rise in social provision from housing associations. Third, completions record numbers of units, but not the quality or quantity of housing *services* provided by those homes. This was a period of high-rise construction, heavily influenced by modernist urban building thinking; between the early 1960s and 1990 approximately 50 % of social homes were flats, the majority of which had fewer than three bedrooms (Holmans 2005, Table B.11).

The most influential analysis of housing supply in recent years, published in 2004, was the Barker Review of Housing Supply (Barker 2004), which showed that large increases in the provision of new housing would be required to reduce the long-run growth in house prices and to improve affordability. The Report was produced against the background of Britain's decision not to join the Economic and Monetary Union (EMU) in 2003, where differences in housing market structures between Britain and other European countries were an important part of the decision. On average, between the early 1970s and 2003, the trend increase in real house prices was 2.4 % per annum, compared with a European average of little more than 1 %. The Barker Review was concerned with the ways in which housing supply could be increased to bring the growth in real prices more in line with Europe. The recommendations of the Review were wide ranging, but a key proposal was for the establishment of long-term goals for improved affordability, where regional and local planning would be more responsive to market price signals. The establishment of the National Housing and Planning Advice Unit was an outcome, although abolished in 2010 with the in-coming coalition government's movement away from regionally-based targets towards an emphasis on local decision making.

Research for the Barker Review (Meen 2005) pointed to the decline in the price elasticity of housing supply over time, in other words the responsiveness of supply to changes in house prices, consistent with the impact of land-use restrictions; the elasticity is low by international standards. We return to this issue later, but it is not entirely clear that there ever was an age in which the elasticity was high.

7.4 Suburban Building and Population Dispersion

The last section concentrated on national trends in house building; equally important were the spatial patterns of development, particularly the increasing suburbanisation that took place through the twentieth century. Much of the modern policy debate is still concerned not so much with the absolute level of house building—there is consensus that there is a shortage—but with its spatial distribution, notably between urban and green field locations. Chapter 2 illustrated how the development of London's first underground railway, the Metropolitan Line completed in 1863 between Paddington and Farringdon, ran through working class districts and displaced the poor to surrounding neighbourhoods. Therefore, initially, city overcrowding increased; this and subsequent railway developments heavily influenced population flows and house building. Casson (2009, Table 2.1) shows that Local and Personal Acts of Parliament authorising railway construction expanded rapidly from the 1830s and peaked in the 1860s.[4] A first period of railway mania took place between 1844 and 1846 and a second between 1861 and 1866: 251 new schemes were authorised in 1865 alone. New Acts declined after this period, but numbers were still significant up to the First World War. Despite strong pressure from the railway companies to extend overground networks across the capital, the building of mainline stations within the centre of London was controlled from the mid-nineteenth century, leading to the pattern of termini outside what was known as the 'Quadrilateral'. Methods were needed therefore to transport passengers from the termini to the heart of the City and the new Metropolitan Line provided the first such development. By the early part of the twentieth century, however, the Metropolitan and District underground lines had been heavily extended outwards as well.

As seen in Chap. 5, by the start of the twentieth century slum clearance programmes only had a modest impact on the housing problems of the poorest sections of cities. The expansion of the railways raised the possibility of an alternative approach to alleviating poverty, by moving workers away from the centre. Charles Booth, for example, was a strong advocate of the approach, although highly critical of the provision made by the railway companies. Nevertheless, the number of workers' daily tickets had risen from 7.2 million in 1882 to 46.7 million in 1899 (Haywood 1997, Table 4). However, the viability of commuting for the poor depended on the provision of cheap fares; although Gladstone's 1844 Railway Regulation Act provided for third class passengers to travel at a rate of 1 (old) penny per mile, its impact was limited until the 1883 Cheap Trains Act, which incentivised operators to provide workers' trains, by removing passenger duties on trains charging less than a penny a mile.

Cheap fares and network expansion affected the development of working-class suburbs. As an example, the Great Eastern company's extension to Liverpool Street in the east of the capital in 1864 led to an increase in the population of Edmonton from 10,930 in 1861 to 61,892 in 1901

[4] The Acts granted the companies compulsory powers to purchase land for railway construction, although any surplus land could not be used for associated property developments.

Table 7.1 Net additions to the housing stock and population/dwellings (London, 1871–1901)

Registration districts	Net additions to the housing stock (% change 1871–1881)	Population per dwelling 1881	Registration districts	Net additions to the housing stock (% change 1891–1901)	Population per dwelling 1901
West Ham	85.8	5.8	Hendon	74.6	6.3
Fulham	62.7	6.1	West Ham	60.7	5.8
Edmonton	59.5	5.3	Edmonton	47.4	5.4
Wandsworth	54.7	6.3	Barnet	45.9	5.4
Camberwell	53.9	6.2	Brentford	35.1	5.2
Bromley	44.3	5.4	Wandsworth	33.4	6.3
Hackney	39.7	6.4	Croydon	33.4	5
Brentford	35.3	5.3	Bromley	29.5	5.1
Hampstead	33.9	7.2	Fulham	25.3	7.1
Croydon	32.7	5.4	Richmond	23.2	4.8
Richmond	30.3	5.2	Hampstead	19.4	6.8
Barnet	27.8	5.6	Camberwell	9.1	6.8
Hendon	27.1	6.7	Hackney	7.7	6.8
Chelsea	24	7.6	St Pancras	−3.3	9.3
St Pancras	2.2	9.1	Chelsea	−5.3	7.9
St Marylebone	−1.1	9.1	St Marylebone	−12.7	8.9
Holborn	−5.6	9.3	Holborn	−16.3	9.3
Strand	−13.7	8.8	Strand	−30.7	8.2

Source: Census of Population 1871–1901

(Haywood 1997, Table 3).[5] The mobility of the population is discussed in more detail in the next chapter, but here the associated construction of new housing provides the focus of attention. Table 7.1 highlights the growth in net additions to the housing stock and population divided by the number of dwellings in sub-periods between 1871 and 1901. The maps in Appendix 1 in Chap. 5 show the locations of the Inner London districts. Net additions take into account not only new construction, but also demolitions of the stock, and conversions and changes in use, for example from or to industrial or commercial premises. The first three

[5] Haywood (1997) provides an excellent overview of the relationship between housing, transport and planning.

columns use a sample of Registration Districts in London and the surrounding areas for 1871–1881 and are ranked according to their rates of construction. At the maximum, dwellings in West Ham to the east of the capital grew by 85 % over the 10 years. All the areas that experienced rapid growth were in the outer districts and benefited from the railway network expansion; at the other extreme, central Strand and Holborn were losing dwellings. The final three columns take the same districts and rank them according to growth between 1891 and 1901. The same broad pattern still emerges with an even faster decline in the stock in the central areas as commercial development took over. The table also shows that, although the population per dwelling was lower in the suburbs than the centre, the rapid expansion of new building in the suburbs up to 1901 only had a limited effect because the growth was accompanied by a similar increase in population.

Despite increasing competition from other forms of motorised transport, the involvement of the railways in the development of housing estates remained important up to the First War and beyond. The term 'Metroland' was coined in 1915 and referred to the suburban areas in north and west London, serviced by the Metropolitan Railway Company.[6] Unusually, the company was allowed to retain surplus land for property development, leading to ribbon developments along its lines. Through a subsidiary company, estates were developed in Neasden, Wembley Park, Pinner, Rickmansworth and Harrow. The Acts governing the other railway companies did not permit the use of surplus land for housing, but co-operation with developers led to similar results in other directions outwards from London, aided by improvements to the quality of services, such as electrification of the lines. Haywood (1997) shows that routes to Orpington, Sutton, Dorking, Guildford and Windsor were all electrified by 1930 and reached the south coast during the 1930s. Housing expansion was by no means limited to the private sector; Sect. 7.2 discussed the importance of the 1919 Housing Act, which also allowed the London County Council to build outside its boundaries. The best-known example, Beacontree, was constructed to the east of London between 1921 and 1935, becoming the largest

[6] Sir John Betjeman wrote and narrated a BBC documentary on Metroland in 1973.

social housing estate in the world, and involved the construction of almost 28,000 homes by its completion. The development was built as part of the commitment to 'Homes Fit for Heroes' and rehoused residents from the East End slums, although it was still the case that the level of rents meant that most residents were from the relatively prosperous working class. Nevertheless, the mono-tenure nature of the scheme and consequent social segregation was a characteristic that the later new towns attempted to avoid.

The period before and immediately after the First World War also saw the development of the Garden City Movement, an approach to urban planning advocated by Ebenezer Howard in the late nineteenth century. Letchworth was founded in 1902 and Welwyn in 1919. Hampstead Garden Suburb, established by Henrietta Barnett in 1906, was a residential area rather than a city with full facilities and industry, but was heavily influenced by the principles of Garden Cities. In 1919, the Garden Cities and Town Planning Association adopted the definition as; 'a town designed for healthy living and industry of a size that makes possible a full measure of social life, but no larger; surrounded by a rural belt, the whole of the land being in public ownership or held in trust for the community' (quoted in Ministry of Housing and Local Government 1968). The aim of both Garden Cities and, indeed, Hampstead Garden Suburb was that access should be for a mix of social classes and income groups. The difficulty in maintaining truly mixed communities is discussed below and is a theme of Chap. 11.

The outward growth of the underground network continued through the 1930s, but the associated expansion in the London suburban population and light industries contrasted both with those who believed that growth should be based around satellite towns, such as Garden Cities (with a reduced need for rail transport into London) and those who pointed to the decline of northern industrial cities and the unbalanced nature of growth. The Royal Commission on the Distribution of the Industrial Population (the Barlow Commission) was established in 1937 to consider the disadvantages of concentration and to propose remedies. Among its many recommendations, the Commission proposed the dispersal of population to peripheral new towns.

Just as Sir Christopher Wren had produced ambitious plans for the rebuilding of London in the wake of the Great Fire, the Second World War and the destruction of significant parts of London in the Blitz gave rise to the opportunity for a reconsideration of the future structure of the capital. However, the 1943 County of London Plan and the broader 1944 Greater London Plan developed by Sir Patrick Abercrombie needed to address the immediate housing shortages created by the War as well as the longer-term strategic design of the city. His plan recommended four rings in order to control urban sprawl—an inner urban ring, a suburban ring, a greenbelt ring with restrictions on development and an outer ring containing satellite towns to take population from the city.

The full recommendations of the plan were never realised, but both the Green Belt and satellite towns became important features of post-Second World War planning. As noted above, concern had already been expressed in the 1930s about the sprawl associated with suburban and industrial developments. Broadly, ownership of the land conveyed the right to develop; prior to the Second World War few local authorities had planning schemes in operation. The 1947 Town and Country Planning Act (and the 1946 New Towns Act) provided the basis for post-war planning legislation until the 1990 Town and Country Planning Act, the 2008 Planning Act and the 2011 Localism Act, coupled with the 2012 National Planning Policy Framework. The 1947 Act stated that land development should not take place without permission from local authorities and also required local authorities to develop plans. Authorities were given the power to use compulsory purchase either to develop land themselves or to sell to private developers. Since development values were now invested in the state, although subsequently abolished, a development charge was payable to capture uplift in property values. The idea of the Green Belt was developed in the 1930s, but its roots lay in the Garden City Movement and also appeared in the Abercrombie Plans. The 1947 Act permitted authorities to incorporate Green Belts into their development plans, although the legislative formalisation did not occur until 1955. Its provisions continue to attract considerable controversy, because of the potential economic costs and delays imposed by the restrictions; these are extensively discussed in Cheshire et al. (2014). Of the more recent pieces of legislation, section 106 of the 1990 Town and County Planning Act allowed planning agreements between local authorities and developers, where the latter could contribute to the external costs of development, such as infrastructure provision. Section 106 also became an important mechanism through which social housing was incorporated as part of private housing developments. The 2008 Planning Act was intended to speed up processes for agreeing major infrastructure projects, establishing an Infrastructure Planning Commission (abolished in the 2011 legislation) and introduced a Community Infrastructure Levy through which a proportion of an increase in land values arising from the granting of planning permission would be used to finance local infrastructure provision such as schools. Delays in development caused by planning regulations have been a regular concern and the 2012 National Planning Policy Framework established a presumption in favour of sustainable developments, so that local authorities were required actively to promote development. Planning permission would only be refused where the benefits were outweighed by the costs set out in detailed strategic local development plans. In turn, local plans should reflect national priorities as well as local needs and where the criteria are met, permission should be granted without delay. Plans were expected to take account of market signals, such as land prices, in assessments of housing requirements, an approach recommended in the 2004 Barker Review, noted above and were also required to provide an assessment, possibly in conjunction with neighbouring authorities, of the need for market and affordable housing and to identify sites that could provide five years' worth of housing. The approach moved away from the Regional Strategies that had previously been in place, where required housing was determined at a higher central level and cascaded down to lower levels. The wider concern with local empowerment was enacted in the 2011 Localism Act, delegating a range of functions to local authority and neighbourhood levels. This included neighbourhood planning, allowing communities to have an input into the location of new housing developments and granting a community right to build. Such schemes were, however, required to be consistent with national planning policy.

7.5 New Towns, Tenure and Segregation

By the early 1960s, 21 New Towns had been established in Britain in two waves, eight of which were in the London ring, eight in other areas of England, four in Scotland and one in Wales. The earlier Becontree estate had been almost exclusively built by the London County Council for working-class housing, but broadening the social mix was an important concern of the New Towns. Nevertheless, in 1966, the proportion of owner-occupied housing was generally modest. In the London ring, Crawley had the highest percentage at 26 %, but was only 9 % in Harlow; percentages outside London were generally higher with 54 % in Runcorn, Cheshire. A further wave of six New Towns was established between 1967 and 1970[7]; although no New Towns have been formally established since 1970, plans for Eco-Towns were put forward in 2007 and plans for new Garden Cities were announced in 2014 for Kent and Oxfordshire.

The initial modest levels of home ownership in the New Towns need to be seen in the light of the national picture; owner occupation in England overall stood at only 50 % in 1971, but tenure and patterns of segregation changed over time. Table 7.2 shows the proportions of households, who were home owners in each of the New Towns[8] around London in the four census years 1981–2011. The 1980 Housing Act marked the introduction of the Right-to-Buy programme, where local authority tenants gained the right to purchase their properties at discounted prices. This is discussed further in Chap. 10, but it led to sharp increases in home-ownership rates in subsequent years, including the New Towns. New Town households in ownership had already risen by 1981, although they were still below the English average and remained particularly low in Harlow. Ownership rates rose further in 1991 and 2001 and, by the latter date, had reached levels similar to the national average of 69 %. However, following the national decline, ownership had fallen strongly in the New Towns by 2011.

[7] Milton Keynes, Peterborough, Northampton, Warrington, Telford, Central Lancashire.

[8] The table uses the relevant local authority district for each New Town.

Table 7.2 Tenure and segregation in the New Towns

New Towns	Home ownership (%)				Dissimilarity Index	
	1981	1991	2001	2011	1981	2011
Bracknell Forest	47.4	64.4	73	69.6	0.531	0.363
Milton Keynes	49	65.5	70.4	63.9	0.626	0.386
Crawley	39.9	58.6	68.3	60.5	0.545	0.321
Peterborough	51.7	61.2	66.4	60.1	0.622	0.404
Basildon	53.2	65.7	70.6	66.9	0.595	0.454
Harlow	23.4	47.2	59.6	57	0.422	0.293
Hemel Hempstead	52.5	63.5	70.4	65.4	0.511	0.373
Welwyn Hatfield	41.8	58.8	63.9	58.2	0.611	0.447
Corby	30.1	55.1	62.7	62.6	0.518	0.334
Stevenage	34.9	53.6	63.2	59.5	0.359	0.305
Northampton	60.9	66.7	71.9	63.9	0.649	0.458

Source: Census of Population and authors' calculations

In aggregate, ownership rates in the New Towns are now broadly similar to other local authority districts, but it might still be the case that the patterns of segregation *within* the New Towns differ, given the original intention to promote integration. Segregation is a multi-dimensional concept as discussed in Massey and Denton (1988), but the most commonly-used measure in the literature is the Index of Dissimilarity. The measure is not without its critics, but compares the percentage of minorities in any local area relative to the majority percentage. More precisely, the index is a measure of the percentage of a given minority who would need to move across boundaries in order to obtain a perfectly even distribution of that group across a city. The index has traditionally been used to analyse racial concentrations, but can be applied to other socio-economic variables as well, including tenure. Here, we compare owners against non-owners and therefore aggregate social and private renters. Formally the index is set out as Eq. 7.1; the value of the index ranges between zero and one, where a value of zero suggests that every area within a town has the same minority distribution, but a value of one implies complete segregation into one area. Massey and Denton suggest that, for ethnicity, a value of less than 0.3 indicates low segregation and segregation is high above an estimate of 0.6. However, as Abramson et al. (1995) note, measures based on income rather than race typically produce much higher estimates. Meen et al. (2005) find high values for tenure-based segregation lie in the range 0.45–0.55.

$$DI = 0.5\sum_{i=1}^{N}\left|\frac{m_i}{M} - \frac{nm_i}{NM}\right|, \tag{7.1}$$

DI = Index of Dissimilarity
m_i = Number of minority group members in area (i)
nm_i = Number of non-minority group members in area (i)
M = Total number of minority members in the town
NM = Total number of non-minority members in the town

The results are dependent on the size of the local spatial units and are usually constructed for pre-determined administrative entities for which data are readily available. Here, estimates of the Dissimilarity Index are constructed for the New Towns in 1981 and 2011; for the former (i) is defined by the Enumeration Districts, but for the latter, Output Areas are used, since enumeration district-based data were not published in 2011. Both are small areas; average household numbers in the New Town Output Areas in 2011 were approximately 125, compared with an average of 170 in the 1981 Enumeration Districts, but the change in definition needs to be borne in mind. Nevertheless, in 1981, from Table 7.2, the average value of the Index across the New Towns stood at a substantial 0.54 and was particularly high in Northampton, Milton Keynes and Peterborough. By 2011 the Index had fallen sharply to an average 0.38, suggesting a reduction in segregation, although this, of course, at least partly reflects the rapid rise in ownership between 1981 and 2011. The simple correlation between the change in the Dissimilarity Index and the change in the home ownership rate between 1981 and 2011 was −0.35. The policy of promoting home-ownership in the 1980s as a means of developing a more inclusive society appears to have had some success at this level in the New Towns.

7.6 Achievable Construction: Lessons from History

Housing conditions have obviously improved over the last one and a half centuries, but some concerns are recurrent, notably problems of affordability and housing supply. The view that Britain needs to produce more homes to alleviate shortages runs through the history of housing policy. Estimates suggest that net additions to the housing stock now need to be in the order of 250,000 to 300,000 dwellings per annum in England if affordability is to be improved (National Housing and Planning Advice Unit 2008). This is rather faster than the expected growth in the number of new households and takes into account increased demand for housing services by existing households as their income increases over time. Formally, Meen and Andrew (2008) show that if the income elasticity of housing demand is greater than the price elasticity—and there is evidence to support this—then affordability, measured by the ratio of house prices to earnings, will worsen unless net additions to the housing stock rise faster than the number of new households. We return to this condition in Chap. 10 but, because the number of new households formed each year is dependent on the state of the economy and is not purely determined by demographics, worsening affordability leads to more sharing and remaining with parents for longer. Cairncross (1934) notes the housing adjustments that took place in the 1870s, following the Glasgow market collapse discussed in Chap. 6:

> It was notorious that in the slumps of the 'seventies and 'eighties the unemployed crowded together, with their relatives, or in lodging-houses, or even under haystacks and hedges. … The effect on the marriage-rate was also substantial. In the two years 1877–9 the number of marriages concluded fell from 4943 to 4180, while the dissolution of marriages by death probably gathered speed. (p. 5)

The view that, since completions approached 400,000 per annum in the mid-1960s, current requirements could be met gives rise to two confusions. First, from Sect. 7.3, net additions to the housing stock, which is the more relevant variable, never reached these levels in the 1960s. Second, 250,000–300,000 dwellings represent a *permanent* annual requirement in order to improve affordability, whereas 400,000 dwellings were built for only a temporary period. Increases in construction have been achieved for limited (although in some cases extended) periods, particularly during a recession when there were unemployed resources available (construction is labour intensive and can be used counter-cyclically), but permanent rises, including over periods of full employment, imply resource costs for the economy as a whole, due to a switching of output from other sectors. An important strand of the international literature in the early 1980s suggested that too many resources were, even then, devoted to housing because of the tax advantages, diverting activity away from 'more productive' investment in manufacturing (see, for example, Hendershott and Hu 1981). This was probably less relevant in the UK at the time, but a shift of resources from higher productivity manufacturing to lower productivity construction reduces the overall economy growth rate, unless the indirect effects of housing shortages are severe, which may, indeed, be the case as Cheshire et al. (2014) discuss fully.

It is helpful to distinguish the trend from the cycle in construction. Ball et al. (2010) point to the unusual time-series properties of private housing starts (or completions) in Britain, the US and Australia. The key feature is that in each case the measures have no upward or downward post-Second World War trend; formally they are stationary processes.[9] Nevertheless, the variables are still highly volatile and, as Fig. 7.1 shows, similar results hold over much longer periods for England and Wales. This figure concentrates on total housing completions, rather than those produced only by the private sector, because an extensive literature suggests that public sector construction may, at least partly, crowd out private building.

Formal tests for stationarity in England and Wales confirm that, as suggested by the quotation at the start of the chapter, the main structural shift in resources going to housing was after the First World War, not the Second.[10] The estimated long-run levels for the two periods are plotted in Fig. 7.1. Allowing for the collapse of completions during the wars, on average, construction between 1858 and 1913 was approximately 100,000 dwellings per annum, but between 1921 and 2013, this rose

[9] In the US, the NBER Macro History data base shows that the level of housing starts was much lower between 1900 and 1940 than in the post-war period, although, there was little trend pre-war. However, starts were heavily hit by the Great Depression when single-family starts fell from 436,000 in 1928 before the collapse to 76,000 in 1933 at the bottom of the slump. From Fig. 7.1, Britain did not experience a construction slump in the Great Depression.

[10] From 1921–2013 (allowing for the Second World War), an Augmented Dickey Fuller test yields a value of −5.4 (the 5 % critical value is −2.9), but the test suggests non-stationarity before the First World War.

to approximately 230,000 dwellings per annum. The graph reinforces the fact that there was no upward or downward trend in construction from 1921 onwards. Despite the major differences in policy environments, including inter-war subsidies to private as well as public housing, New Towns and more restrictive post-war planning controls, following temporary cyclical shocks, levels of construction reverted to the mean of 230,000 per annum. Housing volatility was high and major crashes were experienced, but these do not appear to have been sufficient to shift output to a permanently different level. Nevertheless, it is noticeable that construction has been below the long-run level since the 1980s.

It is not clear that post-Second World War construction was restricted by the new planning controls to lower levels than in the inter-war period; rather they hindered construction from meeting the increase in demand that occurred as the economy improved, given the high income elasticity of housing demand (relative to the price elasticity). Meeting that demand would have required an increasing proportion of GDP being devoted to housing, which, as noted above, has resource implications, particularly in periods of full employment. The share of housing investment in GDP for the UK is plotted in Fig. 7.2 between 1861 and 2013, with breaks for the First and Second World Wars, when little housing construction took place. The data are taken primarily from Holmans (2005, Tables M1–M3), updated for the more recent national accounts information. Holmans notes the approximations necessary to construct the series in the early periods, but the general picture appears plausible and is consistent with the evidence from completions. Again, there is little evidence of any upward or downward trend since the 1920s.

7.7 Booms, Busts and Volatility

Volatility in international real estate markets is evident in the data from the nineteenth century onwards. Chapter 6 described the causes in Glasgow, whereas Fisher (1933) and Simpson (1933), for example, describe the historical causes and consequences of US speculative booms and slumps. Discussing the Great Depression, Simpson states that,

> … we can safely say this much: that real estate, real estate securities, and real estate affiliations in some form have been the largest single factor in the failure of the 4800 banks that have closed their doors during the past three years and in the "frozen" condition of a large proportion of the banks whose doors are still open; and that as the facts of our banking history of the past three years come to light more and more, it becomes increasingly apparent that our banking collapse during the present depression has been largely a real estate collapse. (p. 165)

The lessons were not learned in the 2008 Global Financial Crisis. In addition, Eichengreen (2015) describes the speculative errors that led to the first US residential market collapse in Florida in the early 1920s, whereas Merrett (2013) discusses the credit-fuelled speculative boom of the 1880s in Melbourne, followed by the collapse in the early 1890s; property prices peaked in 1891, but did not return to the previous peak until 1917. Crises of these proportions were, however, infrequent and possibly unpredictable in the sense that they cannot be readily anticipated from variables included in conventional models. Nevertheless, even in the absence of these periodic major crises, construction still experiences 'normal' volatility, which is more amenable to econometric analysis.

The data in Fig. 7.1 can be used to illustrate, but, in this instance, we need to distinguish between the private and public sectors because of differences in causal influences; Fig. 7.3 shows the variations from 1923 onwards. During the inter-war period, there was a positive correlation between movements in the two. As noted above, a high proportion of private construction received subsidies, reaching more than 50 % of private completions between 1926 and 1928, but almost no private dwellings were constructed with support during the 1930s. Overall, in the inter-war period, approximately 75 % of new dwellings were private homes. Post-Second World War, public and private construction were negatively correlated, but not strongly (–0.15 between 1948 and 2013). Private construction averaged approximately 65 % of the total over the whole period, but since the mid-1980s has risen to approximately 85 %.

A considerable empirical international literature exists on the determinants of private house building whether in terms of starts, completions or

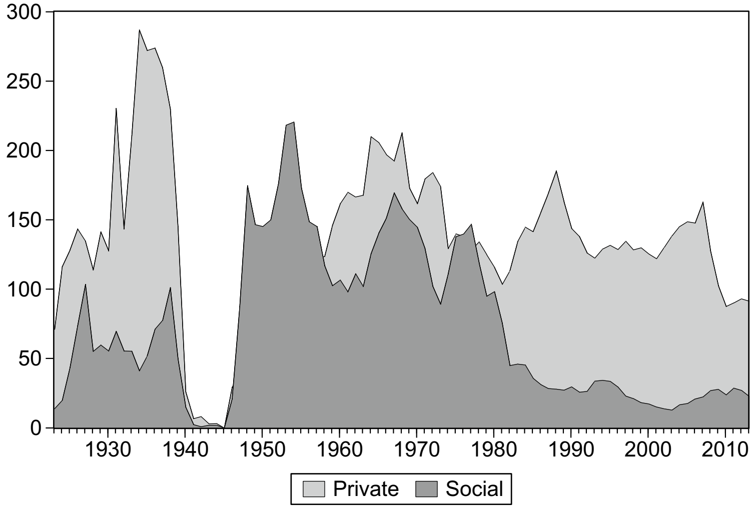

Fig. 7.3 Housing completions, private and public sectors (England and Wales (000s), 1923–2013, financial years until 1944/1945, calendar years thereafter) (*Source*: Holmans 2005)

investment, which is summarised in Ball et al. (2010). The central determining variables in empirical studies are, typically, found to be house prices (both the level and rate of change), building costs and the cost of credit; in other words profitability. Additional factors include credit availability, land-use regulation and zoning, uncertainty, impact fees, the history of past development, geography and even the weather. All can be important in explaining the volatility of construction, although land-use regulation has received particular attention internationally. Nevertheless, the average within-sample prediction errors for housing construction equations remain large. For example, Ball et al. (2010) find that, since the early 1970s, the average error was approximately 9 % for British private housing starts (rather than completions), with similar values for the US and Australia. Consequently, models find it difficult to explain the full volatility in construction. There are clues however; the *level* of house prices has only a limited effect on the *long-run* level of construction. Ball et al. (2010) find an elasticity of approximately 0.2 for Britain as a whole; Meen (2005) finds similar values with little variation across the English regions, but, the *growth* in house prices[11] has a much stronger effect on construction. In Ball et al., a 1 % increase in the growth of prices raises construction by approximately 3 %. House prices are also volatile over the cycle, but an elasticity of three implies that housing construction is even more volatile than prices.[12] A 20 % fall in house prices, which is similar to that experienced in the Global Financial Crisis, would, temporarily, reduce house construction by 60 % and this is an important part of the story but, as above, movements in prices are not the only influence on construction, which is particularly sensitive to monetary policy, both through changes in interest rates and the availability of credit.

7.8 Conclusions and Policy Implications

The previous sections lead to a number of controversial conclusions, given the directions of housing policy over the last 20 years. First, history does not suggest that substantially higher, permanent increases in construction in order to stabilise affordability are achievable, although short-run increases are possible, depending on the position in the economic cycle. Given the plethora of policies that have been attempted since the 1920s, the conclusion that initiatives have only had temporary effects is rather surprising. The share of national resources devoted to housing appears to have an equilibrium from which it is hard to deviate permanently. Nevertheless, the evidence also shows that construction has been below trend since the 1980s. In addition, the long-run price elasticity of supply is low and unlikely ever to reach the value needed to improve affordability significantly, through policy changes. This does not appear to be a new event. This, in turn, suggests that greater attention needs to be paid to the demand side, which is one of the issues raised in Chap. 10. Second, there is an unproven possibility that a relaxation of land-use planning controls might divert construction to lower cost sites, rather than substantially increasing the overall level of output. The possibility is simply raised here

[11] Formally, the growth in prices is a stationary process, formed from differencing the non-stationary price level. Since construction is also a stationary process, the properties of the two time series are consistent.

[12] Even larger values were found for nineteenth century Glasgow in Chap. 6.

since the evidence suggests that currently the price elasticity of supply is, counter-intuitively, greater on higher-cost brownfield sites, reflecting the policy stance (Meen and Nygaard 2011). Third, the efficiency losses from planning controls have been convincingly argued in the literature, but the full macroeconomic effects of switching production towards a relatively low productivity industry, particularly at times of full employment, also need to be taken into account.

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8

Residential Density Revisited: Sorting and Household Mobility

8.1 Introduction

This chapter is concerned with residential sorting—the processes by which individual decisions on mobility lead to aggregate structures of segregation or integration, a theme which is continued in the next chapter and in Chap. 11. Chapter 3 set out a number of theoretical models, which are, in principle, empirically testable. These included both the monocentric location model, in which the income elasticity of housing demand plays a central role, and models following the Schelling tradition in which the nature of social interactions between agents is important. Few would dispute that the poor live in the worst locations (the two are *correlated*), but this does not imply that bad neighbourhoods *cause* poverty. Residential sorting suggests that the poorest may 'choose' to live in the worst areas because they are the cheapest or because they want to live amongst those with similar characteristics; furthermore the rich will outbid the poor for the best locations, because the best locations are in fixed supply (and many would argue made worst by the planning system). The issue is just as relevant today as in the nineteenth century.

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Changes in residential density functions over time provide one aggregate representation of mobility decisions. The early work by Clark (1951) showed that the functions flattened over time, a finding subsequently replicated in many countries. Chapter 3 suggested that, at least in theory, segregated communities are a stochastically stable state, and, so, changes to residential density functions might be expected to be a slow process, exhibiting persistence. For example, in the case of Melbourne, the shape of the function changed little between 1986 and 1996 (Baker et al. 2000) and appears to have remained similar in 2011.[1] Chapter 3 also highlighted the fact that most moves are short distance; from Ravenstein's (1885) First Law of Migration, this has been the case since, at least, the nineteenth century. Modern surveys indicate that moves are undertaken most frequently for family or housing-related reasons, rather than from job search. Nevertheless, major innovations to the transport infrastructure (and related changes to the housing stock) or policy can still cause sharp changes. Chapter 5 provided *prima facie* evidence that in one case—London's East End—residential re-sorting took place. Following a large policy initiative (the formation of the London Docklands Development Corporation), the average age and crude death rate rapidly changed after a period stretching from at least the nineteenth century, when death rates had remained persistently above the London average, but, as the area characteristics changed, so did the nature of the residents.

The chapter attempts to go behind aggregate residential density functions and two data sources are introduced, both of which are newly-constructed panel data sets: the first is for nineteenth and early twentieth century London and the second for post-Second World War Melbourne. The London panel refers to the period of strong working-class population outflows from the inner-city areas, resulting from the railway boom, cheap fares and suburban housing expansion as discussed in Chap. 7. We are also able to consider the social interactions that may have contributed to patterns of segregation. Post-war Melbourne corresponds to a period of strong population growth; from Frost and O'Hanlon (2009), Australia's population rose by almost three million between 1947 and

[1] See http://chartingtransport.com/2012/10/19/comparing-the-residential-densities-of-australian-cities-2011/

1961, fuelled by assisted immigration and the cities contributed 68 % of the increase. The cities were already over-crowded, by contemporary Australian standards, and suffered housing shortages. Manufacturing industry was moving out of Melbourne to greenfield sites in search of space and residents began to follow the relocation of industry. This was aided by rising car ownership; in 1945, there was one car for every 14 residents in the state of Victoria, but this rose to one in five by 1960. The increased use of cars led to a decline in the patronage of public transport, including Melbourne's trams, from the 1950s until the start of the 1980s (Public Transport Victoria 2012) and, so, residential location was less influenced by the public transport networks. The period considered lies prior to the two waves of gentrification that subsequently hit Melbourne in the 1970s and from the late 1980s (Wulff and Lobo 2009).

8.2 Internal Population Flows in Nineteenth and Early Twentieth Century London: Initial Evidence from Aggregate Data

Quoting the Registrar General from 1871, Ravenstein (1885) points to the importance of improved road, rail and shipping networks in the promotion of internal migration, which, by that stage, had become extensive across the country. Support for Ravenstein's First Law is provided in Table 8.1, which shows the birth locations of London residents in 1881 and complements the data for Glasgow in Chap. 6. The table indicates that approximately 63 % were native to the capital, 10 % came from the surrounding metropolitan area and 10 % from an inner belt. Although still significant, the proportionate flows decline with distance from the capital. Approximately 3 % of London's population was born abroad; in fact, 56 % of British residents born abroad (excluding Ireland) resided in the 28 largest towns (196,365). London (111,624) dominated, with smaller numbers in Liverpool (15,768), Manchester (9028), Edinburgh (6165), Glasgow (5720) and Birmingham (3440) (Ravenstein 1885, p. 181). International migrant flows are discussed in more detail in Chap. 9.

Table 8.1 London population by birth location, 1881 (%)

Born in:	Population of London (%)
London Metropolis	62.9
Metropolitan group	10.3
Inner belt	10.0
South West	3.6
Outer belt	3.0
Midlands	0.8
North West	0.9
North East	1.3
Wales	0.6
Scotland	1.3
Ireland	2.1
Abroad	2.9

Source: Census of Population 1881
Metropolitan group: Middlesex (ex. London), Surrey, Kent, Essex, Hertford
Inner belt: Norfolk, Suffolk, Cambridge, Huntingdon, Northampton, Bedford, Buckingham, Oxford, Berks, Wilts, Hampshire, Sussex
South West: Somerset, Dorset, Devon, Cornwall
Outer belt: Lincoln, Notts, Rutland, Leicester, Warwick, Worcester, Gloucester, Hereford, Monmouth
Midlands: Derby, Stafford, Shropshire, Cheshire
North West: Lancashire, Westmoreland, Cumberland
North East: Yorkshire, Durham, Northumberland

Despite the migrant flows into the capital, by this stage, drift to the outer London areas was already taking place. Between 1871 and 1881, the total population of the London Administrative County, covering the Registration Districts shown in Table 5.3 (and what would now be considered Inner London) rose by 17 %. Between 1881 and 1891, the growth rate had fallen to 10 % and had become static between 1901 and 1911. By contrast, the corresponding figures for the Outer Ring of London were 50 %, 50 % and 34 % respectively. These are simply an alternative representation of the changes to the residential density functions. More detail is shown in Table 8.2, which concentrates on the inner areas experiencing the largest gains and losses, ranked by changes between 1901 and 1911. There are obvious parallels to the dwelling stock figures presented in Chap. 7. The table excludes the City, which underwent the largest population loss in percentage terms, but had a small population in absolute terms. The table demonstrates that the more distant parts of

Table 8.2 Local population gains and losses (London, 1891–1911) (percentage increase or decrease in inter-census period)

Registration districts	1891–1901	1901–1911
London Administrative County	7.3	−0.3
Outer London		
Wandsworth	49.2	34.3
Lewisham	43.4	26.2
Fulham	49.6	11.7
Hammersmith	15.4	8.3
Hampstead	20.3	4.4
Woolwich	18.4	3.6
Inner London		
Shoreditch	−4.7	−6.0
Stepney	4.7	−6.2
Southwark	1.8	−6.9
St Pancras	0.0	−7.2
Chelsea	1.2	−10.1
St Marylebone	−7.1	−11.3
Westminster	−9.4	−12.4
Finsbury	−7.7	−13.3
Holborn	−11.0	−16.9

Source: Census of Population

See the maps in Chap. 5 for the District locations

the Administrative County, notably Wandsworth, Lewisham and Fulham rapidly gained population, but Holborn, including Saffron Hill, was the biggest loser; the East End, however, did not disproportionately lose population.[2] Although not shown in the table, similar spatial movements were evident earlier; between 1871 and 1881, Wandsworth and Fulham Registration Districts grew most strongly, whereas the Districts around Holborn declined most sharply.

The finding that most moves are short distance continues to the modern era. Analysis in the 1977 Housing Policy Review showed that, in 1971, approximately 50 % of moves in England and Wales were within the same local authority and a further 30 % were to a different local authority in the same region (Department of the Environment 1977, Table II.36) and almost 60 % of owner-occupiers (80 % of local authority tenants) moved under half an hour's travelling distance (Table II.41).

[2] International immigration was particularly important here.

Chapter 3 showed that very similar patterns are still in place today. Households continue to be highly persistent in location; attachment to place is strong and this has been the case since the nineteenth century. This can also be demonstrated from micro data.

8.3 Evidence from Micro Data

A more subtle picture emerges from an analysis of the micro data. Table 8.2 shows that the largest population losses in late nineteenth and early twentieth century London were in Holborn and Finsbury, but these changes are made up of a combination of natural change (births minus deaths) and net migration, both domestic and international. The latter is discussed in Chap. 9, but, for small spatial areas, domestic mobility generally comprises the majority of the changes. Micro data allow us to untangle issues on the underlying flows, which are hidden by aggregate information.

Chapter 2 presented case studies for local areas of London and Melbourne. Related methods can be used to construct panel data sets of individuals for the cities as a whole and to follow the mobility of individuals at different points of time. In the case of London, the panel covers the period 1851–1911 and in Melbourne 1949–1980. Each source has strengths and weaknesses, although both provide individual unit records, giving the exact addresses of each individual. Analysis is not constrained by administrative boundaries and the dynamics of area social status can be recorded at any spatial scale. A caveat is that the sample sizes are modest since they have to be compiled 'by hand' on an individual basis, in effect, constructing a series of family trees.[3] Therefore, some of the conclusions remain tentative and require further analysis on larger data sets.

[3] The advent of Big Data methods should make this easier for future research through, for example, the Integrated Census Microdata project (I-CeM), which has full coverage of the 1851, 1861 and 1881–1911 censuses, but, currently, individual records are not linked across time to develop a panel.

The London Sample

For London, we concentrate on spatial mobility between 1851 and 1911, although only a subset of the information is used in the later econometric analysis. It is possible to track relocation choices and the extent of social segregation consistent with the models developed in Chap. 3. Saffron Hill can again be used to demonstrate how the panel is constructed; this is rarely feasible at fine spatial scales on more modern data sets, because confidentiality currently prevents publication of unit record census material beyond 1911.[4] To take one individual, George Sewell lived at 33 Great Saffron Hill at the time of the 1881 census[5]; he was aged 34, but had not moved far from his birth location of Clerkenwell. He was a brass finisher by trade; a Brass Finisher worked in a foundry to remove marks from brass objects through sanding and polishing. Although he was widowed, he lived with his one son Joseph, aged 11, who was still at school. Overall, 10 people lived at Number 33, which was below the average density for the street of 14 persons per dwelling.

By 1891, George (45) had remarried to Louisa (37) and they lived with five children, George (16), Ada (15), Henry (6), William (4), and Stephen (2). George junior and Ada were not recorded as living with George in 1881; they lived in two rooms at 22 St Helena Street, Clerkenwell. George was employed as a dipper and burnisher. The number of rooms, and hence basic indicators of overcrowding, had been introduced into the census by this stage. In 1901, they still lived at the same address, although George junior and Ada had moved on by this time. George was now 53 and was still married to Louisa. The sons Henry (16), William (14) and Steven (12) were still there and Henry is noted as being 'feeble minded from childhood' and had no employment. William was a hawker and Steven a paper distributor; George, himself, was still a dipper and burnisher. In 1911, George (67) was a widower and lived only with 'feeble minded' Henry (27) still in St Helena Street (now number 76).

[4] An exception is the Anonymised Sample of Individual Records.

[5] The 1881 census is a key source since all unit records are available from the UK Data Archive and is a good starting point. Availability of these records has its roots in the work of the Church of Jesus Christ of Latter-Day Saints (more usually known as the Mormons) and its Genealogical Society of Utah.

It is also possible to work backwards from the 1881 census to 1851. For example, in 1871, George was 25 and married to his 25 year-old first wife, living with their son. They lived at the same address as in 1881 and George was still a brass finisher. In 1861, 17-year-old George lived with his parents in Hatton Wall (around the corner from Saffron Hill) along with his brother Henry (22) and sister Ellen (14). George is recorded as a labourer; in 1851, George (7) lived with his parents and brother and sister at 12, Gunpowder Alley in the parish of St Brides. His father was a labourer, born in Gloucestershire and his mother, Henrietta, was born in St Pancras. In summary, on the basis of a sample of one, the spatial immobility of this working class household between 1851 and 1911 is striking. For the Sewells, slum clearances, the general fall in the population of Holborn and cheap rail fares had little impact, but the example can be expanded across London.

In order to construct a larger sample, the London nineteenth century parishes are divided into five broad groups—North, South, East, West and Central (see Appendix 1 for the definitions); Central includes Holborn and Saffron Hill. The categorisation broadly conforms to that used in Chap. 5. Half of the parishes in each group are randomly sampled and, from these, 100 household heads are taken from each group, recording addresses, occupations, family and demographic characteristics. Each head is required to be male and between the ages of 18 and 35 in 1881. The concentration on males makes it easier to trace movements of the panel over time. Older age groups are less mobile and are therefore excluded. The names and occupations of immediate neighbours who are heads are also recorded, in other words, the heads in residences either side of the sampled household head or living in the same house. Most dwellings, particularly in the poorer areas, had multiple heads, but the neighbouring heads are not required to conform to the age and gender requirements. Including neighbours, this provides information on 3124 household heads in 1881. Of course, taking into account dependants as well, the residential densities are much greater than these figures suggest, but they provide valuable information for testing the importance of social interactions in mobility decisions. In addition, information on fathers and eldest sons is recorded to provide coverage of three generations, although only the information on fathers is used in estimation below.

For comparison, the 500 members of the original sample cover 260 modern Lower Layer Super Output Areas (LSOAs) and 101 Middle Layer Super Output Areas (MSOAs), out of a total of 394 MSOAs in Inner London. In order to construct measures of social status, in line with Long (2005), the official 1950 classification is used to allocate all household head occupations into one of five social classes. In practice, the 1881 census records a bewildering variety of occupations, many of which have become redundant and have no modern equivalent:

- Class (i)—professional occupations
- Class (ii)—intermediate occupations
- Class (iii)—skilled occupations
- Class (iv)—partly skilled occupations
- Class (v)—unskilled occupations.

As examples, Class (i) includes judges and barristers, senior civil servants, doctors, company secretaries, company directors, clergymen and bank managers; it also includes scientists and economists. Class (ii) includes teachers, nurses, vets, clerks of works, managers, government executive officers, librarians, social workers, proprietors of retail businesses and railway officials. Class (v) is heavily made up of labouring occupations.

Columns 2–8 of Table 8.3 show the total sampled household heads in each zone in 1881 and the numbers and shares in each of the social classes. The total numbers are fairly evenly balanced, although numbers in the South are rather smaller than in the other areas. Class (iii) dominates in all areas with approximately 57 % of household heads falling into this category across the sample as a whole, with the share varying between 40 % in the East and 70 % in the North. The absolute numbers and shares that fall into Class (i) are small, but are heavily concentrated in the West and 'better' parts of the central zone. Furthermore, all zones have significant numbers of residents in Classes (iv) and (v). The limits to cheap public transport in 1881, despite the rapid growth in rail and omnibus networks by this stage, still meant that the poorest classes relied heavily on foot transport and therefore needed to live close to their places of employment. Nevertheless, the greater concentrations of Class (v) in

Table 8.3 Household heads in each zone by social class in London, 1881 (numbers and percentages)

	Total number	Class (i)	Class (ii)	Class (iii)	Class (iv)	Class (v)	Sum (iv and v)
North	628	4	42	445	71	67	138
West	640	23	87	367	84	80	164
South	512	3	38	282	85	104	189
East	652	2	97	266	101	186	287
Central	693	13	62	411	118	89	207
All areas	3124	44	325	1771	459	525	984
	Percentages						
North	100	0.6	6.6	70.9	11.3	10.6	21.9
West	100	3.6	13.5	57.3	13.1	12.4	25.5
South	100	0.6	7.4	55.1	16.6	20.3	36.9
East	100	0.3	14.9	40.8	15.5	28.5	44.0
Central	100	1.8	9.0	59.4	17.0	12.9	29.9
All areas	100	1.4	10.4	56.7	14.7	16.8	31.5

Source: 1881 Census of Population and authors' calculations

the East (29 %) and South (20 %), compared with the London average of 17 %, is noticeable. Although not shown in Table 8.3, approximately 60 % of sampled heads were born in London compared with 63 % for the London population as a whole (Table 8.1), but there are noticeable variations: only 52 % of the sample taken from the richer West was born in London, but 72 % in the Central zone. In the sample, almost all those born abroad were living in the East and made up 12.5 % of the heads.

Sample attrition is a fundamental problem in tracing the movements of individuals over time. Death rates were high by modern standards and, without searching the death registration records, we do not know the proportion who died between successive census dates. Of the 500 Original Sample Members (OSMs) in 1881, only 288 are traceable 20 years later, but the distance of these 288 OSMs from the central London location of Westminster in 1901 is calculated; the mean distance is 23 km, but the distribution is highly skewed and the median is only 4.9 km. The mean is heavily influenced by a small number of longer-distance moves; excluding these heads, the mean distance from Westminster is a more modest 5.2 km (and the median 4.6 km). Since by no means all residents lived in Westminster in 1881, the moving distances are, in fact, even shorter. As an alternative proxy for moving distances, 60 % of the sample remained within the same or a contiguous Registration District over the 20 years.

The information on neighbours can be used to construct measures of segregation from the Index of Dissimilarity discussed in Chap. 7. Recapping, the measure compares the percentage of minorities in any local area relative to the majority percentage. The chapter noted that the Index suffers from the problem that the results are dependent on the size of the local spatial units and is usually constructed for pre-determined administrative entities for which data are readily available. However, given the sample addresses, a modified version of the Index can be constructed: in this case (i) (see Eq. 7.1), is defined as the individual addresses in 1881 and $N = 100$ in each of the five zones. m_i is now the number of immediate neighbours (and in the same house for multiple heads) in the same social class as the original sample members. For example, if the first sample member has an occupation in Class (iii), then m_i is the number of neighbours also in Class (iii) and nm_i is the number of neighbours in the remaining four classes. M and NM respectively are the total numbers in the relevant classes in the five areas.

As an illustration, we concentrate on the Central area in 1881, whose composition is shown in Table 8.3 and includes both relatively rich and poor areas. The calculated value of the Index is 0.35. By comparison, in the richer western zone, the value is 0.54. Both exhibited a moderate degree of segregation, but this was noticeably higher in the richer West. It should be remembered, however, that the division of parishes into Central and West is not clear-cut and other allocations might produce different results. By 1901, the Dissimilarity Index for the Central zone had risen to 0.47, implying that moves had led to an increase in segregation.

The Melbourne Sample

Just as the London sample is derived as an extension of Saffron Hill, the Melbourne sample is obtained using the same methods and sources as for Harris and Chapman Streets. The electoral rolls have both advantages and disadvantages compared with the censuses. An advantage is that they are compiled more regularly and so we are not constrained to examining mobility over 10 or 20 years; shorter periods, combined with the long-run data, provide more information on moving decisions. In addition, although attrition remains a problem, it is not as severe as in 10-yearly censuses. The disadvantage is that electoral rolls provide less information on individual characteristics. Details of individual occupations were collected until the mid-1980s, but the manner in which the data are recorded means that the information cannot be readily compiled into aggregate indicators of area social status for Melbourne as a whole.

We concentrate on the 1949–1980 period, although the collection of data from 1903 is feasible. Four subdistricts are sampled: North Melbourne (which includes Harris Street and Chapman Street), South Yarra, Carlton South, and Melbourne. All are located in the urban core or inner suburbs and, from Fig. 4.2, South Yarra lies on sedimentary rocks associated with more highly-priced housing. In 1949, the state of Victoria as a whole had 34 registration districts and 256 subdistricts. Residents, both male and female, were randomly sampled in each of the four for 1949 and their subsequent moves were traced through to 1980. Although the sample sizes are again modest, this is still a significant data extraction exercise. Across the four areas, there are 1111 observations in 1949, which are, in principle, observed in each of 7 years between 1949 and 1980,[6] all of which have to be traced manually from the electoral rolls. In practice, given attrition over the 30 years, the maximum number of observations available is 3200 rather than 7777; inevitably, more observations are traceable for the earlier than later years. There are a number of contributory factors of which age is likely to be the most important: in 1954, the proportion of the sample estimated to be over the age of 60 ranged between 10 % and 23 % for the four subdistricts and the average age was approximately 40 and, so, death rates are significant in the later years. A caveat is that the electoral rolls do not report ages directly; these have been approximated from the first year in which the individual appears on a roll,

[6] 1949, 1954, 1963, 1968, 1972, 1977, 1980 are chosen, although additional intervening years are possible.

given that the voting age was 21 at this stage. Attrition rates are also affected by international migrants returning home and by inter-state moves, which are probably not fully captured. Furthermore, although between 53 % and 69 % of females were married in 1949, single women who subsequently married (and changed their names) cannot readily be tracked. Table 8.4 summarises the key characteristics of the sampled residents; the table shows that approximately 40 % of women undertook home duties as their main occupation. As for London, the recorded occupations are allocated to social classes, but an additional Class (vi) is added for home duties.

The highest proportion (excluding home duties) again falls in Class (iii), but Table 8.4 confirms the traditional status of working-class North Melbourne with high proportions of Class (iv) and (v) residents, along with Carlton South, in a pre-gentrification era. North Melbourne possessed the lowest proportion of residents in Classes (i) and (ii); by contrast, both South Yarra and central Melbourne (which includes East Melbourne) have noticeably higher proportions. The table also indicates differences in average ages in the four areas; in particular, the average age and proportion over the age of 60 are higher in South Yarra.

The numbers and percentages moving in the different subperiods between 1949 and 1980 are set out in the table, but note that the time periods are not equal in length. For example, the first period covers 1949–1954 and the second 1954–1963 and so the mobility rates are higher throughout the subdistricts in the latter. Nevertheless, the percentage moving typically declines over time, consistent with the international literature that finds mobility to fall with age. The absolute number of movers also declines, but this reflects the increase in sample attrition as well as a pure mobility effect. The final two rows of the table indicate spatial variations in mobility rates between 1949 and 1963; overall approximately 20 % did not move over the period, but non-movers were noticeably lower at 17 % in the Melbourne subdistrict and higher at 26 % in Carlton South. In terms of mean distances from the CBD[7] of each individual in 1963, the table indicates that, on average, residents originally in Carlton and South Yarra were the furthest away at more

[7] Distances are measured from Melbourne Central in Swanston Street.

Table 8.4 Melbourne sample characteristics

	Carlton South	South Yarra	North Melbourne	Melbourne
Registered electors	4496	16,366	5786	13,420
Sample (% of electors)	232 (5.2)	326 (2.0)	235 (4.1)	318 (2.4)
% women	56	56	52	55
% married	53	57	69	64
% occupied in home duties	36	37	44	41
% of males in Classes 1,2 (1954)	18	21	14	24
% of males in Classes 4,5 (1954)	39	17	29	24
Estimated % aged>60 (1954)	11	23	10	15
Estimated average sample age (1954)	39.3	42.7	37.7	39.6
Nos. moving 1949–1954 (% moving)	46 (31)	94 (40)	75 (35)	153 (48)
Nos. moving 1954–1963 (% moving)	54 (57)	79 (52)	101 (58)	111 (48)
Nos. moving 1963–1968 (% moving)	17 (24)	37 (29)	36 (26)	40 (21)
Nos. moving 1968–1972 (% moving)	4 (7)	26 (22)	23 (20)	28 (19)
Nos. moving 1972–1977 (% moving)	12 (26)	25 (26)	14 (13)	24 (20)
Nos. moving 1977–1980 (% moving)	5 (12)	4 (5)	9 (12)	11 (11)
% not moving 1949–1963	25.5	21.0	18.6	16.7
Average distance from CBD, km (1963)	23.3	20.5	9.3	14.0

Source: Victorian Electoral Rolls and authors' calculations. All values relate to 1949 except where stated

than 20 km; this is despite the fact that residents of South Yarra are older, but average distances for both are affected by a small number of long-distance moves and most were over much shorter distances. Modal moves were between 1 and 2 km and the median distance was 5.5 km. Moves were in all directions, except to the outer western areas, which subsequently became a major growth area, but contained fewer houses in this era. These are areas of infertile volcanic rock, which were less attractive for original development, as discussed in Chap. 4.

8.4 Modelling Mobility

This section attempts to quantify the impact of some of the factors thought to determine mobility and location choice. It tries to measure the relative contributions of three sets of forces: the first concerns the impact of individual characteristics and proxy measures of income; the second stresses social interactions; the third discusses the impact of changes in the spatial distribution of housing. However, given the sample sizes, some caution is needed in the interpretation of the results.

Relocation depends on two inter-related decisions—whether to move and where to move to. For the first, we model the probability that any individual in the samples will choose to move between two time periods (formally, a probit model is employed). In London, because individuals are only observed every 10 years, almost everyone moved over the sample period and, so, Melbourne between 1949 and 1980 is the focus. Note that this models the moving decisions of residents already located in the core or inner suburbs in 1949; it does not model the inflows into the centre from outside arising from gentrification which became important from the 1970s. For the second, we concentrate on changes in distances from the CBD between two periods; because of the availability of information on neighbourhood social status, London is emphasised. The precise form of the models and a discussion of the econometric issues are set out in the fairly lengthy Appendix 2.

The probability of moving in Melbourne between 1949 and 1980, using information from all seven observed years, is assumed to depend on the following variables: the age of each individual; a dummy for each of the four subdistricts; the individual's marital status; any change in marital status; gender; occupational class; and the moving subperiod between 1949 and 1980 shown in Table 8.4. The full econometric results are shown in Table 8.6: column (2) includes all the above variables, whereas column (3) excludes variables found to be statistically insignificant. Between 1949 and 1980, 959 moves are observed and 2107 non-moves. However, that this does not mean that only approximately a third of individuals moved between 1949 and 1980—most individuals moved at some stage—but reflects the fact that few, if any, individuals moved in every sampled year.

The choice of explanatory variables is heavily influenced by those found to be important in modern models of mobility, as discussed in Chap. 3, although the omission of housing tenure and the presence of children are notable exceptions; these are not available from the data set. Occupational status is a proxy for income; although it has its weaknesses, notably it changes infrequently over time whereas income typically grows, arguably it is a better representation of permanent income. The results indicate, first, that moving probabilities fall with age, although the effect is non-linear and gradually levels off. Second, initial locations in 1949 have little effect on the moving probability, although there is some evidence (at the 13 % level) that residents of South Yarra had slightly higher moving propensities. Third, being married reduces the likelihood of moving, although the effect is not strong, but changes to marital status have, unsurprisingly, a strong positive effect. Fourth, women have a lower moving propensity, but it should be remembered that women who change their names are not identified. Fifth, the probability of moving is higher in all periods relative to moves between 1977 and 1980 (the comparator period), although some care is needed in interpreting the coefficients because the moving periods are not equal; in other words, the coefficient on moves between 1954 and 1963 (1.33) is partly higher because of the 10-year span. Nevertheless, standardising for length, mobility falls slightly over time but stabilises by around 1968. Finally, the table indicates that only occupational Class (ii)—the intermediate group—has a significant effect on mobility; it is not the case that those in the highest class are the most mobile. On the basis of those included in this category (see above), this is, perhaps, not surprising, since the group includes professional and managerial employees.

Two findings stand out. First, variables typically found to be important in modern micro mobility studies remain important over longer time periods than are usually taken into account, at least on our sample of approximately 3000 individual observations; demographics and socio-economic status matter. Second, individual characteristics cannot fully explain decisions to move; based on the goodness of fit, additional factors appear to be at work. Omitted variables—tenure, children and income growth—are probably part of the explanation, but are unlikely, in our view, to be the whole story. Similarly, the omission of labour market variables, at a time when the location of manufacturing industry was moving out from the centre, could play a role but again in our judgement are unlikely to be the main factor. Most moves were short distance and relatively few were to the new employment centres, such as the northern suburbs.

Further light is shed by the second aspect, location choice, or, more precisely, the distance from the CBD that each individual lives; this is the dependent variable, measured in kilometres. Because of the available information on neighbours, the focus is on London in 1901, when, as we have seen, population outflows from the centre were strong. The sample excludes observations more than 25 km from the CBD in order to eliminate the limited number of long-distance moves. The key explanatory variables are the individual's own social class; the proportion of neighbours who are in the same class; the percentage of neighbours who are in Classes (iv) and (v); the number of children in the household; individual age in 1881; marital status; and the growth in the dwelling stock. All the area social class variables are measured in 1881 for the areas in which individuals originally lived.

The detailed estimation results are shown in Appendix 2, Table 8.7[8] and indicate that demographic variables had only a limited impact and, indeed, differed between, on the one hand, the West and Central zones and, on the other hand, the East and South. But individual social class and the percentage of neighbours in the same social class have strongly significant influences at least for this modestly-sized sample. The second column of the table finds that those in the lowest social Classes (iv) and (v) moved shorter distances, consistent with the predictions of standard location theory. Furthermore, those who live in neighbourhoods where a high proportion of immediate neighbours are in the same social class as the individual, also move shorter distances; this is consistent with models in the Schelling tradition, where segregation is a stable state. More research

[8] The table excludes individuals living in 1881 in the northern zone, where results differed from the other areas. This is influenced by the fact that there is limited variation in occupational classification. Seventy percent fall into Class (iii); see Table 8.3. Estimation also included the location of the OSM's fathers as a possible factor, using the intergenerational aspects of the data set, but no significant effect was found for this sample.

is needed with larger samples, but, to our knowledge, this is the first study to quantify the neighbourhood influences at fine spatial scales.

The implications—both what the results imply and do not imply—need emphasis. First, they provide insights into why patterns of segregation and poverty were persistent in that era; those in the lowest social classes were, in the late nineteenth century, less likely to move long distances away from the worst slums based on their own characteristics. Second, the fact that a high proportion of their neighbours were in the same social class further reduced mobility. Similarly, social interactions reduced the probability that the rich would move away from the best locations, primarily in the west zone. Third, since the neighbourhood effects are measured in the base year, the estimated coefficient is not affected by biases arising from endogeneity; nevertheless we are unable to distinguish between the three possible causal influences identified by Manski (1993, 2000) and discussed in Chap. 3. The distinctions matter because they have different implications for policy, but the identification of significant effects is, at least, a first step.

Fourth, the results in column 2 have a low goodness of fit—an indication that there are other factors affecting moving distances. From Chap. 7, differences in the growth of the housing stock between areas are a candidate, although the strong growth in the suburban stock, partly related to the railway expansion, is not entirely an external shock. The induced population growth generated further housing and, so, is endogenous. The growth in housing is, therefore, partly a *response* to population pressures rather than a *cause*, recognising that planning controls were limited at this time. Adding the growth in the housing stock in the area to which individuals move relative to growth in the area they are leaving, gives the results in the third column. The variable is highly significant, but reflects the fact that additional building took place at more distant locations from the centre. Accounting for this requires the estimation of a system in which household mobility and construction are jointly modelled, which is beyond the scope of this chapter. Nevertheless, if moving distances are to be explained, it is clear that additional factors to individual and group characteristics, which reinforce immobility, are required; changes to policy, technology and other innovations play an important role.

8.5 To Conclude

The analysis of mobility using long-run micro data sets at fine spatial scales provides novel insights into residential sorting, population density and the nature of social interactions that cannot be fully captured by aggregate data. The chapter shows how much information is potentially available from non-conventional sources, although its retrieval is highly time-consuming. Nevertheless, it is clear that much remains to be done; the chapter points to a way forward, but sample sizes need to be increased. The fact that social interactions and status are important in the conditions of nineteenth century London, promoting segregation through sorting, is, perhaps, unsurprising. The question remains whether the finding is universal or disappears in later years and in conditions where poverty and segregation are less pronounced. Davison (1974) points out, for example, that Melbourne's suburbs in the late nineteenth century were homogenous by international standards, with poor houses standing next to richer. Melbourne's slums were modest compared with those in London. We noted in Chap. 5 that death rates were considerably lower than in London.

The chapter also finds that factors affecting the decision to move home in recent years are similar to those observed over longer periods of time. Most moves continue to be local and socio-economic and demographic influences affect the decision to move. However, whereas most studies emphasise how much can be explained by such variables, our study highlights the limitations over long time periods. It is the missing influences that are the most interesting; we hypothesise that these include policy and technological changes (which affect the location of the housing stock or industry) or other unanticipated influences, for example, wars or natural disasters. This is explored further in the next chapter in the context of international migration.

8.6 Appendix 1: Nineteenth Century London Parishes (Table 8.5)

Table 8.5 Nineteenth century London parishes

Central	North	East	South	West
Shoreditch*	Paddington	Bethnal Green	St Saviour*	St George, Hanover Square
Clerkenwell	St Marylebone*	Whitechapel*	St George*	St James
St Luke Old Street*	St Pancras*	Mile End Old Town	Bermondsey*	St Martin in the Fields*
St Anne, Soho	Islington	St George in the East*	Rotherhithe*	St Margaret
St Paul, Covent Garden*	Hackney*	Limehouse*	The Martyr	St Margaret (detached)
St Giles in the Field*		Poplar*	Christ Church, Southwark	Chelsea*
St George, Bloomsbury		Christchurch, Spitalfields	St Thomas, Southwark	Kensington*
St George the Martyr, Queen's Square		Mile End New Town*	St Olave, Southwark*	St John*
Gray's Inn		Holy Trinity Minories*	St John, Horsleydown	
Lincoln's Inn		Tower Liberty		
Liberty of the Rolls		St Katherine by the Tower		
Temple*		St Botolph Without, Aldgate*		
St Clement Danes*		St John, Wapping		
Precinct of the Savoy*		St Paul, Shadwell		
St Mary Le Strand		Ratcliff*		
Liberty of Saffron Hill*				
St Sepulchre				
Charterhouse*				
Liberty of Norton Folgate*				
Old Artillery Ground				
St Andrew, Holborn*				
St James, Clerkenwell				

(continued)

Table 8.5 (continued)

Central	North	East	South	West
St John, Clerkenwell*				

Sampled parishes are denoted with an asterisk

8.7 Appendix 2: Modelling Mobility (Tables. 8.6 and 8.7)

Table 8.6 Probit model for moving probabilities—Melbourne (1949–1980)

Variable	Unrestricted (1949–1980)	Restricted (1949–1980)
Constant	0.371 (1.2)	0.372 (1.2)
AGE	−0.061 (5.5)	−0.061 (5.5)
AGESQ	0.0005 (4.8)	0.0005 (4.8)
Carlton	−0.0100 (1.2)	−0.097 (1.2)
South Yarra	0.068 (1.0)	0.080 (1.2)
Central Melbourne	−0.046 (0.7)	−0.038 (0.6)
MAR	−0.084 (1.5)	−0.084 (1.5)
DMAR	0.491 (5.5)	0.490 (5.5)
GNDR	0.104 (2.0)	0.108 (2.1)
OCC1	0.031 (0.3)	–
OCC2	0.188 (2.3)	0.185 (2.3)
OCC4	0.039 (0.3)	–
OCC5	0.033 (2.3)	–
OCC6	0.075 (0.6)	–
Y(1949–1954)	0.853 (6.6)	0.851 (6.6)
Y(1954–1963)	1.334 (10.7)	1.333 (10.7)
Y(1963–1968)	0.601 (4.7)	0.602 (4.7)
Y(1968–1972)	0.478 (3.6)	0.480 (3.6)
Y(1972–1977)	0.502 (3.7)	0.503 (3.7)
McFadden *R*-squared	0.106	0.106
Number of observations	3066	3066
M = 1 (movers)	959	959

z-values in brackets
AGE = the age of each individual
AGESQ = age squared
MAR = marital status—married = 1
DMAR = change in marital status—changed status = 1
GNDR = gender—male = 1
OCC1 … OCC6 = occupational class—dummies for each class are included and Class (iii) is the default
Y(·) = the moving period—separate dummies for (1949–1954), (1954–1963), (1963–1968), (1968–1972), (1972–1977) and (1977–1980) is the default
A dummy for each of the sub-districts is included (North Melbourne is the default)

Table 8.7 Distance moved in London, 1881–1901 [dependent variable: ln(DISTANCE)]

Variable		
Constant	1.938 (14.9)	1.758 (14.8)
OCC45	−0.301 (2.8)	−0.282 (2.9)
OWNCLASS	−0.0055 (3.8)	−0.0048 (3.7)
KIDS (East + South)	0.066 (1.7)	0.064 (1.9)
KIDS (West + Central)	−0.067 (2.1)	−0.058 (2.1)
AGE (West + Central)	0.021 (1.5)	0.019 (1.5)
CLASS45 (West + Central)	−0.005 (2.1)	−0.005 (2.2)
MARRIED (West + Central)	−0.209 (1.4)	−0.167 (1.3)
%Δ DWELL	–	0.011 (7.1)
R^2	0.13	0.31
Equation standard error	0.549	0.490
Number of observations	204	204

t-values in brackets. Equations also includes a dummy variable for West and Central
DISTANCE = distance from central London (taken as Westminster) in 1901
OCC45 = dummy variable = 1 if the individual is in Class (iv) or (v)
OWNCLASS = percentage of neighbours who are in the same social class as the individual in 1881
CLASS45 = percentage of neighbours who are in Class (iv) or (v) in 1881
KIDS = number of children in the household in 1881
AGE = age of the individual in 1881
MARRIED = 1 = single; 2 = married
%Δ DWELL = percentage change in the housing stock, 1881–1901, in the area in which the individual lives in 1901 relative to where he/she lives in 1881
West + Central implies that the coefficient refers only to individuals living in the West and Central zones
East + South implies that the coefficient refers only to individuals living in the East and South zones

The decision to move and the choice of location are jointly determined and, therefore, have to be modelled together. Although different aspects are emphasised for London and Melbourne, it is useful to develop the general model. Because of the concentration on distance from the centre, the adopted approach differs from most micro residential sorting models that use multinomial logit approaches (see, for example, Meen and Andrew 2004). In the basic form of the monocentric model, since all locations are identical apart from distance to the CBD, location depends only on individual characteristics and preferences. Therefore the distance from the centre for individual (k) at time (t), Y_{kt}, can be written as (8.1a).

$$Y_{kt} = a_1 + a_2\text{OCC}_{kt} + \sum_{j=1}^{r} b_j X_{kjt} + \sum_{p=1}^{4} c_p D_{pt-1} + \mu_{1kt} \tag{8.1a}$$

The extended version of the model allows for the possibility that choices depend also on the characteristics of the locations (8.2a).

$$Y_{kt} = a_1 + a_2\text{OCC}_{kt} + \sum_{j=1}^{r} b_j X_{kjt} + \sum_{p=1}^{4} c_p D_{pt-1} + \sum_{l=1}^{v} d_l N_{klt-1} + \mu_{2kt} \tag{8.2a}$$

where:

OCC_{kt} = the occupational status of individual (k) in period (t), which proxies permanent income.

X_{kjt} = vector of (j) individual socio-demographic characteristics; age, marital status, gender.

D_{pt-1} = dummy variable representing the district in which individual (k) lived in period (t–1), which is the base period. There are four dummies for Melbourne and five in the London case.

N_{klt-1} = vector of (l) neighbourhood characteristics for (k)'s location. These may include both physical characteristics and the aggregate social structure of the population, i.e. a measure of area social status. Area social status is measured in the base period location.

μ_{1kt}, μ_{2kt} = error terms.

An important parameter to be estimated is a_2. A significant positive value implies that higher status (income) individuals are more likely to live further from the centre, conditional on the vector of other individual characteristics, X_{kt}. The set of dummy variables, D_{t-1}, needs further explanation. Take, for example, the first individual, $k = 1$ assumed to live in the first district in the base year, $p = 1$. In this case the dependent variable can be rewritten as: $Y_{kt} - c_1 D_{1,t-1}$ where $D_{1,t-1} = 1$. Therefore, the dependent variable now measures the distance moved between (t–1) and (t) and c_1 approximates the average distance between each of the districts and the CBD. Typically c_1 is small as each of the districts is chosen to be close to the centre. N_{klt-1} adds to the basic model, and captures both neighbourhood characteristics in the area to which the individual considers moving (including the housing stock) and the proportion of like-status neighbours in the area the individual considers leaving. In order to reduce endogeneity issues, these are measured in the pre-move period. In practice, the most important variable for our purposes is the aggregate social structure of the neighbourhood, which is only constructed for London. Its role is discussed extensively in Chap. 3, including the potential econometric problems.

Three additional types of estimation problem arise—omitted variables, truncation and identification. Omitted variables take two forms: first, individual heterogeneity, correlated with OCC_{kt}, may bias the parameter, a_2 (and, indeed, other parameter estimates). The nature of the data makes it difficult to overcome this by the estimation of fixed effects; since OCC changes relatively infrequently, the standard fixed effects estimator, which removes the time means, eliminates the occupation variable as well and cannot be separately identified. Note, however, that since status is highly persistent over time, it may be poorly correlated with current variations in omitted variables. Second, there are variables that are considered important in the literature and are potentially measurable, but cannot be obtained directly from the electoral rolls in the Australian case, notably housing tenure and numbers of children. Note that house prices are not included amongst the set of the regressors; this is because, under the monocentric model, for example, prices are endogenous and decline with distance from the CBD. Therefore, their inclusion in (8.2a) would lead to highly significant, but spurious coefficients; the causality is in the opposite direction.

Truncation of the dependent variable for non-movers implies that (8.2a)—the outcome equation—should be estimated jointly with a selection equation for moving, given by (8.3a). The limited information Heckman two-stage estimator can be employed, for example, or the more efficient full information maximum likelihood method. M^* is a latent variable indicating the propensity to move, taking binary values of one for movers and zero otherwise. Z_k is a vector of variables determining the decision to move, and is not identical to X_k. The probability of moving is given by the probit model (8.4a), where Φ is the standard normal cumulative distribution function. Since distance is only observed for those who have moved, $\left(M^*_{kt} > 0\right)$, the expected distance for movers, is given by (8.5a).

$$M_{kt}^{*} Z_{kt}\gamma + \varepsilon_{kt} \tag{8.3a}$$

$$\Pr\left(M_{kt}^{*} > 0\right) = \Pr\left(\varepsilon_{kt} > -Z_{kt}\gamma\right) = \Phi\left(Z_{kt}\beta\right) \tag{8.4a}$$

μ_{2kt}, ε_{kt} are error terms with a bivariate normal distribution, with means, variances and covariance (0, 0, σ_u, σ_ε, ρ).

$$\begin{aligned} E(Y_{kt} \left| M_{kt}^{*} > 0\right.) &= a_1 + a_2\mathrm{OCC}_{kt} + \sum_{j=1}^{r} b_j X_{kjt} + \\ &\sum_{p=1}^{4} c_p D_{pt-1} + \sum_{l=1}^{v} d_l N_{klt-1} + E(\mu_{2kt} | \varepsilon_{kt} > -Z_{kt}\gamma) \\ &= a_1 + a_2\mathrm{OCC}_{kt} + \sum_{j=1}^{r} b_j X_{kjt} + \\ &\sum_{p=1}^{4} c_p D_{pt-1} + \sum_{l=1}^{v} d_l N_{klt-1} + \theta\lambda_{kt} \end{aligned} \tag{8.5a}$$

where $\theta = \rho\sigma$; $\lambda_{kt} = \phi\left(Z_{kt}\gamma\right) / \Phi\left(Z_{kt}\beta\right)$ and $\phi(.)$ is the standard normal density function.

In practice, the extent to which joint estimation is important depends on the proportions of non-movers in the sample. If sufficiently long periods are chosen between (t–1) and (t), the percentages are fairly modest. The cost is that attrition rates increase with the period. In the London case, since a 20-year period is chosen—choices are limited by the decennial census period—almost all the sample moved, in which case (8.2a) can be estimated alone. The neighbourhood status variable is only available for London and, so, the main text concentrates on location for London and the decision to move for Melbourne (the probit Eq. 8.4a), although the joint model (8.5a) was also estimated for Melbourne, using the Heckman maximum likelihood estimator.

A third issue concerns identification since each equation must contain at least one variable which is not in the other. The neighbourhood variables may provide exclusion restrictions since they are more likely to affect location that the moving decision. Furthermore, individual characteristics may have stronger effects on mobility than location.

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9

Path Dependence, the Spatial Distribution of Immigrant Communities and the Demand for Housing

9.1 Introduction

This chapter continues the theme of long-run urban spatial dynamics arising from population mobility, but from international rather than domestic migration flows. The economic consequences of immigration are politically-charged, but the controversies are not new. White (2012, pp. 158–162), for example, describes the strong London antipathy to Irish immigrants in the eighteenth century; the worst outbreak of violence took place in 1736 and was partly anti-Catholic in nature, due to fears of a resurgence in Jacobitism, but the primary cause was economic, initially arising from an allegation that a contractor building a church in Shoreditch in the East had discharged local workers to take on Irish immigrants at lower wages. The aim of the rioters was to drive the Irish out of the East End. The effects of low-skilled migrants on the wages and rents of the domestic poor have remained a focus of attention to the current day. In 1888, the House of Commons set up a Select Committee to report on emigration and immigration, whereas the House of Lords ran a parallel committee to investigate sweated labour arising from immigration (Fishman 1988, Chap. 3). More recently, the UK House of Lords

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(House of Lords 2008) highlighted similar issues, leading to a considerable volume of research (see, for example, Migration Advisory Committee 2012; Devlin et al. 2014; Kochan 2014).

In England, according to the 2011 census, 14 % of the population was born outside Britain; of this share 5 % was born in Europe, including Ireland, 5 % in the Middle East or Asia and 2.5 % in Africa. However, inasmuch as there is an immigration problem, it is the spatial distribution rather than absolute numbers that is important. In Chap. 8 we saw that, even in the late nineteenth century, London dominated as a destination for migrants and the city still remains the most important. In 2011, 37 % of its population was born abroad, with strong representations from Europe (12 %), the Middle East and Asia (12 %) and Africa (8 %). Furthermore, within London, there are considerable variations; Brent, Newham, Westminster and Kensington all had foreign-born shares greater than 50 %. In one Middle Layer Super Output Area in the north western local authority district of Brent, 68 % of usual residents were born abroad. Even within Brent, at the finest Output Area level (where the population averages 375), the born-abroad share ranged between 25 % and 75 %. This chapter discusses in detail the spatial concentration of international migrants, their spatial persistence in some locations over long time periods, and the effects on the demand for housing.

The stability of the location of migrant communities, unless disturbed by major events, such as wars, is a theme of the chapter and, given its pre-eminence in attracting migrants, London is the focus. Some care is needed in the use of the data because the conclusion depends on the chosen spatial units; the use of local authority districts, for example, gives the appearance of greater stability than the much smaller Output Areas, reflecting the fact that most moves are short distance. Nevertheless, local authorities are important since these are the spatial units that are responsible for the provision of local services and therefore bear the costs. The title to the chapter stresses 'path dependence' and we suggest that Polya processes, discussed in Chap. 3 and which exhibit path dependent properties, provide a useful characterisation of how migrant distributions arise. Because of transactions costs, it is only when large shocks occur that the patterns are disturbed. Since major events are infrequent, long time series are required, but information on countries-of-birth, which is our measure of immigration, has been published on a fairly consistent basis since 1851 in the population censuses. Data are available at local authority or Registration District level, although finer spatial scales cannot be analysed until more recently. Throughout history, immigrants have arrived for both economic and political reasons; those arriving out of political necessity tend to arrive in waves rather than gradually and can be considered as exogenous, external shocks that affect local housing markets. A further theme of the chapter is the displacement effects on domestic populations that these events may cause, possibly adding to the strength of segregation.

9.2 Migration, Displacement and Housing Costs

Policy concern with the influence of migrants on housing has focussed on rents, house prices and the availability of social housing, but, nationally, there is little evidence of large effects, which is unsurprising since the share of migrant households is limited across the country as a whole. As discussed in detail below, migrants are spatially concentrated and any effects might also be expected to be localised. A possible exception is if local housing markets are integrated, so that the arrival of migrants displaces the resident population to wider areas. Moreover, increases in migrant numbers do not necessarily translate into a proportionate increase in housing demand. Household formation rates may differ from the domestic population and tenure choices take time before they converge towards those of UK residents. Initially, the majority are housed in the private rental sector. Whitehead (2014), quoting research conducted at the London School of Economics, finds that, between 2007 and 2013, EU migrants were much less likely to be in social housing than domestic residents and this was also the case for non-EU migrants controlling for household structure and economic circumstances, but, 'after ten years those from outside the EU are somewhat more likely than average to be in social housing' (p. 150). Furthermore, she finds that 92 % of new social lettings in England in 2012–2013 went to UK national heads.

Nygaard (2011) models the headship rates and tenure choices of UK migrants between 2003–2004 and 2005–2006. He finds that the length of time an individual has been in the country has only a limited effect on inter-ethnicity differences in the probability of being a head of household, but a major impact on the probability of becoming an owner-occupier. For example, across all immigrant ethnicities, a male migrant with a child, living in London, has a 4 % probability of being an owner after one year in the UK, but this rises to 58 % after 12 years, although outcomes are dependent on economic factors, notably income and housing costs. Outside the UK, a range of studies of migrant home ownership have been conducted. Haan (2005) and Sinning (2010) model immigrant home ownership in Canada and Germany respectively. Painter and Yu (2014), using US data, contrast domestic and migrant mobility, household formation and home ownership before and immediately after the Global Financial Crisis. Constant et al. (2009) also consider migrant home ownership in Germany, taking into account not only traditional socio-economic variables, but also measures of ethnic identity. Those migrants that display a stronger attachment to the host country are more likely to become home owners.

At first sight—and in line with the popular view—it might appear self-evident that an increase in immigration should generate rises in house prices, particularly in areas where migrants are heavily concentrated[1] but, in fact, the overall effect depends on the spatial scale. At a wide scale, Gonzalez and Ortega (2013) find that house prices and new construction across the Spanish provinces were strongly positively affected by an immigrant inflow between 1998 and 2008 amounting to 17 % of the original working-age population. The evidence also suggests that prices rise at the city level, where Saiz (2007) provides strong support for the US and Accetturo et al. (2014) for Italy, although the prices of dwellings *within* the neighbourhoods where migrants concentrate may fall. The outcome depends on the income of migrants, the price elasticity of housing supply and displacement of domestic residents to other areas. The last has received particular attention, both in the UK and elsewhere, and

[1] Card (2007) reviews the US evidence on the implications of immigration for housing and labour markets as well as wider effects.

the work of Card (2001) and Borjas (2006), both for the US, has been influential. Recent work for the UK includes Hatton and Tani (2005), Meen (2011), Gordon (2014) and Sá (2015). *Regional* displacement of natives is lower than at city or local authority level, since, from Chap. 3, most moves are under 10 miles (see Sá 2015). Nevertheless, both Hatton and Tani and Meen find dispersion even at the regional scale. In the light of Chap. 3, the threshold model of Card et al. (2008) is particularly interesting; they find that native outflows in the US only takes place once migrant shares reach critical levels.

For the English local authorities, Sá (2015) finds evidence that displacement produces a negative effect on house prices, which is particularly strong where low-skilled migrants replace higher-skilled domestic residents, remembering that the high-skilled are more mobile than the low-skilled. The changes to prices in areas receiving the domestic residents tend to be modest because they are dispersed over wide areas. A similar negative relationship, within US cities, between the growth in house prices and changes in local immigrant shares is found in Saiz and Wachter (2011).[2] They suggest that the native flight that causes slower price growth arises primarily because immigrants are of lower socio-economic status. Accetturo et al. (2014) attribute similar findings in Italy to lower levels of amenities in migrant areas. Price effects may be mitigated where the price elasticity of supply is high. Gordon (2014) indicates that, for London, the increase in migrants has been accommodated primarily by an increase in population density, for example through house sharing, rather than new development. Sá finds that migrant inflows reduce local construction, because of the induced lower house prices; Meen and Nygaard (2011) indicate that the price elasticity is higher in urban areas, because of the impact of planning controls on green field sites, but the elasticity is still modest. Overall, at least in an English context, there

[2] Note that the relationship could be reversed—immigrants are attracted to areas where prices are growing more slowly. Furthermore, significant effects from immigration could arise from omitted variables which are correlated with both immigrant flows and prices, for example, the quality of the environment. To overcome the problems, instrumental variable strategies are employed. The instruments typically exploit the findings below, that new migrant flows are correlated with the existing migrant stock in each area.

is little evidence that construction acts as a stabiliser to price changes induced by migration.

9.3 The Distribution of Immigrants in London, 1861–2011

Migrant location choices within cities, therefore, matter both for prices and for domestic displacement but, in order to analyse immigration, long-run data sets are required, because extensive periods may exist with very little change and households become locked into existing spatial patterns. Long-run migration flows over centuries have been studied by Ferrie and Hatton (2013), Hatton (2003, 2005) and Hatton and Williamson (2004). This chapter takes data from population censuses between 1861 and 2011. From the earliest date, information has been published on migrants by country of birth at local authority levels. In practice, the identified countries of birth have varied over time according to the relative importance of the migrant flows and comparisons also suffer from changes in administrative boundaries. For example, data were published by Registration Districts until 1901, by Metropolitan Boroughs until 1961 and by Local Authority Districts thereafter. Appendix 1 in Chap. 5 shows the changes in London boundaries.

From Gordon et al. (2007), Lombard Street in the City of London was established in the twelfth century as a banking centre by merchants from Northern Italy; they suggest that, by 1501, there were an estimated 3000 foreign traders in London. Ravenstein (1885) estimates that there were 5060 foreigners in London in 1580, with a total population of 150,000 residents at the time. Persecution of Protestants in France induced Huguenot immigration in the sixteenth century, which became a flood after the revocation of the Edict of Nantes in 1685. White (2012) suggests that, by 1700, there were approximately 25,000 Huguenots in a London population of a half million, distributed mainly in Spitalfields in the East End and the newly-developed Soho area. Spitalfields became a centre of the silk-weaving industry, drawing on the skills of the Huguenots with settlement taking place outside the City walls. However, by the nineteenth century, a series of crises in the silk industry, including the availability of cheap imports, had led to a decline in the industry and to the area as a whole. Part of the area had consisted of fine Georgian houses built for merchants, including properties designed by Hawksmoor (as well as more modest properties), reflecting the fact that by no means all the migrants were poor and unskilled. By Victorian times, however, the area had deteriorated to provide some of the worst London slums; it was into this environment that new waves of Jewish émigrés arrived in the mid- to late-nineteenth century.

Following Cromwell's relaxation of controls on Jewish immigrants in the mid-seventeenth century, which had been in force for 300 years, White estimates that there were only approximately 750 Jews in London in 1700, but, by the end of the century, the number had expanded to around 15,000, most of whom had arrived in the second half of the century from Germany and Eastern Europe. The re-drawing of the international map at the Congress of Vienna in 1815, following the Napoleonic wars, led to subsequent important migration flows. Key changes involved the annexation of most of Poland by Russia (with the remaining parts going to Prussia); following the partition, Russian Poland experienced a series of uprisings, for example in 1830 and 1863 in attempts to free Poland from Tsarist rule, contributing to waves of migrants coming to Britain. The assassination of Tsar Alexander II in 1881 and the subsequent anti-Jewish pogroms and legislation, generated further waves of emigration.

Perhaps the common perception of nineteenth century migrants is that they were poor and were concentrated in the East End of London. Indeed, even today, the view that all migrants are unskilled is widespread, although, in practice, skill levels vary widely as was the case in the nineteenth century. From Table 9.1, only a third of the total migrant population in 1861 and 1881 lived in the East End, here defined as the Registration Districts of Bethnal Green, Mile End, Poplar, Shoreditch, St George in the East, Stepney and Whitechapel. Approximately 15 % of migrants lived in Whitechapel alone, but, even here, migrants only made up approximately 14 % of the total population in 1881. Of the remaining two-thirds, only the central spine north of the River Thames, consisting of Kensington, Westminster, Marylebone, St. Pancras, Islington and Holborn, had shares of total migration greater than 5 %. Table 9.1 also

Table 9.1 Migrants in the nineteenth century

	Migrant (%)		Average rateable value (£ pa)	
Registration District	1861	1881	1815	1841
Kensington	6.1	9.7	32.7	29.1*
Chelsea	1.3	1.2	36.9	29.1*
St Georges Hanover Square	3.9	3.9	98.9	79.2
Westminster (incl. St James)	4.9	5.4	58.1	50.7+
Marylebone	6.8	6.1	61.8	57.5
Hampstead	0.6	1.3	42.2	n.a.
St Pancras	5.5	6.5	39.2	33.1
Islington	3.3	5.2	41.9	24.9
Hackney	1.5	3	33.1	22.4
St Giles	2.3	2	53.9	47.8
Strand (incl. St Martins)	4.8	1.7	71.3	75.3++
Holborn (incl. Clerkenwell & St Luke)	5.8	5.6	43.5	27.7+++
London City (incl. E&W London)	5.9	2.5	47	51.4++++
Shoreditch	2.7	1.9	18.7	13.4
Bethnal Green	1.2	1.5	11.7	8.1
Whitechapel	15.2	16	25.4	22.4
St George in the East	6	4.6	29.1	23.6
Stepney	2	1.2	19.9	14.8
Mile End Old Town	3.8	4.8	23.2	n.a.
Poplar	4	2.6	53.3	31.7
St Saviour Southwark (incl. St George & Newington)	2.4	1.8	22.9	18.9**
St Olave Southwark (incl. Bermondsey & Rotherhithe)	3.5	1.6	24.9	20.2***
Lambeth	2.4	3.1	29.4	21.5
Wandsworth	1.1	2.2	28.3	n.a.
Camberwell	1.2	2	43.5	12.3
Greenwich & Lewisham	1.8	2.9	19.6	15.8

Source: Census of Population (various years) and Registrar General's Report
Note: Appendix 1 in Chap. 5 maps the location of the Registration Districts
*The same value for Kensington and Chelsea is taken; **average value of St Saviour, St George and Newington; ***average value of St Olave, Bermondsey and Rotherhithe; +average value of Westminster and St James; ++average value of Strand and St Martins; +++average value of Holborn, Clerkenwell and St Luke; ++++average value of City, East and West London

shows estimates of the average annual rateable value per house; the 1815 figures, collected on a parish basis, were published as part of the 1831 census and the 1841 values were calculated for Poor Law assessments and appear in the Registrar General's Report. Despite the 30-year gap, the correlation between the two sets of estimates is very high at 0.9. The low property values in the East End, where migrant shares were high, are evident. At this time, property values were also low south of the river, but the area attracted few migrants. Equally, high priced St Georges Hanover Square, Westminster and Marylebone contained relatively large migrant communities, reflecting the differences in the nature of migrant groups across London.

In the mid to late-nineteenth century, more than 90 % of migrants in London came from Europe, summarised in Table 9.2 for a selection of the largest districts and migrant groups. By contrast, the 2011 census indicates that only approximately 30 % came from Europe.[3] Some care is needed in nineteenth century comparisons, as a result of the formation of the German nation state in 1871 and boundary changes to Poland; therefore, the countries of birth sometimes refer to different entities between the 1861 and 1921 censuses. The final column of Table 9.2 shows that migrants in Whitechapel were dominated by arrivals from Holland, Russia and Poland. However, migrants from Germany (the largest group) were more widely distributed, perhaps reflecting the fact that Germany was a new country, made up of previously very different entities. Outside the East End, the largest grouping was of Italian migrants in Holborn in Little Italy, based around Saffron Hill as discussed in Chap. 2, but with these exceptions, most migrants were broadly based.

Comparisons over time are hindered by London boundary changes, with the new Metropolitan Boroughs in place for the 1901 census; Whitechapel, then, became part of the borough of Stepney. Table 9.3 shows standardised estimates for the share of Polish migrants in Stepney, for selected years, between 1881 and 1961 and for the London Borough of Tower Hamlets from 1971, which subsumed Stepney.[4] The table indicates a gradual decline between 1881 and 1901, but the proportions remained very high.[5] The decline had become more significant

[3] The 1861 figures refer to Inner London, but 2011 values are for Greater London.

[4] Note that values for 1888 and 1901 refer to Russian Poland in the censuses.

[5] Although the reported boundaries are slightly different, the indications are that concentrations were similar in 1861.

Table 9.2 Selected spatial distribution of migrants in 1881

	London (No.)	Kensington (%)	Westminster (%)	Marylebone (%)	St Pancras (%)	Islington (%)	Holborn (%)	Whitechapel (%)
Total	60,252	9.7	5.4	6.1	6.5	5.2	5.6	16
France	8252	15.3	11.6	12.8	11	4.3	4	1.4
Italy	3504	7.1	8.7	5.2	6.3	2.4	44.6	0.5
Germany	21,966	9.6	4.4	5.7	6.9	7	4.2	8.2
Belgium	1492	9.6	12.3	9.1	10.2	4.2	2.8	2.5
Holland	4193	3.6	1.9	1.9	3.3	6.1	1.1	44.1
Russia	1778	3.7	2	1.1	1.8	2.6	1.4	47
Poland (Russian)	6931	0.8	2.3	0.4	0.8	0.8	0.6	64.3

Source: Census of Population 1881

Table 9.3 Distribution of Polish migrants, 1881–2001

	Stepney males (%)	Stepney females (%)	M&F (%)	M&F (Nos, London)	Tower Hamlets (M&F, %)	Ealing (M&F, %)
1881	78.6+	84.5+		6931+		
1901	75.4+	78.6+		15,420+		
1911	68	71		23,918		
1931	47	51.1		29,857		
1951			9.1	32,787		
1961			7.6	22,473		
1971				32,505*	3.1	12
1981				25,780*	1.8	14.3
2001				22,224*	1.2	16.6
2011				158,300*	1.7	13.6

Source: Census of Population (various years)
*Greater London; +Russian Poland only

by 1931, presumably because of deaths amongst the original migrants, but even more dramatic changes occurred between 1931 and 1951. There was no census in 1941, but most of the change appears to have occurred in the short period between the outbreak of war and 1941. During the war years, overall population losses in Stepney were strong and the period also covers the Battle of Cable Street in 1936 and the influence of the British Union of Fascists. The decline continued post-war, but Polish communities then developed in the western district of Ealing, although by no means on the same scale as in the nineteenth and early twentieth centuries. Table 9.3 also illustrates the effects of A10 migrants who began to arrive from 2004; for London as a whole, Polish migrants rose from approximately 22,000 in the 2001 census to 158,000 in 2011. This new wave of Polish migrants was different in its characteristics from previous generations and was more widely dispersed across London, leading to a fall in the Ealing share. Nevertheless, the impact in Ealing was still strong with the absolute number rising from 3695 to 21,507; a factor may have been that the community was supported by delicatessens supplying them with their accustomed food. The contiguous districts of Brent and Hounslow accounted for a further 13.2 % of total Polish migrants, so that approximately 27 % lived in three western districts in 2011.

As noted above, immigration from outside Europe in the nineteenth century was limited. Even in 1931, the European proportion stood at 65 % across (Inner) London, but a shift towards arrivals from the British Dominions took place after the Second World War, although Germany, Russia and Poland initially remained the primary sources. For example, the 1931 census identifies 44,000 residents in the London Administrative Area born in the whole of the British Dominions, but 60,000 came from these three countries alone. In 1951, the 'foreign' (non-dominion) migrant share stood at 73 % of the total and the census still identifies Poland as the country of birth for the largest migrant group. Nevertheless, the foreign share had fallen to 47 % in 1961; whereas those born in Poland had declined to 22,000 across London, migrants from Jamaica totalled 37,000, followed by 26,000 and 25,000 from Cyprus (aided by the Greek-Turkish conflict) and India respectively. Immigration continued in the sixties with flows from South Asia and Asian refugees from Uganda and Kenya. Table 9.4 sets out the spatial distribution of the migrants pre-and post-war; once again the collapse in the migrant share in Stepney between 1931 and 1951 stands out. By the early 1960s, the area no longer had a disproportionate share of immigrants. Kensington was particularly multi-national and includes most of Notting Hill, the location of the notorious race riots of 1958. Perhaps, surprisingly, Hampstead had the second highest percentage of foreign migrants.

Jamaicans and Indians made up high numbers of migrants in 1961 and, although countries of birth have since widened, migrants from India still comprise the largest number from the identified countries in the 2011 census at 262,000. Although now surpassed by migrants from Poland (158,000), Pakistan/Kashmir (112,000) and Bangladesh (110,000), Jamaican migrants (87,000) are still a major proportion of the total[6]; Table 9.5 ranks the local authority districts according to the highest shares of Jamaican and Indian migrants in 2001. There have been changes over time, but Ealing and Brent have largely maintained their dominance of Indian migrants, although, from the above, Indian

[6] Local government reorganisation in the 1960s led to new boundaries in the 1971 census, covering a wider area than the former Metropolitan Boroughs. Therefore the absolute numbers from 1971 onwards are not comparable with the 1961 figures.

Table 9.4 Spatial distribution of migrants, 1931–1961 (London Metropolitan Boroughs)

	Dominions 1931 (%)	Foreign 1931 (%)	Dominions 1951 (%)	Foreign 1951 (%)	Dominions 1961 (%)	Foreign 1961 (%)
Battersea	2	0.9	1.4	1.6	2.9	1.8
Camberwell	2.8	1.4	2.2	2.1	4.1	2
Chelsea	2.7	1.2	3.6	2.4	1.6	2.8
Fulham	3.5	1.7	2.9	3	2.9	3.2
Hackney	1.5	7.7	1.4	7.6	6.4	5.8
Hammersmith	2.4	1.8	2.5	2.9	3.5	3.4
Hampstead	5.3	4.3	6.3	9.4	4.4	9.3
Holborn	2.5	2.6	1.8	1.3	0.6	1.3
Islington	3.4	3.8	4.9	4.5	12.1	5.4
Kensington	14.4	6.2	16.1	12	11	13
Lambeth	5.3	3.6	5.1	4.5	8.7	4.6
Lewisham	4	1.3	3.2	2	3.1	2.5
Paddington	8.8	4	7.5	7.7	6.9	7.9
St Marylebone	5.4	3.9	4.9	5.4	2	5.7
St Pancras	5.1	5.5	8.4	4.8	5.4	4.7
Stepney	1.8	22.6	3.6	5.1	3	3.3
Wandsworth	8	7.1	7.4	8.2	8.2	8.1
Westminster	7.6	6.9	6.2	5.7	2.1	5.8

Source: Census of Population (1931, 1951, 1961)

Only boroughs where migrants exceed 3000 in 1951 are included. Figures exclude migrants from Ireland

migrants are now competing for housing with the increased number of Polish migrants in the area. Administrative local authority boundaries are artificial and contiguous boroughs dominate the distributions so that approximately 40 % of Indians lived in 2011 in the contiguous districts of Ealing, Brent, Hounslow and Harrow in West London, not far from Heathrow airport. A further 19 % lived in the contiguous districts of Newham and Redbridge. A similar degree of concentration emerges for Jamaican migrants; more than 40 % in 2011 lived south of the River Thames in the contiguous districts of Lambeth, Lewisham, Croydon, Southwark and Wandsworth. This position has showed little aggregate change across the five districts since 1971, whereas concentration amongst Indian migrants appears to have increased.

Of the remaining country of birth groups, Bangladeshis are the most striking. Whereas Table 9.4 suggested that, by 1961, Stepney no longer had

Table 9.5 Distribution of Indian and Jamaican migrants, 1971–2011 (% of total)

	1971	1981	2001	2011
Jamaica				
Lambeth	15.4	14.5	12.4	11.1
Lewisham	8.2	8.7	10.2	11.1
Brent	13.3	11.7	9.7	8.2
Croydon	4.1	4.7	8.1	10.6
Southwark	6.3	7.6	7	6.4
Hackney	7.4	7.2	5.5	5.1
Wandsworth	9	8	4.6	4.1
India				
Ealing	15.4	15.2	11.9	9.9
Brent	7.6	10	10.5	10.9
Newham	5.6	8.4	7.4	10.2
Hounslow	6.5	7.9	8.9	10.4
Harrow	2.6	4.6	7.2	8.2
Redbridge	2.8	4.1	6.8	8
Croydon	5.3	5.1	5.5	5

Source: Census of Population (1971–2011)

a disproportionate share of any migrant group, this subsequently changed dramatically. In 2011, 35 % of Bangladeshis lived in Tower Hamlets and, including the neighbouring districts of Newham and Redbridge, the total rises to more than 60 %. By contrast, 40 % of Pakistani migrants lived in contiguous Newham, Redbridge and Waltham Forest in London's north east, but only 1 % lived in Tower Hamlets, which is also a neighbour.

The fact that approximately 40 % of Indian, Pakistani and Jamaican migrants live in contiguous districts, of course, implies that 60 % do not live in these areas and that there is considerable diversity across London. The degree of concentration is also, arguably, overstated by the reliance on local authority district information. The example of Brent above shows the diversity that can occur within districts. Furthermore, data on stocks of migrants hide the underlying patterns of gross inflows and outflows and differences in behaviour between cohorts. A constant stock could be consistent with high out-movements of existing residents, compensated by strong inflows of new migrant arrivals. Some insight into these issues is provided by Paccoud (2014) and Datu (2014). The former uses census information to examine differences in movements between 2001 and 2011 of migrants born abroad and of second generation migrants born in the UK. For most countries examined, relocation patterns of the two groups appear to be similar (Indians are the main exception), although the conclusion again depends on spatial level. The correlations are typically higher at the borough than output area scales. Datu considers information newly available in the 2011 census on the length of time migrants have been in the UK, which allows differences in the behaviour of the cohorts to be examined. From this, it is increasingly becoming clear that migrants are no longer confined to the Greater London region and are now spreading further into selected towns of the South East.

9.4 Explaining Migrant Distributions

In general terms, domestic households move home because of perceived economic benefits, to take advantages of better housing conditions, because of changes in family status, or to be closer to family, friends or social groups. There is strong empirical evidence that international migrants to the UK, and indeed to other countries, are influenced by relative economic conditions, including the educational advantages. Net inflows increase when the UK performs well relative to the rest of the world (see, for example, Mitchell et al. 2011). Most research has concentrated on the drivers of the total number of migrants, which, as we saw in the last section, relate to political push factors as well as economic pull throughout history. Less research has been conducted on where, within the country, migrants choose to live once they have arrived. *Prima facie*, given that different migrant groups are heavily spatially concentrated, the location of family or friends already in the country and the existence of networks are expected to be even more important than for domestic households. The advantages include perceived safety in numbers in the face of racial attacks, the existence of infrastructure, including food shops where owners speak the local community language and import ethnic foods, the availability of clothes and fabrics, and religious support. Housing and labour market influences still probably also affect the location of migrants within the UK; nineteenth century migrants appear to have been attracted by the location of the London docks, cheap housing and the availability of employment opportunities, notably in the tailoring trade. However, the last section also showed that cheap housing, south of the Thames, was not sufficient to attract migrants. More recently, job opportunities in the neighbourhood of Heathrow airport were influential in the location of Indian migrants and so distinguishing between explanations can be problematic. For example, if an area already has large numbers of low-skilled migrants, this may depress house prices, attracting even more low-skilled migrants. Furthermore, the concentration of migrants may lead to a demand for new services, such as ethnic restaurants, increasing job opportunities that favour new arrivals. The main job opportunities for some ethnic groups are likely to be in small businesses amongst the local community, due to language barriers. Neither of these explanations requires network effects.

If networks are important, then the Polya process introduced in Chap. 3 is a useful device to explain more formally how concentrations of migrant groups arise, why they exhibit path dependence and the conditions that are necessary for the concentrations to change. To recap on the essential features, a non-ergodic or path dependent stochastic process is defined in terms of the limiting probability distribution that governs the systems dynamics. A Polya process is an example of a system that exhibits non-ergodicity; under its definition, the probability that any new migrant chooses a particular location depends on the distribution of nationalities already in the area. If there is already a high stock of migrants from a given country, this raises the probability that the next arrival to the area will be of the same nationality. Equally, migrants from other countries are less likely to choose the area. In the early stages of an area's development in terms of migrant numbers, the proportions of different immigrants are volatile, but stabilise over time and the patterns are persistent and irreversible unless major shocks are sufficient to overcome the agglomeration economies or transactions costs associated with the persistent structures.

The factors contributing to the spatial migrant distributions are considered in detail for 1951 and 2011.[7] 1951, as the first post-war census, allows us to quantify the effects of bomb damage to the housing stock, which, as discussed in Chap. 5, was not equally distributed across

[7] The distributions at other dates between 1861 and 2001 were also modelled, but the key issues can be seen from these two dates.

London. The 2011 census provides the most recent data; since broadly consistent local authority boundaries were in place from 1971, the extent of persistence in spatial patterns can be examined. Appendix 1 discusses the formal specification of the equations and the potential econometric issues that arise. We relate the stock of migrants from a country (i), located in any local area (j) in 1951 or 2011 to the stock of migrants from (i) in earlier periods, the stock of migrants from the same country of birth in contiguous areas, the stock of migrants in the area from other countries, and a set of housing and labour market indicators. Data restrictions mean that some variation in the specifications occurs between the two years; full results are shown in Tables 9.6 and 9.7.

The first equation in Table 9.6 for 1951 presents results for all the countries of birth identified in the 1951 census and the second for the

Table 9.6 Migrant shares in 1951 (dependent variable $= x_{ijt}$)

	All countries	Europe
Constant	−8.690 (1.9)	−12.077 (1.9)
x_{ijt-k}	1.132 (25.4)	1.170 (16.5)
$x_{ijt-k} \cdot DEATH_{t-k}$	−0.168 (3.4)	−0.333 (4.7)
$x_{ijt-k} \cdot DEMOL_{t-k}$	−0.028 (11.5)	−0.026 (7.8)
$W \cdot x_{ijt-k}$	0.164 (3.6)	0.330 (4.6)
$(MIG/POP)_{jt-k}$	0.300 (6.2)	0.361 (5.2)
$(CROWD)_{jt-k}$	−1.574 (5.2)	−2.304 (5.3)
$\ln(EMPL)_{jt-k}$	1.067 (2.6)	1.467 (2.5)
R^2 (adj.)	0.63	0.60
Equation St. error	3.07	3.17
Number of observations	600	315

t-values in brackets. Subscripts refer to the year of measurement for each variable. $k = 20$, which is 1931 for all variables except *DEATH* and *DEMOL* which are measured in 1941

x_{ijt} = share of migrants from country of birth (i) in local authority district (j) at time (t)

W = spatial weights matrix

CROWD = total population/total number of dwellings

DEMOL = houses destroyed, demolished or damaged as a percentage of the 1939 housing stock

DEATH = numbers killed or seriously injured by May 1941 as a percentage of 1939 population

MIG/POP = total number of migrants/total population

EMPL = total employment

Table 9.7 Migrant shares in 2011 (dependent variable = x_{ijt})

	All countries IV estimation	Europe IV estimation	Richer countries IV estimation	Poorer countries IV estimation
Constant	12.700 (5.7)	21.221 (5.2)	−3.456 (1.4)	16.871 (5.3)
$x_{ijt-k+20}$	0.812 (45.0)	0.680 (13.5)	0.651 (17.7)	0.828 (38.5)
$W \cdot x_{ijt-k}$	0.148 (4.8)	0.235 (3.4)	−0.056 (1.4)	0.187 (4.9)
$\sum_{r \neq i}^{I} x_{rjt-k}$	−0.020 (2.4)	–	–	−0.016 (1.3)
$\ln(DENSITY)_{jt-k}$	0.447 (4.0)	0.725 (3.8)	1.140 (10.4)	0.056 (0.4)
$\ln(PH)_{jt-1}$	−0.991 (5.4)	−1.700 (5.1)	0.320 (1.6)	−1.325 (5.0)
R^2 (adj.)	0.85	0.76	0.89	0.86
Equation St. error	1.18	1.38	0.75	1.30
Number of observations	825	297	297	528

PH = index of local house prices; *DENSITY* = number of dwellings per acre; *t*-values in brackets

The subscript $k = 30$, which is 1981

European countries alone (excluding Ireland). The 1951 census identified in detail those boroughs where the total number of migrants was greater than 2000, which implies that estimation only covers those boroughs where migrant concentrations were relatively large. Consequently, the total number of pooled observations is 600 and 315 for Europe. Note also that modelling is for the Inner London Metropolitan Boroughs, which, at the time, dominated migrant numbers. Both equations present similar messages. The measures of housing and labour market conditions are significant and migrants were attracted to areas of strong labour markets, but disliked over-crowded boroughs, experiencing housing shortages. Migrants were also attracted to areas where the total number of migrants as a percentage of the population was high. The coefficients on the lagged migrant stock shares, and hence the degree of persistence, need explanation. The equation includes: a conventional lagged dependent variable—the share of migrants from country of birth (*j*) living in borough (*i*), measured pre-war in 1931; the share of same-country migrants in contiguous boroughs, captured through an equally-weighted, spatial weights matrix; and lagged dependent variables interacted with deaths and demolitions caused by war-time bombings. From Chap. 5, across Inner London, approximately 10 % of the housing stock was destroyed, but Stepney lost 26 %, Lambeth 18 % and Hackney 14 %. At the other end of the scale, Hampstead lost only 1 % of its stock. Deaths and serious injury varied from 1.7 % of the population in Westminster to 0.3 % in Hackney and Hampstead. At first sight, the coefficient on the 'simple' lagged stock (1.132 for the first equation) might suggest instability in the equation, but account also has to be taken of the interaction variables. Using the mean values across London for *DEATHS* and *DEMOL*, the total effect from the three lagged dependent variables is 0.76. The structure of migration across London exhibits considerable persistence, but since the coefficient is less than one, the equation is stable. This represents the *average* value, but the distribution depends on the distribution of fatalities and dwelling losses. The same calculation for Stepney yields a value of only 0.26; over a 20-year period, this is, arguably, a modest degree of persistence. Large shocks, even if temporary, disturb highly persistent migrant spatial patterns and Stepney, as in Table 9.3, is the prime example. For comparison, the equivalent value for the west London suburb of Hammersmith, which was much less impacted by the war, has a coefficient of 0.93.

The migrant distributions in 2011 provide the second example. Here, the migrant shares in each of the 33 London districts are examined for the 25 countries of birth, which are identified in both the 2011 and 2001 censuses. The 2011 shares are regressed on the shares in 2001, the shares in contiguous districts, the shares of migrants from other countries, the density of housing (dwellings per acre), and local house prices (measured in 2010). As discussed in the appendix, the coefficient on the lagged stock may be biased because of correlated omitted variables and house prices may be endogenous and so both are instrumented. Since all the other variables are measured with a 30-year lag, endogeneity is less likely to be an issue. Four equations are presented in Table 9.7: the first shows the results for all 25 countries, the second for Europe, the third for 'richer' countries and the fourth for the 'poorer'. In all cases, from the lagged dependent variable, a high degree of persistence occurs; across all countries the value is 0.812. In addition, high house prices act as a deterrent, but housing availability, measured in terms of density attracts migrants. Nevertheless, the differences between groups are noticeable; first, spatial persistence is weaker for migrants from richer countries—an indicator that networks are less important for this group. Indeed, own country migrants living in contiguous districts only have a significant (negative) effect at the 15 % level; the total coefficient is 0.595. By contrast, for the poorer countries, own country migrants in the same and contiguous districts have a very strong effect (total coefficient = 1.015).[8] Second, high house prices deter only migrants from the poorer countries; there is some evidence that richer migrants prefer the high-prices areas. Third, concentrations of migrants from other countries have, at best, only a limited impact on location and any effect occurs primarily amongst migrants from poorer countries. Finally, contrasting Tables 9.6 and 9.7, for all equations in 2011, the degree of persistence is much higher than for the residents of war-time Stepney. Again, large shocks are required for spatial distributions to change rapidly.

9.5 In Conclusion: The Implications for Segregation

The chapter shows that migrants from poorer countries are more likely to be attracted to areas with low housing costs and large percentages of residents from the same country of birth, although there is evidence that they are now moving beyond the borders of London. Once poorer migrant groups have become established, they are highly persistent unless disturbed by large shocks. By contrast, the literature finds that native households are mobile with respect to migrant inflows, even if the distances are fairly short. Furthermore, migrants from richer countries are more likely to live in expensive boroughs and are also mobile. As a caveat, the analysis is conducted in terms of stocks and it is possible that poor migrants are, in fact, mobile and out-movers are replaced by gross-inflows of migrants with similar characteristics. Overall, these forces suggest that long-standing patterns of segregation are likely to be reinforced and we return to the persistence of segregation in Chap. 11.

[8] Similar results occur, estimating the 2001 shares conditional on the 1981 shares. These results also find that migrants from countries with large stocks already in the country exhibit higher degrees of persistence, consistent with the predictions of the Polya process (see Meen 2012, Table 3).

9.6 Appendix 1: Modelling the Local Distribution of International Migrants

The sets of influences discussed in the main text can be captured in the general model, given by Eq. (9.1a). The proportion of migrants arriving from a country (i) who locate in any local area (j) is a function of the existing stock of migrants from (i), the stock of migrants from the same country of birth in contiguous areas, the stock of migrants in the area from other countries and a set of variables, relating to housing and labour market conditions. The housing market variables are house prices, density (measured as the number of dwellings per acre) and overcrowding (total population/number of dwellings). Theory stresses relative wages as an indicator of labour market conditions. In practice, within cities, for comparable occupations, differences in local wages are expected to be modest, because of commuting and, therefore, they are excluded. Arguably, commuting might suggest that local employment conditions should also have a limited effect but, nevertheless, the level of employment is included. The focus is on the housing variables, which, in practice, are correlated with employment; employment plays a greater role in the results for 1951, where no house price information is available.

$$x_{ijt} = \gamma_0 + \gamma_1 x_{ijt-k} + \gamma_2 W \cdot x_{ijt-k} + \gamma_3 \sum_{r \neq i}^{I} x_{rjt-k} + \gamma_4 Z_{jt} + \varepsilon_{ijt} \tag{9.1a}$$

x_{ijt} = share of migrants from country of birth (i) in local authority district (j) at time (t)

W = spatial weights matrix

Z = vector of housing and labour market variables, *PH*, *DENSITY*, *CROWD*, *EMP*

PH = index of local house prices

DENSITY = number of dwellings per acre

CROWD = total population/total number of dwellings

EMPL = local employment

ε = error term

The dependent variable is measured as a share, but since this is bounded between 0 % and 100 % in principle the equation could be specified as a logistic function. In fact, this makes little difference to the results and so the simpler share results are shown here. γ_1 and γ_2 measure the degree of persistence, where γ_1 is the lagged dependent variable coefficient. In practice (k) is varied in order to test the degree of persistence. For example, for the equations of migrant shares in the 2011 census, modelling conditional on the 2001 shares (the minimum period), implies $k = 10$; modelling conditional on 1981 means $k = 30$ and so on. The need for γ_2 and the spatial weights matrix arises from the fact that boroughs are administrative units and do not represent true spatial boundaries for migrants. The spatial weights matrix, W, employs first-order contiguity and equal weights are used for migrant shares from the same country of birth in surrounding boroughs. The sum of γ_1 and γ_2 provides the full measure of persistence. γ_3 captures the influence of migrants from other countries; the effect could be either positive or negative, depending on international alliances or tensions. In 1951, this variable is proxied by $(MIG/POP)_{jt-k}$, which is the total number of migrants as a proportion of total population.

The equation is tested for two time periods, 2011 (as the most recent census) and 1951, where the aim is to test the impact on shares of the Second World War—a major temporary shock that might be strong enough to overcome the effect of long-established networks. Other periods were also tested, which reinforce the findings (see Meen 2012). The 1951 regressions require the addition of measures of the local war time shocks; as in Chap. 5, these are captured by *DEMOL* and *DEATH*.

These variables are interacted with the lagged dependent variables as well as being entered as independent regressors, so that:

$$\gamma_1 = \delta_0 + \delta_1 DEMOL + \delta_2 DEATH \tag{9.2a}$$

DEMOL = houses destroyed, demolished or damaged as a percentage of the 1939 housing stock

DEATH = numbers killed or seriously injured by May 1941 as a percentage of 1939 population

In addition to persistence, we are particularly interested in the extent to which the coefficients vary between migrant groups and so separate equations are estimated.

Potential coefficient biases arise from the endogeneity of house prices and employment and because the lagged dependent variable may be correlated with omitted variables. Instrumental variables can be employed to compensate. The possible bias in house prices arises from the fact that high proportions of (poor) migrants in any area might reduce house prices, in addition to (poor) migrants being attracted to areas of low house prices. In the case of house prices (and to some extent employment), the growth in local prices exhibits a common trend that can be exploited. In other words, movements in local house prices are highly correlated with movements in national prices, but because migrants are a small proportion of the *national* population, they are unlikely to have a major impact on *national* prices and so the latter provides a good instrument. In practice, the fitted values from (9.3a) are used in (9.1a), converted to levels.

$$\Delta PH_{jt} = \alpha_j + \theta \Delta PH_{Nt} + \mu_{jt} \tag{9.3a}$$

PH_N = index of house prices for England

μ = error term

The 10-year time span between censuses reduces the likelihood of bias to the coefficient of the lagged dependent variable, but since spatially-consistent measures of the lagged dependent variable can be constructed from 1971 onwards, earlier measures are also employed as instruments on the assumption that these are even less likely to be correlated with any contemporaneous omitted variables.

The results are shown as Tables 9.6 and 9.7. No measures of local house prices are available for 1931 or 1951, but they are likely to be correlated with the included overcrowding measure. Including house prices in Table 9.7 for 2011 led to insignificant labour market coefficients; given the correlation between housing and labour market conditions, this is, perhaps, unsurprising. Both *DEATH* and *DEMOL* were insignificant when included as separate regressors in addition to the interaction terms, although they are significant if the interactions are excluded. In general, insignificant variables are excluded from Tables 9.6 and 9.7. The 'richer' countries cover: Ireland, France, Germany, Italy, Portugal, Spain, Canada, the US and Australia. The 'poorer' countries are: Romania, Poland, Turkey, Nigeria, Kenya, South Africa, Zimbabwe, Iran, China, Hong Kong, Bangladesh, India, Pakistan, Sri Lanka, Jamaica and South America.

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10

Affordability and the Rise and Fall of Home Ownership

10.1 Introduction

This chapter shifts the focus towards the national picture with regional and local issues taking second place. Housing markets and affordability certainly exhibit spatial differences, but there are common movements that affect all areas arising from national policies and wider economic developments. Meen (1999) discusses the relationship between regional house prices in England, associated with the so-called 'ripple effect' where, over most housing cycles since the early 1970s, prices have risen first in London and the south east and then gradually spread to the other regions, re-establishing the long-run relativities. In a small country such as England, co-movements are perhaps unsurprising, but an increasing volume of evidence indicates that a lead city or area also occurs internationally and that prices in some cases converge. Examples include: Gupta and Miller (2010, 2012), Holmes et al. (2011) and Barros et al. (2012) all for the US; Berg (2002, Sweden); Stevenson (2004, Ireland); Luo et al. (2007, Australia); Shi (2009, New Zealand); Chen et al. (2011, Taiwan); and Balcilar et al. (2013, South Africa). Over short distances,

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Table 10.1 Tenure in England (%), 1918 to 2013–2014

	Home owners	Social renters	Private renters
1918	23	1	76
1939	32	10	58
1953	32	18	50
1961	43	23	34
1971	51	29	20
1981	57.2	31.7	11.1
1991	67.6	23	9.4
2001	70.4	19.5	10.1
2003	70.9	18.3	10.8
2005	70.7	17.7	11.7
2007	69.6	17.7	12.7
2009/2010	67.4	17	15.6
2011/2012	65.3	17.3	17.4
2013/2014	63.3	17.3	19.4

Sources: 1918: Holmans (2005); 1939–1971: Holmans (1986); 1981–1991: Labour Force Survey, Housing Trailer; 2001–2007: Labour Force Survey; 2009–2010 onwards: English Housing Survey

the population displacement activities described in Chap. 9 are likely to be part of the explanation.

Table 10.1 sets out the long-run trends in tenure in England; it shows the well-known long-run decline in private renting associated with rent controls, in operation in different forms between 1915 and 1998, and rising real incomes. Higher real incomes lead to a disproportionate rise in the demand for housing quality and space if the income elasticity of housing demand is greater than one. Higher demand was less likely to be met in the regulated private rental sector, but the decline in private renting was still reversed from the mid-1990s. The table also shows the rise and fall in social housing, reflecting changes to funding regimes and dwelling transfers. Finally, it highlights the rise in home ownership, arguably one of the success stories of the twentieth century.

At the end of the First World War, Holmans (2005, Table S.15) estimates that around 23 %[1] of households in England and Wales were home

[1] A figure of 10 % has been widely quoted. Swenarton and Taylor (1985) attribute this to Cleary (1965), but suggest that the estimate is flawed.

owners[2] and, given the modest contribution from the social sector, the remaining households lived in private rentals. Rising real incomes and wider availability of mortgage credit contributed to a rise in home ownership in the inter-war period, reaching 32 % by 1939,[3] but quantitatively the major expansion took place after the war; home ownership rose almost continuously between the early 1950s and a peak of 71 % in 2003, before falling back to 63 % in 2013–2014. This was a very large decline in a relatively short period and its beginnings predated the Global Financial Crisis (GFC). As we saw in Chap. 5, affordability was a problem for many working-class households in the nineteenth and early twentieth centuries, but it remained an issue for succeeding generations and worsening affordability for those at an early stage of their housing careers still played a major role in the post-2003 fall in home ownership. Private rentals fell from 76 % in 1918 to under 10 % by 1991 but, since the nadir, the sector has doubled under the influence of buy-to-let borrowing and now exceeds public renting for the first-time since the 1960s. However, given supply shortages, buy-to-lets compete with owner-occupation demand by potential first-time buyers and are a contributory factor to the decline in ownership. Table 10.1 shows, as discussed in Chaps. 5 and 7, the modest contribution played by social housing (including both local authority and housing association homes) in the early twentieth century and its expansion in the inter- and post-war periods peaking in 1980, when it accounted for approximately 30 % of the housing stock. Social renting declined thereafter because of low levels of new building and the right-to-buy scheme, where local authority tenants have the option to purchase their homes at a substantial discount; approximately 2 million homes have been transferred into ownership.

Affordability has been a long-term problem, but all housing is affordable by someone, otherwise prices would fall; rather it involves the inability of significant proportions of the population to obtain adequate housing. Affordability is therefore heavily concerned not only with aggregate income growth, but also with its distribution and the nature of taxation

[2] We define home owners as those who own outright, are buying with the aid of a mortgage and, in later years, shared ownership schemes.

[3] This refers to England only.

or subsidies; it also concerns access to housing finance. Affordability does not have a commonly agreed definition, but the simplest measures take the ratio of house prices to incomes on the principle that this ratio cannot increase without bound. An extension considers the ratio of mortgage repayments to income thus allowing for variations in mortgage interest rates and the length of loans. A third approach adopts a residual income definition, which calculates the amount of income left for other consumption after deducting housing costs. A fourth defines the housing user cost of capital, generally the preferred approach amongst economists because it can be derived consistently from textbook life-cycle models; it can also be developed to allow for mortgage shortages. Whereas house price to income ratios fell during the GFC, the user cost rose because of the inability of households to access credit.

The development of mortgage markets and their impact on affordability and tenure provides one of the themes of this chapter. Movements in mortgage advances and house prices or construction are highly correlated, but this is not sufficient to conclude that variations in credit *cause* changes in housing activity since the causality may be in the opposite direction. As a derived demand, increases in the demand for housing lead to an increase in mortgages; formally, mortgages only have an impact on housing demand and house prices if: (i) households are constrained in their access to funds—this was common in the UK before financial deregulation in the 1980s; (ii) asymmetric information requires households to provide deposits; (iii) increases in the supply of credit open up new markets such as buy-to-let or sub-prime lending. Mortgage lending expanded rapidly during the inter-war period, facilitating an expansion in home ownership, but deregulation of financial markets in the 1980s was arguably the key structural change and its effects were still being felt during the GFC. The 1980s changes in turn reflected the political climate of the time, which emphasised the deregulation of markets more generally.

A second theme is the impact of land-use planning on affordability, linking up with Chap. 7 where the institutional developments were discussed. A part of the standard case against controls rests on a comparison of real house price trends before and after the 1947 Town and Country Planning Act which are striking. The Act is seen as a major structural change before which owners of land had limited constraints on their activities. A key question is whether the Act really represented a fundamental shift in practice and whether increases in housing supply could have feasibly limited the rise in prices; alternatively, were demand-side changes influential, such as tax advantages, which lowered the user cost of capital facing households and raised the return on housing relative to other assets? Formal models are necessary to distinguish between different explanations; this requires the use of a suitable house price model and we suggest that our own work, conducted over the last 25 years, provides a basis. A key feature of this work is the constancy of the estimated coefficients; it is not the case that house price behaviour in the UK has changed dramatically and, the fundamentals of housing demand have changed rather little. As above, the main structural change was caused by deregulation of mortgage markets in the 1980s which implied that most households no longer faced mortgage rationing.

10.2 Affordability in the Long Run

The construction of long-run house price indices has become a popular research area internationally; studies include, Eichholtz (1997) who constructs an index for the Herengracht area of Amsterdam between 1628 and 1973, Eichholtz et al. (2012) also for Amsterdam (1550–1850), Lunde et al. (2013) for Denmark (1860–2012), Stapledon (2010) for Australia (1880–2010), Shiller (2005) for the US (1890–1952), and Fishback and Kollman (2012) who concentrate on prices in the Great Depression in the US. Much of the international information is brought together in Monnery (2011). In England, a number of indices have been constructed including Clark (2002) for 1550–1909 and Ormrod et al. (2011) for 1580–1914. However, these indices are typically based on small samples, for example, taken from charitable or ecclesiastical property records, but Holmans (2005) provides the most comprehensive analysis of the availability and limitations of UK house price indicators in the more modern era.

Since only approximately 23 % of houses were owner-occupied in 1918, most estimates of house prices prior to the Great War have to be derived by multiplying market rents by the 'years of purchase'. 'Twenty years purchase, for example, meant a capital value equal to 20 times the current annual rental' (Holmans 2005, p. 272). Holmans derives a capital value index for rented property between 1895 and 1913 and finds that on average capital values rose by only 0.2 % per annum, although rising at a faster rate in the first half of the period. Information on house prices in the inter-war period is scarce,[4] although Samy (2015) constructs a hedonic price index for London between 1895 and 1939. He documents steady inflation between 1895 and 1903, followed by rapid deflation between 1903 and 1914 in the Edwardian era (Fig. 7.1 shows that these correspond to the boom and slump in construction activity) and a surge immediately after the First World War as demand exceeded supply. Prices rose by 35–50 % (according to the chosen index) between 1920 and 1925, then fell by 5–8 % between 1930 and 1935, but a recovery later in the decade meant that nominal house prices in 1938 were only modestly below those at the start of the decade. Housing markets in Britain never suffered to the same extent as the US in the Great Depression (see Fishback and Kollman 2012) partly due to the differences in the mortgage market structure and housing contributed to leading the country out of the Depression. Samy (2012) argues that lengthy loan periods were provided even in the early twentieth century to working-class households and the UK had a tradition of providing long mortgage terms; but, before the Great Depression, mortgages in the US were generally only short term and at low loan to value ratios. The inability to roll over mortgage loans was important in explaining the collapse in US markets and subsequently led to the creation of what became Fannie Mae as a government agency to operate a secondary market in Federal Housing Administration guaranteed mortgages.

'Officially published' house price measures are available from 1930 for the country as a whole. Series expressed in real terms (deflated by the consumers' expenditure deflator) and relative to average earnings[5] are shown in Fig. 10.1, although the data are spliced from different sources and are

[4] Holmans (2005) describes the sources that are available for this period.

[5] Consumer prices and earnings are taken from the Bank of England 'Three Centuries of Data' data bank.

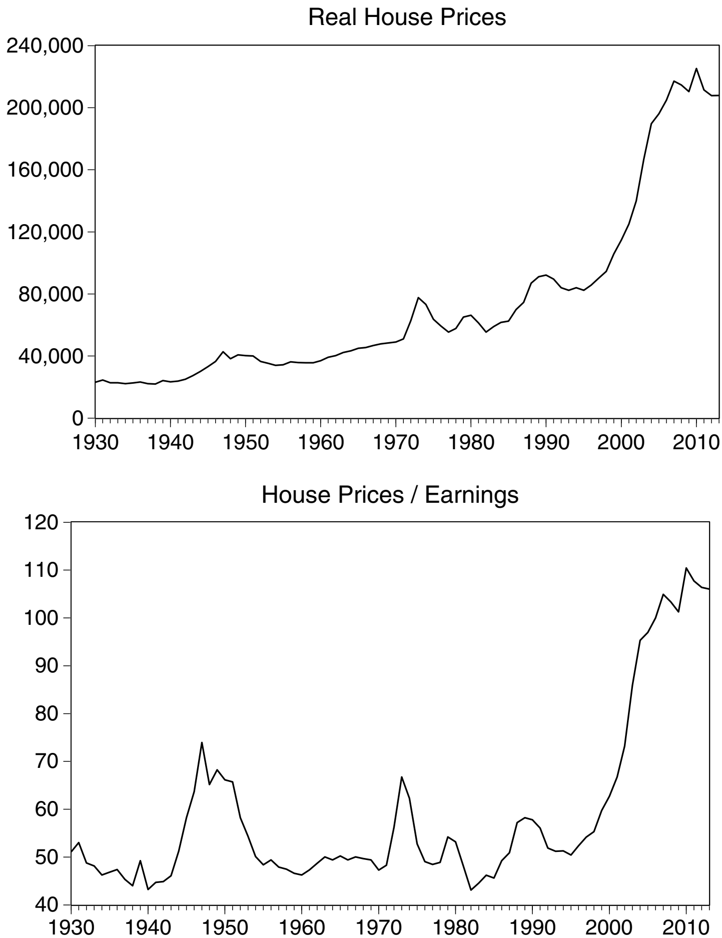

Fig. 10.1 Real house prices (£) and prices/earnings (2006 = 100), UK, 1930–2013 (1939–1945 interpolated)
(*Source*: Bank of England and ONS)

not strictly consistent over time. The graph shows the relative stability of prices in real terms before the Second World War, but the major post-war increase; this provides *prima facie* evidence for the effects of supply constraints introduced by the Town and Country Planning Act, but the rise is unlikely to be mono-causal. Relative to earnings, prices show less

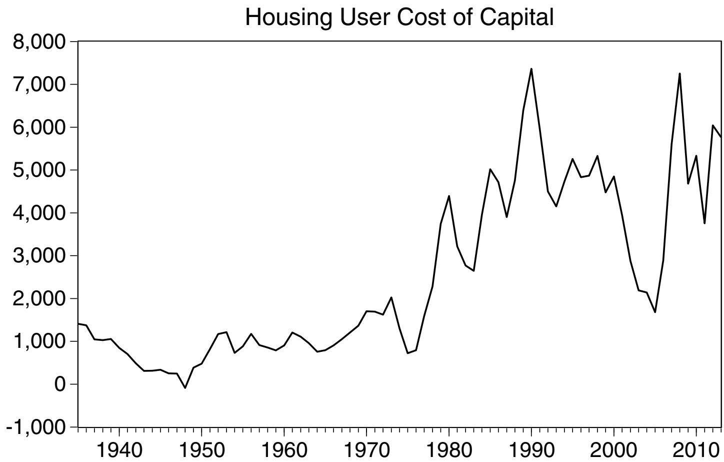

Fig. 10.2 Housing user cost of capital (£ pa), 1935–2013 (1939–1945 interpolated)
(*Source*: Authors' calculations)

of a trend until the boom of the mid-1990s.[6] Although not evident from the graphs, Andrew and Meen (2003) showed that the earnings of young households had declined relative to older households from the 1980s, a trend that is continuing and has implications for the distribution of housing.

Figure 10.2 shows a version of the housing user cost of capital which represents the annual price of a unit of owner-occupier housing services. In addition to measuring real house prices, the user cost takes into account movements in interest rates, mortgage subsidies, maintenance expenditures, depreciation and local taxation, but the key extension to the previous indicators is that it also includes, as a negative cost, the expected capital gain on housing.[7] In practice, most of the volatility in the user cost arises from variations in house prices, mortgage rates or

[6] Between 1930 and 1995 (the start of the boom), an Augmented Dickey-Fuller ADF(1), test on the price to earnings ratio gives a value of –3.01 (5 % critical value –2.9), suggesting borderline stationarity. Over the same period, real prices are non-stationary.

[7] The measure is defined more precisely in Appendix 1.

capital gains.[8] There is no universally-agreed measure of expected capital gains and here it is calculated as the average annual appreciation over the previous three years. Visually, the graph suggests differences between the pre- and post-1980 periods; the user cost showed little trend either side of 1980, but there was a structural change that raised the user cost in the early 1980s, at least on this version of the variable. The average user cost between 1981 and 2013 was approximately four times higher than between 1935 and 1980. Given the centrality of the user cost to housing demand theory, the difference needs explaining; this brings us to the role of credit markets.

10.3 Mortgage Markets and Structural Change

Building societies dominated the provision of mortgage finance for most of the twentieth century; their roots lay in the self-help, building clubs of the eighteenth century which were wound up when each member obtained a home, but they evolved into mutual permanent societies, expanding rapidly in the second half of the nineteenth century. At the turn of the twentieth century, 2208 societies were registered with 578,000 shareholders.[9] The number of societies then steadily fell, but shareholders and borrowers continued to grow strongly, particularly in the inter-war period; shareholders more than trebled between 1919 and 1939, whereas borrowers increased at double-digit rates for most of the 1930s. As noted in Chap. 7, Humphries (1987) stresses the tax advantages enjoyed by societies, under the composite tax rate arrangements, in attracting depositors, which particularly favoured higher-income investors; these tax benefits were heavily marketed in the 1920s. Scott and Newton (2012) also emphasise the role of strong advertising expenditures in promoting business in this era when the close relationships between

[8] Consequently, maintenance expenditures, property taxation and depreciation are excluded from Fig. 10.2, since data are not available for the early part of the period.

[9] Building Societies Association and Council of Mortgage Lenders (1995, Tables G1 and G2). This volume is the source of most of the statistics in this section.

societies and speculative builders aided the inter-war expansion in home ownership.

The strength of building societies continued after the Second World War and, in the mid-1960s, accounted for approximately 70 % of the outstanding mortgage stock and 80 % in 1980. Banks at this stage had only very modest quantities of mortgage loans and most of the remainder was advanced either by local authorities or insurance companies. In terms of balance sheet structures, until the 1980s, mortgage loans accounted for approximately 80 % of building society assets with the rest primarily held in liquid assets; liabilities still overwhelmingly took the form of shares and deposits attracted from households. In summary, the UK mortgage finance model remained at this stage heavily retail funds based. Similarly, building society deposits constituted more than 40 % of total household gross liquid assets in 1980. Crucially, until 1983, the trade body—the Building Societies Association—recommended the interest rates that societies should pay to investors and charge on mortgage loans; in practice most societies followed the recommendations, so that there was a common interest rate structure across the industry. Furthermore, interest rates were changed relatively infrequently and did not necessarily follow market rates, implying that shortages of retail funds could lead to mortgage rationing; Meen (1990a) demonstrates that rationing was common post-war until the early 1980s. Rationing typically took the form of controls on loan to value and loan to income ratios and required savings periods before the society would consider granting a loan. The extent of mortgage rationing in the earlier inter-war period is quantitatively unclear, although Broadberry (1987) suggests that rationing was the norm and Scott (2013, p. 214) points to differences between the north and south of the country in the 1920s. Nevertheless, from the above, mortgages were expanding rapidly in the 1930s, deposit requirements were modest and increasingly working class households were entering into home ownership.

All this was to change in the liberalised and competitive markets that were to characterise the 1980s. A number of key structural developments can be identified; first, the abolition of the 'corset' controls on bank lending in 1980 led to a major increase in loans from this source; bank loans secured on dwellings rose from 5 % of the total in 1979 to 30 % 10 years later. Second, led by the Abbey National Building Society (the second largest), the recommended interest rate system broke down in 1983, to be replaced by an advised rate system, which was itself removed in 1984. Third, the arrival of banks in the market meant that building societies were at a competitive disadvantage since they relied almost exclusively on retail funds. In principle, they could raise funds from wholesale sources, but the requirement that societies should pay interest net of tax (and was unreclaimable) provided an effective barrier. The 1983 Finance Bill contained provisions, however, that allowed societies to pay interest gross on Certificates of Deposit. The use of wholesale funding expanded and, by the end of 1984, wholesale deposits accounted for 3.7 % of total liabilities; this was the beginning of the widespread use of wholesale funding models in later years throughout the industry. Fourth, from the late 1970s, societies came under increasing pressure, both internally and externally, to increase competition and to maintain interest rates at levels which would meet mortgage demand. Given the new competition from banks, societies argued for a restructuring of the legislation under which they operated—a 1962 Act consolidating legislation dating back to 1874; therefore the legislation had largely been unchanged for more than 100 years. This legislation required societies to lend on the security of freehold or leasehold property and so societies could not, for example, issue credit cards; societies argued that they should be allowed to enter into wider fields. A Green Paper published in 1984 (which was the forerunner of a new Building Societies Act in 1986) stated that the collective interest rate agreement inhibited free market forces and recommended a process of change, beginning with the withdrawal of exemption from the Restrictive Trades Practices Act. More generally, after the 1986 legislative changes, objectives were more closely aligned with profits and moved away from the more socially-orientated focus that had historically characterised the mutual organisations. The 1986 Act (subsequently revised in 1997, 2000 and 2012) provided the new operational framework; in addition to extending the range of operations to allow unsecured loans and other functions of banks on an equal basis, the Act also set out conditions for mergers, demutualisation and take-over on the agreement of members. The Abbey National was the first to demutualise in 1989 becoming a public company, but mergers and take-overs (usually by banks) meant

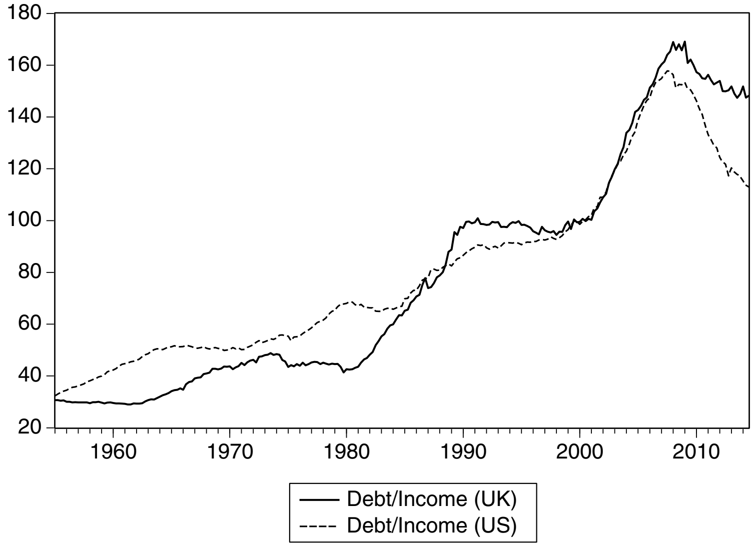

Fig. 10.3 US and UK mortgage debt relative to household disposable income (2000 = 100), 1955–2013
(*Source*: UK: Bank of England and ONS; US: Federal Reserve Board and Bureau of the Census)

that in 2015 only 48 societies remained in existence. At the end of 2012, societies only accounted for 16 % of the outstanding mortgage stock, compared with almost 70 % by banks.

For our purposes, the key change of the 1980s was the ending of rationing arising from the entry of banks on a large scale and the more competitive practices of building societies, highlighted in Fig. 10.3, which shows the aggregate household mortgage debt to income ratio since 1955. The same ratio for the US is also given for comparison. Despite very different mortgage systems, historically based on retail deposits in the UK and securitised debt in the US, the trends have been similar. Neither country, over long time periods, shows any obvious equilibrium debt to income ratio.

Concentrating on the UK, the figure reveals the distinct phases; up to the early 1980s there was little trend, because of the rationing of building society advances. The period until the late 1980s then saw an explosion of credit as controls were relaxed, banks entered the market and households adjusted their portfolios. The ratio flattened during the first half of the 1990s as a result of the recession, but did not fall since households were locked into long-term debt and the option to reduce debt either by over-payments or by moving were limited during a downturn, particularly for those experiencing negative equity. Credit again expanded rapidly from the mid-1990s to 2007 during the extended boom for the housing market and the economy more generally. But the growth could not be financed by retail deposits alone; rather growth corresponded to the expansion in wholesale markets and in securitisation, which only fell with the Global Financial Crisis from the beginning of 2008. However, although net mortgage advances, the *flow* of credit, fell sharply and has still not fully recovered, Fig. 10.3 indicates that the stock of debt declined more modestly, certainly compared with the US. The expansion in debt since 1996 also coincided with the growth of buy-to-let mortgages, which were largely responsible for a reversal of the long-run decline in the private rental sector by providing an alternative investment vehicle for small landlords, particularly at a time when returns on financial assets were weak. The market was heavily affected by the GFC, but subsequently rebounded and, in 2015, 17 % of gross loans were buy-to-lets, a similar value to loans to first-time buyers with whom, at least partially, there was competition in the demand for the limited housing stock.

First-time buyers also suffered from rising deposit requirements; this was particularly evident from the onset of the GFC, although the rise may have begun earlier[10] and the increase appears greater than might be expected from asymmetric information considerations alone. Default rates on mortgages rose in the GFC, but never approached those experienced in the US, aided by low interest rates; properties taken into possession in the UK in fact reached their maximum in 1991. Instead, the rise in deposits partly reflects a return to the absolute mortgage shortages that characterised the pre-liberalisation period. The inability of first-time buyers to raise the required deposit has shaped much of recent housing policy, notably through the introduction of help to buy and shared ownership initiatives.

[10] Mean and median loan to value ratios provide conflicting evidence. The former suggests that deposits had been rising over the whole of the boom period since the mid-1990s.

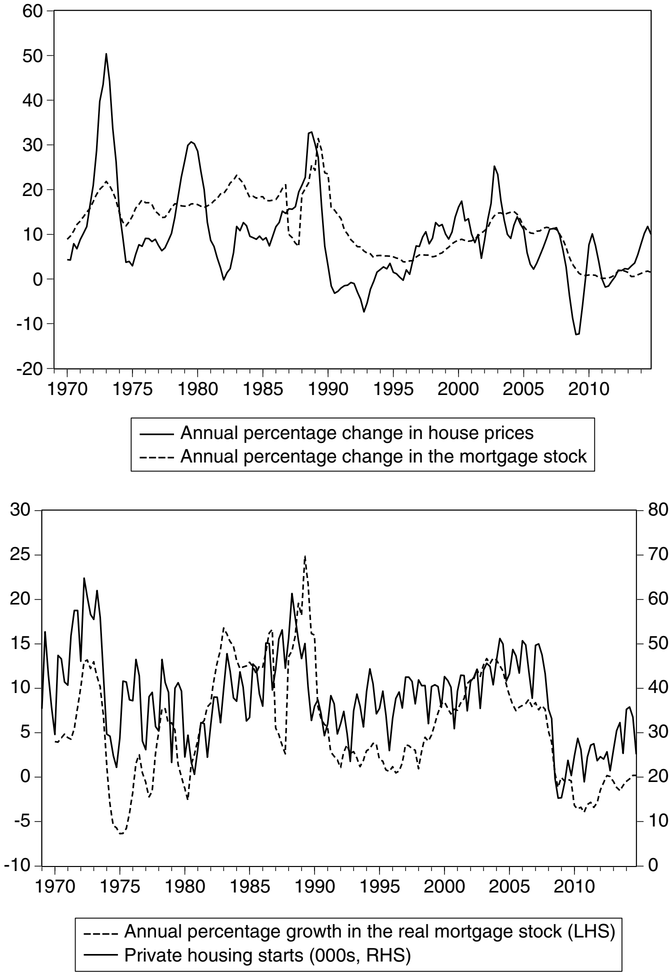

Fig. 10.4 Housing activity and mortgage debt, 1970–2014 (*Source*: ONS and Bank of England)

Empirical and theoretical work on the relationship between housing volatility and debt has a history dating back to at least the 1950s in North America and the UK. Superficially, it is easy to see why this should attract attention since, even on modern data, there remains a strong correlation. From Fig. 10.4, between 1984 (when, as discussed above, mortgage controls began to be relaxed in the UK) and 2014, the correlation between the annual growth in nominal house prices and the nominal growth in the mortgage stock was 0.57. The correlation between housing starts and the growth in real mortgages was even higher at 0.67.

Of course, causality cannot be inferred; however, theory helps to define the conditions under which it is valid to conclude that credit availability causes changes in activity. From the conventional life-cycle model, Eq. (10.1) can be derived. This simply states that the real house price at time (t), (g_t), is determined by the present value of the stream of (imputed) rental payments (R_t), discounted by the user cost of capital (UCC_t). This is similar to the conventional discounting formula used in financial analysis with two exceptions; first, the numerator is the *imputed* rent and therefore the price depends on the tax provisions for owner occupied properties (see Sect. 10.4); second, the denominator—defined in Eq. (10.2)—is broader than the conventional discount rate.[11]

As (10.1) and (10.2) stand, there is no role for credit in determining either housing demand or house prices, despite the strong observed correlation. In the standard model, increases in mortgage availability only affect house prices if households are rationed; mortgages affected prices before the liberalisation of markets in the 1980s and during the GFC, but not in the intervening years.[12] Formally, rationing constraints can be taken into account by amending the user cost (10.3), where λ_t is related to the difference between mortgage demand and supply (10.4). Credit shortages raise the user cost and therefore have a negative effect on house prices.

$$g_t = R_t / UCC_t \tag{10.1}$$

where:

$$UCC_t = \left[(1-\theta_t) i_t - \pi_t + \delta_t + pt_t + m_t - \dot{g}_t^e / g_t \right] \tag{10.2}$$

[11] Note that Fig. 10.2 multiplies this by the real house price.

[12] As above, an exception is the need to provide deposits because of asymmetric information, but this version of the model does not allow for risk.

or:

$$UCC_t = \left[(1-\theta_t) i_t - \pi_t + \delta_t + pt_t + m_t - \dot{g}_t^e / g_t + \lambda_t \right] \quad (10.3)$$

$$\lambda_t = \alpha_1 \left(M^d - M^S \right)_t \quad (10.4)$$

g = real purchase price of dwellings (£)
R = imputed rental payment (£)
UCC = user cost of capital (%)
θ = rate of mortgage interest tax relief (%)
i = mortgage interest rate (%)
δ = depreciation rate on housing (%)
π = general inflation rate (%)
pt = property tax rate (%)
m = maintenance expenditures as percentage of the property value (%)
λ = measure of mortgage rationing (%)
M = growth in the mortgage stock, (d, s) are demand and supply respectively (%)
$(\cdot)$ = represents the rate of change
(e) = expected value
t = time subscript

Rationing implies that Fig. 10.2 for the user cost needs to be amended and Fig. 10.5 plots the user cost with and without rationing. In each case, Eqs. (10.2) and (10.3) are multiplied by the real house price, as in Fig. 10.2. The measure of rationing prior to the early 1980s is taken from Meen (1990a) and measures the difference between the growth in estimated mortgage demand and supply. Information is only available from 1963; a similar variable post-2007 is constructed by calculating what mortgage demand would have been in the absence of the constraints imposed by the GFC.[13] Two findings are striking: first, the inclusion of rationing means that there is no longer a structural break from 1980.

[13] This is calculated from the constructed value of mortgage demand, derived from an equation estimated between 1983 and 2007, i.e., the unconstrained period.

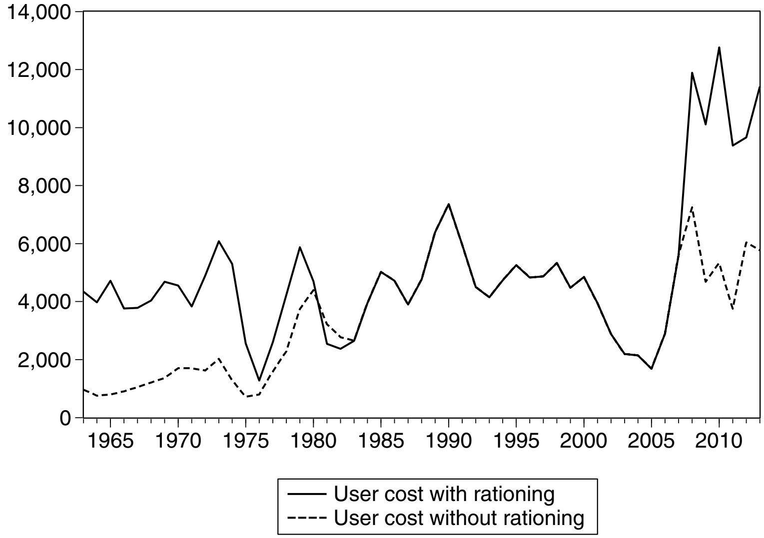

Fig. 10.5 Housing user cost of capital (£ pa) with and without mortgage rationing, 1963–2013
(*Source*: Authors' calculations)

The user cost between 1963 and 2007 shows no trend[14] and is no longer higher post-1980, reflecting the fact that the user cost was underestimated in Fig. 10.2. Second, the user cost rose sharply during the GFC. Since the constraints primarily affected potential first-time buyers, the fall in the owner occupation rate shown in Table 10.1 is unsurprising. Under the extended version of the user cost, renting becomes 'cheaper' than owning. Furthermore, on this definition, home ownership costs were noticeably higher than those faced by any earlier post-war generation.

A final important issue is the sensitivity of house prices to changes in monetary policy, an issue discussed in Meen (1996), where the deregulation of mortgage markets was found to increase significantly the responsiveness of house prices to changes in interest rates. The reason is straightforward: a reduction in mortgage interest rates leads to an increase in housing demand which, for a given housing stock, increases

[14] The ADF(1) test yields a value of −5.32 compared with −2.31 if the rationing measure is excluded (the 5 % critical value is −2.93). Note that $\alpha_1 = 2.0$ and is determined by the data (see Appendix 1).

house prices. But, at times of rationing, the inability to obtain credit acts as a buffer to housing demand and mitigates the price response. Similarly, the reduction in bank base and mortgage interest rates during the GFC did not produce the stimulatory effect on housing that might have been expected because of the offsetting increase in mortgage shortages.

10.4 Demand Subsidies

As discussed in Chap. 7, building subsidies, for both the public and private sectors, were first introduced in Britain after the Great War, but subsidies evolved over the next hundred years. For home owners, subsidies have included tax relief on mortgage interest payments, the absence of taxation on imputed rents (after 1963) or capital gains on principal homes, deposit assistance, mortgage guarantees, and renovation grants. Low-income private tenants have benefited from income support, rent control and security of tenure. Social tenants have gained from direct housing provision at below market rents, housing benefit, and the opportunity to purchase their properties at substantial discounts through the right-to-buy scheme introduced in 1980.

The details of support differ considerably, but most countries recognise housing as a merit good and provide subsidies in some form. Support can be classified, broadly, as demand and supply subsidies or producer and consumer subsidies or, as above, by tenure. Yates (2012) provides a general classification for international subsidy regimes and discusses the motivations for their provision. *Market supplementing* subsidies are designed to improve allocative and productive efficiency by correcting cases of market failure or externalities. *Market supporting* policies include the provision of well-defined property rights, well-developed land-use planning regimes and a supportive mortgage market structure. *Market replacing* subsidies are those that over-ride the market, such as the direct provision of housing by public authorities.

Gibb and Whitehead (2007) highlight four phases of post-Second World War European policy. The first involved large-scale government construction programmes in the 1950s and 1960s to address acute housing shortages; the second emphasised renovation and slum clearance programmes, which were particularly prevalent in the UK between the

1950s and 1970s and were a continuation of stalled pre-war programmes; the third comprised a transition towards a market-orientated approach to finance provision and targeted support, which included a shift from general supply subsidies to means-tested demand subsidies notably housing benefit; the fourth was a period of increased concern with affordability and access, particularly for those on low incomes. They show that, in 1975–1976, 82 % of public spending on housing in England was on supply subsidies and only 18 % on demand subsidies; of the latter, 14 % was spent on mortgage interest tax relief and less than 4 % was allocated to rent rebates or allowances for tenants in the social and private sectors. By 1999–2000, the position had been reversed with 86 % of expenditure going on targeted demand support; since mortgage tax relief was being phased out by this stage (see below) 70 %, or approximately £9 billion, financed rental housing benefits in the social and private sectors. By 2012–2013, benefit payments had risen to £24 billion (Wilcox et al. 2015, Table 122),[15] reflecting the move to market-related rents and rising housing market costs generally as house prices rose—Eq. (10.1) shows the direct theoretical relationship between house prices and rents, although this has not always held in practice.

As noted in Chap. 7, rent controls were first introduced in the 1915 Rent and Mortgage Interest (War Restrictions) Act in response to the severe housing shortages; the measure was originally intended to be temporary, but controls continued in various forms until 1989. The original Act froze rent and mortgage payments on properties with a rateable value above £35 in London and £26 elsewhere in England. Subsequent Acts modified the types of properties covered and the value limits, but Samy (2015) indicates that only one-eighth of working class properties controlled in 1919 had been derestricted by 1930. Further decontrol was introduced in 1933, but war-time restrictions were re-imposed in 1939; once again these were intended to be temporary, but full deregulation was not completed until the 1988 Housing Act. In the interim, the 1957 Rent Act decontrolled more valuable houses and those obtained with vacant possession. The 1965 Rent Act introduced regulated tenancies with fair rents set by new independent rent officers, where rents took into account

[15] For Great Britain.

market levels and the 1988 Housing Act provided that all new lettings would be assured tenancies, whose rents were not regulated. As Wilcox et al. (2015, Table 72) show, deregulation led to significant increases in private rents as a percentage of average earnings, from 17.5 % in 1990 to 26.4 % in 2013. Moves towards market levels for housing association rents over the same period increased the share of earnings from 10.9 % to 13.7 % (8.9 % to 13.1 % for local authority tenants). As noted above, the rises led to major increases in targeted benefit payments.

Mortgage interest tax relief was initially introduced in the 1923 Housing Act (Holmans 1986, p. 86), accompanied by the imposition of Schedule A tax on the associated imputed rental income. This system relied on the regular revaluation of properties, but the last revaluation took place in 1934. The tax yield therefore gradually, declined and was, finally, abolished in 1963. In simplified form, Eqs. (10.1) and (10.2) show the expected effects; if rents are taxed, but relief granted on mortgage payments, then real prices are not distorted, but the maintenance of tax relief alone leads to a capitalisation of the subsidy into house prices or, if the price elasticity of housing supply is high, to a distortion of resources towards housing construction and away from other (capital) goods. The cost of mortgage tax relief was minor until after the Second World War and few working-class owners had sufficiently-high incomes to benefit; the estimated cost in 1945 was £10 million and this had only risen to £45 million by 1958/1959. The cost rose dramatically, however, peaking at £7.7 billion in 1990/1991. The cost of relief depended positively on the level of owner occupation, the outstanding mortgage stock, the mortgage interest rate and the household income tax rate. Until 1990/1991 tax relief was at the borrower's marginal tax rate and was therefore more beneficial to higher-rate payers. From then until 1993/1994, relief was restricted to the basic tax rate and, then, reduced in stages until its final abolition in 2000/2001. The rise in the nominal mortgage rate contributed particularly to the peak in the subsidy, reaching a record 15 % in 1990. The subsequent fall in interest rates, aided by restrictions on eligibility for relief, led to a sharp fall in the cost (£1.6 billion in 1999/2000) and, in fact, the estimated reduction in house prices arising from the final abolition appears to have been minor and attracted remarkably little public criticism. The timing matters; by contrast, Meen (1996) estimates that, if tax relief had been abolished in 1994, house prices might have been 5–7 % lower than the outturn.

The move to phase out mortgage tax relief reflected its heavy budgetary burden, but it had also been regularly criticised on the grounds that it contributed to the economic distortions that were widespread across housing since the structure of subsidies was far from tenure-neutral. An important strand of the housing literature in the late 1970s and 1980s concentrated on the interaction between high rates of inflation in this era with a tax system that conferred benefits to owner occupation, which other forms of investment did not enjoy. The distortions arose because the user cost of capital is not neutral with respect to the rate of inflation and so, at times of high inflation, the relative return to housing rises. Interest in the issue became less intense with the subsequent fall in general inflation, but the impact of housing on the macroeconomy more generally was beginning to be appreciated, notably through the relationship between house prices and consumers' expenditure (see, for example, Maclennan et al. 1998).

10.5 Decomposing House Price Changes

The consensus amongst economists is that the trend rise in real house prices and worsening affordability after the Second World War can be primarily attributed to the land use regulations introduced by the 1947 Town and Country Planning Act. Some planning controls had already been introduced in the nineteenth century as a means of improving sanitary conditions; building regulations had also been put in place after the Great Fire of London in order to prevent a recurrence and owners of private large estates were able to control the types and speed of development, such as in the residential squares of central London in the eighteenth century. Chapter 6 discussed the nature of development controls imposed by the land rights system in Scotland but, nevertheless, the 1947 Act is seen as a turning point. But other events were taking place at the same time, which also influenced house prices, for example, the demand subsidies discussed in the last section. Understanding the relative contributions requires a formal model. Three factors are crucial: (1) the income elasticity of housing demand relative to the price elasticity and the growth in real income, (2) the time-series properties of the user cost of capital in Eq. (10.3), (3) the growth in the owner occupier housing stock and the associated elasticity of house prices with respect to housing supply.

Decomposing price changes into these elements requires a model where the underlying elasticities are fairly constant over long periods of time; a series of papers by Meen (1990b, 2013) and Meen and Andrew (1998) provides the basis. Table 10.2 sets out the most important long-run elasticities in each of the three papers with, in the final column, an updated version using more recent data. Further discussion of the derivation is given in Appendix 1, but the elasticities are similar over different generations. Using the equation in the final column, Fig. 10.6 compares the estimated *equilibrium* real house price with the *outturn* since 1963. Although the two series track closely, the graph indicates that, as expected, equilibrium prices lead the outturn, because prices only adjust gradually to the equilibrium. This is particularly clear for the 1996–2007 boom, but was also a feature of earlier upturns.

Importantly, Table 10.2 indicates that the elasticity of house prices with respect to income exceeds two. By inversion, this implies that the

Table 10.2 The long-run determinants of house prices [dependent variable: ln(*g*)]

	Oxford Bulletin of Economics & Statistics, 1990	Scottish Journal of Political Economy, 1998	Urban Studies 2013	Updated version
Estimation period	1964(3)–1987(4)	1969(3)–1996(1)	1969(3)–2007(4)	1969(2)–2012(4)
Equation st. error	0.0155	0.0148	0.0157	0.0159
ln(*RY*/*HH*)	3	2.401*	2.614	2.298*
ln(*RW*)	0.451	0.336	0.321	0.222
UCC	−0.054	−0.037	−0.061	−0.048
ln(*HS*/*HH*)	−1.809	−1.744*	−1.545	−1.630*

*Specification is slightly different because neither variable is divided by HH
g = real house price index (2002 = 100)
RY = real household disposable income (£m)
HH = number of households (000s)
RW = real gross wealth (£m)
UCC = user cost of capital (%)
HS = stock of owner-occupied dwellings (000s)

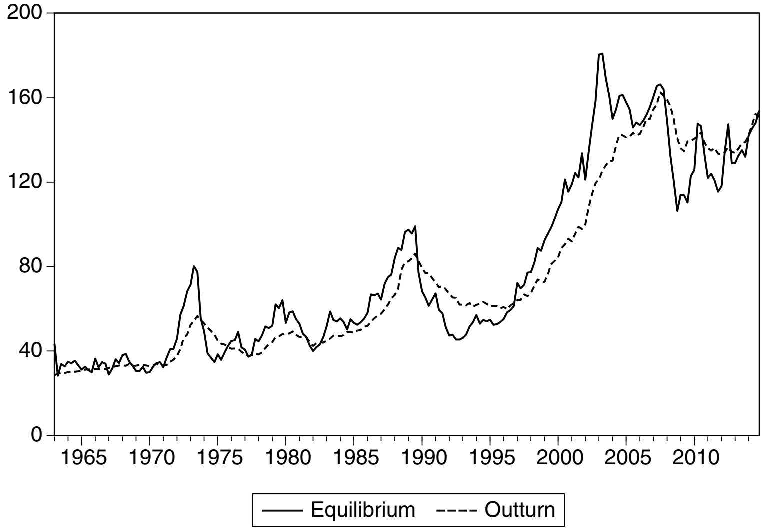

Fig. 10.6 Equilibrium and outturn (2002 Q1 = 100) real house prices, 1963–2013

income elasticity of housing demand is approximately twice the price elasticity, for a given housing stock. There is evidence in the literature that the demand for space is, indeed, income elastic (see Chap. 3); given inelastic supply, this adds to price pressures. Using the coefficients in Table 10.2 and the actual growth rates in income, wealth, the user cost and the housing stock,[16] the trend price increase can be decomposed into its constituent elements between 1963 and 2013. Over this period, real house prices rose by an average 3.5 % per annum: of this increase, real income contributed a rise of 6.5 %, real wealth contributed 1 %, but the increase in the housing stock reduced the price trend by 3.1 %.[17] However, since the user cost had no long-run increase, it had little impact on long-run price growth. Changes in the user cost were particularly important in explaining the short-run volatility in house prices, but did not affect the long-run growth path.

[16] The annual average growth rates between 1963 and 2013 are, respectively, 2.9 %, 4.7 %, 0.0 %, and 1.9 %.

[17] The remaining variables shown in the Appendix produced the difference of approximately 1 %.

The key policy question is the required level of construction necessary to reduce the house price trend. If the policy aim was to reduce real growth to zero then the growth in the housing stock would need to approximately double. This translates to a *permanent* level of private housing starts of more than 300,000 per annum, whereas Chap. 7 showed that these levels had only been achieved historically on a temporary basis. There are significant error margins associated with these estimates, but the general problem is clear. It might reasonably be argued that constant real house prices are neither necessary nor desirable, since increasing real prices are common in Europe. However, even to reduce real house price growth permanently by one percentage point would require an increase in the growth rate of the housing stock of approximately 30 %. There must be some doubt whether the market would have achieved these increases permanently even in the absence of the Town and Country Planning Act.

The fundamental issue is that the income elasticity of demand is high relative to the price elasticity and demand subsidies have their main long-run influence through an income effect. It is important to stress that the price increase does not just reflect new households; it also reflects increasing demands for housing services by existing owners either trading up or purchasing further homes. As Meen (2013) demonstrates, existing home owners take advantage of gearing from increases in the values of their current homes, a benefit that first-time buyers do not enjoy.

10.6 Final Comments on Changes in the Distribution of Home Ownership

We tend to forget that the dominance of owner occupation is a relatively recent event, only exceeding 50 % in the early 1970s and with growth from 1980 fuelled by Right to Buy. There is no divine right for ownership to remain the dominant tenure; but neither is it the case that the post-2003 decline will necessarily continue indefinitely. On the demand side, the key factors historically have been the relative costs of renting versus home-ownership, income growth, access to mortgage credit, competition from investors and, on the supply side, levels and types of construction.

Samy (2012) finds that, even before the Great War, mortgage interest payments for working-class households were often lower than corresponding rents. Even small differences mattered for the low paid since the average percentage of earnings spent on rents was strongly negatively correlated with average earnings. From the records of the Co-operative Permanent Building Society, Samy suggests that mortgage loans favoured members of the working classes able to afford mortgage repayments through the combination of second incomes (particularly those provided by children or through taking in lodgers) and the fairly easy terms on which mortgages were granted, notably low interest rates and long repayment periods. However, different societies adopted different practices and by contrast the London Grosvenor Building Society favoured richer borrowers, who were buying for speculative purposes. Swenarton and Taylor (1985) argue that, subsequently in the 1920s, the growth in owner-occupation was an overwhelmingly middle-class expansion, although Scott (2013) indicates that, in the 1930s, home ownership received a major boost from working-class households. By the early 1930s, affordability had improved to record levels and, as discussed above, the availability of mortgages and the terms on which they were offered favoured home ownership.

The spatial distribution of new construction for home ownership was also changing towards the Midlands and South and away from the traditional heartlands of building societies in the North. Prior to the Great War, Swenarton and Taylor indicate that concentrations were amongst isolated working-class towns and newly-built middle-class suburbs. The former included Lancashire cotton towns, Yorkshire wool districts, mining areas of South Wales and ship-building towns. The security of well-paid employment, relative physical isolation (since well-established rental investment markets were less likely to exist) and the institutional framework provided by building societies to channel savings into ownership opportunities were particularly important. However, by the inter-war period, high-ownership towns had shifted and had distinct characteristics: first, those with a tradition of working class ownership in the nineteenth century, carried over to the twentieth century; second, towns with large middle-class or retired populations; third, boom towns were associated with high ownership since these locations experienced both

Table 10.3 Regional home-ownership (%)

	1971	2001	2011	Change 1971–2001	Change 2001–2011
North East	38.2	63.6	62.2	25.4	–1.4
North West	59.2	69.3	65	10.1	–4.3
Yorks & Humberside	51.5	67.6	64.5	16.1	–3.1
E. Midlands	53.2	72.2	68	19	–4.2
W. Midlands	53.7	69.6	65.6	15.9	–4.0
East of England	53.6	72.7	68.3	19.1	–4.4
Greater London	39.3	56.5	49.5	17.2	–7.0
South East	57.2	74	68.7	16.8	–5.3
South West	55.6	73.1	68.2	17.5	–4.9

Source: Census of Population 1971, 2001, 2011

strong population growth and new building, including the expansion in the outer suburbs of London discussed in Chap. 7.

Scott (2013, Table 6.2) shows that ownership rates in 1937–1938 across the English regions were broadly similar for working-class households, although much lower in Scotland and Northern Ireland, and Table 10.3 shows the spatial distribution for all (not just working-class) households[18] in 1971. Ownership rates were similar with the exception of the north east and London and, in the case of the former, home ownership had caught up by 2001; between 1971 and 2001, all regions experienced large increases, although London still remained out of line. Low levels of ownership in London reflect not only the highest average house prices, but also the fact that the population is younger, mobile and as likely to be renters by choice as by necessity. A different pattern emerges between the inner and outer London districts however: the outer areas behaved in a similar manner to the other regions; home-ownership exceeded 70 % in 2001 in many outer boroughs, but was under 40 % in inner Camden, Hackney, Islington, Lambeth, Southwark, Tower Hamlets and Westminster. The decline in ownership between 2001 and 2011 also exhibited common trends, again with more modest changes in the north east, but London experienced the biggest fall from an already low base.

Finally, although regions have experienced similar changes, different households within the regions have certainly not been equally affected.

[18] Data are standardised to the Government Office Regions.

The decline in ownership has fallen heavily on the young. The English Housing Survey shows that the percentage of household reference persons (broadly heads of households) who are owners aged 25–34 fell from 67 % in 1991 to 40 % in 2012–2013. Even for those aged 35–44, the percentage fell from 78 % to 62 %. Nevertheless, baby-boomers gained; the passage of time meant that the percentage of the 45–64 age group who were owners was approximately unchanged between the two dates at 75 % and for those aged 65–74 the proportion rose from 62 % to 79 %. At the start of 2015, only 19 % of gross residential loans were advanced to first-time buyers (with similar values in the previous three years), whereas buy-to-let loans, primarily taken out by older households had risen to approximately 17 %. Meen (2013) shows that, despite the undoubted benefits of a vibrant private rental market, the ability of buy-to-let borrowers to access accumulated equity from their existing dwellings adds to market volatility.

10.7 Appendix 1: Models of House Prices

This appendix discusses the fundamentals of theoretical and empirical models of house prices, paying particular attention to that used in Meen (1990b, 2013), where more details can be found. The starting point is the life-cycle model of household behaviour, including housing, where households maximise an inter-temporal utility function, with arguments consisting of housing and an aggregate consumption good, subject to a budget constraint. The longevity of the housing stock, which can be sold as an asset as well as being consumed, implies that behaviour is related across periods and expected capital gains become important. Eqs. (10.1) and (10.2) in the main text are derived from the first-order conditions. If households face credit shortages, then (10.3) holds instead. Constraints raise the user cost of capital.

There are, however, issues in operationalising the model for empirical estimation. In the UK, because of the historical controls on rents, there are inadequate data for the numerator to test (10.1) directly. Instead, the expected determinants of rents are substituted into (10.1); these are taken to be real incomes, wealth, the number of households, and the housing stock. Meen and Andrew (1998) also suggest that changes in the distribution of income became important from the early 1990s. The basic equation, suppressing time subscripts, becomes:

$$\ln(g) = f\left(\ln(RY), \ln(RW), \ln(HH), \ln(HS), \lambda, \ln[UCC]\right) \quad (10.1a)$$

g = real house prices
RY = real personal disposable income
RW = real wealth
HH = number of households
HS = housing stock
λ = measure of mortgage rationing
UCC = user cost of capital

There are further issues: first, the user cost is defined in logarithms, but since the series has occasionally taken negative values, this would imply that housing demand is infinite. The presence of credit constraints suggests that it should in fact never be negative but, the usual approach has been not to take logarithms of the term. Second, *nominal* interest rates may affect housing demand as well as real rates because of front-ending loading. This can be taken into account by allowing a coefficient of less than one on the expected capital gains term in the user cost; our empirical work suggests a value of 0.3. Incorporating these changes gives rise to the long-run or equilibrium specification in Table 10.2. Third, house prices do not adjust immediately to changes in the determinants, because of transactions costs for example. This implies a dynamic specification where prices adjust gradually towards the equilibrium. Error correction approaches are common in the field (Eq. 10.3), where γ_3 is the error correction coefficient determining the speed of adjustment to the long-run equilibrium:

$$\Delta\ln(g) = \gamma_1\Delta\ln(g)_{-1} + \gamma_2\Delta\ln(X) + \gamma_3[\ln(g) - \gamma_4\ln(X)]_{-1} + \mu \quad (10.2a)$$

$X' = [RY, RW, HH, HS, \lambda, UCC]$ and μ is an error term.

Table 10.4 Modelling house prices (dependent variable: $\Delta\ln(g)$)

Estimation period	1969(2)–2012(4)
constant	−1.476 (5.5)
$\ln(g)_{-1}$	−0.110 (7.0)
$\ln(RW)_{-1}$	0.024 (2.7)
$\ln(HS)_{-1}$	−0.179 (4.1)
$\ln(RY)_{-1}$	0.252 (5.0)
UCC_{-1}	−0.005 (12.9)
WSH_{-1}	0.402 (2.8)
$\Delta\ln(RY)$	0.258 (3.1)
$\Delta(UCC)$	−0.006 (5.5)
R^2 (adj.)	0.73
Equation standard error	0.0159

Equation includes seasonal dummies and dummies to reflect the abolition of double mortgage tax relief in 1988. *t*-values in brackets

This provides the basis of the model used to decompose the long-run trends in house prices. The full estimation result is shown in Table 10.4, which is solved to give the long-run solution in Table 10.2. In Table 10.4, λ is included as part of the user cost, where α_1 is estimated at 2.0 [see Eq. (10.3) in the main text]. *WSH* is an additional variable measuring the share of wages and salaries in household income and, as above, attempts to capture changes in the income distribution. Figures 10.2 and 10.5 use a slightly simplified version of the user cost from that employed in estimation, excluding property taxes and maintenance expenditures for which there are no data back to the 1930s. The volatility in these elements is small compared with the included terms and the omissions are unlikely to affect the conclusions.

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11

On the Persistence of Poverty and Segregation

11.1 Introduction

Chapters 8 and 9 were concerned with the (im)mobility of domestic residents and international migrants and the patterns of spatial segregation, which represent the aggregate outcomes of the micro flows. Chapter 3 introduced important concepts for understanding segregation and found that distinct branches of the literature—neo-classical residential location theory and social interactions models—reach the same conclusion; segregation, whether by ethnicity or income, is the most likely state to emerge. Outside economic theory, social filtering and the adoption of common norms of behaviour within social groups contribute to their isolation from others who do not share the norms (Scott 2013). The existence, between 1934 and 1959, of the Cutteslowe Walls in North Oxford, constructed to divide private housing from a council estate, was one of the more extreme examples in England. With exceptions, long-run historical case studies also support this conclusion and so the focus of the chapter is rather different from most of the extensive recent literature and concentrates primarily on the long-run persistence of poverty and segregation and the factors that lead to changes. We have already seen that wars

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induce change, but we consider the effects of major economic events, notably the Olympic Games, which are typically located in areas of deprivation and are seen as major regeneration initiatives. Is there evidence that these temporary events produce permanent changes? The London Olympics is taken as the main example, although reference is also made to other Games.

Some of the issues were summarised in Fig. 3.4, which is a stylised representation of the possible non-linear relationship between poverty levels and local housing markets. It showed that the areas most likely to take off lie around the thresholds, but areas at high levels of deprivation, well above the thresholds, may become stuck in poverty traps. In this case, only large events such as the Olympics are likely to be of sufficient magnitude to drive such areas towards the threshold, but success is by no means guaranteed. An assessment of the evidence for non-linearity is helpful because, if the relationship is instead linear, the success of policy interventions is independent of the initial level of poverty. In order to examine persistence, comparisons between the late nineteenth century and the current day are conducted, starting with Charles Booth's famous work on London poverty. Section 11.2, therefore, examines the evidence on segregation in the Victorian era and asks whether similar spatial patterns of relative poverty and segregation remain in place today. Absolute poverty has, of course, changed enormously over the period, but it is the relative spatial distributions that are the concern. Section 11.3 examines the evidence for non-linear behaviour; most research in this area relates to the US, for example by Galster et al. (2007) and Card et al. (2008), but the limited UK findings are also considered. Section 11.4 analyses the effects of the Olympics and the concluding section discusses the evaluation of regeneration policies more generally, which have typically paid inadequate attention to theories of urban dynamics. The criteria for successful policies are different in a non-linear than linear world and, since large numbers of neighbourhoods lie well above the poverty threshold requiring large public funding, following Berube (2005), it may not be feasible to improve all:

> Incremental improvements in social conditions of the most severely deprived communities may produce little market response, and may thus

fail to catalyse the broader forces on which regeneration programmes depend. Again these communities are not necessarily beyond "the point of no return", but the effort needed to achieve sustainable improvements in those places, absent some more radical intervention, may exceed what society is willing to expend. (Berube 2005, p. 29)

11.2 From Booth to the Present

According to Olsen (1974), the nineteenth century marked the beginning of the systematic social sorting of London's neighbourhoods. The process had begun in the seventeenth and eighteenth centuries, for example through the development of London's major new squares in the West End but, at that stage, the absence of adequate transport infrastructures meant that pockets of poverty were closely located to areas of wealth. As discussed in Chap. 1, three sets of forces promoted segregation: strong population growth in the first half of the century; the concentration of land rights amongst the wealthy; the development of transport, which initially favoured the middle classes wishing to live in suburban locations. Poorer households still had to rely on walking to work.

The work of Charles Booth in the later decades of the nineteenth century is generally recognised as the first major empirical study of poverty in London. There have been criticisms of some of its methods by modern standards, but the sheer immensity of the undertaking still attracts admiration and his results, published between 1889 and 1903 in 17 volumes, are still widely used.[1] Booth's surveys covered Inner London and were primarily based on interviews with informed professionals, notably School Board Visitors who had detailed knowledge of the conditions of local residents. School Boards had become important after the introduction of compulsory education in 1871 and Visitors were officials required to collect information on household circumstances in order to assess eligibility for fees remission (Abernethy 2013).

[1] Digitised versions of Booth's original notebooks and other materials are available online at the LSE's Charles Booth Online Archive.

The information compiled by Booth and his team grouped households into seven colour-coded social classes: (a) Wealthy—upper middle and upper classes (yellow); (b) Well to do—middle class (red); (c) Fairly comfortable—good ordinary earnings (pink); (d) Mixed—some comfortable, others poor (purple); (e) Poor—18–21 shillings a week for a moderate family (light blue); (f) Very poor—casual labour, chronic want (blue); (g) Lowest class—vicious, semi-criminal (black). The information was recorded on Booth's famous descriptive maps of London poverty, providing an early indication of the power of mapping for the analysis of poverty and segregation. Orford et al. (2002) note that Booth's classifications continued to have a strong influence on the censuses and social surveys throughout the twentieth century.

Booth's work is perhaps the most widely known, but the research was followed up approximately 40 years later by *The New Survey of London Life and Labour* (Llewellyn-Smith 1929), published in nine volumes by the London School of Economics and Political Science between 1930 and 1935, directed by one of Booth's assistants Hubert Llewellyn-Smith (Abernethy 2013). The objectives of the survey were two-fold: to provide a comparison with Booth's work and to provide information for subsequent later comparisons (Bowley 1936; Thomas 1936). The eminent statistician Sir Arthur Bowley oversaw the household survey that formed a central part of the research; Bowley argues that it was necessary to stay as close as possible to Booth's original methods in order to permit comparisons, but a key difference was the introduction of random sampling methods across London, rather than the full house-by-house coverage employed by Booth. In 1912, Bowley had already undertaken a pilot study of working-class households in Reading, based on a 5 % sample (Abernethy 2013) to demonstrate the accuracy of sampling methods. Outside London, the three surveys of poverty in York in 1899, 1935 and 1951, conducted by Seebohm Rowntree, are well known. Rowntree came from the Quaker chocolate-manufacturing company, based in York; his work had been influenced by Booth and the results for his first study, (Rowntree 1901) were derived from visits to working-class homes in York. Based on the first definition of a poverty line, derived from the minimum level of income necessary to maintain a healthy life, Rowntree found similar levels of poverty as in London at the time. The later studies were published as Rowntree (1936) and Rowntree and Lavers (1951).

Orford et al. (2002) use digitised versions of Booth's work to compare changes in London poverty between 1896 and 1991; the latter uses ward-level information from the census, whereas the 1896 information is collated to the same ward boundaries. They find some degree of convergence, but the key finding is the persistence of the spatial patterns of poverty over the hundred years. Ranking the wards by poverty quartiles, they show that approximately a half of wards did not change their position and three-quarters of the richest wards in London in 1896 (primarily in west London) maintained their pre-eminent status in 1991; 85 % of the poorest wards in 1896 remained in the bottom two quartiles in 1991. They also show a significant correlation between standardised mortality rates in the 1990s and poverty in 1896.

The most recent English local Indices of Multiple Deprivation (IMD), published for 2010, weight together seven separate indicators—income (22.5 %), employment (22.5 %), health and disability (13.5 %), education, skills and training (13.5 %), barriers to housing and services (9.3 %), crime (9.3 %) and living environment (9.3 %). In light of Orford et al.'s long-run results, it is perhaps unsurprising that, despite changes in methodology, the local rankings in the IMD have remained highly correlated over time; the poorest areas have largely remained the poorest across England in recent years. Meen (2009) shows that the indices in 2000 and 2004 are highly correlated with (but not caused by) a small number of indicators: the unemployment rate, the proportion of the population who are retired, the percentage of the population with no qualifications, the percentage with long-term illnesses and the percentage from ethnic minorities. Typically, none of these variables change quickly in the most deprived areas.

Poverty is not the same as segregation; for example, it is possible for a town to have a high level of deprivation, but poverty to be equally distributed across space, although in practice this appears to be rare. In order to examine long-run changes in segregation the samples introduced in Chap. 8 are useful, although small scale. As discussed in that chapter, the 1881 census provides exact addresses for all households and there is no constraint on aggregation to any definition of neighbourhood, but constraints arise from the 2001 census, which is our comparator, where the finest spatial scale is the Census Output Area (COA), averaging approximately 200 residents. In order to compare 1881 and 2001, the 1881 addresses have to be assigned to current COAs; this is a major undertaking, requiring detailed study of nineteenth century maps and so we concentrate only on the observations from the central and western zones in Chap. 8. Unsurprisingly, some small nineteenth century residential streets no longer exist, although their original location can frequently be tracked down. Excluding streets that could not be located, this gives information on the occupations for 998 household heads that can be used to construct information on neighbourhood socio-economic status. These cover approximately 110 COAs but, in some, the number of observations is small and so the COAs are aggregated to the higher Middle Layer Super Output Areas (MSOAs). The sample then covers 26 MSOAs out of 123 (21 %) across the current London boroughs of Camden, Hackney, Islington, Kensington & Chelsea and Westminster. All the MSOAs now lie within central London, even though they included some very poor areas in 1881.

The social status of different occupations changes over time and the 2001 Census employs a different Socio-Economic Group Classification. Nevertheless, there is a strong correlation between the current classifications 'semi-routine and routine' occupations and the former social Classes (iv) and (v), which were discussed in Chap. 8. Thus, the shares of households in Classes (iv) and (v) in both 1881 and 2001 in each of the sample MSOAs can be constructed. A final complication is that the share of workers in Classes (iv) and (v) for London as a whole has changed between 1881 and 2001 (from 23 % to 12.5 %) and so values have to be standardised. The measure becomes for each MSOA in 1881 and 2001:

$$100 \times \left[\frac{\left(\%\text{inClasses}(\text{iv}),(\text{v})\right)_i}{\sum\left(\%\text{inClasses}(\text{iv}),(\text{v})\right)} \right] \tag{11.1}$$

$\sum$ is summed over the sampled MSOAs.

The Dissimilarity Index, introduced in Chap. 7, is the most widely-used measure of segregation but, as noted in that chapter, it suffers from a number of well-known problems, summarised in Musterd (2012), who brings together the latest state of play on the large number of different

Table 11.1 Dissimilarity and isolation in London in the nineteenth and twenty-first centuries

Period	Dissimilarity Index	Isolation Index
1881	0.191	0.259
2001	0.250	0.236

Source: Authors' calculations

measures now available. Even if minority groups are disproportionately located in certain areas, this does not necessarily imply that they have no contact with other groups and so a second index examines the exposure of one group to another; the Index of Isolation (11.2) measures the probability that, for a member of the minority group, someone else chosen randomly from the same area will be from the same minority group.

$$S = \sum_{i=1}^{n} \left[\frac{x_i}{X} \cdot \frac{x_i}{t_i} \right] \tag{11.2}$$

where, X is the total population of the minority group across the city; x_i is the population of the minority group in MSOA (i) and t_i is the total population in MSOA (i). Table 11.1 sets out the findings; given the small sample sizes, both indicators suggest that changes in the extent of segregation of the lowest socio-economic groups across more than a hundred years has, at best, been modest and the results broadly support those of Orford et al. (2002) discussed above.

11.3 Evidence for Non-linearity

The evidence above suggests that segregation has been persistent in London, but London is only one city, as dominant in the UK as it is. We also presented related evidence for persistence in Glasgow housing markets in Chap. 6, but this section explores the reasons in a more general context. Chapter 3 argues that segregation is a property of different models, including those in a neo-classical tradition, but we concentrate on those approaches that exhibit non-linear behaviour, tipping and path dependence. We are also concerned with the extent to which structures are mean reverting in response to shocks in line with the analysis of Chap. 3.

In fact, providing convincing empirical evidence in support of tipping across a range of socioeconomic variables is more challenging than obtaining evidence in favour of persistence, although there are indications or hints. The difficulty partly arises from the inadequacies of the spatial data to which tests have been applied, since they are usually based on administrative boundaries such as US census tracts. The key to neighbourhood effects, however, is the characteristics of the residents, which do not necessarily readily correspond to administrative boundaries. This problem lies behind our attempts to move in the direction of the micro modelling of household mobility. Nevertheless, at the aggregate level, the work of Card et al. (2008) provides an important example of tipping arising from social interactions, consistent with the Schelling approach and with empirical evidence. In the context of outflows of white populations, they find that the displacement of white residents from cities takes place in the US once minority shares reach critical levels, which vary between 5 % and 20 %.

The work of Galster and his colleagues discussed in Chap. 3 arguably provides the most comprehensive analysis of thresholds arising from the extent to which individuals come into contact with a peer group, but the group has to reach a critical mass before it exerts influence on the behaviour of others. Galster et al. (2007) examine the empirical evidence for thresholds in seven variables across five US cities between 1988 and 2003: property crime, violent crime, low birth weights, births to teenage mothers, median house values, property tax delinquency and home sales. The time-series element of their panel allows them to test the properties of each variable from versions of the stationarity tests used in earlier chapters. The authors are interested in the *endogenous* dynamics of each variable; in other words, if each is subject to a random shock, does the variable exhibit stability and return to its initial state, instability (progressively diverging from the original position), multiple equilibria (the variable gravitates towards a different stable state) or threshold instability (stability exists up to a threshold, but instability beyond that point)? This is a different question from the effect of large changes, for example through policy, on each of the indicator variables to which we return later. The authors' central conclusion is that, in almost all cases, the variables exhibit stability and there is little evidence of the existence of thresholds. The result is perhaps unsurprising given the discussion of wars in Chap. 3; most of the literature considered there found that large temporary shocks such as bombings in the Second World War did not have permanent effects on population distributions, which were mean reverting, although there was some evidence of multiple equilibria.

Similar analysis does not exist for the UK, although it would be surprising if the results were fundamentally different. However, using an alternative approach, Meen (2009) provides indicative, although not conclusive, evidence for non-linearity in local English house prices.[2] Bearing in mind the shape of Fig. 3.4, the paper explores the relationship between house prices and the Index of Multiple Deprivation for 2001 and 2004 for the English local authorities, standardising on other variables found to affect house prices, notably the housing stock, the number of households and local incomes. The S-shaped relationship is captured by a logistic function, which generates thresholds, but is also tested as a non-linear cubic relationship and through the use of spline functions. These tests suggest that there is evidence of non-linear responses at high levels of deprivation and the estimated relationship is shown in Fig. 11.1, where deprivation on the horizontal axis is expressed as deviations from the regional mean and house prices, on the vertical axis, are standardised over the range from zero to unity. The remaining variables used in estimation are set to their mean values.

The key result is that the thresholds lie at approximate values of ±30 (expressed in deviations from the mean) so that policy would have to reduce deprivation in any area to this level before it will 'take off' of its own accord. Small-scale interventions in the areas of the highest poverty are unlikely to be sufficient to bring neighbourhoods to the tipping point and become self-sustaining; since most areas do not regularly experience large shocks, spatial structures remain stable for long periods of time. Furthermore, the quotation in Section 11.1 from Berube (2005)

[2] However, Card et al. (2008) indicate that, even if tipping in population flows occurs, this does not necessarily imply tipping in prices.

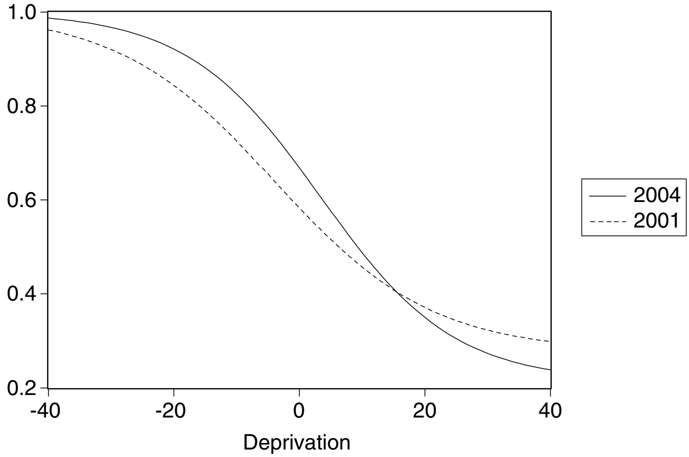

Fig. 11.1 The relationship between local house prices and deprivation in the English local authorities
(*Source*: Meen 2009)

illustrates the problem; if there are large numbers of neighbourhoods that lie above the poverty threshold, the resource costs will be large. Policy interventions in areas close to the threshold will be more successful on conventional cost-benefit calculations, but they represent the easier end of the policy spectrum.

Deprivation in most local authorities, taken as a whole, lies in the central part of the distribution because they are large enough to contain both rich and poor areas and so poverty needs to be considered at a finer spatial scale. The 2004 IMD gives results at the Super Output Area (SOA) level and Berube (2005) shows the proportion of SOAs that lie above a level of 40,[3] which he defines as 'extremely deprived SOAs'; nationally, approximately 1.5 % of SOAs fall into this category. Meen (2009) provides further evidence at the even finer Census Output Area level. Across four English regions, the North East, North West, Yorkshire and Humberside and the South East, summary measures were constructed for the proportion of Output Areas with estimated deprivation indices lying in the

[3] Note that this value is not directly comparable with the horizontal axis in Fig. 11.1, because the graph is defined in terms of deviations from the mean.

range ±30, in other words, those lying in the steepest part of the price curve, and the proportion with values greater than 70—the flattest part of the curve. The vast majority of COAs lie within the steepest part of the price curve, but there are important tails. In the North, slightly more than 1 % of COAs have calculated deprivation scores above 70, although the percentage is much lower in the South East; the tails are concentrated in the older industrial conurbations.

11.4 The Effects of the Olympic Games

The London Olympics were focused on a site in Stratford, which lies in the east of the capital; in the Industrial Revolution it had housed some of London's most unwanted industries; it was bombed in the Second World War and was also affected by the later closure of the docks. Chapter 5 discussed the impact of war-time bombings and the London Docklands Development Corporation on the East End. Both undoubtedly had a strong effect on the area's structure, but it remained the case that, in 2010, the four boroughs in which the Olympic Park was located—Hackney, Newham, Tower Hamlets and Waltham Forest—were, respectively, the second, third, seventh and 15th most deprived local authorities in England out of 326, according to the Index of Multiple Deprivation. The area also formed part of the major London Gateway re-development, which covers an area along the Thames from the East End to its estuary in the North Sea; the Gateway had been designated as a priority area for a major expansion in housing supply, in order to mitigate the south of England's housing shortages. Stratford also features as part of the major London Crossrail infrastructure project, linking areas to the west and east of London.[4]

The use of the Olympic Games for regeneration purposes was not confined to London and regeneration has commonly been cited as a goal of other major sport-led initiatives, for example, in Sydney, Barcelona and Athens. Among the advantages is the relative cheapness of land for

[4] More precisely Crossrail will run from Reading in the west to Shenfield in the east and includes Stratford along its route, tunnelling under central London.

construction. 'Relatively' should be stressed; median house prices in all Inner London districts are high by national standards, but the four boroughs were among the lowest in Inner London in July 2005, when London's successful bid was announced. Similarly, land costs influenced the location of major infrastructure projects in the nineteenth century; railway networks, for example, were not built through the most expensive areas. From Gratton et al. (2005), more generally during the 1980s, major sporting events began to be seen as a form of urban regeneration; both Sheffield and Manchester in England spent major sums on the World Student Games in 1991 and the Commonwealth Games in 2002, respectively, although these were modest compared with the Olympics.

A considerable body of evidence exists on the economic effects of the Olympics, relating to three phases of the process (Kontokosta 2012); first, short-term or announcement effects; second, effects during the pre-Games construction period; third, post-Games outcomes associated with wider area regeneration. The first could be short-term and speculative, involving over-shooting, but the second and third are more likely to be permanent. Since the winner of the Olympics is unknown before a set date, immediate announcement effects on stock market prices are expected, particularly for construction companies and tourism-related industries. Studies for different Games include Merman et al. (2000), Veraros et al. (2004), Mirman and Sharma (2008) and Dick and Wang (2010). In general, positive announcement effects are found for the winners, but there are no negative effects on the stock prices of losing cities, because the probability of winning is relatively low and already discounted into prices. Veraros et al., for example, find that the overall index in Athens rose by approximately 8 %, but there was no effect in the losing city of Milan. Studies of stock market prices for the UK are complicated by the contemporaneous infrastructure projects noted above and also by the fact that the July 7th bombings occurred on the day after the announcement of London's success.

Studies of the effects on house prices are more limited, but valuable because in principle they can be used to capture wider economic effects discounted into prices. House prices include not only the direct effects of new housing construction, but also increases in employment and potential neighbourhood improvement. The Council of Mortgage Lenders

(2005) compared five-year changes in house prices in four Olympic cities—Barcelona (1992), Atlanta (1996), Sydney (2000) and Athens (2004)—and found that in each case price growth was greater than in the countries as a whole, particularly in Barcelona. However, although indicative, no attempt was made to control for other subnational variations that might account for the price differentials.

By contrast, Kontokosta (2012) compares house price growth in six host cities—Los Angeles, Seoul, Calgary (Winter Games), Barcelona, Atlanta, and Sydney—using other cities within the countries as controls, and employing a form of difference in difference estimator as a pseudo natural experiment; the study distinguishes between the pre- and post-Games periods. Price outcomes differed across host cities and only in Barcelona and Sydney were permanent price rises found to be statistically significant. With a data set on individual properties, rather than city aggregates, Kavetsos (2012) explores dwelling prices in the four London Olympic boroughs[5] and, using a hedonic pricing approach, finds that prices were approximately 3 % higher than would otherwise have been the case, although this did not include the post-Games period.

Since regeneration typically refers to the resuscitation of the worst-performing areas *within* cities rather than cities as a whole—indeed major projects may simply displace investment elsewhere—local studies are arguably more relevant and we noted in the previous section that most towns include both wealthy and poor areas. Data on local house prices for MSOAs can be used to combine elements of the Kontokosta and Kavetsos approaches. Across the four Olympic boroughs there are 125 MSOAs. The MSOAs in the remaining Inner London boroughs plus two Outer London boroughs contiguous to the Olympic site[6] are used as controls.[7] Land Registry data between 2000 and 2013 are available for the sale prices of dwellings disaggregated between detached, semi-detached, terraced dwellings and flats/maisonettes. Since sales of the first

[5] He also includes Greenwich, which lies south of the River Thames, and was where some of the Olympic events took place, notably equestrianism.

[6] Barking and Redbridge.

[7] Kavetsos (2012), in fact, shows that price effects are felt outside the four boroughs, which are purely administrative units, but the size decays with distance. This affects the ability of some boroughs to act as controls.

two groups are modest in Inner London, we concentrate on the effects of the Olympics on the prices of flats and terraced houses and also on the total number of property sales as an indicator of market activity.

The equation to be estimated takes the semi-logarithmic form (11.3):

$$\ln(PH)_{it} = a_1 + a_2 HOST_{it} + a_3 ANN * HOST_{it} + a_4 INV * HOST_{it} + a_5 POST * HOST_{it} + e_{it} \quad (11.3)$$

In addition, yearly dummy variables are included to capture the effects of common changes over time across London, remembering that the period covers both the boom and the Global Financial Crisis (GFC). (*PH*) measures median house prices for flats or terraced properties in area (*i*) at time (*t*); *HOST* takes a value of one if the MSOA lies in one of the Olympic boroughs. Therefore, by itself, the coefficient indicates the percentage difference in prices from those of the control group. To estimate the impact of the Games, the sample is divided into four (slightly arbitrary) periods, bearing in mind that sales are slower than in stock markets because the transactions costs are higher and so lagged responses are to be expected. Therefore, 2000–2004 is taken as the pre-Games period; 2005–2006 is the short-run announcement period; 2007–2011 is the construction period; and 2012–2013 is the post-construction period. At the time of writing, the valuable post-2013 data were not available. Dummy variables are constructed for each period, denoted *PRE*, *ANN*, *INV*, *POST* respectively and were interacted with *HOST*, but the first

Table 11.2 The effects of the London Olympics on house prices

	Flats/maisonettes	Terraced houses	All dwellings	Property sales
HOST	−0.252 (13.0)	−0.419 (14.6)	−0.237 (13.8)	−0.149 (6.2)
ANN × *HOST*	0.068 (1.9)	0.047 (0.9)	0.051 (1.6)	−0.065 (1.4)
INV × *HOST*	0.009 (0.3)	−0.016 (0.4)	−0.009 (0.4)	−0.126 (3.7)
POST × *HOST*	−0.049 (1.4)	−0.081 (1.5)	−0.054 (1.7)	−0.148 (3.3)
R^2	0.32	0.24	0.36	0.29
Observations	6535	6151	6622	6622

All equations include year dummy variables and a constant. *t*-values in brackets is omitted in estimation to provide the baseline comparison. Results are shown in Table 11.2; the first row of the results indicates that the prices of flats in the Olympic boroughs were on average 25 % lower than those in the remaining Inner London boroughs; similarly the prices of terraced houses were more than 40 % lower; for completeness, overall dwelling prices were 24 % lower and property sales were 15 % lower. Weaker prices and activity are both symptoms of the deprived status indicated by the Index of Multiple Deprivation.

The second row of the results, however, indicates some limited evidence of a positive announcement effect, particularly for flats. In the year following the winning of the Games, prices appear to have risen by approximately 7 % relative to the non-Games boroughs. By contrast, over the construction and post-Games phases (rows 3 and 4) there is no evidence, on the basis of these simple tests, that the Olympic boroughs have made any gains; the announcement effects appear to have been purely temporary, at least in terms of the effects on house prices and sales, which continue to be low. The results are consistent with poverty traps and, although later data are needed, are not encouraging for the regeneration effects of even large changes.

11.5 Wider Regeneration Initiatives and Social Mixing

Across Europe, a wide variety of area-based initiatives have been implemented, including physical neighbourhood improvement, changes to the tenure mix, efforts to combat crime, the empowerment of local residents, attempts to attract firms to the area, and an emphasis on education and job training. A perfectly fair criticism of the provocative results in the last section is that it is far too early to judge the success or otherwise of the Olympic legacy as a vehicle for regeneration. After all, a theme of the book is the persistence of housing markets and it may be five, 10 or 20 years before the Olympics can be fully assessed. Even now, a walk, bus or train journey around the East End quickly reveals how much has changed in recent years, although not necessarily because of the Olympics, but persistence raises the more general issue of how regeneration schemes can be evaluated; not unreasonably, policy makers cannot wait 10 years for an answer. Chapter 3 emphasises that where path dependence occurs, outcomes are not independent of the starting conditions. In terms of Fig. 3.4, 'success' is easier to achieve through interventions around point B than at much higher levels of poverty, issues that have, of course, been recognised both in policy circles and in the academic literature. Tyler et al. (2013) state, 'We can also expect that policy effects will take time to emerge and there will be discontinuities such that certain thresholds of activity may have to be reached before significant impacts may occur. It is also difficult to be clear as to what are the precise spatial boundaries of impact and the extent of interactions with other surrounding areas' (pp. 172–173). They also show the major role of housing in regeneration activity in England; between 2009–2010 and 2010–2011, 64 % of regeneration expenditure was housing related, through new building, improvements to the existing stock, demolition and reducing homelessness.

As an example, Rhodes et al. (2005) provide an evaluation of the Single Regeneration Budget (SRB), which was the largest area-based initiative (ABI) in operation in England between 1995 and 2001. 'The underlying rational for the programme reflected a recognition that, if the deep-seated problems of deprived areas were to be tackled, there was a need to encourage policy interventions that were holistic in the sense that they tackled the economic, physical and social factors …' (p. 1926). They point to three limitations in traditional approaches to evaluating the success or otherwise of ABIs: identifying the underlying theory of change behind policy interventions; insufficient development of the evaluation methods; inadequate attention to the impact of the policies on outcome indicators. Their own evaluation, based on interviews in the SRB areas, suggests significant, but still fairly modest, improvements between 1996 and 2001. In addition, Lawless et al. (2010) provide an evaluation of the New Deal for Communities (NDC), which constituted a central element in the (Labour) government's National Strategy for Neighbourhood Renewal. This was one of the most ambitious area-based initiatives introduced in England, designed to transform 39 of the most deprived neighbourhoods, with designation based on the Index of Multiple Deprivation. Seventeen Pathfinder areas were announced in 1998 and 22 a year later, and these were 10-year programmes, recognising the length of time necessary to achieve results, although Lawless et al. concentrate on an interim evaluation, based primarily on household survey results in all 39 areas up to 2006 and assessed against a comparable control group of deprived areas that did not receive NDC funding. Even by 2006, some moves towards the programme's objectives had been achieved, but it is striking that, averaged across the 39 areas, only modest improvements in indicator variables occurred compared with the control group. 'For instance, analysis across outcome areas suggests that NDCs as a whole were significantly outperforming their comparator areas between 2002 and 2006 in relation to only a handful of some 31 indicators' (p. 262). As part of the explanation, Lawless et al. argue that, although a well-funded programme by the standards of most ABIs, on a per capita basis, expenditures remained modest for areas that had experienced deep-seated deprivation over many decades. In our terms, expenditures were not necessarily sufficient to bring the neighbourhoods to the threshold and to overcome path dependency. More generally, in a review of social housing-based neighbourhood regeneration schemes between 1975 and 2000, Kintrea (2007) concluded that programmes over these years had not resolved the problems of the estates and had failed to 'reposition council-built estates from the bottom of the residential hierarchy'.

An understanding of urban dynamics for policy purposes is enhanced by analysis of the underlying micro behaviour of local residents and examples were provided for our case study cities. A useful wider review of the current state of knowledge is provided in van Ham et al. (2013), but Chap. 3 highlighted the technical difficulties associated with assessing the likely impact of neighbourhood interventions particularly operating through social interactions. Nevertheless, despite the limitations in the empirical evidence base, ABIs both in the UK and other countries have typically included attempts to promote social and economic mixing. For example, English government targets set out in 2005 included 'Faster progress to narrow the gap between the best and worst off to make sure opportunity and choice are for all, including a new more radical approach to renewal in a small number of very disadvantaged areas with the aim *to create neighbourhoods with a more sustainable mix of tenures and incomes* and address the problems of worklessness, skills, crime, poor environments and poor health' (ODPM 2005, our italics). In these terms, 'sustainability' is associated with integration and mixing, but Chap. 3 finds most economic theories, supported by historical experience, indicate that segregated communities are the most likely stable state. Attempts to promote mixing are fighting against very strong forces and housing policies have, in some cases, entrenched segregation. Nygaard and Meen (2013) show that slum clearances in London were often replaced with large social housing estates, rather than promoting a broader tenure mix. Furthermore, as Cheshire et al. (2014) suggest, segregation may be the outcome of free choices—the poor may choose to live in the poorest areas simply because they are the cheapest.

Alternatively, models in the Schelling tradition show that high levels of segregation arise as an externality. The economic case against segregated communities therefore rests on the potential efficiency losses arising from negative externalities, including possible poorer school performance, worse health and higher rates of unemployment. This view rests on the idea that place has an independent effect on economic outcomes in addition to those associated with the characteristics of individuals and their families. The evidence is strong that intergenerational persistence in economic outcomes is important (see, for example Blanden et al. 2007); arguably the best predictor of a child's future life chances still remains the income and status of the parents, transmitted, for example, through low birth weights for the children of poorer parents and worse educational opportunities. In practice, it is more difficult to demonstrate that weak educational performance in the most deprived locations arises because of the location itself—a poverty of place—since location variables are typically correlated with parental income and status. Chapter 3 briefly discusses the econometric problems and proposed solutions, including the use of pseudo-natural experiments, such as the US Moving to Opportunity programme, and instrumental variable approaches in order to allow for the problems of self-selection. Spatial samples are not random, but reflect the characteristics of individuals. In addition, by their nature, neighbourhood influences are local, but few large-scale data sets provide sufficient information at the neighbourhood level. Regional or local authority data are, for many purposes, inadequate; this observation lies behind our attempts to move towards the construction of micro data sets with exact spatial identifiers. Nevertheless, on the basis of existing evidence, we should not conclude that place has no effect on outcomes, but there are difficult technical problems in identifying the quantitative influence. The extensive literature on the issue is brought together in van Ham et al. (2012).

11.6 Concluding Comments

The evidence in support of the persistence of spatial patterns of poverty and segregation is overwhelming, whether derived from long-run comparisons between Booth's poverty maps and the present or from the invariance of the rankings displayed by the Index of Multiple Deprivation. In itself, segregation is neither good nor bad, since segregation may produce both positive and negative externalities, but the idea of thresholds and tipping as an urban phenomenon, perhaps, requires further validation. There are hints that they exist, and a limited number of concrete examples, but whether they are a pervasive influence in urban systems requires further research. The effort is well worthwhile because, if they exist, the policy implications are profound compared with a linear world.

Following Rhodes et al. (2005), the absence of an underlying theoretical model of urban dynamics to be used in the evaluation of urban policy in a possibly non-linear world is a significant drawback. The finding that regeneration programmes typically appear to have only limited effects leads to questions about the appropriate assessment criteria, given the quotation from Berube (2005) in the opening section. Simple rankings of cost-benefit ratios are less relevant under non-linearity, since they are likely to lead to a concentration of policy in areas that lie closest to take-off points, rather than in those of greatest social and economic need.

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12

Final Reflections

Few, if any, economists take pleasure at the thought of a destruction of the natural environment and green spaces through housing development. Wildlife and conservation matter. A walk in the countryside is said to be one of the best ways of improving human happiness and reducing stress. By and large, economists enter the profession because they want to make a modest contribution to the well-being of society, but economics is about scarcity and the discipline provides one approach to the optimal allocation of scarce resources. Economics helps us to highlight difficult, incompatible choices and land is one of these scarce resources. Economics teaches us that, with scarce resources, there are always likely to be trade-offs and the objectives that politicians and the electorate may wish to achieve are often conflicting. We cannot have everything; the alternative to under-supply of housing includes affordability problems for the young, overcrowding, and increased housing market risk.

The desire of residents to oppose local developments is a perfectly reasonable response, even if development is in the best interests of the wider community. There are trade-offs between groups; the fact that all options are unpalatable to the electorate constrains the willingness of politicians to make fundamental changes. Housing falls into the too difficult

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category; instead, policies tinker around the edges or are partial without taking into account the wider consequences of the actions. Even the most radical politicians have been constrained by the history of past policies.

Since this book is concerned with the long term, comments on sustainability are in order. The idea of sustainability is widely discussed in housing policy, but not always precisely defined. Sustainability from an *environmental* perspective has two central elements: first, a concern for the well-being of future generations in the face of growing pressure on the natural environment. Sustainable consumption is the level that can be maintained indefinitely without depleting the stock of natural resources. Second, there is a concern with the ability of the economic system to substitute other forms of wealth for any diminution of the natural capital stock—if natural resources are used up now, this may matter less if other resources can be substituted in the future. Both of these aspects place emphasis on the long-term future as opposed to the short term.

Environmental concepts are not necessarily directly applicable, without modification, in housing. At one level, housing is clearly closely bound up with environmental considerations through its use of land. Housing generates externalities through pollution and congestion, but its use of land cannot be analysed in quite the same way that oil, for example, might be considered. As a finite resource, for oil, models of optimal depletion policy can be developed, but, although land changes its characteristics through development[1] it is not permanently destroyed or used up and it has features of a (partly) renewable resource. If a building becomes economically obsolete, it will be demolished and an alternative put in its place and so the physical quantity of land (as opposed to planning regulations) does not necessarily impose a constraint on sustainable development. Indeed, proposed expansions in housing construction imply relatively modest increases in land in Britain devoted to housing. According to the Barker Review (2004, p. 126), over 60 % of land in the south east is protected (either green belt or designated as conservation areas) and 11.4 % is urbanised. Of the remaining land 1.5 % was, at the time of the Review, required for future planned house building before 2016.

[1] Notably from greenfield to brownfield status.

A further environmental concern relates to the impact of house-building on biodiversity. The international evidence on the relationship between population density and species richness is summarised in Luck (2007), but more research is required. Urban sites are not necessarily environmentally barren and former industrial sites demonstrate the resilience of the natural environment, having the ability to be repopulated relatively quickly by wildlife. There is considerable debate in the literature concerning the most appropriate definition of biodiversity, which is itself a complex issue, but Helm and Hepburn (2012) argue that 'biodiversity loss should be regarded as one of greatest economic problems of this century'. They indicate that economic and population growth has led to the degradation of the ecosystem and that losses of diversity reduce the productivity of the economic system as a whole. As Polasky et al. (2005) suggest, economics has a role to play in the evaluation of conservation strategies and can support the environment, rather than being seen as a force for destruction. Since biodiversity is a non-market good, its price is not readily observed and the private sector will typically under-provide. However, stated preference approaches to the measurement of the value of environmental goods are now common, although imperfect. In practice, the fusion of an economic analysis of housing markets and biodiversity has yet to take place in an integrated framework. Similarly, the implications of climate change and flooding for housing have not perhaps attracted as much research as might be expected, given its potential importance, beyond hedonic studies; the work of Chen et al. (2013) and Pryce et al. (2011) provide exceptions.

There are alternative approaches to sustainability, which have occurred in past housing policies. For example, in the (Labour) Government's Five-Year Plan (ODPM 2005): 'sustainable communities are places where people want to live and work, now and in the future. They meet the diverse needs of existing and future residents, are sensitive to their environment, and contribute to a high quality of life. They are safe and inclusive, well planned, built and run, and offer equality of opportunity and good services for all'.

Other approaches to sustainability relate to owner-occupancy. During the 1980s, an objective of home ownership policy was to increase the rate of ownership, but, by 1995, this had subtly changed to promote the growth of sustainable owner-occupation. The additional word tells something about the state of the market at the time (housing was still in recession) and the growing awareness that the promotion of ownership, regardless of underlying economic conditions, was bound to cause problems, notably arrears and defaults. A wider definition of sustainability is used in Maclennan et al. (1997): 'an overall level or rate of home-ownership which is not subject to significant short-term attrition (or growth) in the cyclical downswing (or upswing) and which is consistent with economic fundamentals in the long term'. Implicit in this definition is the avoidance of sharp variations in prices, construction volumes, arrears and possessions.

Economics teaches the inter-connections between markets and has been good at producing complex mathematical models that profess to explain the nature of the interconnections. However, in this book we have suggested that economic models certainly have their place in housing, but pay insufficient attention to the constraints on policy action arising from history. The fact that these are sometimes harder to incorporate in mathematical models does not make them any less important. Real understanding of housing requires knowledge of history and institutional structure as much as mathematical skills. Economics remains a long way from providing an integrated model of how housing markets work over different spatial scales and over time and, arguably, a pluralistic approach for policy analysis is required. Different models are necessary for different policy problems. For example, we have not argued that neo-classical models are better than social interaction models or vice versa since both shed valuable insights; sometimes the different approaches can be integrated, but not always. We have suggested that history, geography, social policy and economics all come together in housing. This does not always lead to elegant models, but no single discipline should dominate in the study of housing; that is the attraction.

In Chap. 1, we argued that the long-run progress in housing conditions is often overlooked in light of the many short-run crises, but what have been the key drivers of long-run change? Others will have their own rankings, but we point to seven that have featured prominently throughout the book. First, housing conditions were improved by a greater understanding of the relationship between health and housing from the mid-nineteenth century, for example, through the identification of the causes of cholera and the efforts of the social reform movement; most early legislation concerning housing and the subsequent introduction of building standards related to health and sanitation. Second, advances in technology had a fundamental effect on the development of both urban areas and suburbs. Until the innovations in transport systems, the scope for, initially, the middle classes and, subsequently, the working classes to move away from city centres was limited because of the need to walk to work. Patterns of segregation emerged in the nineteenth century partly because of the new rail networks; transport networks also allowed the development of large municipal housing estates in the inter-war period. Third, wars were amongst the few temporary events large enough to produce permanent changes in population distributions, for example, amongst international migrants residing in London. The idea that wars have long-run positive effects in addition to giving rise to misery is not new. Morris (2014), for example, views wars as transformative events, which produce strong governments and lead to economic growth; related ideas were explored in Chap. 3. Fourth, economic globalisation and the accompanying migrant flows have fundamental implications for housing markets, both in terms of the absolute numbers of houses required and the spatial distribution. Fifth, architecture is outside the subject area of the book, but the development of the principles of modernist design and urban planning, under the influence of Le Corbusier, as a solution to mass housing problems and slum clearances, had a major long-lasting effect on the structure of Britain's cities. Sixth, because the demand for housing is income elastic, long-run growth in the economy implies that housing demand exceeds population growth, but supply has shown little long-run growth from the 1930s onwards. This is why affordability has been a long-run problem rather than just a recent event and why the introduction of housing subsidies for the first time after the Great War was so important. Finally, deregulation of mortgage markets in the 1980s was part of the wider political and economic ideology of the time that favoured the free operation of markets in both the US and UK. Deregulation removed the shortages in housing credit that had been in existence for decades in the UK, but also opened up the possibility of abuses to the system that eventually led to the Global Financial Crisis.

However few policies directly targeted at housing feature in these top seven key drivers.

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Note: Page number followed by "n" refers to footnotes.

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