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A Tale of Two Victorian Cities in the 21st Century

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1. Introduction

In 1963, Asa Briggs published his classic study of Victorian cities, covering London, Melbourne, Manchester, Leeds, Birmingham and Middlesbrough. Although the growth of these cities took off at similar periods, each city 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. 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 white settlement in the 1830s, followed by very rapid expansion after 1851. London was a city where most residents were born and bred, whereas growth in Melbourne arose from migrants. Inequality levels were high in 1880's London, but low in Melbourne, (Davison, 2004). Melbourne's booming construction industry was attracting skilled labour from the London area/south-east England (then currently in recession) and wages for unskilled labour were comparatively high with excess demand for low skilled labour (McCarthy, 1970). But the distinctions between London and the other English cities were also considerable, for example, in terms of industrial structure.

Although Briggs' analysis is highly illuminating and readable, his work does not rely on modern statistical analysis or economic theory. Nor did he attempt to examine the dynamics of change in urban areas from the Victorian era to today. These are the aims of this paper. One of the features of urban spatial structure is its persistence. The areas that were poverty stricken in the 19th century are frequently the same deprived areas today. But some economic growth models predict a convergence of spatial outcomes, particularly *within* cities. Although long-lasting differences in *international* growth rates might be expected, because of variations in human capital, infrastructure, R&D, capital mobility etc, *a priori* the impediments to the elimination of intra-urban differences appear less severe, particularly in advanced economies. Nevertheless, in practice, the differences persist for long periods of time. Even at the urban level, there appears to be possible evidence of poverty traps, where areas fail to achieve a critical threshold for independent growth to occur. Since the residential and commercial buildings and the underlying infrastructure change only slowly, these may provide one reason why areas become "stuck". The roman road structure still provides a basic layout for some cities. Furthermore, disparate property rights in British cities make it difficult to implement grand redesigns along the lines of the Haussman redesign of Paris. Wren's plans for redesign of London following the Great Fire in 1666 fell foul of similar problems. Also, late 19th century slum clearance programmes in London following the 1875 Artisans' and Labourers' Dwellings Improvement Act, were piecemeal and attention was focussed on discrete sites rather than a general plan (Yelling, 1986, page 17). Sites were not necessarily physically adjacent, nor involved a re-shaping of the city. Even today, given the diversity of ownership, assembling land packages from existing sites for redevelopment is problematic. The average age of dwellings in England is much older than in the US, for example, and some empirical evidence is presented below to suggest why this occurs. Demolition rates of residential properties in the UK are extremely low.

There is a growing body of theoretical and empirical evidence that indicates that neighbourhood quality is a key factor in determining location choice. Although some aspects of neighbourhood are endogenous and change relatively quickly, as discussed in the previous paragraph, the physical structure does not and, therefore, it is unsurprising that the socio-economic status of areas also changes only slowly. Wealthy households will always be able to outbid the poor for the best neighbourhoods. A range of different economic theories discussed below suggest that segregation between rich and poor households is a stable state and that UK government attempts to achieve mixed communities are fighting against strong trends. There is no equivalent Australian policy focus on mixed communities in terms of the social inclusion/cohesion arguments often encountered in the UK policy debate. The Victorian government's strategic plan for Melbourne – *Melbourne 2030* – is concerned with establishing equitable access to services and infrastructure. Nonetheless, *Melbourne 2030* is concerned with countering increasing spatial polarisation and concentrated areas of social disadvantage by improving housing options for lower income families by increasing housing choice across the entire city (DOI 2002).

This suggests that empirical analysis of urban change needs to adopt a very long-run perspective – centuries, rather than the decades commonly used in time-series analysis. Therefore, comparing the Victorian period, when the structure of some cities was laid down, with today has its logic. Over short periods, significant change is less likely to be observed. This, of course, gives rise to considerable problems of data construction. There are few published data sets, which compare commonly-defined areas over centuries. Therefore, in this paper, new sources are exploited. Amongst the key issues explored are:

(i) Have patterns of segregation in cities changed between the late 19th century and today?
(ii) Have the socio-economic statuses of neighbourhoods within cities converged over the last 120 years?
(iii) Are cities path dependent, where growth is determined by initial conditions?

In summary, the argument in this paper is that the physical residential structure of urban neighbourhoods typically changes only slowly (unless they are subjected to major external shocks that fundamentally change their status). Residential structure changes more slowly than commercial structure because property rights are more diverse and, perhaps, because planning constraints are more severe. This implies that the supply of certain neighbourhood characteristics is highly inelastic, even over decades. Consequently rich households will always be able to outbid poor households for the best locations and segregation arises. One indicator of inflexibility in the supply of neighbourhood attributes is the low levels of demolitions in the UK by international standards. This is also reflected in the age of the housing stock. It can be shown that the price of dwellings does not decline linearly with age, but is better represented as a U-shape. Similar results are found for Melbourne and Skaburskis (2006) shows related results in Canada. In other words, older Victorian properties are often more valuable than properties built in the 1960s and 1970s. Given standard conditions for economic obsolescence, this implies that there are few incentives to demolish the Victorian stock, increasing the fixity of spatial structure – areas become locked in. Furthermore, this prevents standard filtering mechanisms from operating and the poorer households suffer the most. The policy implication is that it is very difficult for governments to have a fundamental effect on neighbourhoods quickly except on a small local scale. In addition, following Meen *et al* (2005), the same solutions are not equally applicable to all areas, but depend non-linearly on the existing level of deprivation.

The paper concentrates on two of Briggs Victorian cities – London and Melbourne. Section 2 discusses different theories of urban change, including growth models and models of convergence taken from the international and regional literatures. The central issue is why spatial structural change might be expected to be very slow. Section 3 presents primarily descriptive material on the study areas. It also discusses the construction of the 19th century and 21st century data sets. Section 4 gives the results from the long-run empirical analyses of segregation and convergence in London and Melbourne and discusses the relevance of path dependence. Section 5 considers the policy implications, including whether convergence (if it exists at all) occurs gradually or in discrete jumps and more generally the implications of non-linear change. Section 6 draws conclusions.

2. Theories of Urban Change

A number of different traditions of analysis provide valuable insights:

(i) filtering models
(ii) models that stress the ageing of the housing stock
(iii) models of tipping resulting from externalities

Filtering

The seminal work of Grigsby (1963) and Grigsby *et al* (1987) provides the natural starting point for models of filtering (see Megbolugbe *et al* (1996) and Galster (1996) for summaries of the importance of Grigsby's work). Although a number of related approaches have been employed, filtering can be defined as "the process by which dwellings descend over time from higher to lower income households". An important feature of this process is that sub-standard housing in the most deprived areas is not an inevitable outcome of physical deprecation. The stock can be maintained almost indefinitely if the incentives are sufficiently strong for the required maintenance expenditures to be undertaken. Rather, deterioration is the outcome of an economic decision not to undertake the maintenance. This decision, in turn, depends on relative shifts in demand and supply, not only for individual properties, but also for the neighbourhood since the neighbourhood provides an externality. Neighbourhoods and properties can become obsolete if, for example, demand shifts in response to income or demographic changes. Furthermore, Grigsby defines locational obsolescence as "the process by which shifts in demand for shared attributes of a neighbourhood (owing to location, housing and site characteristics) make obsolete entire neighbourhoods" (Megbolugbe *et al* (1996, page 1781). Although much of Grigsby's work was concerned with neighbourhood decline – the best quality and newest housing originally built for higher income groups eventually moves downmarket - shifts in demand may also cause upward price pressures, leading to gentrification. Note, however, that the movement of properties down market does not necessarily imply a physical worsening of those properties. An increase in housing supply at the top end of the market may lead to an improvement in the quality of the stock for all households, including those at the bottom. Physical deterioration only occurs when the houses reach households on such low incomes that they cannot afford the maintenance expenditures. Deterioration can also occur even in the absence of a low income population in the areas. In these cases, there will be rising vacancies and falling returns to owners. This route also suggests that maintenance will not be carried out leading to abandonment and permanent vacancies.

However the evidence is not clear cut that filtering, in practice, works efficiently. One approach to the testing of filtering relies on hedonic analysis. But Coulson and Bond (1990), for example, find on US data little evidence that the demand for properties of different ages varies by income group, i.e. high income groups do not necessarily prefer newer properties, although there is evidence that high income groups prefer larger houses.

Further US work by Malpezzi and Green (1996) finds that filtering appears to operate, but its progress may be impeded by land-use controls. Although housing quality for low income households has improved over time, they are required to devote higher shares of their incomes to housing. The increase might reflect the desires of households, but, alternatively, could also reflect a form of market failure. Building code regulations, for example, truncate the filtering process, since quality is not allowed to fall below a certain level. The authors show that the supply of low income housing has fallen in the US and the relative price risen, consistent with the effect of controls. Furthermore, they demonstrate that a city that makes it easier for any type of housing to be built will enhance the stock of low-cost housing. But restrictions on any kind of housing (including high quality housing) will restrict the available stock of low-cost dwellings.

Models of Ageing

Aging obviously plays an important role in filtering models, but models from a different tradition also stress the idea that high income households prefer to live in newer dwellings at least in the US. This is, perhaps, less clearly the case in the UK, but these models are used to explain gentrification. A recent example is the work of Brueckner and Rosenthal (2005), who argue that newer dwellings yield higher housing services. Traditionally, these have been in the suburbs as development proceeds outwards from the city centre. But, subsequently, when the urban core is redeveloped, higher income households prefer to return to the centre since the housing stock will be younger. Therefore, gentrification takes place. The model, therefore, places the age of the dwelling stock as the key driver of neighbourhood dynamics. The authors find support for two propositions:

(i) holding distance from the city centre constant, an increase in the age of the dwelling stock reduces neighbourhood relative incomes
(ii) holding the age of the dwelling stock constant, a decrease in distance from the city centre tends to raise relative incomes.

Further support for the role of the age of the dwelling stock in renovation and gentrification is provided in Helms (2003), who estimates probit and tobit models of renovation expenditures in Chicago. Although age remains a key driver, he finds that both individual and neighbourhood characteristics are also important.

Models of Tipping and Externalities

As Coulson and Bond (1990) indicate, externality models emphasise the role of neighbourhood income and racial composition. For example, all households might want to live in high income areas as the quality of the environment is higher. In Coulson and Bond's example, neighbourhoods, which are initially composed of high income households, might experience some immigration of low-income households. But if the immigration builds up, it will reach a critical point at which it tips into a low-income neighbourhood with high-income households wishing to leave.

Related issues arise in dynamic models of segregation, which also exhibit tipping. Recent work by Bayer *et al* constructs models on micro data for the San Francisco area (2004) and on aggregate census tract data across the US (2004a). The models highlight the role that a shortage of neighbourhoods for well-educated, black households plays in patterns of segregation and integration. The authors suggest that the current shortage promotes a degree of integration since well-educated black households have to choose between living with low-income black households or well-educated white households (given a preference for living amongst households of similar characteristics). However, as the percentage of well-educated black households increases over time, this is likely to raise segregation since more neighbourhoods for high-income black households become available. More precisely, as the percentage increases from low to moderate values, highly-educated black households raise their exposure to other high and low- educated black households and reduce their exposure to white high-educated groups. Furthermore, the authors argue that, when the proportions of highly-educated black households reach very high levels, this sub-group will form separate neighbourhoods with others of similar wealthier status. Although not explicitly stated, this phenomenon describes a threshold.

A series of papers by Galster and his collaborators (Quercia and Galster, 1997, Galster and Zobel, 1998, Galster *et al*, 2000, Galster, 2002, Galster 2003) investigates the evidence for thresholds and tipping in considerable detail. Although he generally finds the empirical evidence to be mixed, he points to three behavioural mechanisms, which may generate non-linear, threshold-like outcomes – collective socialisation, contagion and gaming. The importance of these effects depend on the extent to which individuals come into contact with a peer group and the extent to which the group can exert influence or impose threats on the individual. The group has to reach a critical mass before it exerts influence on the behaviour of others.

A similar set of conclusions arise from the literature on self-organising cities, using techniques from complexity theory. This strand is a development of the classic Schelling (1971) model, whose central insight is to demonstrate that, even if all agents wish to live in mixed (integrated) neighbourhoods, the sum of the individual free choices will, typically, generate segregated communities. Further extensions to a stochastic world by Young (1998) demonstrate that segregation is a stochastically stable state. Although an accumulation of shocks may eventually tip the world to a different state, patterns of segregation are likely to be long-lasting

In summary, contagion models and models following the Schelling tradition typically exhibit tipping points, thresholds or phases of transition, consistent with gentrification and urban decline. Neighbourhoods do not start to decline or gentrify until they pass some trigger point, but past the threshold, their status changes quickly. Therefore, the approaches provide a framework for analysing some of the aggregate occurrences that we observe in local neighbourhoods, including cumulative decline, low demand areas, and the loss of city populations. Furthermore, it provides a framework in which patterns can be stable for long periods of time, but eventually change as areas pass the threshold.

Key Points

From this short review, a number of key points emerge. First, the age of the dwelling stock is important to urban change, but it cannot necessarily be concluded that depreciation is linearly related to age, particularly in Britain. Arguably, some of the Victorian housing stock was constructed to a higher standard than dwellings constructed in the post Second World War Two period. To test this, a set of hedonic models is estimated on the relationship between house prices and dwelling age. Although lacking detailed information on individual characteristics, the Survey of Mortgage Lenders (SML) can be used for the purpose. The SML identifies the following categories for the ages of dwellings:

- new
- built post 1980
- built 1960-1980
- built 1940-1960
- built 1919-1939
- built pre-1919

In addition the SML includes information on the type of property (detached, semi, terraced, flats), the number of rooms, which acts as a proxy for the size of the dwelling[1], and location down to local authority level. Therefore, the hedonic price equation takes the form of (1).

$$PH_i = a_1 + a_2 Size_i + a_3 Type_i + a_4 Age_i + a_5 LA_i + \varepsilon_{2i} \quad (1)$$

PH_i = House sale price
Size = Size of property measured in the number of rooms
Type = Dummies for the type of property (detached, semidetached, terraced, etc)
Age = Dummies for the time period when the property was built
LA = Dummies for the local authority in the region
ε = error term
i denotes a region

The coefficients on the *Age* dummies, therefore, provide an estimate of annual depreciation rates, varying by region and by property type. The estimates of depreciation are calculated for three years of the SML, 1997, 1999 and 2001 in order to test for parameter constancy. Unfortunately information on age was no longer collected in the SML after 2002.

The key parameter estimates for London are set out in Table 1[2]. Flats built before 1919 were used as the reference category. The results show a degree of consistency across the years and most of the age parameters are typically significant. New dwellings command a significant premium, although the premium varies considerably between years. Importantly, a U-shaped relationship between age and house prices exists, with prices for houses built in 1940s-1960s being lower than prices for houses built in prior to 1919. The U-shaped relationship is seen

[1] Although the proxy is imperfect and the reduction in room sizes in recent years is evident in the results.
[2] These results were produced by Diana Kasparova as part of a DCLG funded project into the modelling of demolitions.

most clearly in Figure 1 and holds for all three years. This is in line with expectations since Victorian properties in Inner London suburbs are in high demand and are, generally, of high quality. From Table 1, the price of houses built between 1940 and 1960 are typically 25%-30% below the price of pre-1919 comparable dwellings. As a caveat, however, it is possible that the coefficients are biased by the omission of variables measuring average room size, for which no information is available in the UK survey. If, for example, average room size was larger in the pre-1919 period, the age coefficient for older properties would be biased upwards. Similarly, the location of the properties is defined only down to local authority level. It is possible that the age variables are capturing omitted finer neighbourhood indicators. However, the results for Melbourne below provide some evidence that the problems may not be too severe.

As described below, the U-shaped depreciation function makes it less likely that older dwellings will be replaced. In other words, the spatial structure of the older neighbourhoods becomes more rigid in terms of dwelling types. The physical structure becomes locked in. This is not to say, of course, that these neighbourhoods necessarily suffer from neglect. Indeed, since they are often more structurally sound than newer dwellings, they are occupied by wealthier households and receive higher levels of maintenance.

Table 1. **Hedonic Estimates of Depreciation Rates for London**

	1997		1999		2001	
	coefficient	t	coefficient	t	coefficient	t
No. rooms	0.105	20.591	0.142	22.907	0.133	23.498
age1939	-0.161	-7.783	-0.182	-8.726	-0.021	-0.914
age4060	-0.280	-9.891	-0.311	-11.637	-0.255	-7.947
age6180	-0.310	-11.619	-0.294	-10.541	-0.159	-4.920
agepost80	-0.150	-5.787	-0.052	-1.947	-0.026	-0.814
new dwel	0.007	0.196	0.173	4.733	0.226	6.082

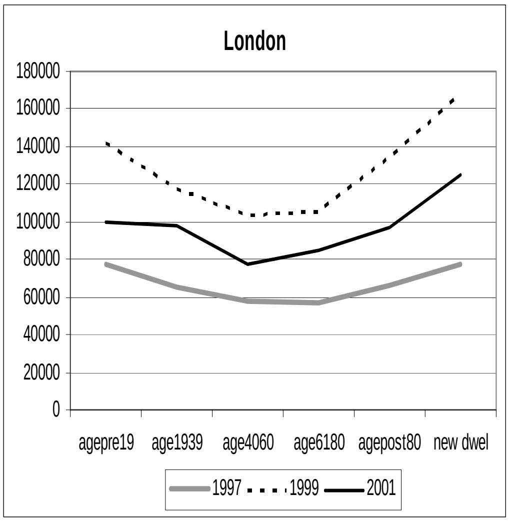


Figure 1. **The Relationship between Prices and Dwelling Age in London**

In England as a whole, .approximately 40% of the housing stock was built before the Second World War. By contrast, less than 20% of the US stock was built prior to the War. However, in Melbourne, only 10% of the stock was constructed over this period. Therefore, the Melbourne housing stock is, unsurprisingly, much newer. Equation (2) defines a similar hedonic specification for Melbourne based on Valuer General price information.

$$PH = a_1 + a_2 Type + a_3 Age + a_4 LGA + a_5 Size(land) + a_6 Size(bdrms) + a_7 Qual + \varepsilon_1 \quad (2)$$

PH = House price (ln)
Type = Dummies for house type and construction material (#31; brick veneer house omitted)
Age = Dummies for time period property was built (prior to 1920 omitted)
LGA = Dummies for local government areas within Melbourne (#32; Whitehorse omitted)
Size(land) = Land package, square meters (ln)
Size(bdrms) = Number of bedrooms
Qual = Quality of style (assessed by the Valuer, scale 1-5)
ε = Error term

***Table 2.* Hedonic Estimates of Depreciation Rates for Melbourne**

	1997		**1999**		**2001**	
	Coeff	**T**	**Coeff**	**t**	**Coeff**	**t**
Size(land)	0.16	14.62	0.13	12.29	0.08	9.94
Quality of style	0.20	14.57	0.25	19.95	0.23	21.95
Number of bedrooms	0.09	11.36	0.11	13.27	0.09	12.59
Constructed 1920-'39	-0.15	-4.04	-0.03	-0.75	-0.04	-1.23
Constructed 1940-'59	-0.41	-12.07	-0.31	-8.25	-0.30	-9.84
Constructed 1960-'79	-0.31	-8.93	-0.22	-5.73	-0.24	-7.87
Constructed post 1980	-0.20	-5.78	-0.12	-3.34	-0.15	-4.97
Adj R2	0.163		0.173		0.181	
Cases	28,061		39,437		51,203	

Omitted categories Brick Veneer House, Whitehorse (LGA) and Constructed before 1920.

The equation is able to control in this case for the size of the land package, which was not possible for the UK. Again Table 2 estimates the relationship for three years. The default category is properties built prior to 1920 and, in all three years, the oldest properties attract higher prices. Furthermore, properties constructed in the 1940-1980 period receive the lowest relative prices (controlling for the LGA). Therefore, there is again preliminary evidence that depreciation in Melbourne is U-shaped.

The second key conclusion from the literature review is that neighbourhood effects, including physical structure, are potentially important in determining location choices. The empirical evidence is discussed briefly below. But neighbourhood effects can generate (i) cumulative processes of decline (ii) spatial structures that change only very slowly, but can suddenly tip to a different state. Gentrification is one example. Furthermore, since physical structures change only slowly, the supply of neighbourhood characteristics is inelastic. The final conclusion is that property rights and planning controls affect poorer households most heavily, because the flexibility in supply involved in filtering is hampered.

Economic Obsolescence

The model of depreciation in the last subsection can be used to demonstrate further why residential urban structures change so slowly, by asking why housing markets for redevelopment do not operate in the same way as commercial property.

At any time the value of a building depends on its ability to generate (imputed) income and the level of its maintenance and running costs. Over time the value of a building will normally fall as its income potential declines because it becomes less suitable for modern use as technology changes and its operating and maintenance costs increase. Therefore the life span of a building is determined by the point at which operating costs equal income; at this point the building is *physically obsolete* and, in the absence of a profitable alternative use, would be left empty. Redevelopment is viable when the net present value of a redevelopment scheme, including the value of the buildings created and the costs of demolition and construction, exceeds the net present value of the existing use. This condition identifies the age at which an existing building becomes *economically obsolete*.

Alternatively, the optimal rule is 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. In most applications, demolitions are considered small and are ignored[3] In this field, the rule was originally developed in Brueckner (1980) and Wheaton (1982). But the first rigorous tests appear in Rosenthal and Helsley (1994). Formally, the valuation equation is (3) if land owners are myopic and capital costs are constant:

$$\frac{R(t,h/q)q}{\alpha} - c(t)h > \frac{R(t,\bar{h}/q)q}{\alpha} \tag{3}$$

Where the left hand side represents the present value of the parcel of land in its new use minus construction costs, i.e. the price of vacant land and the right hand side is the present value of revenue from a structure remaining in its current use. α is the discount rate, (h/q) is the ratio of capital to land. Subsequent to Rosenthal and Helsley's work on Vancouver housing markets, Munneke (1996) applied the same model to industrial and commercial development in Chicago. Dye and McMillen (2006) extend the model to allow for sample misclassification in the Chicago metropolitan housing market. All these studies find strong support for the valuation rule.

Although the rule is applied most frequently to commercial markets (but there is evidence that it holds in residential markets also in the US), we might expect, with modification, similar principles to hold in UK housing markets. Furthermore, the results in Table 1 can be used to shed some light. The valuation rule applied to residential property implies that redevelopment will take place when the price of existing dwellings falls to the underlying land value, i.e. the structural characteristics of the property have no market value. Under residual valuation, the price of land (*PL*) is determined primarily by the price of *new* dwellings and, therefore, is independent of age. If existing house prices (*PH*) depreciate linearly with age, the optimal redevelopment period is shown in Figure 2 at the point of

[3] Rosenthal and Helsley (1994) find that demolition costs in Vancouver are only 1.7% of the average price of redeveloped properties, although costs can clearly be much higher where land is contaminated (McGrath 2000).

intersection. The point will vary with changes in macroeconomic conditions, which shift both functions.

But, from Table 1, in the UK, the *PH* function is U-Shaped, implying more than one equilibrium point. Properties of more than a certain age are less likely to be economically obsolete than properties in their middle years, locking in the older parts of the housing stock.

A number of further structural differences between housing and commercial markets might be identified that contribute to extending the life of existing dwellings beyond that typically found for offices. In general, these relate to forms of market failure arising from controls or externalities. Fist, redevelopment of residential sites differs from commercial projects, because of the absence of concentration of property rights, particularly in the owner-occupier sector. A hectare of land, for example, might have 25 different owners at the average density. The diversity of property rights, the difficulty of assembling large land packages and arguments over compensation have hampered slum clearance programmes since at least the 19^{th} century. The problems associated with property rights are a form of transaction cost (see Webster and Wai-Chung Lai 2003) and add an additional term to equation (2), therefore lengthening the time to redevelopment.

Second, land use controls, zoning, and building regulations may all prevent redevelopment schemes from occurring at the optimal time. There are two reasons why these might be stronger for housing than for commercial development. First, there is evidence that local authorities are keener to attract jobs than any associated residential development, necessary to house the extra workers. Therefore, industrial controls tend to be weaker than on residential developments. Second, as noted above, building codes and minimum housing standards may prevent the filtering of the housing stock from working in the manner predicted by theory.

Third, buildings may have social value. Both residential and industrial buildings may exhibit architectural merit and might be listed. But whether this is likely to be more of a significant factor for houses than industrial or commercial development is unclear. However, attachment to place is more important for households. There is strong evidence that households move only short distances in order to preserve ties with families and friends. Arguably, they also have an attachment to their dwelling since houses in different locations are imperfect substitutes and this attachment is not reflected in market value.

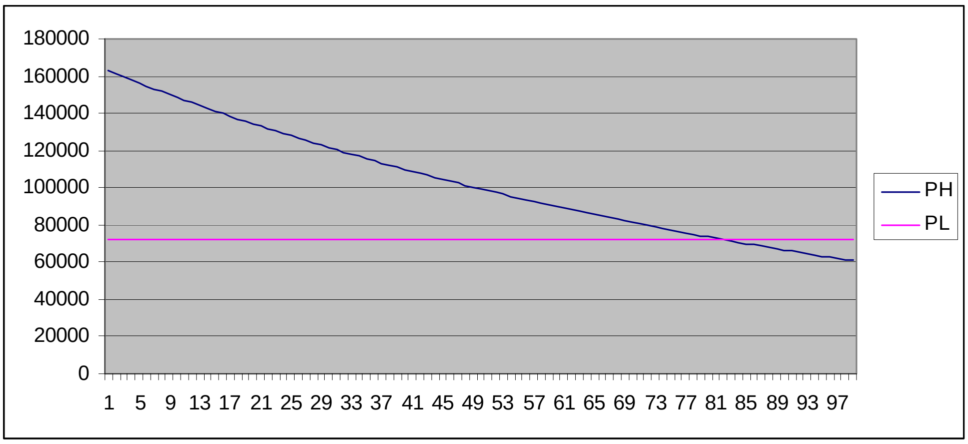


Figure 2. **An Example of Housing Replacement**

All of these points suggest that longer lives for residential properties than commercial developments are to be expected. Also as noted above, the average age of the housing stock in England is noticeably older than in the US and Melbourne.

Neighbourhood Effects and Cumulative Causation

There is a considerable literature on the effects of neighbourhoods in determining individual behaviour, including the effects of physical neighbourhood, parental background and the role of peer groups. In practice, distinguishing the individual impacts of the separate factors is problematic (see Meen 2006, for a discussion of the econometric issues). Although a full discussion is outside the scope of this paper, the literature provides additional reasons why spatial structures change slowly and cumulative processes of decline lead to segregation between rich and poor households. These processes are explored in Andrew and Meen (2006), who construct a nested multinomial model of location choice in London and South East England. The study highlights the importance of measures of local deprivation (as a composite measure of neighbourhood). Since the study also found that high income households also had a higher probability of moving, the processes are self-reinforcing. Higher income households move to the better locations, leaving behind the least skilled, which raises deprivation further in those areas. Greater segregation and poverty traps are the likely outcomes. As explored later, the required levels of intervention necessary to overcome poverty traps is typically very high and occurs infrequently; therefore spatial structures persist.

Growth Models and Convergence

Although there are strong reasons why spatial structures change only slowly, over very long time periods, change might still be expected. If so, a central question is whether local relative patterns of deprivation have converged or diverged over time. Using a different methodology, from that employed in this paper, Orford *et al* (2002) highlight the stability of spatial poverty patterns over the last hundred years in England, although they find a degree of convergence over that period. For example, 76% of the richest wards in 1896 remain in the richest quartile in 1991, but only 55% of the poorest wards in 1896 remain in that category in 1991.

The tests used later use versions of the approach now widely employed to model international growth convergence. Examples in the Australian context can be found in Oxley and Greasley (1995) and Cashin (1995). The former considers convergence in per capita GDP between Australia, the UK and the USA. The latter tests convergence between the Australasian colonies. Both studies are based on the original approach developed by Barro and Sala-i-Martin (1995). In their terminology, we concentrate on tests for β-convergence. In the literature on international or inter-regional growth, this implies that the poorest areas grow faster than the initially richer areas. Therefore, there is a negative relationship between the initial level of per capita GDP and its long-run growth rate. In the standard neo-classical Solow growth model, convergence would be predicted, whereas new-Keynesian models that concentrate on increasing returns emphasise possible divergence.

Equation (4) often forms the basis of the tests (see Aghion and Howitt 1999 for example):

$$\frac{1}{T}\ln(y_{i,t+T} / y_{i,t}) = \alpha - \beta \ln(y_{i,t}) + \gamma X_{i,t} + \varepsilon_{i,t} \tag{4}$$

where (*i)* represents the spatial entity (country or region); $y_{i.t}$ is per capita GDP; $X_{i.t}$ is a vector of variables that control for differing steady-state growth rates across the areas. The dependent variable is measured over a time interval of T years. Therefore, according to (4), growth rates can vary because of differences in the factors that determine the steady-state growth paths or because of differences in the initial positions.

In our case, however, the spatial areas are much smaller than in conventional empirical convergence models and, therefore, fewer impediments to convergence might be expected in terms of labour and capital flows. Furthermore, *within* London or Melbourne, it is hard to see why steady-state growth paths should differ and, therefore, in this version of the paper, $X_{i.t}$ is ignored, although further research is required.

Two additional points arise not considered in standard applications. First, in international studies, the presumption is that residents of poorer countries gradually catch up to the stage of development of richer countries, not that rich countries descend to the levels of the poor. But in examining the intra-urban scale, the processes of change are not clear cut. For example, since London is broadly a single travel to work area, it is likely that any convergence would occur by high skilled residents moving to initially deprived, but cheaper, areas i.e. gentrification. But this does not imply that the original residents are any better off. Second, long run models in the form of (4), concentrate on the average change over the time interval T. But given that there are only two points in time, the model cannot distinguish whether growth is gradual or occurs in discrete jumps. The difference matters for policy and the paper suggests later from case studies that change may be in jumps, although this cannot be observed from the data sets employed in the convergence tests.

3. The Study Areas

The tests of segregation and convergence are based on the central areas of London and Melbourne as they stood in the late 19th century. However, it is useful to begin with a case study of one street and one household within the London area, since it demonstrates two points; (i) the necessary steps to construct the 19th century data sets, (ii) the nature of shocks that local areas face over long periods of time, which potentially change their status.

3.1 A London Case Study

The case study is a street called Saffron Hill that lay in a parish of the same name in the 19th century and, today, is in the borough of Camden. Saffron Hill is an unexceptional, small street and looks little different from thousands of others – indeed, today, it has few distinguishing features. But, it is full of history that can be traced back to the thirteenth century. The only remaining feature of this era is the church of St Etheldreda's, which was established as part of the Bishop of Ely's estate. The church is London's only surviving building from the period of Edward 1 apart from Westminster Abbey. But, by the end of the 17th century, the area had become increasingly run down. During the 18th century, the Saffron Hill area was notorious as a rookery. Its place in 19th century fiction is preserved as the site of Fagin's den in *Oliver Twist*[4]. At the time Dickens was writing, Saffron Hill was a haunt of pickpockets and thieves, but it lies only a kilometre from the British Museum, the LSE and St

[4] Rather than *The Tale of Two Cities* in the paper's title.

Paul’s Cathedral. Wise (2005) describes the southern end of Saffron Hill in 1831 (then called Field Lane) as a steep, narrow, undrained way, comprising rotting Jacobean, Stuart and early Georgian tenements. The east side backed onto the Fleet River or Ditch, which was investigated as a potential source of cholera and typhus. Field Lane traded mainly in second hand clothes.

Much of the Saffron Hill area was torn down as part of major improvement schemes in Clerkenwell. The Farringdon Road scheme was started in 1841 and completed in 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. The line opened in 1863 and ran below and alongside the new road. The railway and new road completely transformed the character of the area. Much of the Saffron Hill area was swept away. 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 Road. Although much of its course followed existing streets, the only major new stretch cut through the slums between Holborn and Farringdon Road and between Little and Great Saffron Hill. In general, slums were cleared away to be replaced with warehouses and commercial developments.

The Clerkenwell improvement schemes were, however, limited in their effect in alleviating poverty. Writing in the 1850s and 1860s, Henry Mayhew, (Neuburg 1985), 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. At the time, redevelopment schemes did not typically improve the lot of the poor. In the absence of cheap public transport, most had to travel to work on foot and, therefore, had to live close to their places of employment. Improvement schemes added to the over-crowding in the surrounding areas. Although in an era of rapid railway expansion, transport innovations were ultimately responsible for a significant reduction in population densities in London, between 1841 and 1871, paradoxically, the demolitions associated with clearance schemes for new rail operations had the *initial* effect of increasing overcrowding at the centre. Between 1859 and 1862, 37,000 people were displaced by railway construction in the deprived areas of London (Yelling 1986, page 15).

The 1881 Census provides more direct evidence of the status of Great Saffron Hill[5]. 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. Number 2 housed the Central Shoeblack Society, where 46 young men lived. By 1881, the Irish-born made up less than 3% of the population, with an average age of 50. Therefore, Saffron Hill was no longer the choice of young Irish migrants. Also, the number of street traders or costermongers was falling in London over the second half of the century as shopping habits changed and working class incomes rose (see Ball and Sunderland 2001, chapter 6). Although the number of Irish-born residents had fallen by 1881, the Saffron Hill parish was still internationally orientated. The parish contained 3,972 residents at the time in total, of whom 123 were Irish-born and 255 from Italy. Parts of Saffron Hill were known as Little Italy.

[5] Little Saffron Hill has now disappeared and Great Saffron Hill and Field Lane have been combined into Saffron Hill.

In his monumental study of poverty in London 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. But, according to Booth's classification, the residents of Great Saffron Hill were, by no means, the poorest in the immediate area.

Table 3 summarises the population changes in the parish of Saffron Hill over the 19th century. In particular, it highlights the sharp rise in population in the first half of the century, reaching its peak around 1830. But by the end of the century, population was under half of that a hundred years earlier.

***Table 3*. Population of the Parish of Saffron Hill 1801-1901**

	1801	**1811**	**1821**	**1831**	**1841**	**1851**	**1861**	**1871**	**1881**	**1891**	**1901**
Saffron Hill Parish											
Population	7781	7482	9270	9745	9455	8728	7148	5907	3980	4506	3396
Popn/acre	243	234	290	305	295	273	223	185	124	141	106
(32 acres)											

popn/acre in Saffron Hill COA in 2001 = 30.4
Source. A History of the County of Middlesex (1911).

During the Second World War, Saffron Hill lay in the Metropolitan Borough of Holborn. Holborn was very heavily hit during the Blitz in 1940/41. 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 per 1,000 population) and the fifth highest casualty rate (25 causalities per 1,000 population) – see Table 4, London Topological Society, 2005. Detailed 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 V1 attack in the last year of the war. Therefore, although the street remains narrow, it is unsurprising that few of the original buildings remain. The bottom of the hill where Fagin's den was located has undergone the most marked transformation, now consisting of new, prime office space. In the 2001 Census, the Census Output Area (COA) that includes Saffron Hill had only 240 residents[6] (1.6 per dwelling). Although not one of the most desirable locations in London, the Super Output Area (SOA) in which Saffron Hill lies[7] is only the 1395th (out of 4765) most deprived in London. At £390,500, the average house price was 58% of the Camden mean in the first half of 2004. Therefore, over very long periods of time, Saffron Hill's status and environment have clearly changed – from the site of the Bishop of Ely's estate in the 14th century (with its gardens and vineyard), through filth and crime in the 17th-19th centuries, to a central business area today.

The Blitz had a major impact and this shows up in indicators of overcrowding, notably the proportion of the population living with more than 1.5 persons per room. Table 4 presents information for the period 1931-2001 for the borough in which Saffron Hill lies – Holborn until 1961 and Camden from 1971. Comparable data are not available prior to 1931. The data show a gradual reduction in overcrowding in the post-war era, but a large discrete change took place between 1931 and 1951. Gregory *et al* (2001) find a similar pattern for England and Wales as a whole. Furthermore, using a slightly different indicator, they find only a

[6] COA reference 00AGGP0032.
[7] It lies in SOA Camden 027B.

modest reduction in overcrowding between 1901 and 1931. Therefore, the evidence suggests that the major reductions in overcrowding were concentrated over a fairly short time span, but one which experienced a major external shock

***Table 4*. Overcrowding in Holborn and Camden (1931-2001)**

Borough/Year	% of population with more than 1.5 persons per room
Holborn 1931	37
Holborn 1951	15
Holborn 1961	12
Camden 1971	8
Camden 1991	4
Camden 2001*	3

* refers to the proportion of *households* living with more than 1.5 persons per room.

In principle, it is possible to construct panel data sets for households throughout the second half of the 19th century, following the migration patterns of individuals across the censuses. As an example of the information available, one head of household, George Sewell, who lived in Saffron Hill at the time of the 1881 census can be tracked.

George Sewell lived at 33 Great Saffron Hill at the time of the 1881 census. George was aged 34, but had not moved far from his birth location of Clerkenwell. He was a brass finisher by trade. Although he was widowed, he lived with his one son Joseph, aged 11, who was still a scholar. Overall ten people lived at Number 33, which was below the average density for the street of fourteen persons per dwelling.

By the time of the 1891 census, George (45) had remarried to Louisa (37) and they lived with 5 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 nor in 1871. Also since George was not married to Louisa in 1881, the status of these two children is not clear. They lived in two rooms at 22 St Helena Place. George was employed as a Dipper and Burnisher.

In 1901, they still lived in the two rooms at 22 St Helena Place, although George junior and Ada had moved on by this time. George was now 53, according to the records, and was still married to Louisa (47) 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.

Returning to George's eldest son Joseph (by previous marriage), in 1891 he was now aged 21 and was living in two rooms at 5 Smithfield with his uncle William Whales, William's wife and 3 children. Joseph was still single and was employed as a glass beveller. By 1901, Joseph had moved to occupy 2 rooms at 20 Malta Street in Clerkenwell. Now aged 30 at the time of the census, he was a sheet glass worker and was married to Rosaline (29) – a french polisher. She was also born in Clerkenwell. They had a daughter also called Rosaline (7). Nine people in total lived at number 20.

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 one-year old son, although their names are hard to decipher on the census record. They lived at the same address as in 1881 and George was still a Brass Finisher. In 1861, seventeen 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's name is difficult to decipher, but he was a labourer, born in Gloucestershire; his mother, Henrietta, was born in St Pancras.

Combining data contained in the ratebooks, Melbourne citizen lists and birth, marriage and death certificates a similar panel can be constructed for Melbourne. Melbourne in the 1850s was an important transit point for migration to the Victorian gold fields, however following the gold-rushes and Melbourne's growing financial and industrial role the city experienced rapid population growth and suburbanisation throughout the 1870s and 1880s. Davison (2004:185) notes that 'the new suburbs, especially in the northwest, were colonized as newlyweds founded their first home, often in patterns which persists to this day – by short-stage radial migration out along a main transport route from the parental home'. The Collingwood observer at the time noted that 'when young Collingwoodians get married they migrate to the comfortable and respectable cottages […] at North Fitzroy' (quoted in Davison, *op cit*). North Fitzroy is located at the northern and north-western boundaries of Collingwood. Unlike London where the construction of railway lines substantially affected the then *existing* urban form, the construction of a railway line (or announcement to construct) in Melbourne often preceded and/or instigated residential development. Melbourne's public transport system, through which the colonial parliament subsidised the developers of suburban real estate, allowed home-seekers to take up housing in new outer suburbs, before the older inner areas were full of houses and people (Frost 1991).

3.2 General Messages

A number of issues arise from this selective illustration of small areas of London's and Melbourne's histories. First, in the 19th Century, areas of high wealth were located close to areas of high poverty. Since walking was the main means of transport, extremes could easily be found within a kilometre of each other. Although advances in transport took place rapidly through the second half of the 19th century, cheap fares did not allow suburbanisation of the poor until early in the 20th century (Crafts and Leunig 2006). Second, over long periods of time, anecdotally, the statuses and uses of locations, which are now classified as central London, appear to have changed considerably. Areas that were once deprived do not necessarily remain deprived[8]. But, if so, what are the processes that lead to change and possible convergence? Third, although the buildings have changed considerably, the street lay out has changed less. Saffron Hill is still narrow and many of the major thoroughfares and most of the smaller streets that appear on 19th Century maps are still there today. Ball and Sunderland (2001) chronicle the major developments to the inner London street structure in the second half of the 19Th 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. Fourth, (international) migration in response to labour market opportunities was important and international communities were spatially concentrated.

[8] However, Orford *et al* (2002), comparing data on social status from the 1991 Census and from the Booth maps highlight the stability of spatial poverty patterns over the last hundred years, although they find a degree of convergence over that period.

Finally, households in the 19th century typically moved only short distances and this remains the case today, although the example presented is extreme by modern standards. The example traced the history of three generations of the Sewell family and they all remained close together over fifty years. George never moved more than a short distance from his place of birth, consistent with one of Ravenstein's (1885) laws of migration. Furthermore, as demonstrated below, since the same information on neighbours can also be compiled, it is possible to build up neighbourhood profiles.

For modelling, it is helpful to identify the sources of the innovations that shape the structure of local areas over long periods of time:

(i) exogenous innovations: examples are wars, acts of terrorism, acts of God.
(ii) endogenous innovations: migration is the key factor. Both London and Melbourne experienced long-term net out-migration towards the suburbs, arguably consistent with conventional residential location theory.
(iii) Policy innovations: these include major infrastructure changes, e.g. new road networks, new social housing estates, slum clearance and major regeneration schemes. These, of course, also affect migration patterns.
(iv) Technology innovations: for example, the Industrial Revolution, powered flight, motorised transport.

Under (i), Table (4) showed the impact of the Blitz on overcrowding. A similar story emerges from an analysis of population density gradients (Clark 1951, Ball and Sunderland 2001). In common with most major cities, density in London falls progressively with distance from the urban core. Furthermore, over time, density has fallen at the centre with the gradient becoming flatter as the city has spread out. In terms of the commonly-used exponential model, (5), (A) is the hypothetical calculated density at the core and (b) measures the gradient. A high value of (b) implies that the density declines sharply with distance, i.e. a compact city. Small values of (b) are to be expected where transport costs are low.

$$y = Ae^{-bx} \tag{5}$$

where:
y = residential density measured in thousands per square mile
x = distance from the city centre

Clark (1951) finds that in London in 1801 and 1841, (b) was high and changed little with an average value of 1.4. This is unsurprising given the heavy reliance on foot travel at the time. But by 1871, the coefficient had fallen to 0.65 as steam trains and horse-drawn omnibuses became more widely established in the capital. The coefficient continued to fall over the study period to 1939. Estimated density at the urban core rose to a peak of 800,000 per square mile in 1841, by far the highest in the sample of international cities considered by Clark. But core density fell in each census up to the Second World War, when the value was 80[9]. However, one of the key messages to draw from both sets of coefficients is that, although they fell gradually over the whole period from 1841, the most striking changes happened

[9] Interestingly in 1933, the value of A in Melbourne was 100 and b was 0.55. Therefore, both were higher than in London at that time. Although Clark provides no information on 19th century Melbourne, the relative positions were likely to be reversed.

fairly quickly over the 1841-1871 period, in response to major transport innovations – these were large permanent shocks.

Smaller scale acts of terrorism than the Blitz can also have an effect on city structures. In England, the regeneration of central Manchester following the IRA bombing is a good example. Speculatively, it would be surprising if the structure of New Orleans did not undergo change, following the natural disaster of Hurricane Katrina.

Endogenous change, arising from migration, was considered above and concentrations of international migrants could dominate small areas even in the 19th century. But equally the poor in London could spend their whole lives hardly moving from their parishes. Policy and technological innovations clearly have an important impact on spatial structure. Many residential patterns originally developed along road and rail networks and, as already noted, these developments were important in explaining the out-migration of the London and Melbourne populations from the 19th Century. Low income households are, by necessity, attracted to the locations where social housing is available and slum clearance programmes during the sixties and seventies in Britain had a major impact on residential densities. East London is likely to change dramatically, because of the 2012 Olympics and the associated infrastructure improvements.

In a given year, the probability that any local area will experience a major shock (of any of the four types) is typically small; therefore patterns of poverty and segregation are likely to persist for long periods of time, because, as argued in Section 2, the physical structure of neighbourhoods only changes slowly. But, over the course of centuries, the probabilities of any of the four shocks occurring rises and major structural change is more likely to be experienced. Therefore, city structures are likely to be (stochastically) stable, but the stable state contains segregated communities (Young 1998). Furthermore, the observed outcomes may be non-ergodic and the history of the areas matter. However, local areas are periodically subjected to major shocks that change the nature of the equilibrium.

3.3 Construction of the Data Sets

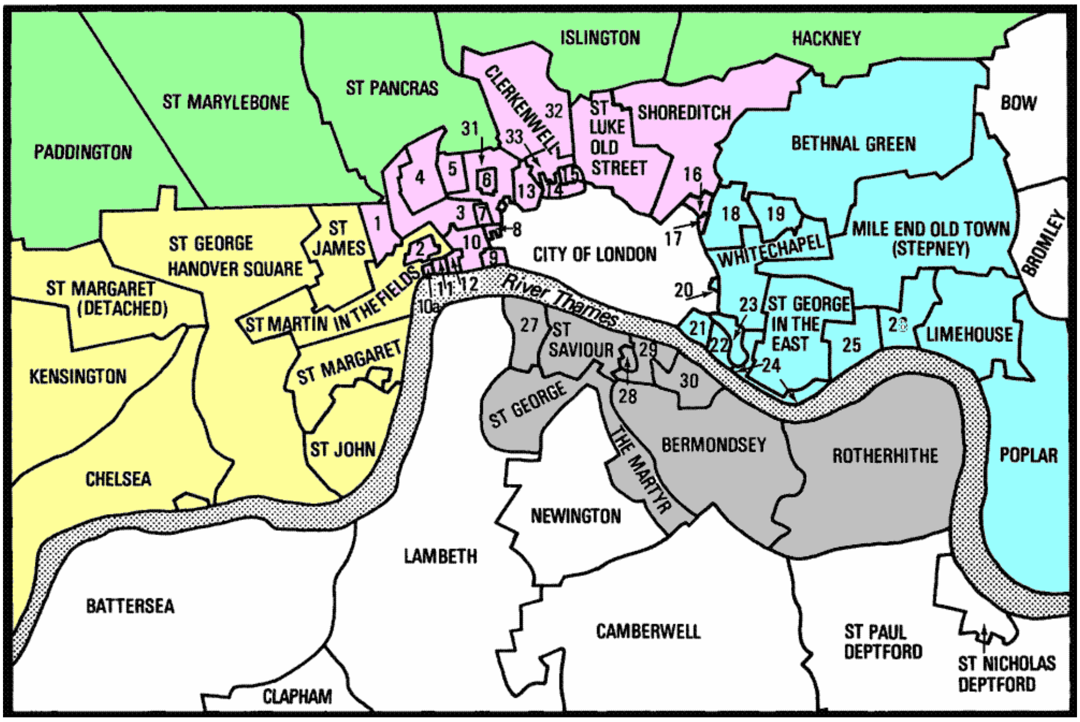
Tests of segregation and convergence require information on neighbourhood socio-economic status in the two centuries on a common spatial unit of analysis. Studies of segregation in the 21st century are hampered by the need to use information from pre-determined, published areas. But the 19th century faces no such constraints since full unit records are available from each decennial census between 1841 and 1901, identifying individual addresses and occupations amongst other material. Therefore, if a method can be devised to classify each occupation by socio-economic status, it becomes possible to construct an aggregate measure of status for any area and its change during the nineteenth century. Similarly, measures for Melbourne can be constructed, using information taken from 19th century municipal Rate Books. These records were compiled each year and also include information on addresses and occupations as well as further data on rateable values for properties, which are not readily available for London.

In practice, there are two main problems. First, although 19th century census records are available and easily downloadable directly from the web and 19th century Melbourne ratebooks and citizen lists are publicly available, converting the records into a useable panel data set is still a major manual undertaking. In this paper, therefore, only a portion of the full panel under construction is used, taking data for 1881 for London and 1885 for Melbourne. The second problem concerns consistency with the 21st century data sets. More information is provided below, but the 19th century individual records are aggregated to the smallest spatial units published in the 2001 censuses in each country. A related set of problems concern the translation of occupations into social status. The social rankings of occupations in the 19th century are not the same as today. Consequently, in Britain, a new set of occupational classifications was used in the 2001 census. The same issues arise in Australia.

As noted above, since the 1881 census provides exact addresses for all households, there is no constraint on aggregation to any definition of neighbourhood. The constraint arises from the 2001 census, where the finest spatial scale is the census output area (COA), which averages approximately 200 residents. The COA is used as the basic unit of analysis for London. However, in order to compare 1881 and 2001, all the 1881 addresses have to be assigned to current COAs. This is a major undertaking, requiring detailed study of 19th and 21st century maps. Unsurprisingly some small 19th century residential streets no longer exist, although their original location can frequently be tracked down. The computerized version of Stanford's 1862 map of London was used to locate missing streets. Nevertheless, the assignation is not feasible for all of London and sampling is necessary.

The 19th century parishes are divided into five broad groups – North, South, East, West and Central (see Figure 3). A half of the parishes in each group is randomly sampled. From these, a sample of 100 household heads and their dependents is taken from each group, although data collection has only been completed for the central and western groups (purple and yellow in Figure 1). The 100 heads in each area are traced backwards and forwards in each census between 1851 and 1901, along with their fathers and eldest sons, giving a panel over three generations. The Sewell family above is one example. In addition, the names and occupations of immediate neighbours, i.e. residences either side of the sampled household head, are recorded. Because of high residential densities, particularly in the poorer areas, there are typically multiple head of household neighbours. All the information is stored in consistently-recorded spreadsheets.

As noted above, the address of each household head in 1881 has to be allocated to a current COA. 153 households out of the 200 households in the two areas can be allocated. The missing households arise mainly because some streets are long and straddle multiple COAs. For the two London areas, including neighbours, this gives information on occupation for 998 household heads that can be used to construct information on neighbourhood socio-economic status.



http://www.british-history.ac.uk/

***Figure 3*. 19th Century London Parishes**

Although occupation is the basis for defining the social classification of each area, there are other possibilities, notably population density. Although overcrowding was certainly a key indicator of deprivation in the 19th century, high densities are not now necessarily correlated with poverty. Indeed, current government policy encourages building at higher densities.

Members of the sample cover approximately 110 COAs, but, in some, the number of observations is small. Therefore, for estimation purposes, the COAs are aggregated to Super Output Areas level (MSOA). The sample, therefore, covers 26 MSOAs out of 123 (21%) across the current London boroughs of Camden, Hackney, Islington, Kensington & Chelsea and Westminster. Note that all the MSOAs lie now within central London, even though they include some very poor areas in 1881. Therefore, if convergence occurs at all, it is more likely to occur in this sample than if the East End had been included, for example. Across the sample areas, free movement of labour and capital exists, particularly given the transport improvements in the late 19th century.

The occupations of each of the 998 household heads have to be assessed in terms of social status. In practice, the 1881 census records a bewildering variety of occupations, many of which have become redundant and have no modern equivalent. However, in line with standard practice (see Long 2005, for example), the official 1950 classification can be used to put all occupations into one of five social classes:

Class i - professional occupations
Class ii – intermediate occupations
Class iii – skilled occupations
Class iv – partly skilled occupations
Class v – unskilled occupations

But 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 new classifications “semi-routine and routine” occupations and the former social classes (iv) and (v). Therefore, the shares of households in classes (iv) and (v) in both 1881 and 2001 in each of the sample MSOAs can be constructed. The 2001 information is available directly on line.

A final complication is that the share of workers in (iv) and (v) for London as a whole has changed between 1881 and 2001 (from 23% to 12.5%). Therefore, values have to be standardised. The index of deprivation becomes, for each MSOA for 1881 and 2001:

$$100 * \left[\frac{(\% \, in \, classes \, iv, v)_i}{\sum (\% \, in \, classes \, iv, v)} \right] \qquad (6)$$

Σ is summed over the sampled MSOAs.

As an indicator of the size of the areas covered, Figure 4 depicts the MSOA covering Saffron Hill.

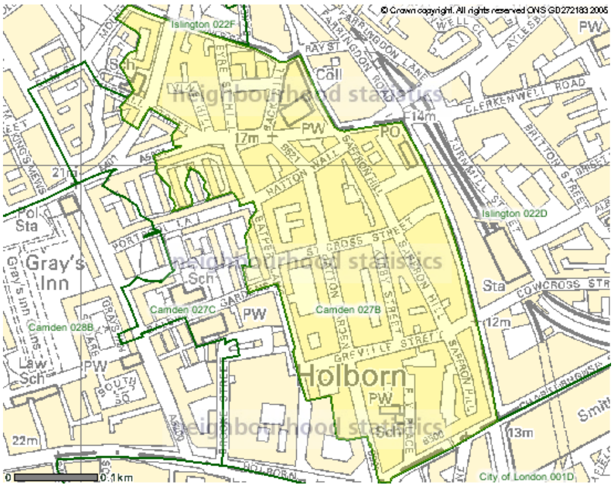


***Figure 4.* The MSOA including Saffron Hill.**

Depending on the time of municipal constitution, ratebooks for Melbourne municipalities are available from the mid 19th century. The type and degree of address exactness differs to some extent between municipalities. Typically a ratebook will contain the ratepayers name and occupation, the property owner’s name, type of property (i.e. house, shop, stable etc), the rateable value and location of the property. Some ratebooks contain exact addresses (house numbers), in other ratepayers are listed consecutively from one street corner to the next (sometimes also identifying side of the street). Several ratebooks contain information on number of rooms at the property. The Appendix gives an example of the type of information that can be compiled. For entries with exact addresses or block location there is no constraint on aggregation to a neighbourhood definition comparable to 21st century census data. As in the case of London, aggregation constraint arises from the 2001 census where the finest spatial scale is the census collection district (CD) averaging approximately 225 dwellings.

The 2001 census contains some 5500 collection districts within 31 Local Government Areas (LGA). As with the London sample, 1885 addresses have been allocated to current (2001) collection districts. The Melbourne sample contains 1687 ratepayers in 21 neighbourhoods (23 CDs) over six LGAs (thirteen suburbs). The sample was stratified to cover early settlement areas, but is essentially non-random. Each neighbourhood was profiled by recording the occupation of ratepayers residing in a (the) street(s) contained within a 2001 collection district. In two cases boundaries for streets straddling multiple CDs could only be established by amalgamating CDs. Figure 5 shows collection district #2280402 containing sections of Carlisle Street, Inkerman Street (these could not be assigned with any degree of accuracy and were omitted), Westbury Street and Blenheim Street. Collection district #2280402 is situated in the suburb of Balaclava in Port Philip LGA.

The remaining CDs are located in the following Local Government Areas: Yarra, Stonington, Maribyrnong, Moonee Valley and Boorondara; or suburbs: Collingwood, Fitzroy, Abbotsford, St Kilda, St Kilda East, South Melbourne, Prahran, Footscray, Yarraville, Flemmington, Kensington and Hawthorn

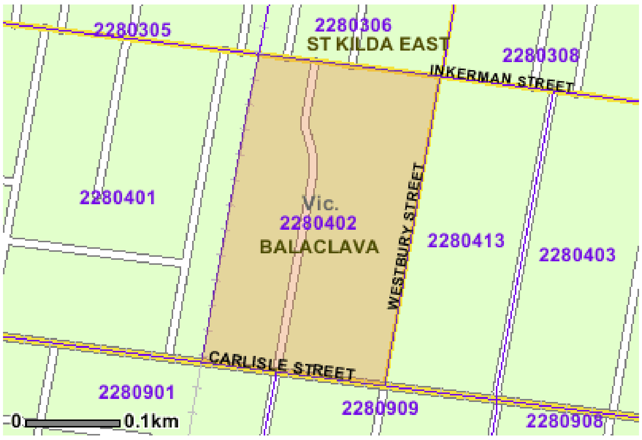


Figure 5. **Collection district # 2280402 (Balaclava, Port Philip).**

Each ratepayer' occupation was assessed in terms of social status. 19th century occupational classifications are largely industry based and provide a limited basis for comparison with modern data. The 1947 Census contains a first skills based classification of occupations. It contains 10 orders (0-9). The occupation of each ratepayer was classified according to the 1947 classification;[10] entries were subsequently re-classified in order to correspond with the Australian Standard Classification of Occupations (ASCO) 2nd edition used in 2001 census based on the 2001 ranking of 3-digit 1947 classifications. The 1947 classification is not as coherently structured in terms of skills level as the classification for the 2001 Census and several of the main groupings contain multiple skills level assessments (see column 2, Table 5). Three-digit 1947 classifications were used to extract low skilled occupations in correspondence with the ASCO classification used in 2001 – for instance 'messengers' classified as 'commercial and clerical' in 1947, were reclassified as 'Elementary clerical, sales and service workers' in concordance with the ASCO classification. Table 5 contains further details about the two classifications.

[10] In some cases occupations were first assigned to the 1891 occupational classification before re-classified to the 1947 census. The detailed classification of individual ratepayers is obtainable from the authors on request.

Table 5. **Australian Occupational Classifications, 1947 and 2001**

1947 Occupational Classification	1947→ 2001 Skills assessment	2001 Occupational Classification
0. Rural, fishing and hunting	Low/semi	1. Managers and Administrators
1. Professional and semi professional		2. Professionals
2. Administrative		3. Associate Professionals
3. Commercial and clerical	Low/semi/high	4. Tradespersons and Related Workers
4. Domestic and protective service	Low/semi	5. Advanced Clerical and Service Workers
5. Craftsmen		6. Intermediate Clerical, Sales and Service Workers
6. Operatives	Low/semi	7. Intermediate Production and Transport Workers
7. Labourers	Low	8. Elementary Clerical, Sales and Service Workers
8. Indefinite or not stated		9. Labourers and Related Workers
9. Persons not in the work force		10. Inadequately described

The lowest skills and status assessment in the 2001 census are categories 8 and 9 (the ranking of occupations corresponds to the ranking of average weekly earnings). As the overall share of unskilled/low status workers differs in the two periods (for the sample the aggregate share of individuals in categories 8 and 9 were 20.6 and 14.2 per cent in 1885 and 2001, respectively).[11] Therefore values have been standardised according to equation (6) (substituting *iv*, *v* for categories 8 and 9).

4. Segregation and Deprivation Convergence in the Two Cities

The distinction needs to be made between deprivation and segregation. Although both are discussed in the paper, they are not the same concept. For example, a city may exhibit a high score on the official UK Index of Multiple Deprivation, i.e. a relatively high level of poverty, but this represents an average across the city. Segregation refers to the distribution of deprivation within the city, perhaps across the parishes, MSOAs or collection districts. The indices of segregation used here attempt to capture aspects of the distribution. The Dissimilarity Index, for example, measures the extent to which minority groups would have to move between two spatial units to obtain an equal distribution of the minority group across the city. It does not necessarily follow, therefore, that high average levels of deprivation in a city are closely related to high levels of segregation. In an extreme case, *all* the MSOAs, parishes or CDs of a given city could have a high level of deprivation, in which case there would be no segregation.

There are many potential measures of segregation. Cutler *et al* (1999) consider segregation in five dimensions: evenness (dissimilarity), exposure (isolation), concentration (the amount of physical space occupied by the minority group), clustering (the extent to which minority neighbourhoods are contiguous) and centralisation (proximity to the city centre). The Index of Dissimilarity, equation (7), is, in fact, the most commonly used measure in the literature. The index is frequently used to measure the distribution of ethnic groups, but the index can

[11] According to the 1891 Victorian censuses the share of the adult male workforce in Melbourne classified as 'Unskilled manual, menial' was 23.6 per cent – lower than London (25.5%) or Brisbane (26.9%). See Davison 1978, Table 1.

be constructed for any socio-economic variable, including those discussed in the last section. Therefore, the minority group for London can be taken as the number of household heads, who fall into social classes (iv) and (v). The value of the index ranges between zero and one. Massey and Denton (1988) suggest that, for ethnicity, a value of less than 0.3 is low; between 0.3 and 0.6 is moderate and, above 0.6 is high. A value of zero would imply that every MSOA has the same percentage of minorities as the city average. A value of one implies total segregation, where all of the minority live in certain areas and everyone else lives in other locations. However, these rules of thumb apply primarily to ethnicity-based measures. As Abramson *et al* (1995) indicate, income-based indicators typically show lower levels of segregation, despite the fact that race and poverty are highly correlated. Abramson *et al* calculate an average dissimilarity index value across the 100 largest US metropolitan areas in 1990 of 0.36 based on income compared with a value of 0.61 based on race.

$$D = 0.5\sum_{i=1}^{n} \left| \frac{\min ority_i}{\min ority_{total}} - \frac{majority_i}{majority_{total}} \right| \qquad (7)$$

Although widely used, there are problems with the measure. First, the results can be distorted if the areas used in the construction of the index are not of equal size. Second, many applications are based on administrative boundaries, leading to the "Modifiable Areal Unit Problem", where artificial spatial patterns may be generated through the use of data based on administrative boundaries. Third, the index takes no account of the spatial relationship between the areas. Shuffling the spatial units has no effect on the index. But "chequerboard" patterns for minorities across the city clearly have different policy implications from patterns of strong spatial contiguity.

Even if minority groups are disproportionately located in certain areas, this does not necessarily imply that they have no contact with the majority group. Therefore a second measure examines the exposure of one group to another. The index of isolation (8) 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. Therefore, it looks at the extent to which one's neighbours are from the same group.

$$S = \sum_{i=1}^{n} \left[\frac{x_i}{X} . \frac{x_i}{t_i} \right] \qquad (8)$$

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 total population in MSOA (i).

Cutler *et al* characterise a city as having a ghetto if the index of dissimilarity is greater than 0.6 and the index of isolation is greater than 0.3.

Table 6, taken from Dixon (2006), constructs the Dissimilarity and Isolation Indices for each of the five London boroughs in the sample – Camden, Hackney, Islington, Kensington & Chelsea and Westminster - across their wards, using the 1991 and 2001 censuses. The unemployment rate is used as the measure of socio-economic status. Tables 7 and 8 repeat the process based on age and ethnicity.

Table 6. **Segregation of the unemployed in London in 1991 and 2001**

Local Authority	**Segregation of the Unemployed**			
	Dissimilarity Index *100		**Isolation Index *100**	
	1991	**2001**	**1991**	**2001**
Camden	14.0	12.3	14.2	8.2
Hackney	6.2	4.9	22.8	11.3
Islington	4.9	4.6	17.2	9.0
Kensington & Chelsea	18.7	16.3	13.7	8.3
Wandsworth	10.7	11.5	12.1	5.6
Westminster	12.9	11.2	12.6	7.2

Table 7. **Segregation of the 'young' in London in 1991 and 2001**

Local Authority	**Segregation of the 'Young' (aged 20-29)**			
	Dissimilarity Index *100		**Isolation Index *100**	
	1991	**2001**	**1991**	**2001**
Camden	10.5	9.3	21.7	23.5
Hackney	5.2	4.3	20.7	18.2
Islington	5.0	4.7	21.5	21.0
Kensington & Chelsea	10.7	11.0	23.5	19.2
Westminster	10.5	10.3	24.0	23.7

***Table 8*. Segregation of Asians in London in 1991 and 2001**

Local Authority	**Segregation of Asians**			
	Dissimilarity Index *100		**Isolation Index *100**	
	1991	**2001**	**1991**	**2001**
Camden	20.3	21.9	12.8	20.1
Hackney	19.3	13.0	13.8	17.9
Islington	16.0	11.4	8.0	10.9
Kensington & Chelsea	12.1	13.9	7.4	12.6
Westminster	15.2	15.0	12.0	18.8

On all the indicators, the Dissimilarity Index is low in the five boroughs. Indeed this is a feature of London as a whole. For comparison, the maximum value in England on the unemployment measure in 2001 is 30. By contrast, the Isolation Index values are high relative to the rest of England. Based again on unemployment, all the fifteen highest ranked local authorities are based in London and Camden is the second highest nationally.

Table 9 shows the Dissimilarity and Isolation Indices for the five local government areas in the Melbourne sample. Since the late 1970s, income inequality in Australia has widened over successive periods and economic change has acted to reinforce long-standing patterns of residential differentiation within Australian cities (Hunter and Gregory 1996, Beer and Foster 2002). In Melbourne, working-class and middle/upper-class households developed differentiated housing quality and residential movement patterns in the 1880s and 1890s (Davison 1978). A clear social divide, in terms of housing space amenity, the quality of drainage, and the proximity of polluting industries emerged between the high ground and bay side areas to the south and east of the Yarra River and the flatter ground north and west of the

Yarra. By the late-twentieth century, however, former working-class suburbs such as Collingwood, Fitzroy (both in Yarra LGA) and Brunswick had become increasingly attractive areas of residential location for more prosperous households. While the segregation indices are low in all areas it is notable that the Dissimilarity Index for low skilled occupations is substantially lower than that of unemployed people. The Isolation Index is generally lower than the Dissimilarity Index – Braybrook in Maribyrnong had the worst SEIFA rating in Victorian in 2001.

Table 9. **Segregation of unemployment and low skilled population aged 0ver 15 years in Melbourne 2001**

	Segregation of unemployed 2001		**Segregation of low skilled occupations 2001**	
Local Government Area	**Dissimilarity Index*100**	**Isolation Index*100**	**Dissimilarity Index*100**	**Isolation Index*100**
Boroondara	20.3	5.7	12.4	11.6
Maribyrnong	23.1	15.8	16.7	22.5
Port Philip	23.3	8.5	17.4	11.5
Stonnington	21.2	6.6	14.6	11.6
Yarra	27.1	14.2	16.5	14.0

Note: Author's calculations. Indices based calculated from collection districts in each local government area.
Source: ABS cat no. 2001.0 (Basic Community Profile, 2001).

However, the results vary according to socio-economic indicator and choice of spatial aggregation. This needs to be borne in mind in the following comparisons between 1881 (1885 for Melbourne) and 2001, where status is based on the occupational classifications of the last section. In this case, the "city" comprises the sample of MSOAs across the five London boroughs. The results for Melbourne are similarly defined. Table 10 sets out the findings. In the case of London, given the differences in samples between the two years, it would be hard to conclude that segregation has changed dramatically using either the Dissimilarity or Isolation Index. However, there is a marked reduction for Melbourne on both indices.

***Table10*. Dissimilarity and Isolation in the 19th and 21st Centuries**

	London		**Melbourne**	
	Dissimilarity Index	**Isolation Index**	**Dissimilarity Index**	**Isolation Index**
1881	0.191	0.259	0.255	0.256
2001	0.250	0.236	0.147	0.125

Growth convergence models throw a different perspective on the central question. Using a different methodology, Orford *et al* (2002) highlight the stability of spatial poverty patterns over the last hundred years in England, although they find a degree of convergence over that period. For example, 76% of the richest wards in 1896 remain in the richest quartile in 1991, but only 55% of the poorest wards in 1896 remain in that category in 1991.

The tests employ equation (3). However, in line with Section 3, the dependent variable is not the commonly used per capita GDP, but the share of household heads in the lowest social classes as defined in equation (6). A negative value of β implies that MSOAs, which had a high percentage of low status groups in 1881 (or 1885 for Melbourne) were more likely to attract classes of higher status over the following 120 years.

The results for London, presented in equation (9) indicate that convergence, in fact, takes place at a rate of approximately 0.65% per annum. The coefficient is statistically significant. Therefore, convergence is slow, but for these limited locations in central London, it has taken place over the last century. The simple equation can explain approximately 40% of the variation in the relative deprivation changes with a standard error (SEE) of approximately 0.4%.

$$\frac{1}{T}\ln(y_{i,t+T} / y_{i,t}) = \underset{(3.63)}{0.0284} - \underset{(3.72)}{0.00646}\ln(y_{i,t}) + \varepsilon_{i,t} \qquad (9)$$

R^2 = 0.37
SEE = 0.00386
t-values in brackets

There are, however, two important caveats to the findings. First, estimation is only over part of London and the part that is, perhaps, most likely to experience convergence. For example, it cannot necessarily be concluded that central London has converged with the more impoverished East End over the last 120 years. Such tests require an extension to the sample. Nevertheless, the sample does include areas of high poverty in the 19th century around the edges of the City of London. Second, given that there are only two data points, equation (9) sheds no light on the important question of whether convergence takes place gradually or in discrete jumps in line with the ideas put forward in Section 2.

Equation (10) presents the comparable results for Melbourne, based on the total employed population sample. Similar results are found when the sample is restricted to males. Figure 6 plots the estimated relationship. The similarity between the results for the two cities is striking. At 0.7% per annum, the rates of convergence are almost identical. In fact, the R^2 for Melbourne is even higher than for London, although the equation standard errors are the same.

$$\frac{1}{T}\ln(y_{i,t+T} / y_{i,t}) = \underset{(6.52)}{0.0325} - \underset{(-6.33)}{0.00718}\ln(y_{i,t}) + \varepsilon_{i,t} \qquad (10)$$

R^2 = 0.66
SEE = 0.004
t-values in brackets

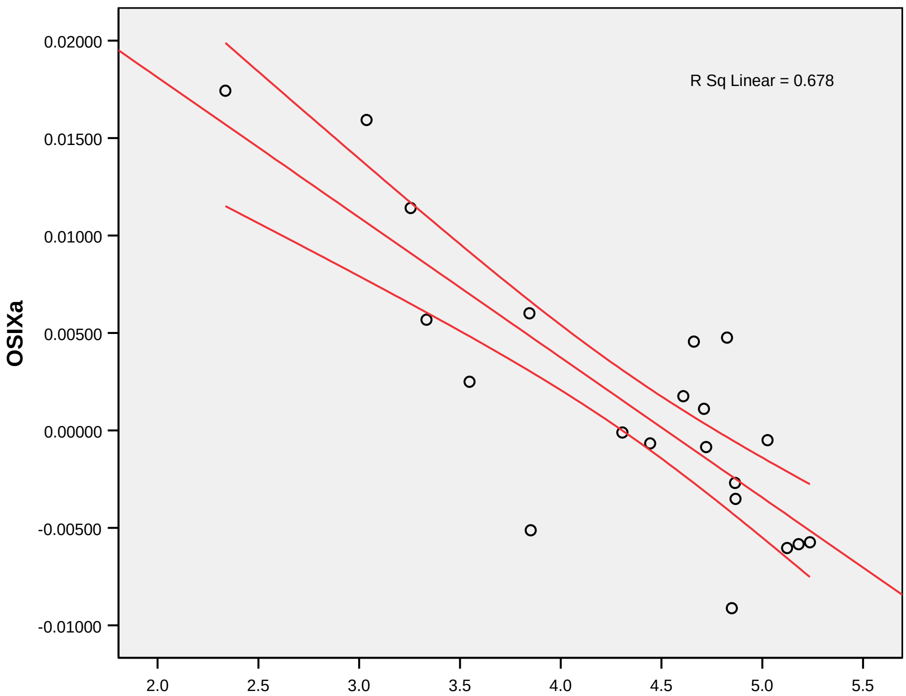


Figure 6. **Convergence in Melbourne**

At first sight, therefore, convergence appears independent of the initial conditions. Despite the fact that Melbourne had a more equal income distribution in the 19th century and is a much younger city, similar processes of convergence appear to exist. However, there are caveats. First, as stressed earlier, the sample sizes in both cities are small and need extending. Thus, the results can only be considered preliminary. Since the samples only cover the central areas of the cities, convergence may not necessarily occur over slightly larger areas. Second, although Melbourne was only fifty years old in 1885, it had achieved very rapid expansion by that stage, based partly on the wealth of the gold rush years. The 1880s were also boom years in Melbourne (see Davison 2004). In terms of per capita income, Melbourne was only exceeded by London and Glasgow in the British Empire. Therefore, in terms of initial conditions, the differences between the two cities were not quite as stark as might be expected.

Nevertheless, the key findings that stand out are:

(i) Over long periods of time, convergence between rich and poor areas of the city centres has taken place.

(ii) But change is slow at 0.7% per annum. In the case of a small area of central London, only 78% of the differences were eliminated over 120 years. The results are similar for Melbourne. This is consistent with the view that the inflexibility of the physical dwelling stock hinders change.

(iii) The analysis can shed no light on the question of whether change is gradual or occurs in discrete jumps. Indeed, it s even possible that convergence occurred for part of the period and divergence over other periods.

5. Policy Implications

Although the results in the last section provide no evidence on whether convergence is gradual or discrete, other research using a different approach suggests that adjustment may be non-linear. Meen *et al* (2005) find that the relationship between local house prices and levels of deprivation can be proxied by a logistic function in both 2001 and 2004, Figure (7). But a non-linear relationship has a number of implications. First, the relationship implies that deprivation has to fall to a threshold level before it will "take off" and experience convergence. Areas of very high deprivation, lying well above the threshold become stuck in poverty traps and the demand for housing in those areas remains low. Consequently, it is unlikely that these areas will experience convergence unless a large external shock takes them to the take-off point. As noted in Section 3, large shocks occur infrequently, are often outside the control of governments and are unpredictable. Traditional regeneration programmes are unlikely to be large enough fundamentally to change the nature of areas. Problems of diverse property rights and planning restrictions worsen the problem, since they lock in the existing spatial structure.

Second, the areas that are most likely to converge are those that lie around the thresholds. Since the London sample excludes the worst areas of the East End, where deprivation was particularly high in the 19th century, the estimation results may bias the findings towards convergence.

Third, the identification of the areas around the thresholds is critical. Relatively small government expenditures (or other forms of exogenous or endogenous shocks) in areas that lie around the thresholds have large effects, whereas expenditure at locations well above the thresholds may have very little effect. In other words, "one size fits all" policies do not work.

Finally, in terms of macroeconomic policy, the need to encourage flexibility in labour and goods markets is often stressed. The need to develop flexibility in the stock of residential capital has received less attention, although the two Barker Reviews have made progress. Inflexibility locks areas into fixed spatial structures. Nevertheless, flexibility means more than loosening the planning system. It also requires the housing stock to become more adaptable to current living requirements. Speculatively, it may also require higher levels of housing replacement than has been observed over the last century so that the average age of the stock falls. It may also require better design and standards so that modern properties are not seen as inferior to Victorian terraces. Controversially, it may also have implications for property rights.

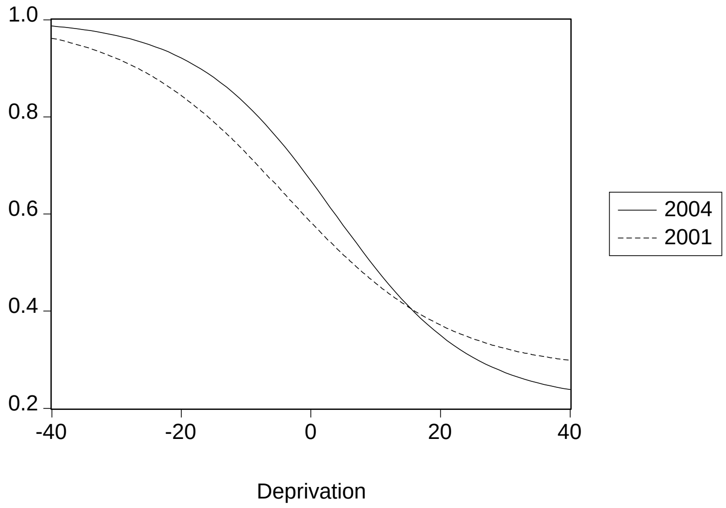


Figure 7. **Relationship Between House Prices and Deprivation**

6. Conclusions

This paper argues that long-run change in urban areas is slow – patterns of deprivation and segregation persist for long periods of time, partly because of the stocks of residential dwellings generate spatial lock ins.This suggests that any empirical study of urban change needs (i) to employ long-run data sets (ii) to take into account differences in initial conditions across cities.

The paper analyses two cities with very different age structures – London and Melbourne. Therefore, given the differences in their states in the 19th century, it is possible that they may have developed in different ways over time. In order to analyse long-run change, the development of novel data bases, covering the centuries is undertaken. In the case of London census material can be used to establish comparable spatial data on socio-economic status in 1881 and 2001. For Melbourne, Rate Books for 1885 and the 2001 census can be employed to establish a similar data base.

Melbourne has always had a narrower distribution of income than London. Although central Melbourne certainly had its areas of deprivation in the 19th century – in fiction, Hume (1886) represents the extremes of rich and poor by the Collins Street "Block" and the slums of Little Bourke Street – deprivation was not on the same scale as in London. Furthermore, the spatial patterns of relative deprivation, measured in terms of Dissimilarity Indices, appear to have remained fairly constant over time in London, although not in Melbourne, where segregation has declined.

But, perhaps, the most important finding in the paper is that, despite the differences in initial conditions between the two cities, the central areas in both have converged at a very similar rate over time, i.e. a rate of approximately 0.7% per annum. In this one aspect and over limited spatial areas relating to city centres, initial conditions do not appear to be crucial. From a policy perspective, this suggests that economic mixing of communities is feasible, although it takes a very long period of time. There are no quick fixes.

There is a considerable body of further work to be undertaken, primarily related to extending the data sets over both space and time. Three further zones of London need to be added and there is no guarantee that convergence will continue to hold over wider areas. Arguably, suburbs also need to be added. Further work will also add other predominantly Victorian cities. – Manchester, Leeds, Birmingham and Middlesbrough, all discussed by Briggs (1963) are prime candidates. There is also a limit to what can be achieved by looking at two data points. Although it is feasible to track spatial change consistently between 1851 and 1901 at ten year intervals, it is harder to conduct the same analysis for London throughout the 20th century. However, case studies can help in order to examine the impact of different types of shock on urban development..

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References

Abramson, A.J., M.S. Tobin and M.R. VanderGoot. (1995). "The Changing Geography of Metropolitan Opportunity: The Segregation of the Poor in US Metropolitan Areas, 1970 to 1990". *Housing Policy Debate*, 6(1): 45-72.

Aghion, P. and P.Howitt (1999), *Endogenous Growth Theory*. The MIT Press. Cambridge, Massachusetts.

Andrew, M and G. Meen (2006), "Population Structure and Location Choice: A Study of London and South East England", *Papers in Regional Science*, 85(3): 401-419.

Ball, M and D. Sutherland (2001). *An Economic History of London 1800-1914.* Routledge Explorations in Economic History.

Barro, R.J. and X. Sala-i-Martin (1995), *Economic Growth*. McGraw-Hill. New York.

Bayer, P., McMillan, R., and K. Rueben (2004). "Residential Segregation in General Equilibrium", *mimeo, Yale Univeristy*.

Bayer, P., Fang, H., and R. McMillan (2004a). "Separate When Equal? Racial Inequality and Residential Segregation". *Mimeo Yale University*.

Beer, A. and Forster, C. (2002) 'Global Restructuring, the Welfare State and Urban Programs': Federal Policies and Inequality within Australia's Cities', *European Planning Studies*, 10 (1): 8-25.

Briggs, A. (1963), *Victorian Cities*. Penguin Books.London.

Brueckner, J.K. (1980), "Residential Succession and Land-Use Dynamics in a Vintage Model of Urban Housing", *Regional Science and Urban Economics*, 10: 225-240.

Brueckner, J.K. and S.S. Rosenthal (2005), "Gentrification and Neighborhood Housing Cycles: Will America's Future Downtowns Be Rich?", *mimeo.*

Cashin, P (1995), "Economic Growth and Convergence Across the Seven Colonies of Australasia: 1861-1991", *Economic Record*, 71(213): 132-144.

Clark, C. (1951). “Urban Population Densities”, *Journal of the Royal Statistical Society: Series A*, 114(4): 490-496.

Crafts, N. and T. Leunig (2006), “Transport Improvements, Agglomeration Economies and City Productivity: Did Commuter Trains Raise Nineteenth Century British Wages?” *mimeo*.

Coulson, N.E. and E.W. Bond (1990), “A Hedonic Approach to Residential Succession”, *Review of Economics and Statistics*, 72(3): 433-444.

Cutler, D.M., E.L. Glaeser and J.L. Vigdor. (1999), “The Rise and Decline of the American Ghetto”, *Journal of Political Economy*, 107(3): 455-506.

Davison, G. (2004), *The Rise and Fall of Marvellous Melbourne*. Melbourne University Publishing. Melbourne.

Department of Infrastructure. (2002), *Melbourne 2030: Planning for Sustainable Growth*, DOI. Melbourne.

Dixon, S (2006), *Social Dynamics, Housing Choice and Urban Renaissance*. Forthcoming PhD thesis, University of Reading.

Dye, R.F. ad D.P. McMillen (2006), “Teardowns and Land Values in the Chicago Metropolitan Area”, *Journal of Urban Economics*, forthcoming.

Frost, L. (2001) ‘The History of American Cities and Suburbs: An Outsider’s View’, *Journal of Urban History*, 27(3)

Galster, G. (1996), “William Grigsby and the Analysis of Hosing Sub-Markets and Filtering”, *Urban Studies*, 33(10): 1797-1805.

Galster, G.C. (2002), “An Economic Efficiency Analysis of Deconcentrating Poverty Populations”. *Journal of Housing Economics*, 11: 303-329.

Galster, G.C. (2003), “Investigating Behavioural Impacts of Poor Neighbourhoods: Towards New Data and Analytic Strategies”, *Housing Studies*, 18(6): 893-914.

Galster, G.C., Quercia,, R.G., and A. Cortes (2000), “Identifying Neighbourhood Thresholds: An Empirical Investigation”, *Housing Policy Debate*, 11(3): 701-732.

Galster, G.C. and A. Zobel (1998), “Will Dispersed Housing Programmes Reduce Social Problems in the US?” *Housing Studies*, 13(5): 605-622.

Gregory, I.N., Dorling, D., and H.R. Southall (2001). “A Century of Inequality in England and Wales Using Standardised Geographical Units”, *Area*, 33: 297-311.

Grigsby, W.G. (1963), *Housing Markets and Public Policy*. University of Pennsylvania Press. Philadelphia.

Grigsby, W., Baratz, M., Galster, G., and D. Maclennan (1987), *The Dynamics of Neighbourhood Change and Decline*. Pergamon. Oxford.

Helms, A.C. (2003), “Understanding Gentrification: An Empirical Analysis of the Determinants of Urban Housing Renovation”, *Journal of Urban Economics*, 54: 474-498.

Hume, F. (1885), *The Mystery of a Hansom Cab*. Text Publishing, Melbourne, Australia. (2006 edition).

Hunter, B. and Gregory R. (1996). ‘An exploration of the relationship between changing inequality of individual, household and regional income in Australian cities’, *Urban Policy and Research*, 14(3): 171–82.

London Topological Society (2005). *The London County Council Bomb Damage Maps 1939-1945*. London Topological Society and London Metropolitan Archives. LTS Publication No. 164.

Long J (2005) “Rural-Urban Migration and Socioeconomic Mobility in Victorian Britain” *Journal of Economic History*, 65(1): 1-35.

McCarty, J. (1970) ‘Australian Capital Cities in the Nineteenth Century’, *Australian Economic History Review*, 10, (September) 107-137.

McGrath, D.T. (2000), “Urban Industrial Land Redevelopment and Contamination Risk”, *Journal of Urban Economics*, 47: 414-442.

Malpezzi, S.and R.K. Green (1996), “What Has Happened to the Bottom of the US Housing Market?”, *Urban Studies*, 33(10): 1807-1820.

Massey, D and N.A. Denton. (1988).”Suburbanization and Segregation in US Metropolitan Areas”, *American Journal of Sociology*, 94: 592-626.

Megbolugbe, I.F., Hoek-Smit, M.C., and P.D. Linneman (1996), *Urban Studies*, 33(10): 1779-1795.

Meen, G.P. (2006), “Modelling Local Spatial Poverty Traps in England”, *University of Reading mimeo.*

Munneke, H.J. (1996), “Redevelopment Decisions for Commercial and Industrial Properties”, *Journal of Urban Economics*, 39: 229-253.

Neuburg, V. (2005). *London Labour and London Poor*, Selections from the writings of Henry Mayhew. Penguin. London.

Orford, S., Dorling, D., Mitchell, R., Shaw, M., and G. Davey Smith (2002). “Life and Death of the People of London: A Historical GIS of Charles Booth’s Inquiry”, *Health and Place*, 8: 25-35.

Oxley, L and D. Greasley (1995), "A Time-Series Perspective on Convergence: Australia, UK and USA Since 1870. *Economic Record*, 71(214): 259-270.

Quercia, R.G. and G.C. Galster (1997), "Threshold Effects and the Expected Benefits of Attracting Middle-Income Households to the Central City", *Housing Policy Debate*, 8(2): 409-435.

Ravenstein, E.G. (1885), "The Laws of Migration", *Journal of the Royal Statistical Society of London*, 48(2): 167-235.

Rosenthal, S.S. and R.W. Helsley (1994), "Redevelopment and the Urban Land Price Gradient", *Journal of Urban Economics*, 35: 182-200.

Schelling, T. (1971). "Dynamic Models of Segregation", *Journal of Mathematical Sociology*, 1: 143-186.

Skaburskis, A. (2006), "Filtering, City Change and the Supply of Low-Priced Housing in Canada, *Urban Studies*, 43(3): 533-558.

Webster, C. and L. Wai-Chung Lai (2003), *Property Rights, Planning and Markets*. Edward Elgar. Cheltenham. UK.

Wheaton, W.C. (1982), "Urban Residential Growth Under Perfect Foresight", *Journal of Urban Economics*, 12: 1-21.

Yelling, J.A. (1986). *Slums and Slum Clearance in Victorian London.* London Series in Economic Geography No. 10. Allen and Unwin. London.

Young, H.P. (1998). Individual Strategy and Social Structure. An Evolutionary Theory of Institutions. Princeton University Press.

Appendix

The following example illustrates how the combination of sources generates a rich data base at individual level for Melbourne: Gustave Brunett aged 44 rented accommodation in Nicholson Street in Melbourne in 1870. Gustave married Eliza Ann Brown in 1864, but, according to the birth certificates, they had a number of children prior to marriage. Their son, Octave, was born in 1856 (not in Victoria) and they had a further 8 children between 1859 and 1872. A second son, George, was also not born in Victoria. Birth and death certificates show that the family moved a number of times in Melbourne and east Melbourne prior to taking residence in Nicholson Street. In the 1870 Citizen List, Gustave is the ratepayer for a property in 184 Burke Street from where he ran a tobacco shop. The following year operated a restaurant from the same property. The Burke Street property was rated at £120 per annum. The house was brick built and contained 6 rooms. By 1875 Gustave had become a Corn & Hay dealer in Stephen Street (now Exhibition Street). The shop he owned in Stephen Street also housed his family. It was brick built shop some 24 by 72 feet large. The property was rated at £60 per annum. Five years later Gustave is recorded as a Corn dealer only, still operating and residing in the Stephen Street property. By now his two sons Octave and George had left the parental home and taken up residence in St Kilda – an up and coming suburb to the south of the inner city. The two brothers operated as Produce Merchants from 117 Flinders Street in the city. The Flinders Street property was rated at £100 per annum. By 1885 Gustave, now aged 59 had retired as a Gentleman to a St Kilda Street property where he also died in the following year. Octave had now inherited his father's business and established himself as a Corn dealer in the Stephen Street shop where he lived and worked. He had married Mary Smith with whom he had 9 children between 1887 and 1896. Unfortunately, 7 of the children died before reaching the age of 5. Octave continued his father's shop until 1890. By this time the rateable value of the property had increased to £80 per annum. After this date there are no more entires for Octave in the Citizen Lists, however he died in Oakleigh in 1908. In 1895 Gustave's second youngest son, Antonio, operated as a Grain merchant from a warehouse in Park Street in the relatively prosperous suburb of Prahran. The property was rated at £142 per annum. Antonio had married Emma Doube in 1892. Their first born, a daughter, Emma Lilly married George Warren Richardson in 1919.