UNIVERSITY OF SOUTHAMPTON

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School of Social Sciences

The role of location choice as an intergenerational transmission mechanism and in determining unemployment duration.

by

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Abstract

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This thesis analyses how the location decision impacts upon intergenerational mobility and unemployment duration. Chapter 1 analyses theoretically within the standard urban framework how location and human capital investment decisions are made when human capital externalities from location exist, as well as how these two factors interact to determine the level of human capital accumulation of the second generation. We consider two distinct forms for the externality effect, and find that in the urban framework with location in continuous space, a rich enough specification for the locational externality is sufficient to provide a viable alternative framework to others used within the literature, even with one dimensional parental heterogeneity. We also present an initial descriptive look at the extent of intergenerational mobility within the UK. The results suggest the advantages that accrue to sons whose parents chose to locate in an affluent neighbourhood are marked.

Chapter 2 provides a more rigorous approach, with an empirical investigation merging information on parent and child from National Child Development Study data with data on socioeconomic neighbourhood characteristics from the 1971 Census. Three different levels of data disaggregation are used to construct the neighbourhood characteristics, and two distinct methods for recovering unobservable permanent wage. We find from a variety of regressions that neighbourhood choice is an important mechanism for intergenerational transfer. We also find that it is unlikely these results are due to omitted variables concerning family background. Furthermore, the magnitude of these coefficients was found to depend upon the level of data disaggregation at which the neighbourhood characteristics were constructed.

Chapter 3 analyses how the location at which one resides affects the transition rate from receipt of unemployment benefit into work. We also attempt to ascertain which occupational groups may be more susceptible to any effect from location. We use the standard hazard rate framework, and estimate a variety of proportional hazard models. Simulations are also carried out to interpret the results in more depth. We find that location is important in determining unemployment duration, and that unskilled manual workers are most responsive to changes in locational characteristics.

Thesis contents:

List of Tables, Diagrams, and Figures.

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Overview

In the first half of the twentieth century economists were often concerned with ways in which agents might interact that were distinct from the interdependence that arises from joint participation in a set of markets. The breadth of their sphere of analysis unfortunately co-existed with what many saw as a lack of rigour. The move towards the neo-classical theory of general competitive equilibrium provided a sounder underpinning for economic analysis, but the study of non-market interactions was perhaps an unintended casualty. However, for many economists, the proper domain of economics still included the analysis of how, for example, social interactions affect the allocation of scarce resources. Consequently, since 1970, much work has been done to extend the rigour that was previously lacking to the analysis of non-market interactions. In the field of labour economics economists have analysed the role of non-market interactions in a wide range of settings, including school drop-out behaviour, benefit receipt, human capital production and job search. Due to the difficulties involved in the empirical analysis of non-market interactions it is fair to say that progress in the empirical literature has lagged the progress of its theoretical counterpart. It is difficult to draw firm conclusions when econometricians predominantly consider data on observed outcomes which could be generated by different interaction processes, or even processes acting in similar ways on individuals in isolation.

In this thesis we consider a particular class of non-market interactions that result from the location at which one resides. In chapters 1 and 2 we attempt theoretically and empirically to ascertain the importance of neighbourhood choice as an intergenerational transmission mechanism. Some progress has been made in understanding what determines the extent of intergenerational mobility, but the literature has less to say about the role of neighbourhood characteristics. In chapter 1 we take a new approach, and analyse the issues of interest within the urban framework popularised by Fujita. The empirical investigation in chapter 2 merges National Child Development Study and census data to create a dataset arguably sufficient to proceed given the potential econometric problems alluded to above. In chapter 3 the focus is empirically ascertaining the relevance of neighbourhood of residence in determining unemployment duration. Much theoretical work has been done on the effect of location in this context, but the empirical literature has made relatively little progress. Again, a special dataset is required to credibly analyse these issues, which in this case consists of JUVOS duration data, census data, and land registry housing price data.

The importance to policy-makers of a better understanding of the issues covered in this thesis is marked, despite the limited progress of the empirical literature. Since 1970 the income distribution in the UK has widened significantly, and it is often argued that this is of

little consequence if it takes place in conjunction with strong growth, since a rising tide will lift all boats. The widening distribution itself acts as an incentive for agents to accumulate human capital, and there is a welfare system designed to aid those who, hopefully in the short term, are disadvantaged by the market system. This view is in many respects correct, but it is important to consider earnings and income distributions in conjunction with more broadly defined measures of inequality. In particular we must distinguish between inequality of outcome and inequality of opportunity. The former, as briefly discussed, is usually viewed as a natural consequence of the market system, though opinions differ on the extent of redistributive policies that should take place. However, inequality of opportunity is something that people with a wide range of political beliefs agree is undesirable. Frustratingly though, it is not a concept that is easy to quantify. However, it is clear that if intergenerational mobility was severely constrained by any of the mechanisms discussed in chapter 1 and 2, that equality of opportunity could be violated.

Additionally, other changes that have occurred in the UK economy over the time period discussed make the issues discussed in this thesis all the more pressing. Though in the aggregate the UK economy can be said to have performed well in recent years, worklessness is increasingly concentrated on certain households, socio-economic groups and geographic areas. It is interesting to note that, though a relatively successful economy, the UK has experienced the most pronounced polarisation of work across households in Europe, and fares surprisingly poorly with regard to the incidence of child poverty. In terms of geographical concentrations much concern has developed about how concentrations of the disadvantaged matter in relation to the persistence and durability of their poor labour market outcomes. Amongst other things Chapter 3 attempts to ascertain whether certain groups are more susceptible to neighbourhood characteristics. With regard to the intergenerational issues discussed in the first two chapters we must ask how inequality of outcome and opportunity interact. Given the widening income distribution, and the observed tendency for this to support sorting along several dimensions, we should acknowledge the possibility that one generation's inequality of outcome can under some conditions imply inequality of opportunity in the next. The rising tide is, perhaps, not so good for those that live too close to the water.

We feel that many overestimate the degree of meritocracy in the UK. The recent good performance of the economy in aggregate serves in part to hide some troubling stylised facts. It is probable that the question of how much inequality of outcome an economy is willing to bear in the face of strong growth is not as pressing as how much inequality of opportunity in a longer time frame is acceptable. Such issues will presumably attract more debate in the next 30 years than in the previous 30 years. Unfortunately, though, policy-makers often have limited information, for example, on the strength of effects from location discussed in this thesis. Ultimately the case for area-based policies in some situations is a good one, but the

question, as always, is in deciding the extent of those situations. In what follows we attempt to provide some tentative answers to the important questions identified in this overview.

Chapter 1: Intergenerational mobility and endogenous location choice.

Abstract

The focus of this chapter is how parental location decisions affect the intergenerational transmission of economic welfare. In particular we examine within the standard urban framework how location and human capital investment decisions are made when human capital externalities from location exist, as well as how these two factors interact to determine the level of human capital accumulation of the second generation. We consider two distinct forms for the externality effect, and find that in the urban framework with location in continuous space, a rich enough specification for the locational externality is sufficient to provide a viable alternative framework to others used within the literature, even with one dimensional parental heterogeneity.

In light of the theoretical examination, data on location choice and intergenerational mobility for the UK are discussed; Section 3 presents an initial look at the extent of intergenerational mobility within the UK by considering an intergenerational transition matrix using data on wages of father/son pairs from the National Child Development Study. The results suggest the advantages that accrue to sons whose parents chose to locate in an affluent neighbourhood are marked, though a more rigourous statistical approach is necessary to continue the analysis.

Contents:

1. Introduction.

This chapter is concerned with the intergenerational transmission of economic welfare. The existing literature has considered several mechanisms through which such an intergenerational transfer could take place, including the role of parents in investment in their child's human capital, and to a lesser extent through social capital resulting from networks or the effect of the neighbourhood in which one grows up. In this chapter we examine within the standard urban framework how location and investment decisions are made when human capital externalities from location exist, as well as how these two factors interact to determine the level of human capital accumulation of the second generation. In light of the theoretical examination, data on location choice and intergenerational mobility for the UK are discussed.

In recent years UK society has arguably become more divided, which has lead to major concerns developing with regard to social stability and cohesion. Exploring the determinants of social inclusion and exclusion constitutes an important research area. One tangible factor that is often linked to increasing division is the rise in wage and income inequality in the UK since the 1970s (e.g. Autor & Katz, 1999). From 1979-1992 average real incomes grew by more than 33%, but the richest decile experienced a rise in incomes of 60% over the period, whereas incomes in the bottom quartile were stagnant. Such statistics are important, but unfortunately cross-sectional measures of inequality by themselves are insufficient for policy-makers with regard to the concerns above. We need to examine the *character* of inequality; that is we need to know how mobile income is between periods, as well as how mobile it is between generations. It is the latter question that is examined here, with particular reference to the effect of neighbourhood of residence. Numerous ways for neighbourhood to influence children have been identified (see Jencks & Mayer, 1990, and Brooks-Gunn et al, 1993 for detailed discussions). Neighbourhoods can influence behaviour, attitudes, values, and opportunities. It is common within the sociological literature to view individuals as developing in the context of the series of environments of relevance, with the neighbourhood of residence being a key example. Jencks and Mayer (1990) provide a comprehensive review of the literature on neighbourhood effects, and discuss four broad categories of theories on how neighbourhood can affect individual development. Firstly, there are contagion theories, based primarily on the power of peer influences to spread either problem or beneficial behaviour. Secondly, there are theories of collective socialisation, in which neighbourhood role models and monitoring are important ingredients to a child's socialisation. Thirdly, there are competition theories where residents compete for scarce neighbourhood resources. Lastly, there are relative deprivation theories, where individuals' decision-making or view of their own well-being is influenced by evaluating their standing

relative to their neighbours. The first two theories imply that affluent neighbours confer benefits on children, perhaps especially low income children, whereas the competition theory predicts the opposite. Finally, the relative deprivation theory is tricky to judge in terms of the affect affluent neighbours have. One interpretation would be that individuals who would be content in a neighbourhood with equally well off or worse off individuals would not be content in a neighbourhood with more affluent neighbours. However, for the questions of relevance to this chapter we are more concerned with the possibility of behaviour being conditioned on that of neighbours. An individual may form views, for example, on the appropriate level education to pursue, by considering outcomes relative to those within the neighbourhood. It is also clear that in this setting that the peer influences theory is also relevant, again perhaps through educational channels. Equally, the role models theory is likely to be relevant, for instance through the effect on expectation formation, or discipline. However, in the sphere of neighbourhood effects and intergenerational mobility, though, it is hard to conceive of an applicable competition based theory, so this possibility gets no further discussion in the piece.

To start we need a framework in which to pose questions pertaining to intergenerational mobility. For example, as in Solon (1999), consider two societies, 'A' and 'B', with completely equal earnings distributions. Assume that in society 'A' your position in the distribution is inherited completely from your parents, whereas in society 'B' the position of children in the earnings distribution is completely independent of their parent's position. This framework supports the point above concerning the need to consider the character of inequality, since there is no reason why these two very different societies would not have identical cross-sectional wage or income inequality. Interest in where the UK lies between the two extremes of the societies above is generated largely by the belief that intergenerationally transmitted income inequality may warrant government intervention over and above a progressive tax system. Furthermore, factors such as the well documented problems of household worklessness (Gregg & Wadsworth, 2003) and child poverty (Gregg & Machin, 1998) in the UK reinforce the need to consider that inequality of outcome in one generation can actually imply inequality of opportunity for the next. We cannot ignore the role of location choice when analysing such problems; in particular concern has developed about the role of poor neighbourhoods in perpetuating poverty, perhaps even across generations, through any or all of the mechanisms discussed above. Whatever one's political persuasion, it is clear that policy-makers need an understanding of the level of intergenerational mobility, as well as the relative importance of the various transmission mechanisms such as neighbourhood of residence.

The existing literature has grown immensely in the last decade, and has provided tentative answers to many of the relevant questions. When considering these issues Becker &

Tomes' (1979) original theoretical intergenerational model is often still at the forefront of people's minds. In this model a single parent of a single child allocates income between consumption and investment in their child's human capital. This model is rich enough to illustrate several crucial aspects of the intergenerational transmission of earnings status, particularly that the child's earnings depend on investment in his/her human capital as well as endowed capacities. These capacities are in turn influenced in this model by the parent's endowment, through some combination of nature and nurture. The model also emphasises the importance the parent places on the child's future earnings, the return to human capital investment and even the relative magnitudes of variances in market luck and endowment luck. Overall this model does a reasonable job of highlighting the complex process through which the degree of intergenerational mobility is determined, but the role of location choice is not included.

However, models relevant to the questions of interest here with a role for location choice have received a boost from a variety of sources. In particular a new strain in research on growth has emphasised segregation or sorting into homogeneous communities as a factor in long-run inequality persistence. Contributions in this strand of the literature often focus directly on neighbourhood influences on children's human capital, and their implications for the evolution of the distribution. Notable examples of structural models of residential choice intended to address questions of sorting, inequality and to a lesser extent intergenerational mobility include Benabou, (1996), Durlauf (1996), and Sarychev (2001). Benabou (1996) in particular discusses issues related to the area of interest in this chapter. Neighbourhood choice in his model is a binary choice between two neighbourhoods. There are two types of agents in his model, with different human capital endowments, who decide endogenously where to reside after factoring in expected neighbourhood influences on their offspring's human capital. However, the binary nature of location choice with two types of agents implies that there will either be complete stratification in at least one neighbourhood or zero stratification whereupon everyone lives in what is effectively the same neighbourhood. Even though many important insights can be obtained in such a framework, it is interesting to see how locating in continuous space could affect the analysis.

Durlauf (1996) constructs a model with continuous types and one-dimensional heterogeneity, where agents differ *ex ante* only in their human capital. Choice of location is limited by the ability of wealthy community members to prevent the entry of undesirable neighbours. This model achieves imperfect sorting due to strong increasing returns to scale in school finance and a finite number of agents. Small affluent communities want to augment their numbers to help pay for the local public good, which is the provision of education. Since there are a finite number of agents, wealthy agents need to dilute the purity of a totally homogeneous neighbourhood with a few poorer residents. The variance in dynastic human

capital and mobility across income groups come from the random shocks to the otherwise deterministic attainment of children. Parents do not condition their residential choice on these shocks, which is equivalent to saying that disturbances are unobservable until after the completion of school. The effective one-dimensional *ex-ante* heterogeneity of the agents in this model implies that the imperfect equilibrium sorting is crucially dependent on the assumption that there are too few people of any given type to fill a homogeneous neighbourhood. The problem of plausibly generating imperfect sorting is a recurrent theme in this literature.

Sarychev (2000) presents a neat model in which imperfect sorting is not generated by questionable indivisibilities. In this model neighbourhood effects act upon children's human capital in an indirect way, through the costs of its acquisition. Unlike in the model of Benabou (1996), the distribution of types for parents is continuous. Furthermore, in each generation agents are heterogeneous across two dimensions: human capital and some unobservable variable, alternatively interpreted by Sarychev as rate of time preference, degree of altruism, or innate aptitude. The housing market is affected by the human capital externality, in that agents' choice of a community is affected by both its price and average human capital of the neighbours. In equilibrium, prices reflect the differences in quality, so neighbourhoods' ordering by quality and price is the same, which makes their distribution one-dimensional. Mapping the two-dimensional distribution of parents onto the one-dimensional line of communities creates the desired imperfect sorting.

In this chapter we take a different approach, though several of the issues discussed above remain important. Sections 2 and 3 present models where the parent allocates income between their own consumption and investment in the child, but also chooses location. Location choice in this chapter is in continuous space, and therefore draws upon the standard urban framework. It is surprisingly uncommon to examine human capital accumulation within this framework, but there is no reason why this should necessarily be the case. The key problem for the purposes of this chapter is the specification of the externality effect from location, which will contribute to the human capital accumulation of the second generation. The chapter adapts techniques formulated for the racial externalities literature which was most prevalent in the 70s and 80s. However, since most of these models assume only one set of agents experience the externality effect from location there are additional problems to be solved. Section 2 discusses the local externality model, and section 3 a more general global externality model.

To augment the theoretical discussion section 4 presents an initial look at the extent of intergenerational mobility within the UK. We construct an intergenerational transition matrix using data on wages of father/son pairs from the National Child Development Study (NCDS). In this approach the data on father's and son's wages are allocated into equally sized

quartile (or other quantile) groups, with individuals being placed into groups according to their observed status. The quartiles are then cross-tabulated for fathers and sons, allowing measurement of the probability of a child attaining a given quartile conditional upon the position obtained by his father. Previous results (Zimmerman, 1992 for the US, and Dearden *et al*, 1997 for the UK) indicate that concern about intergenerational immobility is justified. Furthermore, they indicate a possible asymmetry in that upward mobility from the bottom is more likely than downward mobility from the top. Postulating such an asymmetry, the next step is an investigation of what distinguishes the experience of son's who escape their father's low income status from those who remain trapped at the bottom of the income distribution. Some descriptive analysis examining the role of neighbourhood of residence is undertaken in this section and related to the theoretical model. Section 5 concludes and indicates how the investigation should be taken further.

2. Local Externality Model.

2.1 Background.

Any theoretical model developed in the area of intergenerational mobility must capture the conflict between parental wants and their desires with regard to their children. In the canonical model of Becker and Tomes (1979) a single parent of a single child allocates income between their own consumption and investment in their child's human capital, in order to maximise a utility function spanning two generations. This model illustrates many aspects of the intergenerational transmission process. The model presented here tries to examine how location decisions can form part of the intergenerational link. Naturally, a key feature of any model in the area of intergenerational mobility is how the link between parent and child is formulated; exactly how to specify the human capital externality when location is in continuous space is not trivial. Initially we discuss a local externality model, but the next section deals with a potentially more rich global externality model. In local externality models the agent only receives the neighbourhood exterrnality from other agents that reside at his/her location. This has been likened (Yinger, 1976) to receiving externalities from immediate neighbours but not from agents that live across the street.

2.2 The model.

Consider a continuum of agents uniformly distributed along a linear and closed city of unit width and height Δ, such that the land available for consumption at each location x is Δ. All land is assumed to be owned by absentee landlords, who take the highest price bid for units of land. All firms are exogenously located within the central business district (CBD), which is the sole employment centre located at one end of the linear city. The CBD can, of course, also represent suburban employment within a decentralised city. The city is occupied with N_H high human capital parents, each of whom consume 1 unit of land, and N_L low human capital parents, for whom land consumption is θ, where $\theta<1$, reflecting different income levels. The structure of the city described here differs from landmark local externality models such as Yinger (1976), in which agents at a given location x live in rings around the CBD, and hence receive externality effects from other agents at their radius. This implies that an agent can receive an externality from an agent not necessarily in the near vicinity as long as that agent resides at radius x. It also implies that an agent at x does not get an externality from any agent at any other radius, no matter how close they reside to that agent. In the model presented here the city has unit width, as in many practical models set within the urban

framework. However, the city also has height Δ, and it is from agents that reside at location x but at different heights that the externality effect takes effect. Of course, the implication that agents in other buildings at a different x have no effect on an agent at x remains.

The model has two stages. In the first stage a composite parent chooses location, and pays an endogenously determined housing price. In the second stage he/she observes the first stage decisions of all agents, and chooses the level of investment to maximise a utility function over own consumption of a composite good (the price of which is taken as the numeraire) and child's capital stock. Note that the results are not dependent on the timing of decisions in this model; the model is constructed this way merely to reflect the fact that once chosen, there are constraints to geographical mobility.

In this model neighbourhood human capital does not enter directly into the utility function given by equation (1), but through its effect on child's capital stock. The parent has income y_i with $i \in$(high,low), and potential income y_i is either consumed, invested in the child directly at cost P per unit, or used to pay housing and transport costs, given by R(x) and t(x) respectively. The corresponding budget constraints are given by equations (2) and (3). The child has capital stock k^c, which results directly from parental investment I and the locational externality, as given in equation (4), where L(x) is the proportion of low human capital agents at location x. This equation reflects the earlier discussion of Becker & Tomes (1979) and Jencks and Mayer (1990). We make the further assumption that low human capital parents place more weight on current consumption relative to investment than high human capital parents, which is captured by assuming $\alpha_H<\alpha_L$ in equation (1) below. We also assume $\alpha_H<\theta\alpha_L$. That parents from different income groups place different weights on current consumption relative to investment in their children is a feature of other models with a similar focus to that here, such as Sarychev (2001). It can reasonably be interpreted as reflecting, for example, differing degrees of altruism, or different discount rates, perhaps resulting from credit constraints. In terms of the θ parameter it is common in models within the urban framework to assume exogenous differential land consumption between groups with different incomes. It is a result that is underpinned by the fact that it occurs naturally in models where lot size is endogenous. In many models within the urban framework endogenous lot size complicates the models extensively, without adding much to the results, so the short cut taken here has many precedents. For more information see Fujita (1991).

2.3 The Second Stage.

We solve by backwards induction and hence consider the second stage first. In the second stage the parent chooses investment to maximise utility over parental consumption and child's capital stock. Hence we have:

$$u(C_i, k_i^c) = \alpha_i C_i + \beta \ln k_i^c \tag{1}$$

$$C_H = y_H - R(x) - t(x) - PI_H \tag{2}$$

$$C_L = y_L - \theta R(x) - t(x) - PI_L \tag{3}$$

$$k_i^c = I_i \exp[-\gamma L(x)] \tag{4}$$

where the utility function (1) is maximised subject to the budget constraint and technology (4). In the second stage plugging the budget constraint and (4) into (1) and differentiating with respect to I yields equation (5).

$$\frac{du}{dI_i} = -\alpha_i P + \frac{\beta}{I_i} \tag{5}$$

Setting (5) equal to zero and solving for I_i^* yields equation (6):

$$I_i^* = \frac{\beta}{\alpha_i P} \tag{6}$$

2.4 The first stage.

To obtain the equilibrium configuration we calculate bid rent functions $\psi_i(x,u)$. These functions are specified for all utility levels for both types of parent, and just measure the maximum amount a person residing at x can pay and achieve utility level u. Since we already have optimal investment and hence optimal consumption we can just invert the indirect utility function to yield $\psi_i(x,u^*)$. This yields bid rents as given in equations (7) and (8).

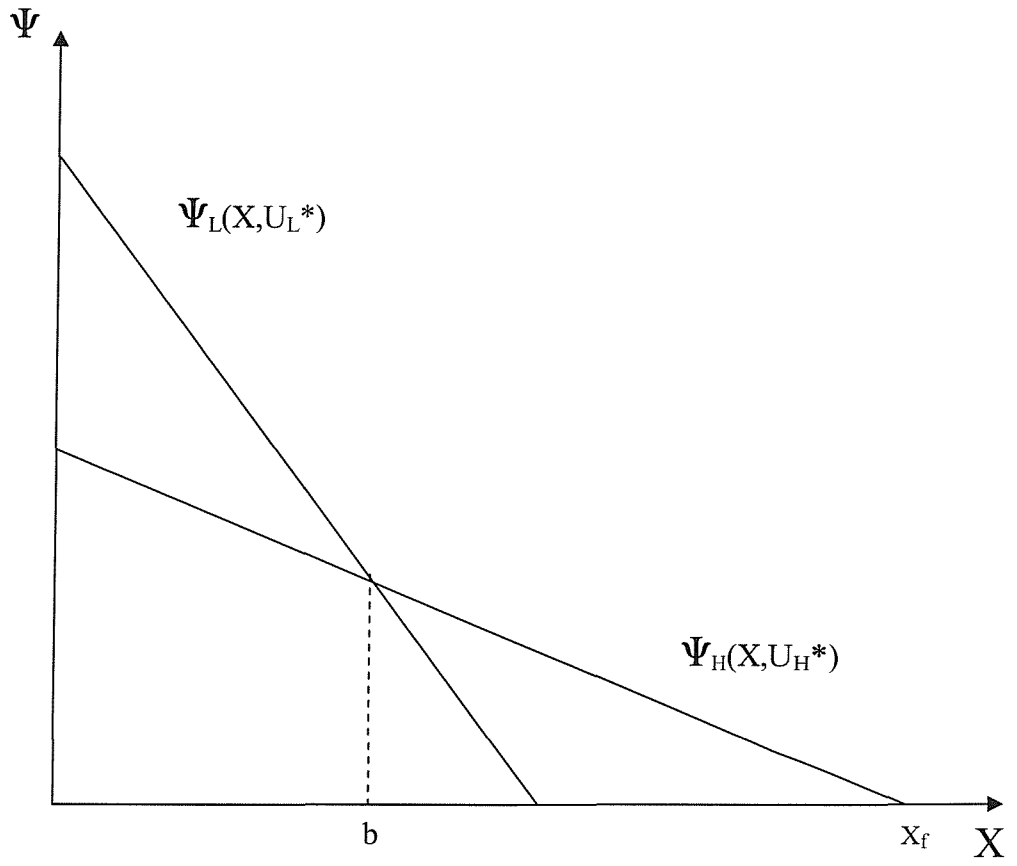
$$\psi_H(x,u_H^*) = y_H - t(x) - \frac{\beta}{\alpha_H} + \frac{\beta}{\alpha_H}\ln(\frac{\beta}{\alpha_H P}) - \frac{\beta\gamma L(x)}{\alpha_H} - \frac{u_H^*}{\alpha_H} \quad (7)$$

$$\psi_L(x,u_L^*) = \frac{1}{\theta}\{y_L - t(x) - \frac{\beta}{\alpha_L} + \frac{\beta}{\alpha_L}\ln(\frac{\beta}{\alpha_L P}) - \frac{\beta\gamma L(x)}{\alpha_L} - \frac{u_L^*}{\alpha_L}\} \quad (8)$$

To determine the equilibrium configuration we need to differentiate these bid rents with respect to x. To proceed assume the agents all get the most favourable human capital externality, so that L(x)=0 for all agents. In this case the bid rents for both agents are continuous across the entire city and intersect once. We further assume transport costs are linear in x. Differentiating equations (7) and (8) with respect to x yields the follow result in absolute terms:

$$\frac{d\psi_L(x,u_L^*)}{dx} = -\frac{t'(x)}{\vartheta} = -\frac{t}{\theta} > \frac{d\psi_H(x,u_H^*)}{dx} = -t'(x) = -t \quad (9)$$

As shown in diagram 1 below this implies a unique land use pattern with the low human capital parents residing nearest the CBD, and with the high human capital parents residing between the border (denoted as b) and the city fringe (denoted as x_f). It should be noted that with segregation in the local externality model no agent resides at b. We have L(x)=1 $\forall$ $x<b$ and L(x)=0 $\forall$ $x>b$, with both neighbourhoods residing arbitrarily close to b. The rent for each parcel of land differs throughout the city, because rents must reflect differences in transportation costs depending on location x. The higher land consumption for high human capital parents gives them an incentive to locate further away from the CBD to take advantage of lower rent per parcel of land, resulting in the equilibrium configuration suggested.



Naturally, L(x) cannot be zero for all agents, so it is necessary to examine whether the land use identified is an equilibrium land use when the negative externality effect of residing with low human capital parents is taken into account. Plugging the relevant values for L(x) into equations (7) and (8) we need the following conditions to hold:

$$\psi_H(x,u_H^*) = y_H - t(x) - \frac{\beta}{\alpha_H} + \frac{\beta}{\alpha_H}\ln(\frac{\beta}{\alpha_H P}) - \frac{\beta\gamma}{\alpha_H} - \frac{u_H^*}{\alpha_H} <$$

$$\psi_L(x,u_L^*) = \frac{1}{\theta}\{y_L - t(x) - \frac{\beta}{\alpha_L} + \frac{\beta}{\alpha_L}\ln(\frac{\beta}{\alpha_L P}) - \frac{\beta\gamma}{\alpha_L} - \frac{u_L^*}{\alpha_L}\} \qquad \text{for } x<b \qquad (10)$$

$$\psi_H[x,u_H^*] = y_H - t(x) - \frac{\beta}{\alpha_H} + \frac{\beta}{\alpha_H}\ln(\frac{\beta}{\alpha_H P}) - \frac{u_H^*}{\alpha_H} <$$

$$\psi_L[x,u_L^*] = \frac{1}{\theta}\{y_L - t(x) - \frac{\beta}{\alpha_L} + \frac{\beta}{\alpha_L}\ln(\frac{\beta}{\alpha_L P}) - \frac{u_L^*}{\alpha_L}\} \qquad \text{for } b<x\leq x_f \qquad (11)$$

Equation (11) just follows from equation (9), but equation (10) requires more care. However, since $\alpha_H<\theta\alpha_L$ and $\psi_L(x,u_L^*)$ is steeper than $\psi_H(x,u_H^*)$ we can see that $\psi^H<\psi^L$ $\forall x<b$. Hence the previous equilibrium configuration remains an equilibrium land use. However we must be careful, because the analysis thus far does by no means imply that the indicated equilibrium is the sole equilibrium of the city with human capital externalities, since we have yet to examine any possible integrated equilibria. Let us consider an arbitrary integrated equilibrium land use. Let $\bar{u}_L$ and $\bar{u}_H$ represent the associated equilibrium utilities, and $L^*(x)$ denote the proportion of low human capital agents at any x. If both types of agent reside at a given x, then $0<L^*(x)<1$. In this case both types of agent must have the same bid rent at x, and equation (12) must hold at that location.

$$\frac{1}{\theta}\{y_L - t(x) - \frac{\beta}{\alpha_L} + \frac{\beta}{\alpha_L}\ln(\frac{\beta}{\alpha_L P}) - \frac{\beta\gamma L^*(x)}{\alpha_L} - \frac{\bar{u}_L}{\alpha_L}\}$$
$$= y_H - t(x) - \frac{\beta}{\alpha_H} + \frac{\beta}{\alpha_H}\ln(\frac{\beta}{\alpha_H P}) - \frac{\beta\gamma L^*(x)}{\alpha_H} - \frac{\bar{u}_H}{\alpha_H} \qquad (12)$$

If we consider L(x) to be a parameter we can examine how the bid rents of both sets of agents respond to changes in L(x), as in equations (13) and (14).

$$\frac{d\psi^H}{dL} = \frac{-\gamma\beta}{\alpha_H} \qquad (13)$$

$$\frac{d\psi^L}{dL} = \frac{-\gamma\beta}{\theta\alpha_L} \qquad (14)$$

If both agents reside at x the high human capital rent curve must intersect that of the low human capital agents at $L^*(x)$. Since $\alpha_H<\theta\alpha_L$ equations (13) and (14) show that the high human capital parents' bid rent responds more to changes in L.

This also indicates the lack of stability of an integrated configuration at any location x. If the proportion of low human capital parents at x decreases slightly the high human capital agents' bid rent at x becomes higher than that of the low human capital agents. This implies further changes in the proportion of low human capital households residing at x, and this process continues until $L^*(x)=0$ or $L^*(x)=1$. Hence segregation prevails at all locations, and the configuration detailed above is the sole stable equilibrium in the city with human capital externalities.

To see that no other segregated pattern of location is possible consider a location x_1 such that $0<x_1<b$ that consists solely of Δ high human capital agents. By construction Δ/θ of the low human capital agents must reside on the high human capital side of the border at, say, location x_2. For this pattern of segregation to be sustainable both sets of agents must be willing to outbid the other set to remain in their current location, with both sets taking the current level of neighbourhood human capital as given. However, it can never be true that the high human capital agents outbid the low human capital agents for a place in the neighbourhood x_1. When L(x)=1 we know from equations (7-9) and diagram 1 that $\psi^L(x,u_L^*) > \psi^H(x,u_H^*) \forall x$ when $0 < x < b$.

2.5 Equilibrium.

We can now define the full urban equilibrium:

$$\psi_H(x_f, u_H^*) = R_A \tag{15}$$

$$\psi_L(b, u_L^*) = \psi^H(b, u_H^*) \tag{16}$$

$$\int_0^b \frac{\Delta}{\theta} dx = N_L \tag{17}$$

$$\int_b^{x_f} \Delta dx = N_H \tag{18}$$

$$\mathrm{R(x)} = \max\{\psi_L, \psi_H, R_A\} \tag{19}$$

From equations (17 and (18) we can see city length is $(\theta N_L+N_H)/\Delta$. Equilibrium market rents and utilities for all agents can now be determined. From equation (15), which closes the model by pinning down the rent at the city fringe as R_A (often thought of as rent for land used for agricultural purposes), we can pin down equilibrium utility for high human capital parents, as in equation (20). We can then substitute equation (20) into equation (7) and determine the bid rent for the high human capital agents at the border, as in equation (21).

$$\frac{u_H^*}{\alpha_H} = y_H - t\left(\frac{\vartheta N_L + N_H}{\Delta}\right) - \frac{\beta}{\alpha_H} + \beta \ln \frac{\beta}{\alpha_H P} - R_A \tag{20}$$

$$\psi_H(x_b, u_H^*) = \frac{tN_H}{\Delta} + R_A \tag{21}$$

From equation (16) we can see what a low human capital parent would bid for a location arbitrarily close to the border on the high human capital side, as in equation (22). We can also pin down their equilibrium utility in this manner, as shown in equation (23).

$$\psi_L(x_b, u_L^*) \equiv \frac{1}{\vartheta}(y_L - \frac{t\vartheta N_L}{\Delta} - \frac{\beta}{\alpha_L} + \beta \ln \frac{\beta}{\alpha_L P} - \frac{u_L^*}{\alpha_L}) = \frac{tN_H}{\Delta} + R_A \tag{22}$$

$$\frac{u_L^*}{\alpha_L} = y_L - \frac{\vartheta t \overline{N}}{\Delta} - \frac{\beta}{\alpha_L} + \beta \ln \frac{\beta}{\alpha_L P} - \vartheta R_A \tag{23}$$

We can easily determine what happens to rents on the low human capital side once the human capital externality is taken into account. Market rents $R^*(x)$ are given by the following:

$$R^*(x) = \frac{t(\vartheta N_L + N_H)}{\Delta} - tx + R_A\} \qquad \text{for } b<x<x_f \tag{24}$$

$$= \frac{t\overline{N}}{\Delta} - \frac{tx}{\theta} - \frac{\gamma\beta}{\theta\alpha_L} + R_A\} \qquad \text{for } 0<x<b \tag{25}$$

$$= R_A \qquad \text{otherwise}$$

We can see from the market rents that the analysis implies a discontinuity in the market rent at the border. That market rents depend positively on population, and negatively with regard to the distance from the CBD to reflect transportation costs, is the standard result (Fujita, 1991). The intuitive result that the market rents adjust so as to reflect the negative externality from low human capital residents is not so common, though similar examples in the literature using different frameworks can be found in Sarychev (1996), Durlauf (1996) and Benabou (2001).

2.6: Capital stocks.

Naturally we want to analyse the capital stocks for the second generation that result from the investment and location decisions of parents. Equation (26) that determines these stocks in equilibrium is below:

$$k_i^* = \frac{\beta}{\alpha_i P} \exp[-\gamma L_i(x)] \tag{26}$$

As such capital stocks for the child are constant within parental capital type. We can of course change this result by complicating the form of heterogeneity analysed. For instance, if tastes for child's capital stock were to vary amongst agents of the same capital type, we could generate a more interesting distribution for capital stocks without affecting the location decision. We could also make a key parameter only observable after the location decision has been made, similar to Durlauf (1996). However, an alternative to complicating the form of heterogeneity or introducing uncertainty is to have a more rich externality effect than the one considered in this local externality model. In particular it is reasonable to believe that one should get an externality effect from those who live close to your location, albeit one that is decreasing as the distance increases. This gives us the global externality model to which we now turn.

3: Global externality model.

3.1 Model.

In principle we would like to have a richer specification for the externality than that discussed in the previous section. In particular we would like the externality effect received at any location to depend on the sum or weighted sum of the distance to all high human capital agents within the city. Such global externality models are often complex, so it is not always possible to proceed in this manner. Fortunately that is not the case here. Other examples of global externality models within the literature can be found in Kanemoto (1987).

The utility function and budget constraints from before are repeated here in equations (27) to (29). Equation (30) shows the new human capital production function. The investment term is as it was in the previous section, but the externality is now the sum of the distance to high human capital agents. More formally it is the integral over all locations of the absolute value of the distance between the individual's location x and that of high human capital agents, with locations at which high human capital agents reside being designated as x'. Due to the complexities introduced in the global externality model we return to the standard case with no city height. We also assume that $\alpha_H=\theta\alpha_L$. This is justifiable in the case where the ratio of incomes for the two groups is also the ratio of land consumptions, and the inverse of the parental taste factors.

$$u(C_i,k_i^c)=\alpha_i C_i+\beta\ln k_i^c \tag{27}$$

$$C_H=y_H-R_H(x)-t(x)-PI_H \tag{28}$$

$$C_L=y_L-\theta R_L(x)-t(x)-PI_L \tag{29}$$

$$k_i^c=I_i\exp[-\int_0^{x_f}|x-x'|dx'] \tag{30}$$

It is very difficult to proceed by analytically deriving the equilibrium location and rents. Hence, we consider the equilibrium configuration from the local externality model, and can then derive the associated bid rents, and assess whether it is still an equilibrium configuration in the global externality model. As such equation (30) becomes:

$$k_i^c=I_i\exp[-\int_{x_b}^{x_f}|x-x'|dx'] \tag{31}$$

Since optimal parental investment has not changed from the local externality model, the appropriate bid rent for each parental type is given by equations (32) and (33).

$$\psi_H(x,u_H^*) = y_H - t(x) - \frac{\beta}{\alpha_H} + \frac{\beta}{\alpha_H}\ln(\frac{\beta}{\alpha_H P}) - \frac{\beta}{\alpha_H}\{\int_{x_b}^{x_f}|x-x'|dx'\} - \frac{u_H^*}{\alpha_H} \tag{32}$$

$$\psi_L(x,u_L^*) = \frac{1}{\theta}\{y_L - t(x) - \frac{\beta}{\alpha_L} + \frac{\beta}{\alpha_L}\ln(\frac{\beta}{\alpha_L P}) - \frac{\beta}{\alpha_L}\{\int_{x_b}^{x_f}|x-x'|dx'\} - \frac{u_L^*}{\alpha_L}\} \tag{33}$$

To evaluate the integral it is easiest to calculate it separately for locations to the left and the right of the border x_b. Furthermore, for agents residing to the right of the border we have two terms in the overall integral, since for any location x that is to the right of the border there will be some high human capital agents in both directions, and it is only the distance that is important. Therefore for $0<x<x_b$ and $x_b<x<x_f$ we have equations (34) and (35) respectively:

$$\int_{x_b}^{x_f}|x-x'|dx' = \int_{x_b}^{x_f}(x'-x)dx' = [\frac{1}{2}(x'-x)^2]_{x_b}^{x_f} = \frac{1}{2}(x_f-x)^2 - \frac{1}{2}(x_b-x)^2 \tag{34}$$

$$\int_{x_b}^{x_f}|x-x'|dx' = \int_{x_b}^{x}(x-x')dx' + \int_{x}^{x_f}(x'-x)dx' = \frac{1}{2}(x-x_b)^2 + \frac{1}{2}(x_f-x)^2 \tag{35}$$

As in the previous model we differentiate the rent function to see what happens to rent for both sets of agents over all locations. Hence, substituting equation (34) into equations (32) and (33) respectively and differentiating with respect to location x yields the following two expressions for locations between the CBD and the border.

$$\frac{d\psi_H}{dx} = -t - \frac{\beta}{\alpha_H}(x_b - x_f) \qquad 0 < x < x_b \tag{36}$$

$$\frac{d\psi_L}{dx} = -\frac{t}{\theta} - \frac{\beta}{\alpha_H}(x_b - x_f) \qquad 0 < x < x_b \tag{37}$$

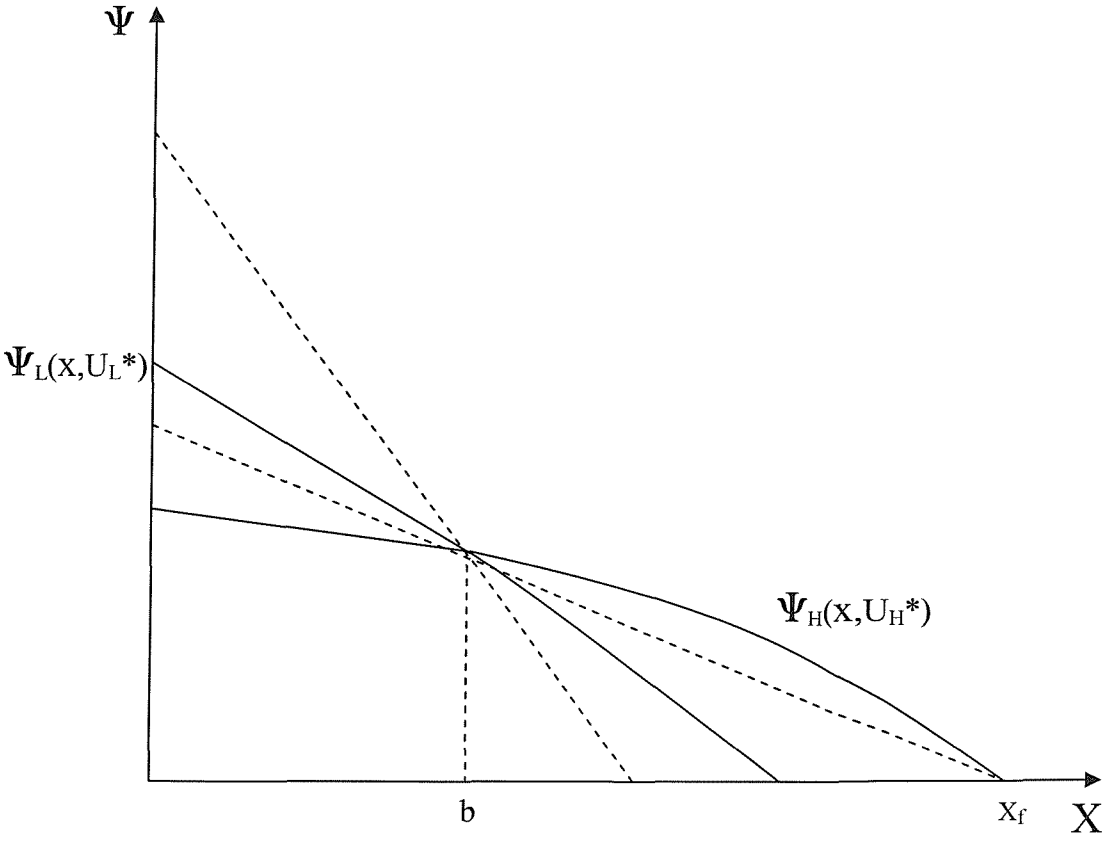
To the right of the border the expression for the slope of bid rent can be derived by substituting equation (35) into equations (32) and (33) and differentiating.

$$\frac{d\psi_H}{dx} = -t - \frac{\beta}{\alpha_H}(2x - x_b - x_f) \qquad x_b \le x < x_f \tag{38}$$

$$\frac{d\psi_L}{dx} = -\frac{t}{\theta} - \frac{\beta}{\alpha_H}(2x - x_b - x_f) \qquad x_b \le x < x_f \tag{39}$$

We assume that $t > \frac{\beta}{\alpha_H}(x_f - x_b)$, in order to guarantee existence of an equilibrium. Like in the local externality model, the rents are continuous along the city and cross once, with low human capital agents bidding more for locations to the left of the border, and high human capital agents bidding more for locations to the right of the border. It is a nice feature of the model that since the total distance to high human capital agents must be the same at the border and the city fringe, the only difference between the rents at those two points for high human capital agents is transportation costs. This implies that the point the rents cross is the same as that from considering transportation costs alone. This is shown in diagram 2 below, in which the dotted lines represent the bid rents from the local externality model.

Diagram 2:



3.2 Equilibrium

We can now define the full urban equilibrium:

$$\psi_H(x_f, u_H^*) = R_A \tag{40}$$

$$\psi_L(b, u_L^*) = \psi^H(b, u_H^*) \tag{41}$$

$$\int_0^b \frac{1}{\theta} dx = N_L \tag{42}$$

$$\int_b^{x_f} 1 dx = N_H \tag{43}$$

$$\mathrm{R(x)} = \max\{\psi_L, \psi_H, R_A\} \tag{44}$$

From equations (42) and (43) we can see city length is $\theta N_L + N_H$. Equilibrium market rents and utilities for all agents can now be determined. From equations (40) we can pin down equilibrium utility for high human capital parents, as in equation (45). We can then substitute equation (45) into equation (32) and determine the bid rent for the high human capital agents at the border, as in equation (46).

$$\frac{u_H^*}{\alpha_H} = y_H - t(\vartheta N_L + N_H) - \frac{\beta}{\alpha_H} + \beta \ln \frac{\beta}{\alpha_H P} - \frac{\beta N_H^2}{2\alpha_H} - R_A \tag{45}$$

$$\psi_H(x_b, u_H^*) = tN_H + R_A \tag{46}$$

From equation (33) we can see what a low human capital parent would bid at the border, as in equation (47). We can also pin down their equilibrium utility in this manner, as shown in equation (48).

$$\psi_L(x_b, u_L^*) \equiv \frac{1}{\vartheta}\left(y_L - t\vartheta N_L - \frac{\beta}{\alpha_L} + \beta \ln \frac{\beta}{\alpha_L P} - \frac{\beta N_H^2}{2\alpha_L} - \frac{u_L^*}{\alpha_L}\right) = tN_H + R_A \tag{47}$$

$$\frac{u_L^*}{\alpha_L} = y_L - t\vartheta \overline{N} - \frac{\beta}{\alpha_L} + \beta \ln \frac{\beta}{\alpha_L P} - \frac{\beta N_H^2}{2\alpha_L} - \vartheta R_A \tag{48}$$

Market rents $R^*(x)$ are given by the following:

$$R^*(x) = t(\vartheta N_L + N_H) - tx - \frac{\beta}{2\alpha_H}\{(x - \vartheta N_L)^2 + (\vartheta N_L + N_H - x)^2\} + \frac{\beta N_H^2}{2\alpha_H} + R_A$$

For $b \leq x < x_f$ (49)

$$= t\overline{N} - \frac{tx}{\theta} - \frac{\beta}{2\alpha_H}\{(\vartheta N_L + N_H - x)^2 - (\vartheta N_L - x)^2\} + \frac{\beta N_H^2}{2\alpha_H} + R_A$$

for $0 < x \leq b$ (50)

$= R_A$ otherwise.

As with the local externality model in the last section the market rents depend positively on population and negatively on distance from the CBD, due to transportation costs. Also, the rents for each location depend negatively on distance from high human capital parents. However, compared to the local externality model the rents in the global externality model are more intricate, reflecting the richer specification of the underlying human capital externality. On the high human capital side of the border rents increase as we move away from the fringe towards the centre of the high human capital neighbourhood, but by more than that necessary to reflect lower transportation costs alone, due to the fact that the sum of the distance to high human capital agents is minimised at the centre of the high human capital neighbourhood. The difference between rents at the border and fringe reflect transportation cost differences alone, as the sum of the distance to high human capital agents is identical at these two points. On the low human capital side of the border rents increase as we move away from the border towards the CBD, but not by as much as would occur in a model with no human capital externality. For comparable and further results from global externality models see Kanemoto (1987).

3.3 Capital Stock.

We can derive the capital stocks implied by the location and investment decisions of parent, as in equations (51) and (52). Diagram 3 below shows capital stocks for all x in equilibrium:

$$k_L^* = \frac{\beta}{\alpha_L P}\exp[-\{\int_{x_b}^{x}(x-x')dx' + \int_{x}^{x_f}(x'-x)dx'\}]$$

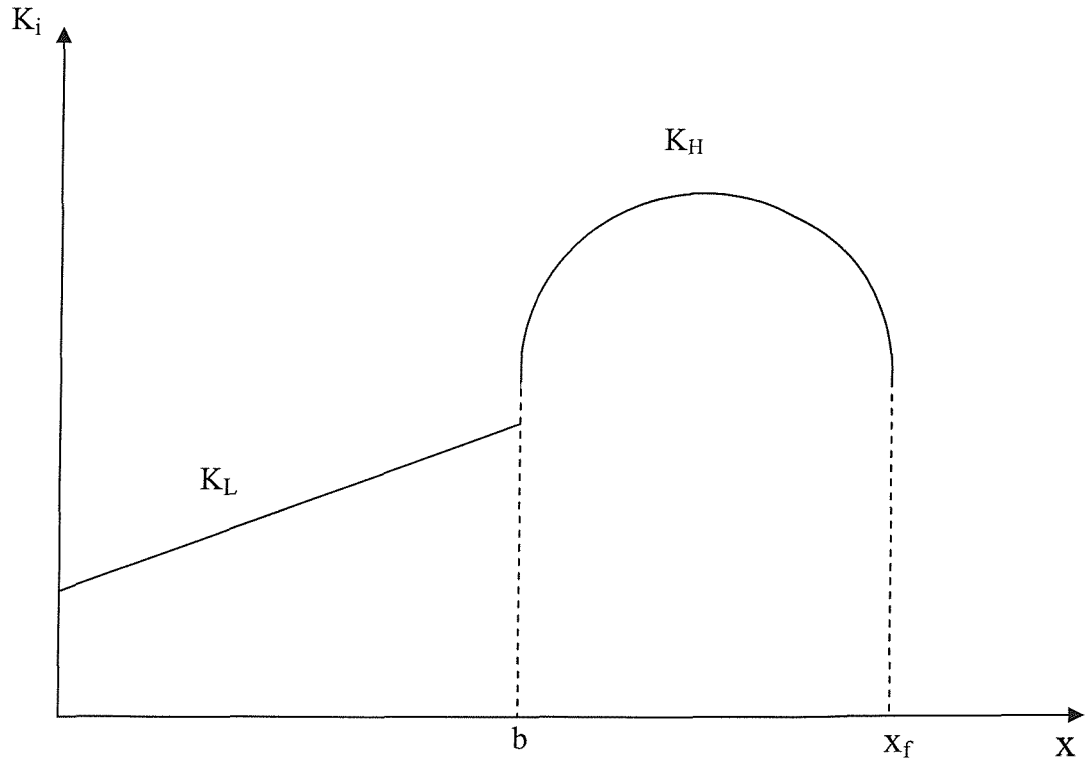
$$= \frac{\beta}{\alpha_L P}\exp[-\{\frac{1}{2}(x_f - x)^2 - \frac{1}{2}(x_b - x)^2\}]$$

$$= \frac{\beta}{\alpha_L P}\exp[-\{\frac{1}{2}(\vartheta N_L + N_H - x)^2 - \frac{1}{2}(\vartheta N_L - x)^2\}] \qquad (51)$$

$$k_H^* = \frac{\beta}{\alpha_H P}\exp[-\{\int_{x_b}^{x}(x-x')dx' + \int_{x}^{x_f}(x'-x)dx'\}]$$

$$= \frac{\beta}{\alpha_H P}\exp[-\{\frac{1}{2}(x - x_b)^2 + \frac{1}{2}(x_f - x)^2\}]$$

$$= \frac{\beta}{\alpha_H P}\exp[-\{\frac{1}{2}(x - \vartheta N_L)^2 + \frac{1}{2}(\vartheta N_L + N_H - x)^2\}] \qquad (52)$$



Intuitively the highest capital stock is that for children living in the centre of the high human capital neighbourhood, with the stocks for children with high human capital parents being equal at the city border and fringe. The capital stocks of the children with low human capital parents at the border is lower than that observed for children with high human capital parents who reside at the border, because of the parental taste factor. Finally, as we move from the border towards the CBD capital stocks are progressively lower. It is important to note the trade-off for both sets of agents in terms of foregone consumption. Within the locations made up of low human capital parents the consumption is lowest at the border, since the overall living costs there are the highest. The high human capital parents at the border and fringe have equal consumption, with the parents living in the centre paying a premium for their location and facing the highest costs, with consequent lowest consumption for this capital type.

4: Data

4.1 Introduction:

The results in this section provide a preliminary look at the extent of intergenerational mobility in the UK. Whilst we do not explicitly test the models discussed in sections 2 and 3 they provide a backdrop against which to interpret results and help ascertain how to take the empirical investigation further. It is clear that to examine intergenerational links and the effect of neighbourhood choice we need a broad dataset. In particular we need measures of individual and parental income or wages, as well as socioeconomic characteristics of the respective neighbourhood. Furthermore, these requirements are complicated by the fact that earnings and neighbourhood characteristics must be available for the appropriate time periods. Fortunately, the NCDS data used for individual and parental information in this chapter (for further information see chapter 2) also has information on so-called Acorn type for the neighbourhood in which the family lives in 1971, when the child is 13. Acorn types are a classification of enumeration districts into 36 residential neighbourhood types based on 40 census variables covering demographic structure, household composition, housing, socioeconomic structure and residents' employment characteristics. These neighbourhood types are classified into 11 Acorn groups. This is still too many for the analysis that follows, so the groups are further aggregated into high human capital neighbourhoods, low human capital neighbourhoods, and intermediate neighbourhoods. Note that although this process involves much aggregation of the detailed neighbourhood types, the enumeration districts are much smaller than the areas that could be considered in any regression based analysis.

4.2 Transition matrix:

In this section we construct an intergenerational transition matrix using father's and son's wages from the NCDS dataset. The wages are observed in 1974 and 1991 respectively. An important question here is to what extent short run observed earnings reflect the long-run status upon which we would wish to have observations. One key issue is that fathers will be at different points in their life-cycle (though the sons are all 33 in 1991), and this needs to be taken into account. A standard approach to removing the age effects from the data is used here; we model observed 1974 earnings y_{ir}^{f} for fathers as in equation (53), where y_{i}^{f} represents permanent earnings, A_{ir} is father's age, Q_i is a matrix of characteristics from the NCDS data, such as education, and v_{ir} is a transitory error term.

$$y_{ir}^{f} = y_{i}^{f} + \gamma_1' A_{ir} + \gamma_2' A_{ir}^2 + v_{ir} = \alpha + Q_i + \gamma_1' A_{ir} + \gamma_2' A_{ir}^2 + v_{ir} \quad (53)$$

We can then calculate an estimate of father's permanent wage as in equation (54), which is used in the analysis that follows:

$$\hat{y}_{i}^{f} = y_{ir}^{f} - \hat{\gamma}_1' A_{ir} - \hat{\gamma}_2' A_{ir}^2 = y_{i}^{f} + v_{ir} \quad (54)$$

In the transmission matrix approach the data on father's and son's permanent wages are allocated into equally sized quartile groups, with individuals being placed into groups accordingly. The quartiles are then cross-tabulated for fathers and sons, allowing measurement of the probability of a child attaining a given quartile conditional upon the position obtained by his father. In this framework if there were complete intergenerational mobility we would expect all of the cell entries to be the reciprocal of the number of groups into which the wages of both generations were allocated. If there were complete intergenerational immobility we would expect all individuals to be on the leading diagonal of the matrix. Using this framework it is possible to identify asymmetries in mobility across wage levels, something that may be lacking in a regression framework. The transition matrix below is for the 1679 father/son pairs, with no attempt to analyse the intergenerational transmission mechanisms.

Table 1:		**Fathers**			
		Bottom	2nd	3rd	Top
	Bottom	0.32	0.3	0.26	0.12
Sons	2nd	0.28	0.26	0.24	0.22
	3rd	0.26	0.23	0.27	0.24
	Top	0.14	0.21	0.23	0.42

These results confirm the asymmetry discussed before, and are broadly consistent with UK results such as those in Atkinson *et al*, (1983), although the magnitude of immobility at the top of the income distributions is not as marked as in Dearden *et al* (1997), where the percentage in the bottom right cell was 52% as opposed to 42% here. Also interesting are the relatively high values for fathers and sons who are in the bottom two quartiles. The results here indicate that 60% of sons with fathers in the lowest income quartile in 1974 remain in the bottom two quartiles in 1991, with only 14% reaching the top quartile. We can also see that

62% of sons in the bottom quartile in 1991 had fathers in the bottom two quartiles in 1974. At the other end of the income distributions we can see that for fathers in the top quartile 66% of sons remain in the top two quartiles, with only 12% falling to the bottom quartile. We can also see that 65% of sons in the top quartile had fathers in the top two quartiles. The next step would seem to be an investigation of what distinguishes the experience of son's who escape their father's low income status from those who remain trapped at the bottom of the income distribution. We can also examine what forces drive the immobility observed at the top end of the income distribution. In particular section 4.3 examines the role of human capital externalities from location choice in light of the theoretical examination in section 2.

4.3 The role of location:

The Acorn classifications based on 40 socioeconomic characteristics are used to split neighbourhood into 3 groups representing high, intermediate and low neighbourhood human capital. The effect of neighbourhood in determining son's position within each column of the matrices is simply analysed by calculating the proportion of each cell in each of the 3 neighbourhood classifications. By making within column comparisons we minimise selection problems associated with location choice, since we are directly comparing the experiences of sons who succeed despite their father's position in the income distribution with those who remain trapped. In the table below the proportions of sons in each cell that resided in neighbourhoods with high, intermediate or low human capital are presented. We also present the relevant number of sons within each cell.

The results below in table 2 are illustrative. We can see that, aside from the one blip for sons in the top quartile with fathers in the third quartile, the proportion living in high human capital neighbourhoods rises as we move down the columns. Furthermore the proportion of the cell living in the low human capital neighbourhoods decreases as we move down the columns. In the first column we can see that 52% of sons live in low human capital neighbourhoods, compared with 20% living in high human capital neighbourhoods. However, the figures for sons that are also in the bottom quartile are 58% and 14%. The corresponding figures for sons that make it to the top quartile are 45% and 29%. The possibility remains in this framework that a variable highly correlated with neighbourhood is driving these results, but considering results within columns has the further advantage that this variable would also have to be uncorrelated with fathers earnings, which helps to minimise the possibility, though heterogeneity may of course remain even within each quartile. Nonetheless, these results set the scene for a more rigourous statistical examination of the effects under study here.

Table 2:		Fathers			
		Bottom	2nd	3rd	Top
	Total	134	125	109	50
	Bottom (L)	0.58	0.53	0.45	0.24
	Bottom (I)	0.28	0.3	0.26	0.31
	Bottom (H)	0.14	0.17	0.29	0.45
	Total	118	109	101	92
	2nd (L)	0.55	0.48	0.40	0.22
	2nd (I)	0.27	0.3	0.25	0.28
	2nd (H)	0.18	0.22	0.34	0.5
	Total	109	97	113	101
Sons	3rd (L)	0.50	0.46	0.35	0.21
	3rd (I)	0.27	0.29	0.26	0.22
	3rd (H)	0.23	0.25	0.4	0.57
	Total	59	88	97	176
	Top (L)	0.45	0.41	0.35	0.17
	Top (I)	0.26	0.31	0.27	0.23
	Top (H)	0.29	0.28	0.38	0.6
	All (L)	0.52	0.47	0.39	0.20
	All (I)	0.28	0.31	0.26	0.25
	All (H)	0.2	0.22	0.35	0.55

Considering fathers in the top quartile of the income distribution, we can see that only 20% reside in low human capital neighbourhoods, with 55% residing in high human capital neighbourhoods. The corresponding figures for sons who fall to the lowest quartile are 24% and 45%, while the figures for those remaining in the highest quartile are 17% and 60%. Of course, there are still a substantial number of sons with fathers in the lower quartiles that reach the higher quartiles themselves, despite living in low human capital neighbourhoods. Similarly, there are a number of sons with fathers in the highest quartile that fall to lower quartiles despite living in high human capital neighbourhoods. This implies neighbourhood is not the only important factor, as we would expect. The fact remains that given father's income, the probability of sons rising or falling in terms of their position in their own income distribution does depend on the quality of the neighbourhood in which sons grows up.

5. Conclusion:

This chapter has tried to take a new approach to analysing the mechanisms through which intergenerational transfer might take place. We retain the flavour of the landmark Becker & Tomes model, whilst introducing endogenously determined location choice. Uncharacteristically the urban framework was chosen to analyse the issues of interest. The local externality model provides a neat place to start, and shows some conditions under which segregation occurs, and integrated equilibria cannot be sustained. However, like in other frameworks used to analyse these questions (e.g. Benabou, 1996) the problem of plausibly generating imperfect sorting remains, which ultimately means that the initial model must be extended in some way to generate a more realistic distribution of capital stocks for the second generation. Two possibilities chosen in the literature so far (e.g. Sarychev, 2001 and Durlauf, 1996 respectively) are complicating the form of parental heterogeneity used and introducing a shock after the location decision has been made. Here we show that in the urban framework with location in continuous space, a sufficiently rich specification for the locational externality is enough to provide a viable alternative framework to aid empirical inference.

In the empirical section we examine a dataset which consists of measures of wages for father/son pairs, as well as socioeconomic characteristics of the respective neighbourhood. We construct a transition matrix to better understand the pattern of intergenerational mobility for the UK, finding the standard [Atkinson *et al* (1983), Zimmerman (1992), Dearden *et al* (1997)] asymmetry in intergenerational mobility at the ends of the income distribution for fathers. We also present some descriptive analysis of the role of neighbourhood, which provides some provocative answers on the systematic benefits enjoyed by those in the second generation who grow up in more prosperous neighbourhoods. However, the statistical analysis clearly needs to be taken further. The next step is to examine the questions raised by this approach within a more rigourous statistical framework.

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Chapter 2: Neighbourhood effects and their role in intergenerational mobility for the UK.

Abstract

The focus of this chapter is the intergenerational transmission of economic welfare. The chapter first presents a simplified theoretical model of how neighbourhood can affect the intergenerational propagation of economic welfare, in order to underpin the later empirical investigation of the importance of these effects for the UK. The empirical investigation merges information on parent and child from National Child Development Study data with socioeconomic neighbourhood information from the 1971 Census.

Three different levels of data disaggregation are used to construct the neighbourhood characteristics, and two distinct methods for recovering unobservable permanent wage. We find from a variety of regressions that neighbourhood of residence is an important mechanism in understanding intergenerational mobility. We also find that it is unlikely these results are due to omitted variables concerning family background. Furthermore, the magnitude of these coefficients was found to depend upon the level of data disaggregation at which the neighbourhood characteristics were constructed. On balance, the evidence presented here confirms the importance of location choice as a mechanism for intergenerational transfer.

CONTENTS:

1. Introduction and overview.

The focus of this chapter is the intergenerational transmission of economic welfare. The existing literature has considered several mechanisms through which such an intergenerational transfer could take place, including the role of parents in investment in their child's human capital, as well as through social capital resulting from the neighbourhood in which one grows up. The chapter first presents a simple theoretical model of how neighbourhood can affect the intergenerational propagation of economic welfare, in order to underpin the later empirical investigation of the importance of these effects for the UK. The empirical investigation merges information on parent and child from National Child Development Study data with socioeconomic neighbourhood information from the 1971 Census.

As described in more detail in chapter 1, the UK has experienced a rise in wage and income inequality since the 1970s. However, this development must be considered alongside the *character* of inequality; that is we would also like to know how mobile income is between generations. Understanding the extent of mobility as well as the intergenerational transmission mechanisms, such as parental investment and neighbourhood of residence, is key to this debate. Numerous ways for neighbourhood to influence children have been identified (see Jencks & Mayer, 1990, and Brooks-Gunn et al, 1993 for detailed discussions). Neighbourhoods can influence behaviour, attitudes, values, and opportunities. It is common within the sociological literature to view individuals as developing in the context of the series of environments of relevance, with the neighbourhood of residence being a key example. Jencks and Mayer (1990) provide a comprehensive review of the literature on neighbourhood effects, and discuss four broad categories of theories on how neighbourhood can affect individual development. Firstly, there are contagion theories, based primarily on the power of peer influences to spread either problem or beneficial behaviour. Secondly, there are theories of collective socialisation, in which neighbourhood role models and monitoring are important ingredients to a child's socialisation. Thirdly, there are competition theories where residents compete for scarce neighbourhood resources. Lastly, there are relative deprivation theories, where individuals' decision-making or view of their own well-being is influenced by evaluating their standing relative to their neighbours. The first two theories imply that affluent neighbours confer benefits on children, perhaps especially low income children, whereas the competition theory predicts the opposite. Finally, the relative deprivation theory is tricky to judge in terms of the affect affluent neighbours have. One interpretation would be that individuals who would be content in a neighbourhood with equally well off or worse off individuals would not be content in a neighbourhood with more affluent neighbours.

However, for the questions of relevance to this chapter we are more concerned with the possibility of behaviour being conditioned on that of neighbours. An individual may form views, for example, on the appropriate level education to pursue, by considering outcomes relative to those within the neighbourhood. It is also clear that in this setting that the peer influences theory is also relevant, again perhaps through educational channels. Equally, the role models theory is likely to be relevant, for instance through the effect on expectation formation, or discipline. However, in the sphere of neighbourhood effects and intergenerational mobility, though, it is hard to conceive of an applicable competition based theory, so this possibility gets no further discussion in the piece.

Though income and wage inequality and intergenerational mobility are distinct concepts, we must also consider possible links. A wider income distribution tends to facilitate sorting, as well as increasing the distribution of parental investment in their children. Furthermore, factors such as the well documented problems of household worklessness (Gregg & Wadsworth, 2003) and child poverty (Gregg & Machin, 1998) in the UK reinforce the need to consider that inequality of outcome in one generation can imply inequality of opportunity for the next. We cannot ignore the role of location choice when considering such problems; in particular concern has developed about the role of poor neighbourhoods in perpetuating poverty, perhaps even across generations, through any or all of the mechanisms discussed above. Whatever one's political persuasion, it is clear that policy-makers need an understanding of the level of intergenerational mobility, as well as the relative importance of the various transmission mechanisms such as neighbourhood of residence.

The empirical literature on intergenerational mobility was summarised in Becker and Tomes (1986), where it was concluded that regression to the mean in earnings in rich countries appears to be rapid. Since then important papers by Solon (1992) and Zimmerman (1992) have questioned the methodology of earlier works, and postulated that the intergenerational correlation in long-run income for the United States may be twice as high as earlier thought. The empirical literature on intergenerational mobility has several parts. Some researchers have used sibling correlation in socioeconomic outcomes to measure the proportion of the variation in those outcomes that can be attributed to family and community background variables. The fundamental idea here is that if the influence of family and community is strong the siblings' status will show a marked resemblance. Such studies have produced a wide range of estimates of sibling correlation, largely for brothers in US data, with a central tendency of a correlation of 0.4 between brothers in the permanent component of their average hourly earnings. This implies that about 40% of permanent income inequality so measured is attributable to variation in family and community origins. It is important to note here that estimates of the proportion of earnings variation shared by brothers far exceeds what economists are able to explain in regressions of log earnings on observed family background

characteristics. The results suggest family and community factors are quite important, as well as posing the question of what accounts for the rest of the earnings inequality within families.

Further evidence looks directly at the intergenerational correlation in earnings. Again these studies often focus on father/son interactions (there are exceptions using mother/daughter and father/daughter pairs, for example Chadwick and Solon, 2002), and usually use averages of father's log annual earnings as the measure of parental income. Such studies yield an estimate of the elasticity of child's earnings with respect to the earnings of the respective parent, and generally indicate that a 10% increase in father's earnings raises son's earnings by approximately 4% (Solon, 1992, and Zimmerman, 1992 for the US). Dearden *et al* (1997) and Atkinson *et al* (1983) found from a multitude of regressions that the intergenerational mobility of labour in the UK is similarly limited. However, the literature is much weaker when it comes to ascertaining the relative importance of different mechanisms of intergenerational transfer. Attempts at ascertaining the importance of neighbourhood are sparse, and only apply to the US [Datcher (1982), Concoran et al (1992)]. The results of these studies are mixed, with it being surprisingly hard to find robust evidence of neighbourhood effects when family background characteristics are controlled for. It is possible that actual neighbourhood effects are small, and neighbourhood effects proxy for unobservable family characteristics in studies with large effects, such as Datcher (1982). It is also possible that the levels of disaggregation at which the neighbourhood characteristics were obtained were too blunt to capture the effects in question. Fortunately the NCDS data that will be used for this chapter have substantial family background information as well as indicators of location that allow construction of neighbourhood characteristics at high levels of disaggregation.

A third strand of the empirical literature uses intergenerational transition matrices to ascertain the extent of intergenerational mobility. A nice feature of this framework is that we can identify possible asymmetries in mobility across wage levels, something that may be lacking in the regression framework. Results from previous papers (Zimmerman, 1992 for the US, Chapter 1 of this thesis, and Dearden *et al*, 1997 for the UK) corroborate regression results in that concern about intergenerational immobility is justified. Furthermore they indicate an asymmetry in that upward mobility from the bottom is more likely than downward mobility from the top. However, the literature is comparatively weak in analysing the relative importance of the various mechanisms for intergenerational transfer, such as location choice. Chapter 1 presents an illustrative descriptive analysis on this point.

There are several econometric difficulties in investigating intergenerational mobility, with various solutions being tried in the papers mentioned above. The first issue is to what extent short run measures of incomes or earnings reflect long-run status. The data we would like that corresponds to the relevant theoretical models is permanent income, but in reality we have noisy measures of this. In this case OLS estimation of intergenerational correlations

using the regression approach is subject to a classic errors-in-variables bias. Whether this tendency for bias is pronounced or not critically depends on whether variances in long run status are large in relation to variances in transitory components. Unfortunately the longitudinal evidence (Blundell, 1998) suggests that the variance of the transitory component is reasonably large, and hence OLS estimates of intergenerational correlations may seriously underestimate the true values. Equally, inference in the transition matrices approach is hindered by not having true measures of permanent income. The second issue is the possibility that samples are unrepresentative. This is particularly relevant to the UK evidence since Atkinson's benchmark work relies on a sample solely considering inhabitants of York. Even abstracting from the problems above, if the variance of permanent status for the sample used is smaller than the population variance bias is introduced into the estimate of intergenerational correlation.

Clearly the NCDS data used in this chapter is free from the second criticism, but the first remains, and this problem and potential solutions are discussed extensively later. The NCDS data does, however, have several advantages over the US datasets. It has detailed information on family background and individual characteristics, and sample sizes are generally larger than in NLS or PSID studies. When trying to find evidence of neighbourhood effects the family background information is critical, since US studies that do find evidence are immediately subject to the criticism that community variables are proxying for unobservable family background variables, through the choice of location. In addition some researchers in this literature have modelled either son's or father's wages, when the relevant data was not available. This technique can be applied to the questions being considered in this chapter, and to this end the detailed information on individual characteristics becomes paramount.

Section 2 outlines a simple theoretical model which allows average neighbourhood human capital to affect the human capital accumulation of the child. A two-stage game is formulated, with the parent having a binary choice between neighbourhoods in the first stage. The average level of neighbourhood human capital then enters as an externality in the production function for human capital in the second stage. Parents choose between utilising their own capital for human capital investment in the child or selling it in the labour market. The equilibrium configuration of agents is obtained by solving the two-stage game, and the implications of the model for the later empirical analysis are discussed.

Section 3 discusses the datasets used in the empirical investigation. The chapter considers NCDS data in conjunction with 1971 Census data. Descriptive statistics are discussed, and issues of representativeness as sample selections are made are considered. Section 4 discusses more formally the econometric difficulties in estimation of the model, as well as potential solutions to these problems. Two methods of recovering permanent wage are

discussed and evaluated, and the results of estimating the model at three levels of neighbourhood characteristic data disaggregation using both of these methods are presented.

Section 5 considers the possibility that focusing on wages in investigations of intergenerational mobility is not all we need to do, since the fact that those at the bottom of the income distribution will not have observations on wages is not taken into account. Results from a variety of regressions using different dependent variables are presented. Section 6 discusses what possible conclusions we can draw from the various results in the last 2 sections, and indicates potentially fruitful areas for further research.

2. The theoretical model.

2.1 Background.

Any theoretical model developed in the area of intergenerational mobility must capture the conflict between parental wants and their desires in regard to their children. In the canonical model of Becker and Tomes (1979) a single parent of a single child allocates income between their own consumption and investment in their child's human capital, in order to maximise a utility function spanning two generations. This model illustrates several crucial aspects of the intergenerational transmission of earnings status, particularly that the child's earnings depend on investment in his/her human capital as well as endowed capacities. These capacities are in turn influenced in this model by the parent's endowment, through some combination of nature and nurture. The Becker and Tomes model also emphasises the importance the parent places on the child's future earnings, the return to human capital investment and even the relative magnitudes of variances in market luck and endowment luck. The model presented here tries to ascertain how neighbourhood can affect the intergenerational link, and consequently does not consider the broad range of factors above. Since the aim is to provide a bridge between the empirical investigation of the effect of neighbourhood on intergenerational mobility and the standard theory as above, this simplification is warranted.

A key feature of any model in the area of intergenerational mobility is how the link between parent and child is formulated. Several models, including Becker and Tomes (1979) and Solon (1999), model child's income as a parametric return to parental investment, sometimes augmented with other relevant factors. This method doesn't lend itself to the examination of the role of neighbourhood, and consequently the link between parent and child in the model that follows is somewhat different. The link in the model presented here draws on the work of Ben-Porath (1967) on human capital production, as well as the household production models of authors like Chiswick (1988). In models of household production the child's educational attainment or capital stock appears in the household utility function, and this stock is produced with inputs from the market in conjunction with parental time. In the optimal human capital accumulation work of Ben-Porath the individual chooses the share of his/her capital stock that is allocated to the production of further human capital, with market inputs as a complement to this share. The wages foregone whilst accumulating human capital are the opportunity cost of the investment process. As in Ben-Porath (1967) the model presented here has effective parental capital stock as an input in the human capital production function. As in Chiswick (1988) effective capital stock reflects parental time, capturing the

conflict between parental wants and their desires in regard to their children, since investment in the child represents foregone consumption. In addition to this input average neighbourhood human capital enters as an externality in the human capital production function for the child. A similar technique has been used in the literature on ethnicity (Borjas, 1992). The justification for this formulation in this setting reflects the discussion of Jencks and Mayer (1990) in chapter 1.

2.2 The model.

The model has two stages. In the first stage a composite parent chooses between two neighbourhoods, and pays an endogenously determined housing price. In the second stage he/she observes the first stage decisions of all agents, and chooses the optimal share of his/her human capital that is allocated to the production of human capital in a single child to maximise a utility function over own consumption of a composite good and child's capital stock. Neighbourhood human capital does not enter directly into the utility function, but through its effect on child's capital stock. Specifically, average neighbourhood human capital enters as an externality in the technology transferring human capital between generations. Parental time and average neighbourhood human capital are thus complements in the production of child's human capital.

The parent has capital stock k_i^p and consumption parameter α_i with $i \in$(high,low), and $\alpha_H < \alpha_L$. For more on the interpretation of α_i see Chapter 1. Income is determined by the respective capital stock and the competitively determined rate of return to human capital, R. Potential income is either consumed, invested in the child directly, or used to pay housing costs h, and the corresponding budget constraint is given by equation (2). The child has capital stock k_z^c, which results directly from the parent using a share s of his/her human capital to invest in the child, and the average human capital of neighbourhood z. In particular, the technology transferring parental human capital to child's human capital is a Cobb-Douglas production function with inputs sk_i^p and average neighbourhood human capital, $\bar{k}_z$, with $z \in (1,2)$. Though not strictly necessary, for convenience both neighbourhoods contain the same number of single-family homes, and the proportion of high human capital parents in the population is given by μ.

2.2.1 The Second Stage.

In the second stage the parent chooses s to maximise utility over parental consumption and child's capital stock. We have:

$$U(C_i^p, k^c) = \alpha_i C_i^p + \ln k^c \tag{1}$$

$$R(1-s)k_i^p - h_z = C_{iz}^p \tag{2}$$

$$k_z^c = (sk_i^p)^\beta \bar{k}_z^\delta \tag{3}$$

where utility function (1) is maximised subject to budget constraint (2) and technology (3). We solve by backward induction. In the second stage plugging (2) and (3) into (1) and maximising with respect to s yields equation (4) for s_i^*.

$$s_i^* = \frac{\beta}{\alpha_i R k_i^p} \tag{4}$$

Hence, s_i^* increases as the technology transferring human capital between generations improves, and decreases as the weight on current consumption increases. s_i^* also decreases as current return to human capital increases, and as capital stock increases. The latter result follows from the quasi-linear utility function used; the result would not be desirable in a theory paper, but since the aim here is just to provide some guidance for interpreting the empirical results the simplification is warranted.

2.2.2 The First Stage.

In the first stage parents choose their neighbourhood. Absent landlords allocate housing to the highest bidder, and housing price h_z consequently adjusts according to the agents' bid rents. In the first stage, conditional on s_i^*, we need to determine equilibrium house prices and configuration. As in the majority of papers dealing (see Benabou, 1996) with a binary choice for location the equilibrium configuration is derived, along with the difference in housing costs such that no person has an incentive to move. The base level of housing costs could be pinned down by further impositions, but this is not necessary here. The indirect utility of high and low human capital parents for a general configuration of agents is given by equation (5):

$$V_{iz} = \alpha_i R k_i^p - \beta - \alpha_i h_z + \beta \ln(\frac{\beta}{\alpha_i R}) + \delta \ln \bar{k}_z \tag{5}$$

To obtain the equilibrium configuration we calculate bid rent functions $\psi_i(z,u)$. These functions are specified for all utility levels for both types of parent, and just measure the maximum amount a person residing in neighbourhood z can pay and achieve utility level u. We can just invert the indirect utility function from equation (5) to yield $\psi_i(z,V)$.

$$\psi_i(z,V) \equiv h_{iz} = Rk_i^p - \frac{\beta}{\alpha_i} + \frac{\beta}{\alpha_i}\ln(\frac{\beta}{\alpha_i R}) + \frac{\delta}{\alpha_i}\ln \bar{k}_z - \frac{V_{iz}}{\alpha_i} \tag{6}$$

Clearly the configuration with half of the high human capital parents in both neighbourhoods is an equilibrium. Furthermore, all agents would pay the same housing cost, which would pin down the utility levels attained by the two sets of agents. However, this configuration is not a stable equilibrium, since the movement of a sole agent sets in motion a process ultimately leading to segregation in at least one neighbourhood. If one agent moves, such that one neighbourhood has a better human capital externality, that neighbourhood will command a house price premium over the other neighbourhood. Since rich families are more willing to trade a higher housing price for the beneficial externality, further moves occur, and the process will continue until one neighbourhood is segregated. Formally, for sorting like this to occur we need equation (7) to hold. It follows from equation (6).

$$\frac{d\psi_H(.)}{d\bar{k}} \succ \frac{d\psi_L(.)}{d\bar{k}} \tag{7}$$

Which neighbourhood is completely segregated depends of course on μ, the proportion of high human capital parents within the population. If μ>1/2 then the segregated neighbourhood contains all high human capital parents, with a mix in the other neighbourhood, and if μ<1/2 the converse is true. Naturally, if μ=1/2 then both neighbourhoods are segregated, but this trivial case is not considered further here. The house price differential such that no agent wishes to move is found by equating the indirect utility across neighbourhoods for the agent type that resides in both neighbourhoods. If μ<1/2 then we need equation (8) to hold.

$$V_{L1} \equiv \alpha_L Rk_L^p - \beta - \alpha_L h_1 + \beta\ln(\frac{\beta}{\alpha_L R}) + \delta\ln\bar{k}_1 =$$

$$\alpha_L Rk_L^p - \beta - \alpha_L h_2 + \beta\ln(\frac{\beta}{\alpha_L R}) + \delta\ln\bar{k}_2 \equiv V_{L2} \tag{8}$$

If we denote neighbourhood 1 as the segregated one then the house price differential is given by equation (9), and the associated difference in utility levels between human capital types by equation (10).

$$h_2 - h_1 = \frac{\delta}{\alpha_L}[\ln(\bar{k}_2) - \ln(k_L)] \tag{9}$$

$$V_H - V_L = \alpha_H R k_H - \alpha_L R k_L + (\alpha_L - \alpha_H)h_2 + \beta[\ln(\frac{\beta}{\alpha_H R}) - \ln(\frac{\beta}{\alpha_L R})] \tag{10}$$

2.3 The implications for the empirical investigation.

The child's income is given by equation (11).

$$y_{iz}^c = R^c(\frac{\beta}{\alpha_i R})^\beta \bar{k}_z^\delta \tag{11}$$

$$\ln y_{iz}^c = \ln R^c + \beta \ln(\frac{\beta}{\alpha_i R}) + \delta \ln \bar{k}_z \tag{12}$$

The model has only two types of parent, and hence two values for α_i. If, in anticipation of the empirical investigation we write $\alpha_i = \alpha(y_i)$, equation (12) becomes:

$$\ln y_{iz}^c = \ln R^c + \beta \ln(\frac{\beta}{\alpha(y_i) R}) + \delta \ln \bar{k}_z \tag{13}$$

This equation, whilst simplistic, highlights the challenges to be faced in the following empirical section. Higher parental income leads to higher investment through the taste factor, with the taste factor associated with higher income also a key driver for location choice, which determines the externality effect received. It is in distinguishing the neighbourhood externality effect from the investment effect that the difficulty lies. If location were just set exogenously then the problem is trivial, but of course in reality we must recognise the endogeneity of neighbourhood choice. In what follows we include family background controls, since otherwise neighbourhood effects could just be picking up the effect of parental tastes or related factors. In reality we have to allow for the possibility that such tastes vary within human capital type for the parent, and would still expect parental income to have an effect even after controlling for neighbourhood and family background. Naturally, the

implication that the effect of an increase in parental income is felt through the impact on tastes is too strong for the empirical investigation, even if the simplifications considered in the model have helped clarify how the intergenerational transfer takes place. Higher parental income leads to higher effective investment, partly through the taste factor. The taste factor is also a major driver of neighbourhood choice, which determines the neighbourhood human capital externality that the child experiences. Family background controls will be included in the coming analysis to aid with identification of the neighbourhood effect, and we would expect the majority of the reason parental income is important to be picked up by the family background controls and neighbourhood characteristics. To the extent that tastes (and therefore investment) vary within human capital type parental income will still have a residual effect.

3. Data

3.1 Introduction.

It is clear that to rigourously examine intergenerational links with respect to the effect of neighbourhood we need a broad dataset. In particular, we need measures of individual and parental income or earnings, as well as socioeconomic characteristics for the relevant neighbourhood. Furthermore, these requirements are complicated by the fact that parental earnings and neighbourhood characteristics must be available for the appropriate time periods. Since we are attempting to ascertain the impact of the neighbourhood where an individual grows up on later earnings, it is necessary to have the parental and neighbourhood information for the time period when the individual was growing up, in conjunction with earnings data from later life. It seems incredibly unlikely that any one dataset will have all the requisite information, and this has meant that investigations of intergenerational mobility have largely been confined to the simplest correlations of individual earnings on parental earnings, with no attempt to examine the different mechanisms suggested by theory. (Solon, (1992) or Zimmerman (1992) for the US, and Atkinson *et al* (1983) or Dearden *et al* (1997) for the UK). Fortunately, the longitudinal nature of the NCDS data used for individual and parental information in this chapter means it has indicators for area of residence for the appropriate time period. It is possible to use these indicators to map in the socioeconomic data we need from a separate dataset, such as the UK census. The UK census is carried out every decade in the second year, so the NCDS children were 13 when the 1971 census was carried out, which means that the census data is ideal for the requirements of this chapter. This section describes in detail the two datasets used in this investigation and discusses the variables to be used in estimating the empirical model. Summary statistics for these variables are also presented, and issues of representativeness discussed.

3.2 The NCDS data.

3.2.1 Information on sons.

The NCDS is a continuing longitudinal survey of persons living in Great Britain who were born between 3rd and 9th of March in 1958. There have been 6 waves of the NCDS, with the last survey having been undertaken in 2000, when the cohort members were 42 years of age. However, at the time of writing only the data from the 5th sweep in 1991 were available, and all sons were 33 years of age in 1991. The NCDS is a particularly rich dataset, with the

longitudinal nature meaning we have access to a substantial amount of information from various time periods. The questionnaires in the first 3 sweeps, in 1965, 1969 and 1974, were filled out by the individuals' parents and to a lesser extent by the individuals' head-teachers. In 1981 and 1991 the questionnaires were completed by the individuals themselves, meaning we have access to information on their labour market outcomes, which can be considered in conjunction with earlier information on education. Note that despite the availability of information on mothers and daughters, this chapter considers father & son pairs, due to the difficulties involved with utilising female wage data.

The NCDS5 survey has information on gross pay, time relevant to that gross pay, and hours worked a week necessary to construct gross hourly wage data. In addition we can obtain information on son's months of completed schooling up to 1981 in NCDS4. This is a derived variable, with information constructed by the NCDS team a couple of years after the survey in 1981. One can also use the NCDS5 and NCDS3 surveys to construct 11 regional dummy variables for 1991 and 1974 respectively. We also have information on inherent ability from NCDS1-NCDS3 in the form of the results of mathematics and english tests from the ages of 7-16.

3.2.2 Parental information.

The NCDS has an advantage over some datasets used in similar investigations in that the parental information is not recorded retrospectively. We also have a variety of data on family background, with information on social class and socioeconomic group being available for 1969 (NCDS2) and 1974 (NCDS3) for fathers. Unusually, there is also information in NCDS3 on completed years of schooling. It is also possible to deduce the father's age from information in NCDS1, which is necessary to remove age effects from the wage data. In addition we have information on whether the family experienced financial difficulties in 1969 and 1974, whether the mother worked in 1974, and whether the family lived in council provided accommodation in 1974. Good family background information is critical when trying to find evidence of neighbourhood effects, since the US studies that do find evidence are immediately subject to the criticism that community variables are proxying for unobservable family background variables. NCDS4 also has indicators for 1981 and 1971 area of residence. Indicators are available at several distinct levels, including parliamentary constituency, local authority, and electoral ward. It is these three indicators which are used to map in the socioeconomic neighbourhood characteristics for 1971 from the census data discussed below.

However, the father's wage data are a weak part of the NCDS dataset with regard to this chapter. We only have one measure of father's wage, in 1974, and the data is banded into

12 bands, with the top band having no upper limit. Overall it would appear that this disadvantage is outweighed by the amount of information we have on both father and son, but some steps to combat the disadvantage will have to be taken. Dearden *et al* (1997) were also concerned with this problem, and compared the NCDS earnings data for fathers with similar earnings data from the 1974 Family Expenditure Survey. They estimate simple age-earnings equations from both datasets and conclude the NCDS wage data for fathers is representative of wages for 1974. Another potential problem is that the NCDS suffers from attrition, as would be expected in such an extensive long-running survey. From an original sample of 18,553 in 1958 only 11,407 respondents remained in 1991. Connolly *et al* (1992) examine the possibility of attrition bias in detail; they estimate a binary model to compute the probability of participation in the sample, and use this to correct for potential bias in their equation modelling occupational outcomes. On the basis of these and related calculations they conclude that attrition in the NCDS represents nothing more serious than an efficiency loss. Robertson and Symons (1996) examine the distribution of the test scores at 7 and 11 in regressions on earnings at age 33, with the conclusion that NCDS5 under-samples the lower tail of the distribution, but not by a significant amount. Further issues of representativeness are discussed in section 3.5.

3.3 Census Data.

The census of population is a survey of the whole of the UK population held every ten years, with the April 2001 census being the most recent. The census is administered separately in England and Wales, Scotland, and Northern Ireland, but most of the statistics published are common to all countries. It covers a wide range of topics describing the characteristics of the British population, including demography, households, families, housing, ethnicity, birthplace, migration, illness, economic status, occupation, industry, workplace, transport mode to work, car ownership and language. No other data set provides such comprehensive spatial coverage, and census data are available in computer format for a variety of geographies and spatial scales. The most basic building block is the census enumeration district, with an average of 400-500 residents, and this data is then provided aggregated to less fine areas, such as parliamentary constituency, local authority and electoral ward. In the UK in 1971 there were 623 parliamentary constituencies, 1765 local authorities, and approximately 17,500 electoral wards, with the latter having an average number of residents of 4000-5000.

The actual dataset used to construct the socioeconomic neighbourhood characteristics at the three levels of disaggregation discussed above is the Small Area Statistics (SAS) 1971 dataset. The SAS dataset has three parts: the 100% household survey; the 100% population

survey, and the 10% sample survey. The household survey gathers information on amenities contained within households and details like the number of persons resident compared with number of rooms. There is also information in the SAS on whether the house is owner-occupied or owned by the council, and the economic activity of household residents. We can create ratios for these factors to serve as socioeconomic neighbourhood characteristics, such as proportion of total households that are owner occupied, proportion of households having no hot water and proportion having full amenities available. We can also create variables indicating the proportion of residents that have over 1.5 persons per room.

The 100% population survey has information on the composition of population by age and sex. There is also considerable information on economic activity, also broken down by age and sex. We can construct variables such as proportion of all males economically active, proportion of single females economically active and proportion of married females economically active. It is also possible to construct variables measuring the proportions of all males, single females and married females that are in work, and the proportions that are unemployed or sick.

The 10% sample data, as the name would suggest, results from a survey of 10% of each area in question. This sampling allows for a more detailed survey, and as long as the average number of residents for each level isn't too small there shouldn't be a problem with using these data. Since electoral wards, which represent the highest level of data disaggregation used, have on average 4000-5000 residents, there is no cause for concern. The 10% sample data contains more information on economic activity, this time broken down by sex and social class, of which there are 7 built from 17 socioeconomic groups. We can use this information to construct variables such as proportion of employed males that are unskilled, or proportion of employed males that hold professional posts. We can also use the 10% sample to calculate the proportion of single parent households, and proportion of area population with 'A' levels, as well as the proportion that have degrees. Having discussed both datasets in detail, some summary statistics for the variables constructed from both datasets are now presented.

3.4 Summary statistics.

Table 1:

Variable	Obs	Mean	Std. Dev.	Min	Max
Son's hourly pay (1983 prices)	1679	5.98	9.53	0.79	261.98
Son's weekly pay (1983 prices)	1679	258.40	382.24	31.5	9693.28
Father's weekly pay (1983 prices)	1679	109.44	36.85	6.04	207.83
Father's age (1974)	1679	46.19	5.75	33	72
Father's age squared (1974)	1679	2166.38	556.57	1089	5184
Father's years of education	1656	10.02	1.93	7	18
Son's experience	1679	14.71	2.91	1	18
Son's experience squared	1679	224.91	75.3	1	324
Son's years of education	1675	12.07	1.99	9.67	20.5
Financial difficulties (1974)	1674	0.05	0.23	0	1
Living in council house (1974)	1679	0.37	0.48	0	1
Mother working (1974)	1679	0.7	0.46	0	1
Father's social class 1 (1974)	1653	0.06	0.23	0	1
Father's social class 2 (1974)	1653	0.21	0.41	0	1
Father's social class 3 (1974)	1653	0.11	0.31	0	1
Father's social class 4 (1974)	1653	0.44	0.5	0	1
Father's social class 5 (1974)	1653	0.01	0.12	0	1
Father's social class 6 (1974)	1653	0.13	0.34	0	1
Father's social class 7 (1974)	1653	0.04	0.19	0	1
Region1(74)	1679	0.10	0.30	0	1
Region2(74)	1679	0.08	0.27	0	1
Region3(74)	1679	0.07	0.26	0	1
Region4(74)	1679	0.09	0.28	0	1
Region5(74)	1679	0.09	0.29	0	1
Region6(74)	1679	0.16	0.37	0	1
Region7(74)	1679	0.08	0.27	0	1
Region8(74)	1679	0.07	0.25	0	1
Region9(74)	1679	0.09	0.29	0	1
Region10(74)	1679	0.06	0.23	0	1
Region11(74)	1679	0.12	0.33	0	1

Table 1 shows summary statistics for fathers and sons for a sample of sons in full time employment at the time of the 5th NCDS sweep in 1991. We require that full-time wage data for 1974 be available for fathers, along with data on age required to remove age effects from wages, and a local authority identifier for 1971. This leaves us with 1679 individuals, although this will decrease as controls are added. Clearly it is possible to present summary statistics with the requirement that information on the other location identifiers be present, but the results are very similar. Furthermore, issues of representativeness as the required sample selections are made are discussed later.

The variables concerning sons' pay show 1991 wages at 1983 prices. We can see there is enormous variability in the son's wage data, due to a few individuals earning six figure sums annually. Since the means of these variables are bad measures of central tendency, the respective medians are £4.63 and £196.27. In comparison, the weekly wage data for fathers is hardly skewed at all, with a mean of £109.44. We can further see that the average father is 46 years of age, with possible ages ranging from 33 to 72. Furthermore, the average father has 10 years of education, with the lowest value being 7 and the highest being 18. We can also see that sons have a mean of just over 12 years of education, with this variable ranging from 9.67 to 20.5. We also have some family background variables, such as dummy variables indicating whether the family was in financial difficulty in 1974, whether the family lived in a council house in 1974, and whether the mother worked 1974. These variables indicate 5% of families were in financial difficulty in 1974, 37% of families lived in council housing, and 70% of families had the mother working in some capacity. Moving on, we have a range of categorical dummies measuring father's social status in 1974. These variables takes value 1 for father's social class 1 (1974) if the father is a professional. Father's social class 2 indicates intermediate status, social class 3 skilled non-manual, social class 4 skilled manual, social class 5 semi-skilled non-manual, and social class 6 unskilled. These variables indicate individuals with professional fathers make up 6% of the sample. Skilled manual fathers are most prevalent, with 44% of respondents indicating this category.

The regional variables are regional dummies for family region in 1974. These variables just take the value 1 if the individual comes from that region, so we can see the percentage of the sample that lives in each region. Region1 refers to the North-West, region2 the North, region3 East and West Riding, region4 North Midlands, region5 the East, region6 London and South East, region7 South West, region8 South West, region9 Midlands, region10 Wales and region11 Scotland. It is clear that London and the South East is again the most represented, with the South-West and Wales the least.

Summary statistics for the relevant neighbourhood variables at local authority (LA) level are presented below in table 2. All the variables are proportions, such as the variable concerning full amenities, which measures the proportion of houses within the local authority in 1974 that have access to hot water, an inside toilet and a bath. For LA this variable ranges from 50% to 100%, with a mean of 86%. The overcrowding variable measures the proportion of houses that have 1.5 or more persons per room within the house; it has a range of 0.1% to 14%, and a mean of 2%. The variables concerning economic activity measure the proportion of residents over 15 within the LA that are in work or actively seeking work. We can see that for LA the proportion of economically active residents over 15 ranges from 39% to 72%, with a mean of 61%. The corresponding figures broken down by sex are ranges of 55% to 91%,

25% to 61% and 21% to 58% for males, single females and married females respectively. Furthermore, these variables have means of 82%, 43% and 42% respectively.

Table 2:

Variable	Obs	Mean	Std. Dev.	Min	Max
Full amenities	1679	0.86	0.08	0.5	1
Overcrowding	1679	0.02	0.02	0.001	0.14
Economic activity (all)	1679	0.61	0.04	0.39	0.72
Economic activity (males)	1679	0.82	0.04	0.55	0.91
Activity (single females)	1679	0.43	0.05	0.25	0.61
Activity (married females)	1679	0.42	0.06	0.21	0.58
Unemployment rate (all)	1679	0.05	0.03	0.01	0.19
Unemployment rate (males)	1679	0.05	0.03	0.01	0.19
Unem. rate (single female)	1679	0.06	0.02	0.01	0.18
Unem. rate (married females)	1679	0.04	0.01	0.01	0.13
Degree	1679	0.08	0.04	0.01	0.36
'A' level	1679	0.11	0.04	0.03	0.48
Professional males	1679	0.17	0.07	0.04	0.61
Unskilled manual males	1679	0.08	0.03	0.01	0.19
Single parent families	1679	0.04	0.01	0.004	0.09
Council Housing	1679	0.33	0.18	0.04	0.96
Persons in council housing	1679	0.35	0.18	0.03	0.96

Similarly, the unemployment rate variables show unemployment rates as a fraction of economic activity for all residents, male residents, single female residents and married female residents respectively. These figures indicate that unemployment rates range from 1% to 19%, with a mean of 5%. Breaking down by sex we can see that male unemployment rates range from 1% to 19%, with a mean of 5%. Similarly, single female unemployment rates range from 1% to 18%, with a mean of 6%, and married female unemployment rates range from 1% to 13%, with a mean of 4%.

Furthermore, we have information on qualifications within the region. In particular the variable concerning degrees measures the proportion of residents over 15 that have degree level qualifications. Similarly the variable concerning 'A' levels measures the proportion of economically active agents with at least one 'A' level qualification or equivalent. These two variables range from 1% to 36%, and from 3% to 48% respectively; they have means of 8% and 11% respectively. The next two variables concern the proportion of economically active males in the LA that work in either professional or unskilled manual jobs. These variables range from 4% to 61 %, and from 1% to 19% respectively; they have means of 17% and 8% respectively. The next variable measures proportion of families in LA headed by a single parent, and ranges from 0.4% to 9% with a mean of 4%. Lastly we have two variables which

measure proportion of housing in LA owned by the relevant council, and proportion of persons within LA that reside in such housing. These variables range from 4% to 96% and 3% to 96% respectively, with means of 33% and 35%.

3.5 Representativeness.

Because of the stringent sample selection requirements for the purposes of this chapter issues of representativeness are relevant. Below are summary statistics for the key variables on fathers and sons as the sample selections necessary for this chapter are undertaken.

Table 3:	Fathers					
	Weekly Pay	**Sample**	**Weekly Pay (2)**	**Sample**	**Years of education**	**Sample**
All	109.24 (38.05)	8390	109.24 (38.05)	8390	9.99 (1.94)	11092
+Son	108.67 (37.81)	4327	108.67 (37.81)	4327	9.97 (1.92)	5688
+ Son in full-time employment	109.15 (36.76)	2106	109.15 (36.76)	2106	10.06 (2.01)	2702
+Father's age (74)	109.23 (36.74)	1982				
+Region(74)	109.23 (36.74)	1982				
+Location (LA/Ward)	109.44 (36.85)	1708			10.06 (2.01)	2376
+Location (PC)			109.4 (36.84)	1730		
+Son's years of education					10.05 (2)	2370
+Father's years of education	110.24 (36.52)	1681	109.42 (36.9)	1708		
+Father's soc.class(74)	110.13 (36.57)	1659	109.27 (36.91)	1682		

The tables in this subsection for fathers and sons have similar formats. We start with the descriptive statistics for weekly pay and years of schooling for the whole NCDS sample, and then see the effect on both these descriptive statistics and sample sizes of adding

requirements. There are two columns containing information on weekly pay, since it is possible that requiring individuals to have location information for parliamentary constituency may lead to different results than requiring information on LA or Ward. We can consider LA and ward together since electoral ward is a subset of LA, so information on ward being present implies information on LA being present. Having two columns also allows us to see the effect of looking at different combinations of restrictions.

We can see from table 3 above that father's weekly pay remains representative as the required sample selections are made, and the same can be said for years of schooling.

Table 4:	Sons					
	Weekly pay	**Sample**	**Weekly pay**	**Sample**	**Years of schooling**	**Sample**
All in Full-time employment	251.85 (374.39)	3755	251.85 (374.39)	3755	12 (1.93)	3195
+Father's pay	257.7 (380.92)	2106	257.7 (380.92)	2106	12.07 (1.98)	1859
+Location (LA/Ward)	266.35 (419.59)	1812			12 (1.93)	3179
+Location (PC)			256.28 (375.36)	1833		
+Father's age (1974)	266.89 (426.07)	1711				
+Region(74)	266.89 (426.07)	1711				
+Father's Years of education	262.53 (410.69)	1678	254.31 (365.83)	1807	12.03 (1.95)	2368
+Father's social class (1974)	261.91 (413.86)	1659	252.78 (363.44)	1779		

We can see from table 4 that son's weekly wage tends to increase slightly as the relevant sample selections are made. Since unemployment is very low amongst fathers in the sample most of the fall in sample size observed as we add the requirement of father's pay being observed is due to employed fathers having missing observations on wages. However, these results suggest that consideration of the role of possible unemployment in intergenerational mobility may prove fruitful, and this is covered in section 6. Also discussed later is the possibility that the endogenous nature of the participation decision may bias any

results obtained. This problem is not relevant to fathers, due to their low unemployment rate, but it is relevant for sons in 1991. For the purposes of this section it is only important to note from table 3 that fathers wages are representative as sons select themselves into employment.

We can also see from the table above that years of schooling remains representative as the less stringent sample selections necessary to estimate equations concerning the intergenerational transmission of capital stock are made. Having described the datasets in detail the statistical model must be discussed and estimated; this is covered in section 4.

4. Regression results.

4.1 Statistical model and econometric difficulties.

Below the statistical model to be estimated is discussed, along with the problems inherent in such an estimation and potential solutions to those problems. The statistical model specifies son's earnings as depending linearly on a set of family and community background variables:

$$y_{it}^{s} = \beta y_{ir}^{f} + \gamma' X_{ir} + \delta' C_{ir} + \varepsilon_{it} \tag{14}$$

In the equation above y_{it}^{s} represents the log earnings of a son from the i^{th} family in year t, and y_{ir}^{f} the log earnings of the father from the i^{th} family in year r. Furthermore, X_{ir} is a matrix of family background measures, C_{ir} is a matrix of community background variables, and ε_{it} is a standard error term. Possible econometric problems include omitted variables bias if important family and community variables are omitted that are correlated with included variables, and errors in variables biases if any explanatory variables are measured with error (Solon, 1999). The coefficient on father's earnings in various specifications is obviously of particular interest, and an important question here is to what extent short run observed earnings for fathers reflect the long-run status that corresponds to theory. Two techniques for recovering the permanent component of observed wages are presented and evaluated in this section. One issue is that fathers will be at different points in their life-cycle, and this needs to be taken into account by the empirical strategy. We model observed log earnings for fathers as in equation (15), where y_{i}^{f} represents permanent earnings, A_{ir} is father's age, Q_i is a matrix of fixed characteristics such as education, and v_{ir} is a transitory error term.

$$y_{ir}^{f} = y_{i}^{f} + \gamma_1' A_{ir} + \gamma_2' A_{ir}^{2} + v_{ir} = \alpha + Q_i + \gamma_1' A_{ir} + \gamma_2' A_{ir}^{2} + v_{ir} \tag{15}$$

We can then calculate:

$$\hat{y}_{i}^{f} = y_{ir}^{f} - \hat{\gamma}_1' A_{ir} - \hat{\gamma}_2' A_{ir}^{2} = y_{i}^{f} + v_{ir} \tag{16}$$

If we use this residualisation method and regress y_{it}^{s} on $\hat{y}_{i}^{f}$ OLS estimation of β in equation (14) is still subject to an errors-in-variables bias, due to the transitory error in the father's observed earnings. In fact, we can show that the probability limit of the estimate of β understates the true parameter, as shown in equation (17), where $\sigma_{y^f}^2$ and σ_v^2 are the variance in father's permanent income and the transitory component v_{ir} respectively.

$$p\lim \hat{\beta} = \beta \frac{\sigma_{y^f}^2}{\sigma_{y^f}^2 + \sigma_v^2} \tag{17}$$

Whether this tendency for underestimation is pronounced or not critically depends on whether the variance in father's long run status is large in relation to the variance in the transitory components. It is common to average earnings information over several time periods, in order to reduce the 'noise' relative to the 'signal'. This procedure, which is likely to attenuate the bias discussed, is not available using NCDS data as we have a sole measure of father's earnings in 1974.

An alternative technique in empirical economics which is often used when earnings data are missing or insufficient is to predict earnings. Since we have reason to be concerned about the banded earnings data for fathers this idea is worth exploring. We have a wide range of parental characteristics so this technique is applicable here. We can run the regression as in equation (15), then calculate predicted income, denoted as $\tilde{y}_{ir}^{f}$. This technique was introduced in this literature by Dearden *et al* (1997).

$$\tilde{y}_{ir}^{f} = \tilde{\alpha} + \tilde{\phi}' Q_i = y_i - u_i \tag{18}$$

Whether or not this is better than the procedure above depends on us having good enough information on parental characteristics when $\tilde{y}_{ir}^{f}$ may be correspondingly less noisy than $\hat{y}_{ir}^{f}$. This is contentious, but this technique is a worthwhile alternative to the residualisation technique.

Lastly, we must recognise in this section that neighbourhood choice is endogenous. In the literature looking at the effect of neighbourhood in binary choice models it has sometimes been possible to specify a system of equations and find a credible instrument for neighbourhood characteristics (Evans *et al*, 1992). In the intergenerational mobility literature this technique has not been applied, due to the absence of such a credible instrument. The

only probable source for such an instrument would be a natural experiment, but such possibilities are very rare and carry their own pitfalls.

It is a common belief in studies such as these that the bias caused by the endogeneity of neighbourhood choice is likely to lead to the neighbourhood effect being overstated. Consider parents who, for a given income level, care more than average about their child's outcomes relative to their own consumption. Such a family, other things being equal, is likely to live in a better than average neighbourhood, and invest more than average in their child. A single equation model with no family background controls would attribute both effects to the neighbourhood of residence, overstating the actual effect. This is equivalent to arguing that, in an appropriate system of two equations, the covariance of the error terms is positive. It was mentioned earlier that studies such as Datcher (1982) that found evidence of neighbourhood effects have been criticised on the grounds the effects were possibly proxying for unobservable family background, and the significant coefficients result from advantaged families selecting themselves into better neighbourhoods. However imperfect a strategy of using cross-neighbourhood differences to identify neighbourhood effects might be, a line must be drawn between studies that can and cannot attempt to control for family background. Of course, there are precedents in identifying causal effects of arguably endogenous variables through controlling for confounding variables (Angrist and Krueger, 1999). Maintaining such a selection-on-observables assumption is perhaps the most basic of identification strategies open to econometricians, but even so may be preferable in some settings to a questionable instrument.

4.2 Empirical results.

4.2.1 Local authority level.

The results of estimating equation (14) by OLS at the three levels of neighbourhood characteristic disaggregation with several specifications are presented on the next few pages, with father's permanent wage obtained through the residualisation and prediction techniques described in section 4.1. Results are also presented for intergenerational transmission of human capital as measured by years of schooling. Clearly, several of the variables discussed in section 3 are likely to be closely related, resulting in problems of multicollinearity. In particular it was necessary to choose one of the qualification variables, one of the economic activity variables, and one of the unemployment variables. Since 'A' levels were the more standard qualification in the relevant time period, and coefficients on the 'A' level variable were generally more significant than those on the degree variables, the 'A' level variable was preferred. Furthermore, coefficients on female activity were generally insignificant for this

sample of males. Similarly, the chapter focuses on male unemployment rates over general or female unemployment rates, with area male unemployment consistently being a significant variable in explaining male wages.

In addition to the obviously correlated variables above, there were some other choices that needed to be made. In particular the variable measuring proportion of workers that were professional or managerial was insignificant in conjunction with the 'A' level variable, but significant if included by itself. This isn't overly surprising, and the latter was chosen as being the more consistent with the underlying theory, as well as being the better defined variable. Again, the 'A' level variable was generally more significant than the variable measuring proportion of professional workers, and it seems likely that qualifications are driving the significant coefficient on the latter variable anyway. The final choice to be made was between proportion of council houses in the LA and proportion of people resident in council houses in the LA. The former was chosen, since we have a separate variable measuring the impact of overcrowding.

All results presented in the following tables have the log of son's wages as the dependent variable, and the father's residualised log wage as an explanatory variable. We initially present some results on simple regressions of son's wage on father's wage, including those from Dearden *et al*, (1997) for comparison in table 5a, before presenting new results in table 5b. Note table 5b has six separate specifications, with the first five specifications being estimated by OLS, and the sixth by maximum likelihood. The first specification has all eight neighbourhood characteristics, whereas the second retains only the variables with significant coefficients. The third specification includes three family background measures as controls, with the fourth specification adding father's squared residualised wage. The fifth specification adds son's years of schooling to the regression, and finally the sixth specification looks at selectivity bias. Examining the specifications in turn, we can see from the first column that there are some immediate casualties amongst the neighbourhood characteristics. In particular the coefficients on the variables concerning proportion of residents that live in council housing, proportion of population with full amenities, and proportion of active males employed in unskilled manual jobs are all insignificant.

The data clearly rejects that the variables concerning amenities and council housing have any impact on wages. It is understandable that the proportion of housing with full amenities has no effect on wages after controlling for the other socioeconomic characteristics, but *a priori* it seemed likely that the proportion of council housing in the LA in 1971 would have an impact on son's 1991 wages. One can only presume that it is one of the other characteristics of areas with significant numbers of council house dwellers that drive any immobility, since the data clearly rejects any link with wages in all regressions after other significant characteristics are present. Moving on, the third failure is more complicated, since

further experimentation shows that proportion of unskilled manual workers in LA in 1971 can have a significant effect on son's 1991 wages, with a coefficient of a similar order of magnitude as that on male unemployment rate. However this is only the case in a specification where the male unemployment rate is not included. These two variables are not obviously related, and were expected *a priori* to have independent effects on wages, so this result is interesting. A recent theme in several sociological papers (e.g Hills and Atkinson, 1998) on income inequality and social exclusion is that employment itself is insufficient to ensure social inclusion if that job has low pay, perhaps with income supplements, and no real prospects for advancement. This result does suggest the possibility that benefit receipt or perhaps low human capital are driving the results, although it is impossible at this stage to say how these effects are transmitted between generations. The unemployment variable is retained due to it being consistently more significant, and having the higher R-squared with this specification.

Moving on to the second column, this specification passed a standard heteroscedasticity test, and all variables are significant at a 5% level. In the absence of misspecification we can discuss magnitude of coefficients and standard errors. We can see that the coefficient on father's residualised log wage is 0.117, indicating that controlling for the neighbourhood characteristics there is still a substantial relationship between earnings of the two generations. Since this coefficient is an elasticity, the inference is that disregarding the role of neighbourhood a 10% increase in father's wages leads to a 1.17% increase in son's wages. That this coefficient is still reasonably large is to be expected, since the role of parents in human capital investment other than through location choice is likely to be critical. Looking at the coefficients of the neighbourhood characteristics themselves we can see that male unemployment rate within the LA has a large and significant effect on wages. The coefficient of 1.7 here suggests that a 1% increase in the proportion of active males over 15 that were unemployed in the LA in 1971 leads to a 1.7% decrease in son's 1991 wages. Similarly, the coefficient on male economic activity suggests that a 1% increase in the proportion of economically active males over 15 in the LA in 1971 leads to a 1.04% increase in son's 1991 wages. It is intriguing that economic activity and unemployment have independent effects on wages, and this point is discussed further later. Moving on, we can see that a 1% increase in the proportion of LA population with 1 'A' level or more increase son's wages by 1.25%. Furthermore, a 1% increase in the proportion of houses that are overcrowded on the earlier definition leads to a very small decrease in son's wages. Lastly, a 1% increase in the percentage of families headed by a single parent leads to a 1.05% decrease in son's wages.

Table 5a:		
	Son's wage	Son's wage (Dearden *et al*, 1997)
Father's residualised weekly wage	0.24 (0.03)	0.22 (0.21)

Table 5b:	Results (LA)					
	Son's wage. (1)	Son's wage. (2)	Son's wage. (3)	Son's wage. (4)	Son's wage. (5)	Son's wage. (6)
Father's residualised weekly wage.	0.117 (0.038)	0.117 (0.038)	0.072 (0.04)	0.104 (0.046)	0.034 (0.023)	0.065 (0.032)
Male unemployment rate in LA	-1.635 (0.799)	-1.736 (0.849)	-1.459 (0.684)	-1.49 (0.684)	-1.553 (0.679)	-1.375 (0.706)
Male economic activity in LA (as prop. of males >15)	1.077 (0.508)	1.043 (0.506)	0.939 (0.506)	0.921 (0.507)	1.002 (0.506)	0.857 (0.416)
Proportion of LA pop. with 1 'A' level or better.	1.189 (0.380)	1.247 (0.341)	1.022 (0.306)	0.959 (0.308)	0.922 (0.305)	0.974 (0.318)
Proportion of LA pop. in overcrowded housing	-0.002 (0.001)	-0.001 (0.0005)				
Proportion of LA with full amenities.	0.067 (0.206)					
Proportion of families in LA headed by single parent	-1.017 (0.455)	-1.053 (0.455)				
Proportion of residents in LA living in council housing	-0.022 (0.095)					
Proportion of unskilled manual workers (male)	-0.878 (0.748)					
Father's squared residualised wage				0.086 (0.042)		
Sons's years of schooling					0.038 (0.007)	
Financial difficulties (1974)			-0.132 (0.058)	-0.133 (0.058)	-0.12 (0.058)	-0.13 (0.062)
Living in council house (1974)			-0.107 (0.027)	-0.098 (0.028)	-0.074 (0.028)	-0.095 (0.029)
Dummy for mother working			0.049 (0.024)	0.056 (0.028)	0.047 (0.028)	0.063 (0.025)
Constant	-0.788 (0.425)	-0.714 (0.354)	-0.570 (0.332)	-0.569 (0.332)	-1.115 (0.343)	-0.493 (0.352)
R-squared	0.033	0.033	0.045	0.048	0.065	N/A
Sample Size	1656	1656	1651	1651	1647	1651

One of the first and most telling criticisms levelled at the few papers that have tried to investigate the role of location choice as an intergenerational transmission mechanism is that significant coefficients of neighbourhood characteristics are a result of these characteristics proxying for unobserved family background characteristics, through the fact that individuals may select themselves into their neighbourhood. Consequently, column 3 presents a set of results with 3 family background controls added for comparison with the results discussed previously. When the controls were added the coefficients on the overcrowding and single parent family variables became insignificant, so they are dropped in this specification. The coefficients on all the remaining variables are still significant at the 5% level. Looking at the results in column 3 we can see that the coefficient on father's wage falls from 0.117 to 0.072. The coefficients on male unemployment rate and male economic activity fall to –1.46 and 0.94 from –1.7 and 1.04 respectively. The falls in the magnitude of the coefficients as controls are added is to be expected, since some of the correlation between the neighbourhood characteristics and son's wages would have been reflecting omitted variables bias. However, the continuing significance of the remaining coefficients is reassuring, and the magnitudes are still quite substantial. The coefficients on the controls themselves are also useful. We can see that one's family being in financial difficulties in 1974 is associated with 13.2% lower wages in 1991, and that living in a council house is associated with 10.7% lower wages. We can also see that having a working mother leads to a 4.9% increase in wages. It is intriguing that being in financial difficulties in 1974 has the largest impact of any of the dummies, especially given that father's wage is already included in the regression. This again raises the possibility that benefit receipt, probably in the form of supplementary income for low wage earners, may be important here over and above wage levels. Also interesting is the significant coefficient on the council house variable, given that the corresponding neighbourhood characteristic was insignificant. The negative effects of living in a council house, regardless of how these effects manifest themselves, could be confined to own experience. Alternatively, whatever may be thought to drive the potential negative effect of the corresponding neighbourhood characteristic could be better captured by the significant neighbourhood variables in the regression. The positive coefficient on mother working is also of interest, since it is often suggested (Ermisch and Francesconi, 2001) that, controlling for the effect of the increase in family income, the mother working decreases child's educational attainment. Hence there are two effects to mother working that move in different directions, and these results would suggest the overall impact is a favourable one.

Moving on, it is also interesting to estimate the model with father's squared wage included, as in column 4. The justification for such a procedure is concern about whether the constant elasticity assumption embedded in the linear model is correct. Some authors have suggested that intergenerational immobility might be more marked at the tails, finding that

mobility is limited when parents have higher incomes. The coefficient on squared residualised wage here indicates a concave relationship between wages of different generations, as is consistent with the discussion above.

Column 5 adds son's years of education to column 3, to attempt to ascertain the extent to which father's wage and neighbourhood socioeconomic characteristics impact through their effect on schooling. Interestingly, it is not the coefficients of the neighbourhood characteristics that fall when son's years of schooling is added to the regression, but rather the coefficient of father's wage. Furthermore this coefficient now has a p-value of 0.14. It is probable that controlling for neighbourhood father's income is important mainly through the ability to buy inputs in the human capital accumulation process, like further education or perhaps private tuition. However we must be cautious in interpreting these results, as years of schooling is endogenous. More direct results are presented later in table 7.

Column 6 attempts to ascertain whether the fact that sons select themselves into employment could bias the results. This problem is more critical than usual for this investigation, since we would like to be able to compare the extent of intergenerational mobility for those at the bottom of the income distribution for whom there are no observations on wages with that observed for those earning wages. Section 5 later extends the analysis to consider individuals at the bottom of the latent wage distribution, and ascertaining the level and direction of selectivity bias here makes any comparison more compelling. Such a procedure is possible, if we have the data to specify an explicit model for the participation decision, and can then estimate the entire system by maximum likelihood. In practice this is difficult, and Heckman's two stage technique is utilised to provide good starting values and assess the consistency of the results. To use this technique first a binary participation equation is estimated by maximum likelihood, then the inverse Mill's ratio is added to the second stage OLS regression. The results of the maximum likelihood estimation are presented in column 6. The results suggest that the magnitudes of the coefficients of the neighbourhood characteristics are slightly smaller, as well as the coefficient on father's income. Overall it would seem that selectivity problems are minimal.

Having discussed the results obtaining father's permanent wage through residualisation, the results using predicted wage are presented in table 6b. Once again we present results from Dearden *et al* (1997) for comparison in table 6a. Note we have more observations in the results presented in table 6b as it is possible to predict wages for fathers with missing observations on wages but observations on the characteristics used to predict wages. Table 6b is similar in structure to the previous one, with different columns representing different specifications of the model. This time column 1 shows the results after the insignificant neighbourhood characteristics have been dropped, with the only difference in specification from the previous specification being that the overcrowding variable is

insignificant here even before the controls have been added. We are left with the same 4 variables as before, which are all significant at the 5% level, except the coefficient on the variable measuring proportion of families headed by single parent in LA, which has a p-value of 0.07. However, there are some differences in the magnitude of coefficients. In particular the coefficient on father's wage has risen to 0.267. This is to be expected, since as discussed in section 3 the estimate of this coefficient is likely to be downward biased when residualised wages are used in the second stage regression.

Table 6a:		
	Son's wage	Son's wage (Dearden *et al*, 1997)
Father's predicted weekly wage	0.44 (0.035)	0.43 (0.027)

Table 6: OLS results (LA)				
	Son's wage. (1)	Son's wage (2)	Son's wage. (3)	Son's wage. (4)
Father's predicted weekly wage.	0.267 (0.045)	0.219 (0.048)	0.201 (0.046)	0.133 (0.066)
Male unemployment rate in LA	-1.57 (0.67)	-1.15 (0.569)	-1.15 (0.567)	-1.16 (0.589)
Male economic activity in LA (as prop. of males >15)	1.073 (0.455)	1.010 (0.451)	1.012 (0.450)	1.060 (0.448)
Proportion of LA pop. with 1 'A' level or better.	0.911 (0.277)	0.916 (0.276)	0.895 (0.276)	0.817 (0.275)
Proportion of families in LA headed by single parent	-0.815 (0.351)	-0.754 (0.692)		
Son's years of schooling				0.034 (0.006)
Financial difficulties (1974)		-0.080 (0.04)	-0.082 (0.04)	-0.074 (0.039)
Living in council house (1974)		-0.064 (0.025)	-0.063 (0.025)	-0.045 (0.025)
Dummy for mother working		0.058 (0.023)	0.058 (0.023)	0.054 (0.023)
Constant	-1.804 (0.354)	-1.597 (0.360)	-1.593 (0.36)	-1.645 (0.358)
R-squared	0.039	0.046	0.045	0.058
Sample Size	2123	2110	2110	2105

Moving on to the neighbourhood characteristics, the coefficient on male unemployment rate in LA in 1971 is –1.57, compared to –1.74 before. The coefficient on economic activity is virtually unchanged, rising slightly from 1.04 to 1.07. The coefficient on proportion of population with 1 'A' level or more in LA is lower, falling from 1.25 to 0.9. Finally the coefficient on proportion of families in LA headed by a single parent is lower, 0.82 compared to 1.05. All things considered, the fact that the same variables are significant with the two methods of recovering permanent wage is reassuring, and the differences in magnitudes of coefficients are for the most part unremarkable. As before, it is necessary to see how the results are altered by the addition of family background controls, and these results are presented in column 2. Note the coefficient on proportion of families in LA headed by a single parent is now insignificant, so the results of the well-specified model in column 3 with this variable dropped will be discussed. The coefficient on father's predicted earnings falls from 0.27 to 0.2 as the controls are added, a similar percentage fall to that observed when residualised wages were used. Moving on, the coefficient on male unemployment rate falls from -1.57 to -1.15 as the controls are added, which is a slightly larger fall in percentage terms than experienced in the previous set of results. The coefficient on male economic activity falls from 1.07 to 1.01, a slightly smaller fall in percentage terms than in the previous set of results. Lastly, the coefficient on proportion of LA with 1 'A' level or more falls from 0.92 to 0.9, a smaller fall in percentage terms compared with the analogous fall in the previous set of results. As before all remaining coefficients are significant at the 5% level. The coefficients on the controls are for the most part slightly smaller when father's predicted wage is used, with the coefficient on financial difficulties in 1974 falling from –0.132 to –0.082, the coefficient on living in a council house in 1974 falling from -0.107 to -0.063, and the coefficient on mother working increasing to 0.058 from 0.049.

As with the previous set of results column 4 adds son's years of education, to assess the impact on the significance and magnitude of all coefficients discussed. Again we can see that the coefficients on the neighbourhood variables are virtually unchanged, with a large fall from 0.2 to 0.13 being observed in the coefficient on father's predicted earnings. This is a slightly smaller fall in percentage terms than was observed before, and the variable is on the borderline of significance at the 5% level, suggesting the variables included may not capture all of the reason why father's wages are important. However, overall it seems these results paint a similar picture to the previous set.

Having discussed intergenerational transmission of earnings, results based on intergenerational transmission of capital stocks themselves are now presented. This is of interest since we would like to ascertain any links between the intergenerational correlations in wage and capital stocks. There have been several papers in this area, most notably Kremer (1997) for the US. From the neighbourhood characteristics it seems most reasonable to take

proportion of LA with 1 or more 'A' levels as the variable proxying for neighbourhood capital stock.

Again there are several columns in the table 7 below, which considers the intergenerational transmission of human capital. The first just includes father's years of education and neighbourhood education. The results here indicate that each extra year of father's education translates into one third of a year more schooling for sons. Furthermore the coefficient of 3.2 on proportion of LA with 1 or more 'A' levels suggests that increasing neighbourhood human capital by 1% increases son's education by 0.032 years. It is interesting to see how these results change as controls are added. The second column adds in family background measures, and these results suggest these other family background measures account for a small part of the intergenerational correlation in capital stocks, since the coefficient on father's years of education falls to 0.27. However, the coefficient of neighbourhood education is stable. Moving on, the third column adds information on individual ability, in response to which the coefficient on father's years of education exhibits a further small fall to 0.24. Furthermore, the coefficient on neighbourhood human capital falls in this specification to 2.71, suggesting that neighbourhood and father's human capital are slightly less important after taking individual ability into account. The theoretical model and the results presented thus far would suggest that more educated fathers have more income, and thus more resources for human capital investment in the child both directly and through location choice. These results are consistent with this hypothesis, with the hitherto unexplored result that there are indeed location based human capital externalities in the human capital accumulation process for the child.

Table 7:	OLS results (LA)		
	Son's yrs of education (1)	Son's yrs of education (2)	Son's yrs of education (3)
Father's yrs of education	0.32 (0.014)	0.27 (0.014)	0.237 (0.015)
Proportion of LA with 1 or more 'A' level	3.198 (0.608)	3.231 (0.6)	2.712 (0.614)
Financial difficulties (1974)		-0.379 (0.096)	-0.193 (0.099)
Living in council house (1974)		-0.624 (0.056)	-0.513 (0.057)
Maths test score			0.099 (0.013)
Reading test score			0.043 (0.004)
Constant	8.333 (0.143)	9.097 (0.154)	7.91 (0.174)
R-squared	0.123	0.153	0.216
Sample Size	4483	4454	3976

Having discussed the results at LA level it is necessary to see how the level of data disaggregation at which neighbourhood characteristics are calculated affects the significance and magnitude of the coefficients discussed. Since the results for the intergenerational transmission of capital stocks are stable the results from estimating this model at other levels are not included.

4.2.2 Parliamentary Constituency level.

Table 8:	OLS results (PC)			
	Son's wage. (1)	Son's wage. (2)	Son's wage. (3)	Son's wage. (4)
Father's residualised weekly wage.	0.112 (0.039)	0.073 (0.034)	0.036 (0.021)	0.104 (0.043)
Male unemployment rate in PC	-1.507 (0.498)	-1.159 (0.505)	-1.069 (0.501)	-1.135 (0.505)
Male economic activity in PC (as prop. of males >15)	0.825 (0.295)	0.888 (0.242)	0.826 (0.241)	0.829 (0.243)
Proportion of LA pop. with 1 'A' level or better.	0.456 (0.196)	0.391 (0.195)	0.342 (0.166)	0.35 (0.176)
Proportion of families in PC headed by single parent	-0.65 (0.32)			
Son's years of schooling.			0.038 (0.007)	
Father's squared residualised wage.				0.082 (0.042)
Financial difficulties (1974)		-0.14 (0.058)	-0.134 (0.058)	-0.147 (0.058)
Living in council house (1974)		-0.094 (0.028)	-0.063 (0.028)	-0.087 (0.028)
Dummy for mother working		0.053 (0.028)	0.054 (0.027)	0.059 (0.028)
Constant	-0.284 (0.192)	-0.265 (0.192)	-0.734 (0.208)	-0.279 (0.192)
R-squared	0.023	0.038	0.056	0.04
Sample Size	1637	1632	1628	1632

The results in this subsection follow the same pattern as before, with results presented in turn using father's residualised wage and father's predicted wage. Table 8 above has 4 columns. Column 1 starts this time with the well-specified model. As before, the variables concerning amenities, council housing and unskilled manual workers are insignificant, with the same caveat applying to the variable concerning unskilled manual workers as before. We can see from the results in column one the remaining four variables are significant at the 5% level. Comparing the magnitudes of the coefficients with the results for LA we can see that

the coefficients on neighbourhood characteristics are lower for PC, as would be expected for an area representing a lower level of data disaggregation. The coefficients on male unemployment rate and male economic activity in PC in 1971 have fallen from -1.74 and 1.04 in table 5 to -1.51 and 0.83 here. Furthermore, the coefficients on proportion of population in LA with 1 or more 'A' level and proportion of families headed by single parent have fallen from 1.25 to 0.46 and from -1.05 to -0.65 respectively, major falls in both cases. The coefficient of father's earnings is also slightly lower, falling from 0.117 to 0.112.

As before, column 2 includes family background controls. As with the results for LA using father's predicted earnings, the coefficient on percentage of families headed by a single parent in insignificant when the controls are added. In percentage terms the falls in magnitudes of the remaining coefficients as the controls are added are very similar to those observed in table 6. The coefficient of father's earnings has fallen to 0.072 from 0.112, as opposed to falling from 0.117 to 0.073 before. The coefficients on male unemployment rate, male economic activity and proportion of population with 1 or more 'A' level have fallen by 23%, 7% and 14%, as opposed to 16%, 9% and 18% before. The coefficients on the controls are virtually unchanged from table 1, with the coefficient on the financial difficulty dummy rising from –0.132 to –0.14, the coefficient on the variable concerning council housing falling from –0.107 to -0.094, and the coefficient on the dummy for mother in work rising from 0.049 to 0.053.

Column 3 adds son's years of schooling to column 2, with the results again showing a similar pattern to table 1. The coefficients of the neighbourhood fall slightly, with a big fall of some 50% being observed in the coefficient on father's wage, with the coefficient becoming insignificant at the 5% level. Column 4 adds father's squared residualised wage, with the coefficient on this and normal wage indicating a higher intergenerational correlation for fathers with higher wages, as observed before.

Moving on, the results using father's predicted wage are presented in table 9 below. Column 1 again starts with the well-specified model, which in this case doesn't include either of the variables concerning overcrowding or single parent families. We can see from the results in column one the remaining three variables are significant at the 5% level.

Comparing the magnitudes of the coefficients with the results for LA using father's predicted wage and the results for PC using father's residualised wage we can see that these coefficients are again smaller than their LA counterparts, and smaller than the results for PC using residualised wage. The coefficient on male unemployment rate is –0.91, as compared to –1.57 using father's predicted wage at LA level, and -1.51 at PC level using fathers residualised wage. Moving on, the coefficients on male economic activity and proportion of LA with one or more 'A' level are 0.79 and 0.38 as opposed to 1.07 and 0.91 in table 7, and 0.83 and 0.46 in table 9. The falls in the second and third of these coefficients between tables

8 and 9 is of the same order as when moving from using father's residualised wage to using father's predicted wage before, although the fall in the coefficient of male unemployment rate is quite a lot bigger.

As before, column 2 includes family background controls. Again, in percentage terms the falls in magnitudes of the remaining coefficients as the controls are added are very similar to those observed in previous tables, particularly table 7 showing the results using father's predicted wage at LA level. The coefficient on male unemployment falls from –0.91 to –0.75, and the coefficient of male economic activity falls from 0.79 to 0.67. Lastly the coefficient of the 'A' level variable falls from 0.38 to 0.35. The coefficients on the controls themselves are also very similar to those discussed previously. Column 3 adds son's years of schooling to column 2, with the results again showing a similar pattern to previous results. The coefficients of the neighbourhood variables are largely unchanged, with a big fall of some 37% being observed in the coefficient on father's wage, which is just significant at the 5% level.

Table 9:	**OLS results (PC)**		
	Son's wage. (1)	Son's wage. (2)	Son's wage. (3)
Father's predicted weekly wage.	0.276 (0.048)	0.235 (0.051)	0.148 (0.074)
Male unemployment rate in PC	-0.914 (0.326)	-0.751 (0.228)	-0.622 (0.226)
Male economic activity in PC (as prop. of males >15)	0.786 (0.243)	0.67 (0.245)	0.665 (0.244)
Proportion of PC pop. With 1 'A' level or better.	0.378 (0.173)	0.346 (0.172)	0.27 (0.132)
Son's years of schooling			0.033 (0.006)
Financial difficulties (1974)		-0.09 (0.048)	-0.082 (0.048)
Living in council house (1974)		-0.055 (0.025)	-0.038 (0.025)
Dummy for mother working		0.061 (0.023)	0.058 (0.023)
Constant	-1.7 (0.254)	-1.418 (0.269)	-1.447 (0.268)
R-squared	0.036	0.041	0.054
Sample Size	2098	2084	2079

4.2.3 Electoral Ward level.

The results in tables 10 and 11 below follow the by now familiar pattern. The same three neighbourhood characteristics as before are significant, with higher magnitude of coefficients of neighbourhood characteristics than in the analogous results from before, as would be expected at a finer level of neighbourhood characteristic data disaggregation. The coefficient on male unemployment rate is –1.92, compared with –1.74 for LA. Additionally, the coefficients on male economic activity and proportion of LA with 1 or more 'A' level are 1.23 and 1.32 respectively, compared with 1.04 and 1.25 for LA respectively.

Column 2 adds the controls, with no effect on the significance of the neighbourhood characteristics as before. The coefficient of male unemployment rate falls slightly more here than at comparable points before, from –1.92 to –1.49, but the falls on the other coefficients from 1.23 to 1.22 and 1.32 to 1.18 are consistent with earlier results using residualised wage. The coefficients on the controls are also as expected.

Column 3 adds sons years of schooling, with no effect on the coefficient of unemployment rate or economic activity. There is a fall in the coefficient of proportion of LA with 1 'A' level or more from 1.18 to 0.92, an analogous fall to that seen in some tables before. The coefficient on father's wage exhibits a large fall, and becomes insignificant, as observed before. Column 4 adds father's squared residualised wage, with the coefficients of the wage variables here indicating that the intergenerational correlation in wages is higher when father's wages are higher.

Moving on to the results using father's predicted wage, the results presented in table 11 below exhibit marked similarities with earlier results. The magnitudes of the coefficients fall as we move from considering residualised wages to considering predicted wages, with the percentage falls being consistent with earlier results. The coefficient on male unemployment is –1.67 here as opposed to –1.92 using residualised wages. Furthermore the coefficients on male economic activity and proportion of LA with 1 or more 'A' levels are 1.13 and 0.78 as opposed to 1.23 and 1.32.

The magnitudes of the coefficients fall when the controls are added, again with the percentage falls being consistent with earlier results. The coefficient on male unemployment falls from –1.67 to –1.33. Furthermore the coefficients on male economic activity and the 'A' level variable fall from 1.12 to 1.11 and from 0.75 to 0.74. In addition, the coefficients on the controls themselves are as expected. Again, the coefficients of the neighbourhood characteristics are constant as we add son's years of education in column 3, with a big fall

being observed in the coefficient of father's predicted wage, which is just significant at the 5% level.

Table 10:	OLS results (Ward)			
	Son's wage. (1)	Son's wage. (2)	Son's wage. (3)	Son's wage. (4)
Father's residualised weekly wage.	0.127 (0.039)	0.079 (0.04)	0.04 (0.03)	0.114 (0.043)
Male unemployment rate in EW	-1.92 (0.682)	-1.49 (0.669)	-1.49 (0.645)	-1.49 (0.638)
Male economic activity in EW (as prop. of males >15)	1.23 (0.598)	1.22 (0.593)	1.23 (0.587)	1.22 (0.591)
Proportion of EW pop. with 1 'A' level or better.	1.32 (0.312)	1.179 (0.312)	0.92 (0.311)	1.165 (0.314)
Son's years of schooling.			0.039 (0.007)	
Father's squared residualised wage.				0.09 (0.042)
Financial difficulties (1974)		-0.132 (0.059)	-0.121 (0.058)	-0.134 (0.059)
Living in council house (1974)		-0.112 (0.028)	0.075 (0.028)	-0.103 (0.028)
Dummy for mother working		0.053 (0.028)	0.052 (0.028)	0.06 (0.028)
Constant	-0.777 (0.386)	-0.842 (0.383)	-1.34 (0.39)	-0.845 (0.383)
R-squared	0.03	0.046	0.066	0.049
Sample Size	1635	1630	1626	1630

Table 11:	OLS results (Ward)		
	Son's wage. (1)	Son's wage. (2)	Son's wage. (3)
Father's predicted weekly wage.	0.29 (0.046)	0.238 (0.049)	0.148 (0.072)
Male unemployment rate in EW	-1.67 (0.78)	-1.331 (0.678)	-1.37 (0.62)
Male economic activity in EW (as prop. of males >15)	1.123 (0.529)	1.114 (0.525)	1.167 (0.523)
Proportion of EW pop. With 1 'A' level or better.	0.751 (0.278)	0.737 (0.276)	0.673 (0.274)
Son's years of schooling			0.034 (0.006)
Financial difficulties (1974)		-0.082 (0.048)	-0.075 (0.036)
Living in council house (1974)		-0.065 (0.025)	-0.045 (0.026)
Dummy for mother working		0.061 (0.023)	0.057 (0.023)
Constant	-2.14 (0.398)	-1.91 (0.404)	-1.89 (0.402)
R-squared	0.039	0.046	0.06
Sample Size	2095	2082	2077

4.3 Summary.

We have seen from the results in this section that there is evidence that neighbourhood choice is an important mechanism for intergenerational transfer. The neighbourhood characteristics that consistently seem to be important are male unemployment rate, male economic activity, and proportion of residents in a given area with 1 or more 'A' level. Furthermore, these characteristics still exert a significant effect on son's wages in 1991 after controlling for certain family background characteristics. However, we have seen that the view that any significant neighbourhood effects observed are probably proxying for

unobserved family background characteristics is partially valid, inasmuch as several variables initially significant become insignificant after the addition of the controls. Of course, we can never rule out the possibility that other unobserved family background characteristics may be important, and that their inclusion may render other coefficients insignificant, but on balance it seems the controls here are adequate. Furthermore, the remaining neighbourhood characteristics are consistently significant in a wide range of specifications. We have also seen that the magnitude of the coefficients depends markedly on the level of disaggregation of the data used to construct the neighbourhood characteristics.

There are two methods presented in this section for the recovery of father's permanent wage, with the coefficients on the neighbourhood characteristics generally being slightly smaller using predicted wages; given no reason to prefer one set of estimates over the other in this case it is probably best to view the two sets as providing bounds on the underlying parameter. It is reassuring that the percentage falls in the coefficients of the neighbourhood characteristics using both methods as controls are added are consistent.

We have consistently observed that the addition of son's years of schooling to the regression does not overly affect the coefficients on the neighbourhood characteristics. We have also consistently observed that the same cannot be said for father's residualised wage, the coefficient of which is always driven to insignificance after son's years of schooling is added. This would seem to indicate that, after considering the effect of neighbourhood, father's wage is predominantly important through the ability to invest in son's human capital. An analogous fall in the coefficient of father's predicted wage is observed when son's years of education is added, although the variable is often still on the borderline of significance, indicating there may be some relevant factors not considered here. Overall the insignificance or near insignificance is reassuring since it implies that the empirical model captures most if not all of why father's wage is important. The constancy of the coefficients of the neighbourhood characteristics after the addition of son's years of schooling was unexpected, however, since it is often believed that if neighbourhood is important one of the critical mechanisms for it to impact upon wages is through schooling. However, these results are a somewhat indirect way of ascertaining the merit of such a hypothesis, and the more direct results in table 7 on the intergenerational transmission of human capital would indicate that neighbourhood human capital is important in the son's human capital accumulation process.

Another important result observed in this section is that father's squared residualised wage is consistently significant in the regressions in which it appears, with the coefficient indicating a concave relationship between son's wage and father's wage. Such a result is consistent with the idea that there may be an asymmetry in mobility between those with fathers at the top and bottom of the wage distribution.

5: Unemployment.

When trying to ascertain the level of intergenerational mobility we are often worried about those at the bottom of the income distribution for whom mobility may be limited. Focusing on fathers and sons with observations on wages is convenient, but these results may need to be augmented through the consideration of those who are unemployed. This problem is less severe for the sample of fathers, who have a low unemployment rate in 1974, but perhaps is an issue for the sample of sons in 1991, who have an unemployment rate of about 5%. Therefore, in this section several models with different dependent variables than before are estimated. From NCDS5 we can obtain information on son's present employment status, as well as whether individual currently employed were ever unemployed. We also have information on the number of months that the individual was unemployed between 1974 and 1981. First, descriptive statistics on the variables discussed are presented. We require that observations be present for father's residualised wage, as well as local authority identifier and significant neighbourhood characteristics from section 4.

5.1 Descriptive Statistics:

Table 12:

Variable	Obs	Mean	Std. Dev.	Min	Max
Son's Months unem. from 1974-81	3218	7.03	16.26	0	100
Son unemployed 1991	2507	0.05	0.22	0	1
Son ever unemployed	2358	0.24	0.43	0	1
Male unem. rate in LA in 1974	3220	0.05	0.02	0.02	0.17
Male economic activity in LA	3220	0.83	0.04	0.58	1
Prop. with one or more 'A' level	3220	0.10	0.04	0.03	0.48
Prop. in council housing	3220	0.33	0.17	0.04	0.96
Son's years of education	3220	11.88	1.89	9.41	20.5
Financial difficulties (1974)	3220	0.07	0.25	0	1
Living in council house (1974)	3220	0.39	0.49	0	1
Mother working (1974)	3220	0.68	0.47	0	1

We can see that the mean number of months unemployed for the sample is just over 7, with a maximum of 100. These results highlight that a substantial number of agents experienced no unemployment over this period, and hence the empirical model estimated later with this variable as the dependent variable is a tobit model. We can see from the variable concerning son's current employment status that 5% of the sample are currently unemployed, and from the following variable that amongst the currently employed 24% had been

unemployed at some stage. Discrete dependent variable techniques will be employed in models with these two variables as the dependent variables.

We can further see that the mean years of schooling obtained amongst the sample is somewhat lower than before at 11.88 years. Since unemployed males with no observation on wages are not dropped in this analysis this isn't surprising. Also, 7% of this sample experienced financial difficulties in 1974, as opposed to 5% before, and 39% lived in council housing as opposed to 37% before. The proportion of the sample with mother working was 68% compared with 70% before. The statistics on the neighbourhood coefficients are largely the same as before, although the mean proportion of LA in 1971 with one or more 'A' level is slightly lower, at 10% compared with 11%.

Next, the results of estimating probit models using the binary variables on son's current and past unemployment are presented. As in section 4 there are several specifications to each model. Note it is not coefficients that are presented, since they have no useful interpretation, but rather the marginal effect of the variable on the probability of the dependent variable taking value one.

5.2 Probit model results.

Column 1 of table 13 shows the results with just the neighbourhood characteristics and father's residualised wage as the explanatory variables. This specification passed the standard lagrange multiplier test for heteroscedasticity. We can see that the marginal effect for father's wage is negative, indicating that the probability of the son being unemployed falls as father's wage increases, as we would expect. As with the coefficient on this variable in section 4 it is significant after the neighbourhood variables have been added, possibly indicating the role of father's income in purchasing inputs in the son's human capital accumulation process. From the magnitude of the coefficient we can see that an incremental change in father's wage leads to a 0.02 fall in the probability of son being employed for the average individual. The marginal effect on male unemployment rate shows a positive relationship between the neighbourhood unemployment rate in 1971 and the probability of son being unemployed in 1991. Furthermore, the magnitude of the effect is clearly quite large, with a marginal change in the value for neighbourhood unemployment being associated with a 0.55 percentage point increase in the chance of unemployment for the average individual. The marginal effects on the other neighbourhood characteristics are negative, indicating a lower chance of unemployment in 1991 as neighbourhood economic activity and education levels in 1971 rise. The magnitudes of the marginal effects indicate falls of 0.23 and 0.27 percentage points respectively in the probability of unemployment for the average individual for these variables.

Table 13:					
	Son Unemp.	Son Unemp.(2)	Son Unemp.(3)	Ever Unem.	Ever Unem. (2)
Father's res. wage	-0.019 (0.011)	-0.012 (0.007)	-0.005 (0.011)	-0.07 (0.024)	-0.043 (0.025)
Male unemployment rate in LA	0.545 (0.204)	0.628 (0.177)	0.574 (0.172)	1.56 (0.465)	1.408 (0.458)
Male economic activity rate in LA	-0.23 (0.12)				
Prop. of LA with 1 or more 'A' level	-0.27 (0.108)	-0.261 (0.107)	-0.224 (0.105)	-0.421 (0.23)	
Prop. of LA living in council housing				0.104 (0.051)	
Son's years of schooling			-0.009 (0.002)		
Financial difficulties (1974)		0.054 (0.024)	0.047 (0.022)		0.067 (0.042)
Living in council house (1974)					0.046 (0.02)
Mother working (1974)		-0.032 (0.012)	-0.029 (0.011)		-0.037 (0.019)
Pseudo R-squared	0.033	0.039	0.049	0.015	0.018
Sample size	2507	2507	2507	2358	2358

As before we wish to see the effect of adding controls. Note that the adverse consequences of missing variables within a limited dependent variable setting apply even when the omitted variables are uncorrelated with the included variables, so this procedure is even more critical here. We can see that the level of male economic activity in the LA in 1971 has no effect on the probability of son being employed in 1991 after the controls are added, and that the other variables remain significant. The marginal effects for father's wage and the 'A' level variable fall slightly from –0.019 to –0.012 and from –0.27 to –0.26 respectively when the controls are added. The marginal effect for male unemployment rate rises from 0.55 to 0.63. Unsurprisingly, the marginal effects for the controls indicate a higher probability of unemployment for sons from families that experienced financial difficulties in 1974 and for sons from families where the mother did not work.

Column 3 adds son's years of schooling to the regression. The marginal effect for years of schooling is negative, as would be expected, but the magnitude of the effect is quite small, indicating a 0.01 increase in the probability of unemployment. We can also see that father's wage is insignificant when son's years of schooling is added, indicating again that after controlling for location father's wage is important only through the ability to purchase inputs in the human capital accumulation process.

Moving on to the next set of results in column 4 of the table we can see that male economic activity is not significant in determining the probability of ever having been unemployed for sons employed in 1991. Note that these are heteroscedasticity corrected coefficients, since the specification in column 4 fails the standard LM test at the 5% level. We can also see that the proportion of LA living in council housing is significant in this specification, with the marginal effect indicating that a incremental change in the proportion of LA that live in council housing increasing the probability of the son ever having been unemployed by 0.1 percentage point for the average individual. The marginal effect for father's wage indicates a 0.07 lower chance of even having been unemployed. The marginal effects on the 'A' level variable indicates a fall of 0.42 on the probability of ever being unemployed. Lastly, the marginal effect for male unemployment rate indicates a 1.56 percentage point rise in the probability of ever having been unemployed, the largest effect of all.

As before column 5 adds family background controls. After the controls are added the proportion of LA living in council housing becomes insignificant and is dropped. In fact, it is only necessary to include the living in council house dummy to render this variable insignificant, indicating that controlling for own experience there is no further disadvantage to living in areas characterised by large amounts of council housing. More surprisingly, the 'A' level variable is also insignificant after the controls are added. The marginal effects on the remaining variables fall from –0.07 to –0.043 for father's wage, and from 1.56 to 1.41 for male unemployment rate. Intriguingly, son's years of schooling is insignificant if added to the specification in column 5.

5.3 Tobit model results.

The results in table 14 below are from estimating a tobit model of months of unemployment from 1974-1981. Again there are several specifications to the model. Column 1 just includes father's wage, male unemployment rate and proportion of LA with 1 or more 'A' level as explanatory variables. This specification passed the standard LM heteroscedasticity test. As with some specifications in the previous table, the level of male economic activity is insignificant in these regressions. The coefficients on the remaining

variables indicate that son's unemployment status is negatively correlated with father's wage. We can also see that son's unemployment status in 1991 is again strongly correlated with male unemployment rate in LA in 1971, with the magnitude of the coefficient indicating a 1% increase in neighbourhood unemployment implies 1.48 more months of unemployment for the son. The coefficient on the 'A' level variable indicates a negative correlation between son's months of unemployment and proportion of LA with 1 or more 'A' levels, with the magnitude of the coefficient indicating a 1% increase in 'A' level attainment for the LA in 1971 implies 0.2 months less unemployment. Column 2 adds the controls, with the result that the 'A' level variable is no longer significant. Column 3 presents the results with the 'A' level variable dropped. We can see that father's wage is no longer significant, and the coefficient on male unemployment rate has fallen to 124 from 148 in column 1. The controls indicate a small positive relationship between months of unemployment and being in financial difficulties or living in a council house in 1974, and a negative relationship between the dummy for mother in work and months of unemployment. Note son's years of schooling is insignificant if added to column 3.

Table 14:

	Son's months of unemployment (1974-1981)	Son's months of unemployment (1974-1981)	Son's months of unemployment (1974-1981)
Father's res. wage	-2.63 (0.838)	-1.18 (0.501)	-1.15 (0.856)
Male unemployment rate in LA	147.77 (13.88)	125.17 (14.02)	123.988 (13.633)
Prop. of LA with 1 or more 'A' level	-20.686 (8.623)	-2.52 (2.99)	
Financial difficulties (1974)		5.931 (1.153)	5.916 (1.152)
Living in council house (1974)		3.349 (0.637)	3.363 (0.636)
Mother working (1974)		-1.96 (0.637)	-1.96 (0.637)
Constant	-11.689 (1.237)	-10.833 (1.3)	-10.518 (0.953)
Pseudo R-Squared	0.01	0.015	0.015
Sample size	3218	3218	3218

5.4 Summary

These results provide another piece of the puzzle of intergenerational transmission. It is evident from these regressions that neighbourhood is a stronger determinant of son's wages than his unemployment status. Apart from male unemployment rate, which consistently has a strong effect, we do not observe the same consistency of significance across specifications and as controls are added. Also different than before is the fact that son's years of schooling is often insignificant if added to the regressions. This is not problematic, since we have less reason to believe schooling is related to unemployment than wages. It seems to be either the case that father's wage is still significant after the family background controls are added, only to become insignificant when schooling is successfully added, or father's wage is insignificant after the addition of the controls and schooling has no further explanatory power. This would seem to be consistent with the belief that once neighbourhood has been taken into account father's wage is predominantly important through its impact on schooling, but schooling is just less important in these regressions.

It is interesting that the coefficient on male unemployment rate is so consistently strong. We must also question the transmission of the neighbourhood characteristics to son's unemployment status, given that schooling effects are of reduced importance. It would seem likely that the role of neighbourhood in providing role models and affecting expectation formation could be critical, a point discussed further in the next section. Whatever the transmission mechanism is believed to be, the evidence again points to location choice having a clear effect on economic outcomes.

6. Conclusion and reflections.

We have seen throughout this chapter that neighbourhood is an important transmission mechanism in the hunt for understanding of intergenerational mobility. It is often suggested that neighbourhood variables that are significant when estimating the relevant specifications merely proxy for unobserved family background variables, which in reality are driving the results. Fortunately there is substantial family background information in the dataset used for this chapter, and we have seen that this view is not completely without merit, since several neighbourhood characteristics consistently became insignificant upon the addition of controls. However there are also characteristics such as male unemployment rate and proportion of area with 1 or more 'A' level that are consistently significant in a wide range of specifications after the inclusion of controls. Of course, it is never possible to be certain that omitted variables are not biasing the results, but on balance the evidence presented here confirms the importance of location choice.

There have been several suggestions as to why the neighbourhood lived in during adolescence may influence later economic outcomes. The evidence presented here in table 7 suggests that average neighbourhood human capital increases the years of schooling obtained. However, we have also seen from other regressions that it is unlikely this is the sole reason neighbourhood is important. The results taken as a whole are consistent with the belief that role models are important, both within family and within neighbourhood. We must also consider that childhood experiences within the family and neighbourhood are critical for expectation formation. Consistent with these factors, the male unemployment rate within the neighbourhood is a strong predictor of both later employment and later wages. This, taken in conjunction with the positive effect of mother working, which is important independently of neighbourhood and father's wages, and the possibility that father's wage is still important after controlling for years of schooling and location choice, suggests these role model effects could be important. Note that qualitative research often highlights the relevance of such effects. The evidence presented would also tentatively suggest that benefit receipt may be the important factor, rather than unemployment itself, since the relevant results are also often applicable to those in unskilled manual jobs who receive supplementary income. Future research should investigate these possibilities further.

It would seem that we have learnt all we can from simple regressions of son's wage on father's wage, with no attempt to ascertain mechanisms of intergenerational transfer. It should be noted that better understanding of the mechanisms involved is not only rewarding in breaking down the standard 0.4 coefficient of father's wage, but may also lead to further upward changes in the conventional wisdom of the extent of immobility. After considering

the results on the respective mechanisms presented here, it seems this literature would benefit from a better theoretical understanding of the interactions between location choice, level of education obtained and the return to that education. The analogous empirical advance would explicitly recognise the endogeneity of location choice, although a very special dataset indeed will be necessary to make any progress here. Also of critical importance for future research is further investigation of individuals with parents at the extremes of the wage or income distribution. It is conventional to state that upward mobility from the bottom is more prevalent than downward mobility from the top. This may well be true, due to the multiple advantages that can be construed upon individuals with parents at the top of the wage or income distribution. However, in regard to policy-making it is critical to note that mobility at the other end may be very limited for a subset of individuals in poor neighbourhoods. That inequality of outcome in one generation can lead to inequality of opportunity for the next seems to an extent inevitable, and these factors must be considered by policy-makers in conjunction with results on cross-sectional snapshots of the wage distribution and individual income mobility.

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Chapter 3: The role of location in unemployment duration.

Abstract

This chapter investigates how, in addition to personal characteristics, the neighbourhood in which one resides affects the transition rate from receipt of unemployment benefit into work. The justification for considering such effects can be that local labour market conditions are important, or that there are spillovers between agents, with a potential problem being distinguishing a true effect from that which could arise from independent location selection. We also attempt to ascertain which occupational groups may be more susceptible to any effect from location. We use the standard hazard rate framework, and estimate a variety of proportional hazard models. Simulations are also carried out to interpret the results in more depth. We find that location is important in determining unemployment duration, and that unskilled manual workers are most responsive to changes in locational characteristics.

Contents

1. Introduction

This chapter investigates how, in addition to personal characteristics, the neighbourhood in which one resides affects the transition rate from receipt of unemployment benefit into work. The chapter also attempts to ascertain which occupational groups may be more susceptible to effects from location. We use the standard hazard rate framework, and estimate a variety of proportional hazard models. Simulations are also carried out to interpret the results in more depth.

In the UK the increase in unemployment since the late 1960s is largely due to a decrease in the outflow rate for individuals experiencing a period of unemployment. Accordingly, the number of long-term unemployed has increased substantially over this period, and unsurprisingly this increase has been most severe for individuals with low human capital. The relative worsening of various labour market outcomes in recent years for low skilled workers in comparison with their higher skilled counterparts is often, quite correctly, largely attributed to technological changes biased towards the latter group. However, other factors are worthy of consideration, at the very least for how they might compound the effects. For example, low skilled workers often live concentrated in poor parts of their area of residence. Topa (1997) shows that unemployment in Chicago is geographically concentrated in a few areas, and that individual employment status depends not only on individual characteristics but also on the characteristics of neighbours. Furthermore, Topa suggests that the spillover effect seems to be stronger for agents with low human capital. These findings are likely to be of relevance to UK labour market policy given that unemployment in the UK is very unevenly distributed amongst local authorities and wards (e.g. Dickens *et al*, 2000 and HM Treasury 2003). The government research paper in particular gathers a lot of telling statistics. Employment rates between regions vary between 68% in the North East to 79% in the South East, but the employment rate for local authorities within the North East ranges from 58% to 87%, and in the South East from 68% to 88%. Associated economic implications of regional disparities can be considerable (Collier, 2003), even in an era of low unemployment. Such disparities tend to reduce output and raise inflationary pressure, whilst also constraining opportunities for unemployed workers in depressed areas, and imposing significant negative welfare effects where selective outmigration of highly skilled workers causes low rates of economic activity to persist. That concentrations of the disadvantaged may affect the persistence of their poor labour market outcomes is a common concern in recent years. However, empirical evidence that can be used to ascertain the strength of any possible spillover effects on unemployment duration in the UK is lacking.

To understand why one's location could be important in determining unemployment duration, it is critical to address how individual job search behaviour may be affected by neighbours' behaviour. The relevant economic literature has considered two possibilities. Firstly, individuals may imitate the behaviour of successful or better informed neighbours; some studies refer to this as positive role models within neighbourhoods. In a theoretical local interaction model where agents need to learn which actions work well Eshel, Samuelson and Shaked (1998) show that imitation is an important factor; in particular agents may copy the neighbours' behaviour if the neighbours on average experience better outcomes. Eshel, Samuelson and Shaked study individuals investing in a public good, but some of the results may also hold for the labour market. As Van der Klaauw and Van Ours (2000) note, an application to the labour market is possible if for example individual outcomes refer to wages or unemployment duration and investing in a public good refers to the amount of search effort.

The second mechanism considered by the literature through which neighbours may affect individual outcomes is that individuals may share information on vacancies with one another. This is often referred to as referral or informal job search, and the distinction between informal and formal job search is quite common in the literature. In contrast to informal search, job search is considered formal if the worker applies for a job after using standard search methods like personnel advertisements and the local job centre. Clearly, an essential requirement to use informal job search is an extensive network of employed relatives and friends. Note also that informal search channels are less costly in time and money than formal search channels, and that firms may consider referrals from their employees as more informative and more reliable [Montgomery (1991)]. Montgomery argues that informal job search allows firms to generate more profit, and that workers with a large social network use informal job search because it generates more income. Holzer (1988) introduces a discrete time model that involves the choice of the job search method by the unemployed worker. As the unemployed worker determines the effort devoted to each job search method, job offer arrival rates are endogenous. Holzer finds that job referral is the most frequent and most efficient search method used by young unemployed workers. Topa (1997) suggests that due to basic insurance motives individuals will share information concerning vacancies with others in their social network. Topa argues that it is in the interest of employed workers to tell relatives and friends about job opportunities, so that if the worker becomes unemployed these relatives and friends will in turn help him/her find a job. However, despite this large literature on the effect of networks on job search, the extension of the analysis to empirical issues such as unemployment duration is sparse, particularly for the UK.

One key empirical study analysing these issues is Van der Klaauw and Van Ours (2000), who use a unique administrative database on welfare recipients in Rotterdam, the

second largest city of The Netherlands. They analyse a sample of welfare recipients for Rotterdam, and distinguish three groups of welfare recipients, Dutch job losers, non-Dutch job losers and Dutch school leavers. For non-Dutch job losers they do not find any evidence that neighbourhood characteristics determine their exit rate to a job. They point out that this does not necessarily mean that the behaviour of non-Dutch welfare recipients is insensitive to social interaction, because it is possible that the social network of non-Dutch welfare recipients does not coincide with the neighbourhood, but is organised differently. This is a recurring theme relevant to this piece, since the methodology used in this literature and in this piece cannot pick up for example the effect of networks other than those that depend on location. In contrast to this result for non-Dutch welfare recipients, their empirical results also show that the neighbourhood does affect the individual exit rate to work for Dutch welfare recipients. Furthermore their empirical methodology is able to distinguish that young welfare recipients are most sensitive to the composition of the neighbourhood. The exit rate of young Dutch welfare recipients decreases if the unemployment rate within the neighbourhood increases. On the basis of further results they claim that this represents a true spillover effect rather than the effect of agents with poor employment potential selecting themselves into neighbourhoods with cheap housing

In addition to possible spillover effects, a relatively small amount of work has been done for the UK on the role of demand side factors such as local labour market conditions in determining unemployment duration. Labour markets in different regions may be independent even if they are characterised by different demand side conditions in terms of wages and available job opportunities, due to a limited geographical mobility of labour. Consequently, local labour market conditions can be an important determinant of local unemployment. Work by Collier (2003) for the UK utilising an econometric model tied closely to job search theory finds that individual characteristics and related 'choice' variables' such as educational attainment, labour market mobility and job search behaviour exercise important impacts on the duration of unemployment. However, after controlling for such factors, there remain significant geographical variations. This echoes the results of Brown & Sessions (1997) for the UK, who reveal that regional disparities in the risk of unemployment are prevalent even after controlling for a wide range of demographic characteristics. However, both of these studies use dummy variables for location, so it is not possible to ascertain what characteristics of the location at which an individual resides are important. We would also benefit from a better understanding of the sensitivity of various groups to changing local labour market conditions. The broader policy question is to what extent a good macroeconomic performance can address the problems discussed.

One empirical study of relevance to this chapter is Hoynes (1996) for the US, who uses micro duration data to show that the role of local labour market variables is particularly

important with respect to the duration that families receive Aid to Families with Dependent Children (AFDC) benefits. In particular this study suggests that local labour market conditions have a significant impact on welfare spells for most demographic groups, but that minorities, residents of urban areas and two parent families are more sensitive to changes in local labour market conditions. The results are robust to including county fixed effects and time effects, On average, a typical employment fluctuation over the business cycle (from trough to peak), if permanent, would lead to an 8-10 percent decrease in the AFDC caseload.

Manski (1993, 1995) analyses the problems that arise when using cross-neighbourhood differences to identify neighbourhood effects. Only in the case where the researcher has prior information specifying the composition of a reference group is inference on the mechanisms through which the neighbourhood affects labour market outcomes possible. Using a reduced-form empirical analysis of duration data it is not possible to make a direct distinction between the rationalisations for a neighbourhood effect discussed above. However, the estimation results may explain the extent to which the neighbourhood characteristics considered are influencing the individual rate at which work is found. Manski also identifies the problems inherent in separating what he terms endogenous and exogenous interactions from correlated effects when considering the effect of location on a given variable of interest. Van der Klaauw and Van Ours (2000) suggest that individuals may prefer to live in neighbourhoods where people have a similar attitude towards joblessness or have similar job search behaviour. This may lead to segregation, and neighbourhood effects are then observed as a consequence of segregation. Another explanation for this type of neighbourhood effects originates if individuals anticipate their future earnings when choosing a neighbourhood in which to live. Individuals with bad labour market characteristics may expect long unemployment durations and low future incomes, and may consequently prefer to live in cheap housing. If such housing is concentrated in certain neighbourhoods then a high proportion of individuals with bad labour market prospects may live in these neighbourhoods. The neighbourhood effects that can be observed in this case are not the result of interaction between individuals, but rather reflect the independent behaviour of similar individuals. These and similar related issues are discussed further in section 2.

In the empirical analysis of unemployment duration in this chapter we use a variety of proportional hazard specifications. With this methodology the exit rate out of benefit receipt into employment is allowed to depend on observed individual characteristics and neighbourhood characteristics, as well as on the elapsed unemployment duration and in some specifications unobservable personal characteristics. Initially we estimate duration dependence parametrically, but also utilise the flexible semi-parametric piecewise constant exponential model. The JUVOS (Joint Unemployment and Vacancies Operating System) dataset is used in the empirical analysis for its detailed information on unemployment spells;

this is a longitudinal database of a sample of claims for unemployment-related benefits. The dataset consists of a selection of unemployed claimant variables including: length of claim; number of claims; age of claimant via date of birth; location of claimant; usual occupation; sought occupation; sex; marital status; start and end date of claim, and length of time between claims. We also use 2001 census data for neighbourhood characteristics at the local authority level. Lastly, land registry house price data is used.

Section 2 discusses the empirical methodology, and potential problems in estimation. Section 3 describes the datasets used in this chapter, as well as the UK benefits system, and appropriate sample selections. Section 4 presents some descriptive statistics and non-parametric estimates of the empirical survivor function for the final sample. Section 5 presents the results of the estimations and some simulations. Section 6 concludes.

2. Econometric Methodology

2.1 Econometric model:

Let T be the length of a completed spell. It is a realisation of a continuous random variable t with a cumulative distribution function F(t), and probability density function f(t). F(t) is also known in the survival analysis literature as the failure function, and the corresponding survivor function is S(t) = 1 - F(t). The probability density function f(t) is the slope of the failure function as in equation (1), and the hazard rate is defined in equation (2).

$$f(t) = \lim_{\Delta t \to 0} \frac{P(t \le T \le T + \Delta t)}{\Delta t} = \frac{dF(t)}{dt} \qquad (1)$$

$$\theta(t) = \lim_{\Delta t \to 0} \frac{P(t \le T \le T + \Delta t \mid T \ge t}{\Delta t} = \frac{f(t)}{1 - F(t)} \qquad (2)$$

To show the distinction between the two concepts consider the conditional and unconditional probabilities of exit after, say, 30 days. $\theta(30)$ is the probability that someone who has been unemployed for 30 days will exit unemployment, and f(30) is the probability that someone will exit after 30 days. As is standard in duration modelling, we proceed by making various impositions on the overall shape of the hazard. Note that it is possible to derive the survivor functions and unconditional probability density functions that correspond to a given specification for the hazard, but it is usually most useful to work with the hazard. The empirical models used in this chapter are a variety of proportional hazard models, both parametric and semi-parametric. We assume that transition rates from receipt of unemployment benefit into work can be characterised by the observed individual characteristics x, the observed neighbourhood characteristics z, and the elapsed welfare duration itself. As usual, we assume x and z to be constant. The transition rate from welfare to work at t conditional on x and z is denoted by $\theta(t;X,Z)$ and is assumed to have the following proportional hazard specification:

$$\theta(t;X,Z) = \theta(t) \exp(\beta' X + \gamma' Z) \qquad (3)$$

Proportional hazards models are also known in the literature as multiplicative hazard models, or log relative hazard models. The models are characterised by their satisfying the separability

assumption as in (3), where θ(t) is the baseline hazard function, which depends only on *t*. The baseline hazard summarises the pattern of 'duration dependence', which is common to all persons. Note that use of the exponential function is not required, but in most practical applications this function is used.

We provide some parametric estimates using the Weibull specification:

$$\theta(t;X,Z) = \alpha t^{\alpha-1} \exp(\beta' X + \gamma' Z) \tag{4}$$

We also use the flexible semi-parametric piecewise constant exponential (PCE) model:

$$\begin{aligned} \theta(t;X,Z) = \ & \bar{\theta}_1 \exp(\beta' X + \gamma' Z) \text{ if t} \in (0, \tau_1) \\ & \bar{\theta}_2 \exp(\beta' X + \gamma' Z) \text{ if t} \in (\tau_1, \tau_2) \\ & \bar{\theta}_k \exp(\beta' X + \gamma' Z) \text{ if t} \in (\tau_{k-1}, \tau_k) \end{aligned} \tag{5}$$

Equation (5) can be rewritten for the interval *k* as:

$$\theta(t;X,Z) = \exp(\log\bar{\theta}_k + \beta' X + \gamma' Z) \tag{6}$$

It is assumed that the hazard rate is constant within each researcher chosen interval, but may, in principle, differ between intervals. As equation (6) indicates, the constant interval-specific hazard rates are equivalent to having interval-specific intercept terms in the overall hazard. An advantage of this model is that the overall shape of the hazard function does not have to be imposed in advance. It is also the case that a very flexible specification for duration dependence can mitigate the problems that arise if there is unobservable heterogeneity. Note that with an increasing number of time intervals any duration dependence pattern can be approximated arbitrarily closely.

Within proportional hazard models such as those used here absolute differences in X or Z imply proportionate differences in the hazard at each t (Jenkins, 2002). For some $t = \bar{t}$, and for two persons *i* and *j* with characteristics vectors X_i and X_j.

$$\frac{\theta(\bar{t},X_i)}{\theta(\bar{t},X_j)} = \exp(\beta' X_i - \beta' X_j) \tag{7}$$

Or, in log relative hazard form:

$$\log \frac{\theta(\bar{t}, X_i)}{\theta(\bar{t}, X_j)} = \beta'(X_i - X_j) \tag{8}$$

Hence, if persons *i* and *j* are identical on all but the k^{th} characteristic:

$$\frac{\theta(\bar{t}, X_i)}{\theta(\bar{t}, X_j)} = \exp[\beta_k (X_{ik} - X_{jk})] \tag{9}$$

If, in addition, $X_{ik} - X_{jk} = 1$, then:

$$\frac{\theta(\bar{t}, X_i)}{\theta(\bar{t}, X_j)} = \exp(\beta_k) \tag{10}$$

The right hand side of this expression is known as the hazard ratio. It shows the proportionate change in the hazard given a change in a dummy variable covariate from zero to one, more precisely a change from $X_{ik} = 0$ to $X_{jk} = 1$, with all other covariates held fixed.
There are further neat interpretations in proportional hazard models. The coefficient on the k^{th} covariate, β_k, has the property:

$$\beta_k = \frac{d \log \theta(t, X)}{dX_k} \tag{11}$$

This tells us that in a proportional hazard model, each regression coefficient summarises the proportional effect on the hazard of absolute changes in the corresponding covariate. We will be utilising these results when discussing the results in section 5.

It is also possible within this framework to deal with unobservable heterogeneity. This is always a concern since unobservable heterogeneity leads to overestimation of negative duration dependence. Additionally, some of the results given above are no longer true; in particular the proportionate response of the hazard to a change in regressor *k* will also be underestimated (Lancaster, 1990). We begin by rewriting the hazard conditional on the unobservable individual effect as:

$$\theta_v(t, X) = v\theta(t, X) \tag{12}$$

From this one can derive the appropriate survivor and density functions (these are used directly in the estimation procedure) with unobservable heterogeneity. However, to proceed we require expressions for the survival and density functions that do not condition on the unobserved effects for, since each individual v is by definition unobserved. We can, however, specify a distribution for v, which is characterised in terms of estimable parameters, and the unconditional survivor (and density) function can be written in terms of this [See Lancaster (1990), or Jenkins (2002)]. This is referred to as integrating out the unobserved effect. In principle, any continuous distribution with positive support, mean one and finite variance is a suitable candidate to represent the distribution for v. For reasons of tractability, however, the choice of distribution is typically limited to those that provide a closed form expression for the survivor function. In this piece, as is most common, we use the gamma distribution as the 'mixing' distribution in any mixed proportional hazard specifications that are used.

2.2 Problems:

This study uses cross-neighbourhood differences at the local authority level to identify the effect location has on the transition rate from unemployment into employment. One potential problem with this approach arises from the fact that location is endogenous. In particular there may be omitted individual characteristics that are correlated with other explanatory variables through location choice. For example, suppose that persons with low levels of education and poor employment prospects are more likely for any reason to be located in areas with adverse economic conditions. Even if there were no relationship between unemployment duration and local characteristics, the estimates would imply an effect. It is also important to be confident that the effects observed are not structural in nature. In particular, if one group of workers is known as a whole to have lower outflow rates, then agglomeration by firms that employ such workers, due perhaps to some positive externality, could cause us to observe an effect from location, even though it is not a local labour market effect as we have discussed thus far, or a spillover, but follows from the structure of employment in a given area. We feel that the individual controls that we possess in this case are sufficient to deal with such a possibility, as, unusually, we have detailed information on worker type. At least in part this variable may also help with the lack of educational information on the individual. However, there are several plausible ways in which the endogenity of location choice could affect the results, and thus there remains a clear need to try to distinguish between the effect of neighbourhoods on individuals through any of the mechanisms discussed in this chapter and the individual selection of the neighbourhood.

It is important to realise that any potentially unobservable personal characteristic may be something more tenuous than educational attainment or human capital type. For example, consider a certain neighbourhood in which housing is cheap and the individual transition rate from welfare to work is low [Van der Klaauw and Van Ours (2000)]. Assume motivation to search for a job is an unobserved individual characteristic. The individuals living in the same neighbourhood may affect each other's motivation and therefore most of the individuals living in this neighbourhood have a low motivation. On the other hand, less motivated individuals know that they face long unemployment spells and low expected future earning. If individuals take their expected future earnings into account many less motivated individuals live in neighbourhoods where housing is cheap.

We cannot make a direct distinction between the alternative hypotheses in such examples, but we can do it indirectly through the use of house price data. More specifically, if significant selectivity effects remain due to the limited individual characteristics for any of the reasons discussed in this section, we would expect the average price of housing in the location to have a significant impact upon the coefficients of the neighbourhood characteristics, and the coefficient of the house price variable itself to show an effect over and above that picked up by the characteristics alone. It's important to note that the identification is by no means a strict one, and we cannot be certain that housing prices will not, in part, pick up some of the local labour market effects we wish to retain. However, on balance, it is better to err on the side of caution and present results which may be slight underestimates of the effects of the neighbourhood characteristics than to present results which can be criticised as probable overestimates due to the fact that the selectivity bias is not addressed.

It is also reasonable to harbour concern about the inability to distinguish the spillover effects from the local labour market effects. However we feel quite strongly that the key to progress in this area is in distinguishing both from the selectivity effect, or in Manski's terms distinguishing the endogenous and exogenous interactions from the correlated effect. The other two studies referenced here [Hoynes, (1996) and Van der Klaauw and Van Ours (1997)] both try to interpret the effects as either a local labour market effect or a spillover respectively. We think that while the areas chosen for analysis by Hoynes are rather large, that spillover effects almost certainly remain. The Van der Klaauw and Van Ours piece is on slightly firmer ground since they consider various smaller neighbourhoods within Rotterdam, and argue that monetary commuting costs are small enough to render local labour market effects irrelevant. However, ever here the effective total costs of commuting for any two neighbourhoods could be sufficiently distinct for observed correlation to be due to shared distance from jobs rather than a true spillover, even if the methodology adequately corrects for selectivity issues. From a policy perspective it is clear that policy-makers have both factors in mind when designing focused area based policies, like the neighbourhood renewal

schemes that operate at present [e.g. Power, (2004)]. These policies address the problem from the local labour market side by, for example, encouraging firms to locate in certain areas, whilst acknowledging that any benefit will have knock on effects since people can, for instance, form expectations from observing others' outcomes. Thus we feel it is the overall effect of location, through both local labour market effects and spillovers that it is of most importance, particularly in light of the fact that any attempt to distinguish the effects individually is arguable.

3. Data

3.1 JUVOS

The JUVOS is a longitudinal database of a sample of claims for unemployment related benefits. It is named after the computer system used to record unemployment statistics – the Joint Unemployment and Vacancies Operating System. It was first established in 1982, when the count of unemployed people was switched from registrant to a claimant count basis, and it contains a historical record of 5% of all claims for unemployment related benefits paid through the National Unemployment Benefits Payment System (NUBS). In order to generate the sample the same 5% of national insurance numbers are checked each month, and the resulting JUVOS cohort includes all the selected national insurance numbers which are on the NUBS2 system. The resulting unique dataset thus allows us to track individuals on and off the NUBS2 system, and allows the creation of a particularly rich dataset for use in this investigation. A JUVOS record consists of the start date and the end-date of the claim. Furthermore, information is gathered on gender, data of birth, marital status and region of residence. We also can create variables that show the individuals' usual and sought occupation by Standard Occupational Classification.

3.2 Census

Since 1801, every 10 years the nation has set aside one day for the Census - a count of all people and households. It is the most complete source of information about the population that we have, with the most recent Census being held in April 2001. The Census is the only survey which provides a detailed picture of the entire population, and is unique because it covers everyone and asks the same core questions everywhere, making it easy to compare different parts of the country. We are able to create a variety of neighbourhood characteristic variables at both the postcode district and local authority level. In particular we have detailed information on housing, economic activity, employment, unemployment, ethnicity and qualifications.

3.3 Land Registry house price data:

The Land Registry reports provide a detailed and authoritative insight into what is happening to average prices and sales volumes in the residential property market for England and Wales. The data covers the whole of England and Wales, and is broken down by property

type and various areas of interest. The figures also incorporate average prices and number of sales within Greater London by individual London Boroughs. Sales in this context are taken to mean the transfer of ownership for value of freehold and long leasehold residential properties, whether or not the purchase was supported by a mortgage.

3.4 UK benefit system:

Jobseeker's allowance (JSA) replaced unemployment benefit and income support for unemployed people from 7 October 1996 [Emmerson and Leicester (2003)]. There are two different types of JSA: contribution-based JSA is paid to people who have satisfied the National Insurance contribution conditions, and income-based JSA is paid to claimants who pass a means test. It is also possible to receive contribution-based JSA with an income-based JSA top-up. To qualify via either method, the claimant must be under pensionable age and cannot be in work for more than 16 hours a week. They must be capable of starting work immediately and actively taking steps to find a job, such as attending interviews, writing applications or seeking job information. They must also have a current 'jobseeker's agreement' with the Employment Service, which includes such information as hours available for work, the desired job and any steps that the claimant will take to find work. They must be prepared to work up to 40 hours per week and have a reasonable prospect of finding work, which means not placing too many restrictions on the type of work they are willing to undertake. If a claimant refuses to take up a job offer without good reason, they may be denied further payments of JSA. In practice this is unusual.

Contribution-based jobseeker's allowance can be paid for up to six months. To claim contribution-based JSA, the person must have paid sufficient Class 1 National Insurance contributions in one of the two tax years prior to the beginning of the year in which the claimant signs on and claims benefit. They cannot have earnings above a specified level or be in receipt of income support. If the claimant qualifies, they can receive contribution-based JSA irrespective of savings, capital or partner's earnings. In May 2001, 147,000 people received contribution-based JSA, with a further 18,000 receiving both contribution-based JSA and income-based JSA.

Those who do not qualify for contribution-based JSA may be able to receive income-based jobseeker's allowance if they have a sufficiently low income. Claimants cannot be in receipt of income support and must not be working more than 16 hours per week. Only one partner in a couple can receive income-based JSA, and the partner of the claimant may not be working for more than 24 hours per week. Income-based JSA is payable for as long as the qualifying conditions are met. In 2000–01, 803,000 awards of income-based JSA were in

payment. More than three-quarters of those receiving any form of JSA are male, reflecting the tendency of males to claim JSA on behalf of a couple.

The structure of the UK benefit system requires that some sample selections be made accordingly. The 1983 Budget provisions enabled men aged 60 and over, who mostly considered themselves to be retired, to receive national insurance credits or supplementary benefit without attending an Unemployment Benefit office. For this reason, men over 60 are excluded from the sample. In September 1988, the 1988 Social Security Act changed the benefit entitlement of the under 18-year-olds. This group no longer needs to sign on as unemployed in order to receive benefits. In line with the official unemployment figures published by ONS, individuals under 18 are removed from the sample. Furthermore, benefit schemes can change resulting in a change in the number of claims. For example, in April 1995 Incapacity Benefit (IB) replaced Sickness Benefit (SB) and Invalidity Benefit (IVB). Under IB more people are passed fit for work, hence may claim the appropriate unemployment benefits. For various reasons explained in section 4 we construct a flow sample that begins on June 1st 1996; this has the further advantage of relative stability in the overall benefit system after this date. However, unemployed persons may have entered government-supported training, such as the New Deal program, which has to be taken into account when interpreting the empirical results in this chapter. An entirely different issue is the unemployment spells of women. After exhausting the unemployment benefits, women with a partner who is working or receiving unemployment related benefits are themselves in general no longer entitled to receiving unemployment related benefits. In this case women stop claiming benefits without having found employment. In order to address the unemployment duration of women, one needs to have detailed information concerning their household situation. Since no information on the situation of individual after leaving unemployment is available, the sample used in the investigation is restricted to men.

4. Descriptive analysis

4.1 Non-parametric analysis.

This section presents the relevant descriptive analysis. The Kaplan-Meier (see, for example, Jenkins 2002) non-parametric estimates of the survivor function are used to get an overview of the distribution of spell lengths in the final sample of 258,337 spells of unemployment, over the period discussed below. We also present standard descriptive statistics for all variables created for these 258,337 spells.

We create a flow sample from the initial stock sample by considering all spells of unemployment which start on or later than June 1st 1996, and hence have no left censoring or initial conditions problems. This is a particularly neat point from which to start, since the variables on sought and usual occupation were only measured from this point. Similarly from June 1st 1996 we are able to ensure that an exit from unemployment is indeed into employment, whereas before this time other exits such as moving abroad or claiming a different benefit not part of the NUBS2 system are indistinguishable from an exit into employment. Additionally, since this chapter is not aimed at answering questions of the effect of the business cycle on exits it seems prudent to consider a short enough time-span for the macroeconomic outlook to be reasonably stable. Finally, the neighbourhood characteristics are measured in 2001, so it is spells from this period that are of greatest use. One might reasonably have concerns about assigning neighbourhood characteristics in 2001 when some spells start as early as mid 1996, but using a flow sample beginning from a later date does not significantly change any of the results discussed in this or the next section, presumably due the stability alluded to earlier.

Table 1 presents non-parametric estimates of the empirical survivor function; in particular we examine the probability that spells last more than 1 month, more than 3 months, more than 6 months, more than 1 year, more than 2 years, and more than 4 years. We also stratify by various characteristics, such as marital status, age and usual occupation. To see how these estimates are formed let $t_1 < t_2 < t_j < t_k < \infty$ represent the observed 'failure times', at which a spell is completed and:

d_j : number of persons observed to fail at t_j

m_j : number of persons whose observed duration is censored in the interval $[t_j, t_{j+1}]$,

n_j : number of persons at risk of spell ending just immediately prior to t_j :

$n_j = (m_j + d_j) + (m_{j+1} + d_{j+1}) + ... + (m_k + d_k)$

The proportion of those entering a state who survive to the first observed survival time t_1, $\hat{S}(t_1)$ is simply one minus the proportion who made a transition out of the state by that time, where the latter can be estimated by the number of exits divided by the number who were at risk of transition, which is $d_1/(d_1 + m_1)$ or $d_1/(n_1)$. Similarly the proportion surviving to the second observed survival time t_2 is $\hat{S}(t_1)$ multiplied by one minus the proportion who made a transition out of the state between t_1 and t_2. More generally, at survival time t_j:

$$\hat{S}(t_j) = \prod_{j|t_j<t} \left(\frac{1-d_j}{n_j}\right)$$

The empirical survivor function is thus given by the product of one minus the number of exits divided by the number of persons at risk of exit, or the product of one minus the 'exit rate' at each of the survival times. From this, one can also derive an estimate of the failure function and the integrated hazard function. Note that one can only derive estimates at the dates at which there are failures (one has to interpolate at times in between) and the maximum depends on the largest non-censored survival time. Figure 1 shows the empirical survivor function for all spells, with the horizontal axis measured in days. From the integrated hazard, one might derive an estimate of the empirical hazard rate. A crude estimate would be the change in the integrated hazard between two time points, divided by the period of time between them. However there will not ordinarily be failures at each unit of time, even if the time axis can be split into regular intervals.

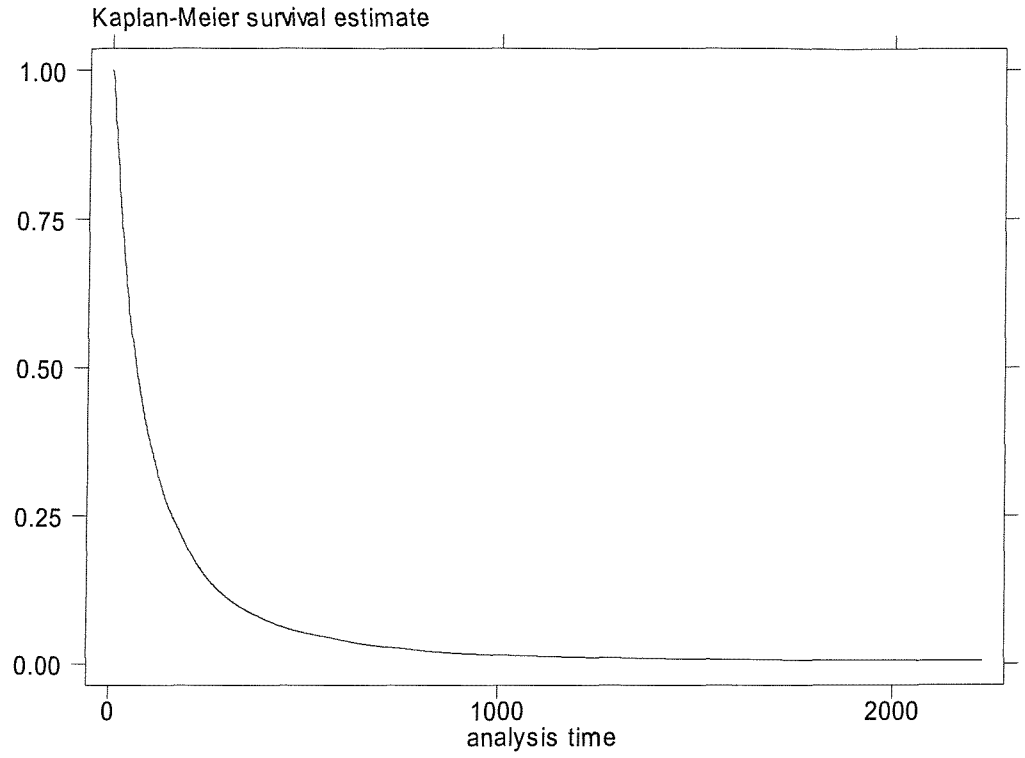
We can see from the results in table 1 below that unmarried people are less likely than their married counterparts to exit at all points. 42.3% of unmarried persons are still unemployed after 3 months, whereas the corresponding figure for married individuals is 37%. The gap closes for long term unemployment, with the figures being 2.8% and 2.5% for spells lasting 2 years or more, but is still present. Intriguingly, out of the age categories it is the middle-age category, 31-40, which exhibits the worse exit rate for spells less than 1 year, although the older two groups have a substantially higher chance of spells lasting 2 years or more. Whereas only 3.9% of individuals aged 31-40 are still unemployed after 2 years, the figure for the older 2 categories are 4.5% and 4.7% respectively. Furthermore, individuals aged 51-60 are twice as likely as the middle age group to have spells lasting 4 or more years. The youngest group have a slightly higher chance than average of still being unemployed after 1 month, but have relatively the smallest chance of still being unemployed at the other time periods measured. The young individuals in this dataset seem to be characterised by

short (but often frequent) spells, with the older groups making up a relatively large proportion of the long term unemployed. All these results seem consistent with others in the literature.

Table 1:

	More than 1 month	More than 3 months	More than 6 months	More than 1 years	More than 2 years	More than 4 years	Total spells
All	72%	41%	22.2%	8.8%	2.8%	0.9%	258,337
Married	67.9%	37%	19.2%	7.8%	2.5%	0.7%	63,478
Unmarried	73.7%	42.3%	23.1%	8.7%	2.8%	0.9%	194,859
18-24	72.2%	37.9%	18.2%	3.7%	0.5%	0.1%	79,164
25-30	73%	42.1%	23.2%	9.8%	2.7%	0.8%	43,506
31-40	73.1%	43.7%	25.2%	11.6%	3.9%	1%	61,868
41-50	71.2%	42.2%	24.2%	11.6%	4.5%	1.6%	42,379
51-60	69.3%	39.8%	22.1%	12.4%	4.7%	2%	31,420
Managerial	71.7%	40.3%	19.2%	6.2%	1.4%	0.3%	12,197
Professional	70.3%	34.4%	17.1%	5.9%	2%	0.9%	8,567
Assoc. prof.	71.3%	38.6%	19.8%	7.9%	2.7%	0.9%	10,721
Clerical	71.7%	41.2%	22%	8.4%	3%	0.9%	22,311
Craft	69.9%	38.6%	20.6%	6.9%	2%	0.8%	39,074
Services	71.2%	39.2%	20%	7.6%	2.4%	0.3%	15,652
Sales	72.8%	41.1%	22%	6.9%	1.8%	0.4%	15,995
Machinery	74%	45%	26.7%	12.4%	5.3%	2.4%	26,870
Other	71.5%	41%	21.8%	8.3%	2.9%	0.5%	89,294
None	73.5%	41.6%	22%	7.5%	2%	0.1%	17,656

Figure 1:



As regards the occupational classifications we can see that managerial workers have a lower than average chance of being unemployed at all points, with this being particularly true for longer spells. This is also largely the case for professional workers, with the effect being even more marked for spells lasting less than 2 years. Intriguingly the professionals have a slightly higher chance than the managerial workers of still being unemployed after 2 or 4 years. The fact that the effect is not so marked for the managerial group is presumably because this group includes all managers, even those of a relatively low status. Associate professionals fare better than average at all points, with secretarial and admin workers close to the results for the whole dataset. Perhaps surprisingly, craft and related occupations fare better than professional workers for spells lasting less than 6 months, though they fare worse for longer spells. It should be noted that this group contains many skilled manual workers, many of which have been in short supply in recent years. People in employment within the service sector fare better than average at all points, though the effect is not as marked as that for the earlier categories. Sales workers fare slightly worse than average for spells of less than 6 months, though seem to make up a relatively small proportion of the long term unemployed. Unskilled manual workers fare significantly worse than average, having a greater chance of being unemployed at all points than all other categories. Group nine, other jobs, is a mix of many types of job that don't fit into the earlier categories. The results for this group are fairly

representative of the sample as a whole. The final group is no previous profession, which fares worse than average for spells less than 6 months, though the effect is not quite as marked as that for the unskilled manual workers.

4.2 Descriptive statistics.

Table 2 below presents the descriptive statistics for the final sample. The duration variable shows unemployment duration in days. The mean duration is 120 days, but this variable is highly skewed; the median duration is approximately 2 months, though as the non-parametric examination showed, this is likely to differ across certain key subsamples. Additionally we can see from the variable that measures right censoring that about 10% of the spells are right censored. This translates to roughly 25,000 people that are unemployed when the sample period ends. The age variable gives us an indication of the distribution of ages at the start date of the spells. This variable always yields a value greater than 18 and less than 60, since individuals not in this age range have been dropped due to the structure of the UK benefit system. The mean age is 33.4, but the variable is slightly positively skewed. The median is 30.8, indicating a preponderance of younger agents' spells in the sample, as would be expected. We include age dummies in the results, so those are also included here. We can see that 31% of individuals fall into the initial age group, 17% into the second, 24% into the third, 16% into the fourth, and 12% into the oldest age group. The descriptive statistics also suggest that 25% of the sample is married, and 75% unmarried. This is not surprising given the predominance of young individuals' employment spells in the sample. For the usual occupation variable, which is a categorical dummy, the coding is as follows:

CODE	OCCUPATION
1	**Managers & administrators**
2	**Professional occupations**
3	**Associate professional & technical occupations**
4	**Clerical & secretarial occupation**
5	**Craft & related occupations**
6	**Personal & protective service occupations**
7	**Sales occupations**
8	**Plant & machine operatives**
9	**Other occupations**

If the individual has no occupation usual occupation takes value 10. We can see that the percentage of individuals in managerial and professional occupations is quite low, about 8% in total. The proportions of individuals in associate professional occupations and secretarial occupations are roughly 4% and 9% respectively. The percentage of individuals in the sample

usually working in craft and related occupations is quite high, at around 15%. The same figure for service workers and sales workers is 7%. Plant and machine operatives make up 10% of the sample. Other occupations make up 34% and no previous occupation 7%.

Table 2:

Variable	Obs	Mean	Std. Dev.	Min	Max
Duration	258337	119.95	171.93	1	2230
Right	258337	0.9	0.3	0	1
Age	258337	33.41	11.45	18.01	59.97
Age 18-24	258337	0.31	0.46	0	1
Age 25-30	258337	0.17	0.37	0	1
Age 31-40	258337	0.24	0.43	0	1
Age 41-50	258337	0.16	0.37	0	1
Age 51-60	258337	0.12	0.33	0	1
Unmarried	258337	0.58	0.49	0	1
Married	258337	0.25	0.43	0	1
Usual(1)	258337	0.05	0.21	0	1
Usual(2)	258337	0.03	0.18	0	1
Usual(3)	258337	0.04	0.20	0	1
Usual(4)	258337	0.09	0.28	0	1
Usual(5)	258337	0.15	0.36	0	1
Usual(6)	258337	0.06	0.20	0	1
Usual(7)	258337	0.06	0.20	0	1
Usual(8)	258337	0.10	0.31	0	1
Usual(9)	258337	0.34	0.49	0	1
Usual(10)	258337	0.07	0.25	0	1
Full time	258337	0.72	0.04	0.53	0.81
Ethnic	258337	0.09	0.11	0.00	0.61
Single Parent	258337	0.07	0.02	0.03	0.12
Workless	258337	0.05	0.02	0.02	0.13
Pro/Manage	258337	0.28	0.06	0.16	0.55
Long term	258337	0.29	0.06	0.09	0.40
No Qual.	258337	0.31	0.06	0.13	0.46
Council	258337	0.15	0.08	0.00	0.42
House Price	258337	102.9	54.12	41.47	577.39

Moving on to the neighbourhood characteristics we can see that the mean for proportion of economically active males within the LA who are in full time employment is 72%, with values ranging from 53% to 81%. Proportion on non-whites within the LA ranges from 0 to 61%, with a mean of 9%. Proportion of households headed by a single parent, either male or female, ranges from 3% to 12%, with a mean of 7%. The variable measuring

worklessness at the household level shows that the proportion of the population living in a workless household and having dependent children ranges from 2% to 13%, with a mean of 5%. The proportion of employed individuals working in managerial or professional occupations ranges from 16% to 55%, with a mean of 28%. This seems large, but again the managerial category within the census data is very broad. The variable on long term unemployment shows that LAs range from having 9% to 40% of their unemployed individuals counted as long term unemployed by census definitions, with a mean of 29%. The proportion of the population aged 16-74 with no qualification greater than level 1 ranges from 13% to 46%, with a mean of 31%. The variable on council housing shows that the proportion of houses owned by the council in the LA ranges from 0 to 42%, with a mean of 15%. The house price variable (in £1,000s) shows that the average house price ranges from approximately £41,000 to £577,000, with a mean of £103,000. The median is £86,000.

5. Results

5.1 Parametric results.

Table 3: Weibull model results.

		Coefficient	Std. Error		Coefficient	Std. Error
Age 26-30		-0.24	0.01		-0.24	0.01
Age 31-40		-0.35	0.01		-0.35	0.01
Age 41-50		-0.39	0.01		-0.38	0.01
Age 51-60		-0.41	0.01		-0.41	0.01
Unmarried		-0.17	0.01		-0.17	0.01
Usual (1)		0.25	0.01		0.26	0.01
Usual (2)		0.3	0.01		0.31	0.01
Usual (3)		0.22	0.01		0.22	0.01
Usual (4)		0.2	0.01		0.2	0.01
Usual (5)		0.25	0.01		0.25	0.01
Usual (6)		0.2	0.01		0.21	0.01
Usual (7)		0.12	0.01		0.13	0.01
Usual (9)		0.12	0.01		0.12	0.01
Usual (10)		0.05	0.01		0.06	0.01
Full time		0.83	0.05		0.50	0.05
Ethnic		-1.16	0.02		-0.82	0.03
Single Parent		-1.04	0.14		-0.82	0.14
Workless		-1.20	0.15		-1.02	0.17
Council		-0.03	0.01			
Qualification		-0.21	0.05			
Long term		-1.06	0.03		-0.72	0.05
House Price					0.001	0.0003
Constant		-3.58	0.12		-3.37	0.13
α		0.89	0.00		0.89	0.00
Log L		-409,340			-409,121	
Sample		258,337			258,337	

The results in this section have the following format: we use three different proportional hazard models, with two specifications for each. The first column for each specification gives the coefficients, and the second the associated standard errors. The reason we have 3 different models is that the initial parametric results in table 3 above have a neat interpretation and are easy to estimate. However, as mentioned in section 2 we may have

reservations about the detrimental effects caused by not allowing the duration dependence term to be sufficiently flexible. Hence, table 4 provides results using the flexible semi-parametric piecewise constant exponential model discussed in section 2. Lastly, we discussed in that section how unobservable heterogeneity can bias results, and a potential method for ascertaining how important this is for this sample is implemented for the results in table 5, which presents mixed proportional hazard model results with the standard gamma distribution used as the mixing distribution, again with the piecewise constant duration dependence. There are 2 specifications for each table, since we would like to see how adding the house price variable affects the results that would be obtained if this variable were not available.

Of the variables discussed in section 4 it is evident that some of these variables may well be correlated, so some difficult choices present themselves when analysing the results. However, the sample size here is very large, and of the variables discussed only the variable measuring the proportion of total employed that hold professional or managerial posts is not significant in the first specification tried in table 3. We can interpret these results using equations (7-10) from section 3. Looking first at the coefficients on the individual characteristics we can see that older workers are significantly less likely to exit than individuals in the omitted age group, which includes everyone from 18-25 at the start of the spell. We use categorical dummies for age in all specifications for reasons that will soon become apparent. Using the results in section 3 in conjunction with the coefficients in table 3 we can see that individuals aged 51-60 are 33.7% less likely to exit at any given time holding the other covariates fixed. We can also see that those aged 41-50 are 32.3% less likely to exit than the omitted group at any given time. These results are expected, and pre-empted by the non-parametric analysis earlier, though the parametric analysis suggests the differences are quite marked. The coefficients also suggest that exits are 21.3% less likely for 26-30 year olds, and 29.5% less likely for 31-40 year olds. We attribute this to the youngest workers perhaps being more mobile between jobs, some of which may be short term in nature. We must also bear in mind that this age group has been targeted by certain government programmes.

Moving on, once again we see that single people are less likely to exit than their married counterparts, everything else being equal, with the coefficient suggesting single people are 15.7% less like to exit. This is a common result, often partly attributed to tax incentives. As regards the usual occupation variable we can see that people that work in managerial and professional occupations are significantly more likely to exit at any given time than the omitted category, which is unskilled manual workers. In particular professional occupations have an exit rate 35% higher than the omitted category, other things being equal. Managerial workers have a rate 28.4% higher than unskilled manual workers. The fact that this is not as marked as for those in professional occupations is presumably because the

managerial class consists of both company managers and some other managerial posts within the service sector for example. The third occupational group are associate professionals, who are 24.6% more likely to exit at a given point than the omitted category. Occupational group four consists of secretarial and clerical workers, and these are 22.1% more likely to exit at a given point than unskilled manual workers. The first potentially surprising result is that skilled manual workers, who make up nearly all of the fifth occupational group, are 28.4% more likely to exit than the omitted category, which puts them behind only the professional group. Given the shortage in many skilled manual professions that has arisen in recent years this result is perhaps understandable. Moving on, the sixth and seventh occupational categories are service occupations and sales occupations. Both are relatively broad groups, but the former consists mainly of relatively skilled service workers, and the latter predominantly consists of shop sales assistants. The first group is 21% more likely than unskilled manual workers to exit at a given point, with the same figure being 12.7% for the sales assistants, the lowest figure of all the categories. The last two occupational groups in the table are other occupations and no previous occupation. Other occupation is, as the name would suggest, a catchall for all occupations that are not included in any of the groups so far, and as such the coefficient is not that interesting, though it is also suggests that individuals in this category are only 12.7% more likely to exit than the omitted group, presumably reflecting than many jobs in this category are manual in nature. The final group has a slightly higher exit rate than unskilled manual workers by 5.1%.

Moving on to the location characteristics we can see that of the variables discussed in section 3 only the proportion of full-time employed that are employed in managerial or professional capacities is not significant, and therefore excluded. All other variables discussed are initially significant in the first specification. These variables can either be seen as reflecting local labour market conditions, or in some cases as measuring potential for spillover effects. They may also proxy for previous shocks to the area that may still have an effect because of low geographic mobility of labour. Once again we can use the results in section 2 to interpret the coefficients. Firstly, the coefficient on the full time employment variable, which measures proportion of economically active people in the LA in full time employment, suggests that a 1% increase in this proportion leads to a 0.8% increase in the probability of exiting unemployment. Furthermore, the coefficient on the ethnicity variable measuring proportion of non-whites in the local authority suggests that a 1% increase in this proportion leads to a 1.2% decrease in the probability of exiting. The coefficient on the single parent variable measuring proportion of single parents implies that a 1% increase in this proportion leads to a 1% decrease in the probability of exiting. Moving on, the coefficient on proportion of household with no person in work and dependent children is also significant, suggesting that a 1% increase in this proportion leads to a 1.2% decrease in the probability of

exiting. The coefficient on proportion of housing owned by the council is significant and negative, but very small in size. The coefficient on proportion of population in the local authority with less than level 1 qualifications suggests that a 1% increase in this proportion leads to a 0.2% fall in the probability of exiting. Finally, the coefficient on proportion of population that are long term unemployed suggests a 1% increase in this proportion leads to a 1% decrease in the chance of exiting. Having finished discussing the size of the coefficients it is useful to consider the size of the weibull parameter, which is estimated at 0.89. This gives us an idea of what the data suggests regarding duration dependence. This coefficient implies that with constant covariates the ratio of the hazard at one month in the state to that at 3 months in the state is 1.13, indicating that the same individual who had only been unemployed for 1 month is 13% more likely to exit than his identical counterpart that had been unemployed for 3 months. The hazard and survival functions are plotted in figures 2 and 3 below.

Figure 2:

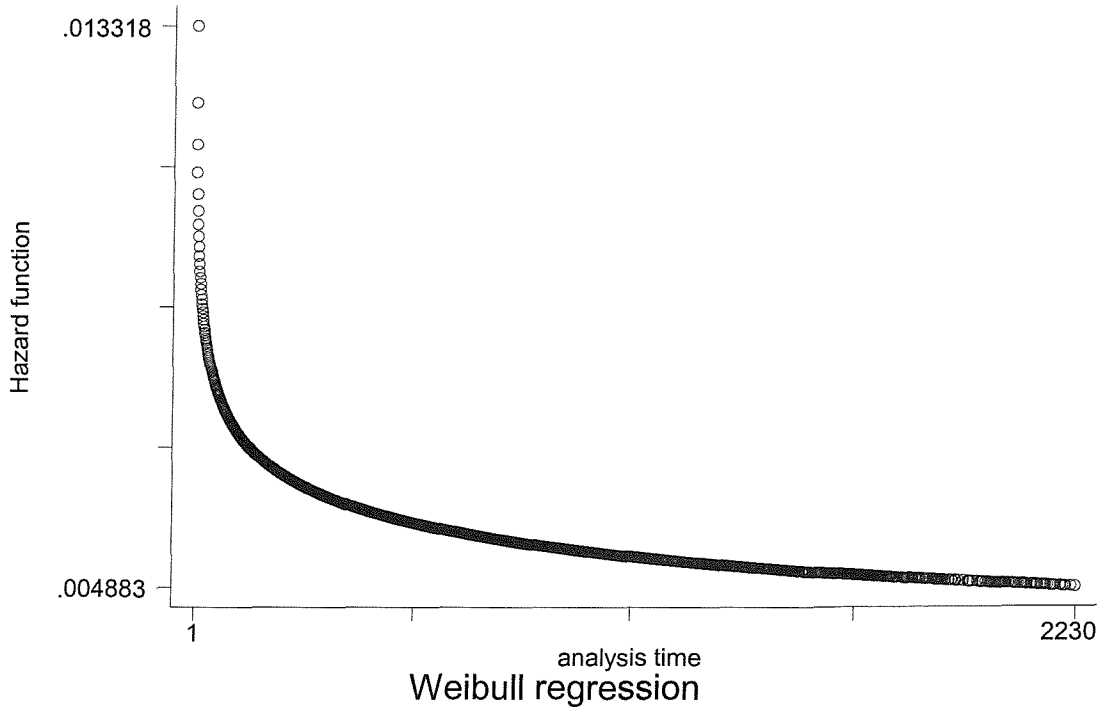
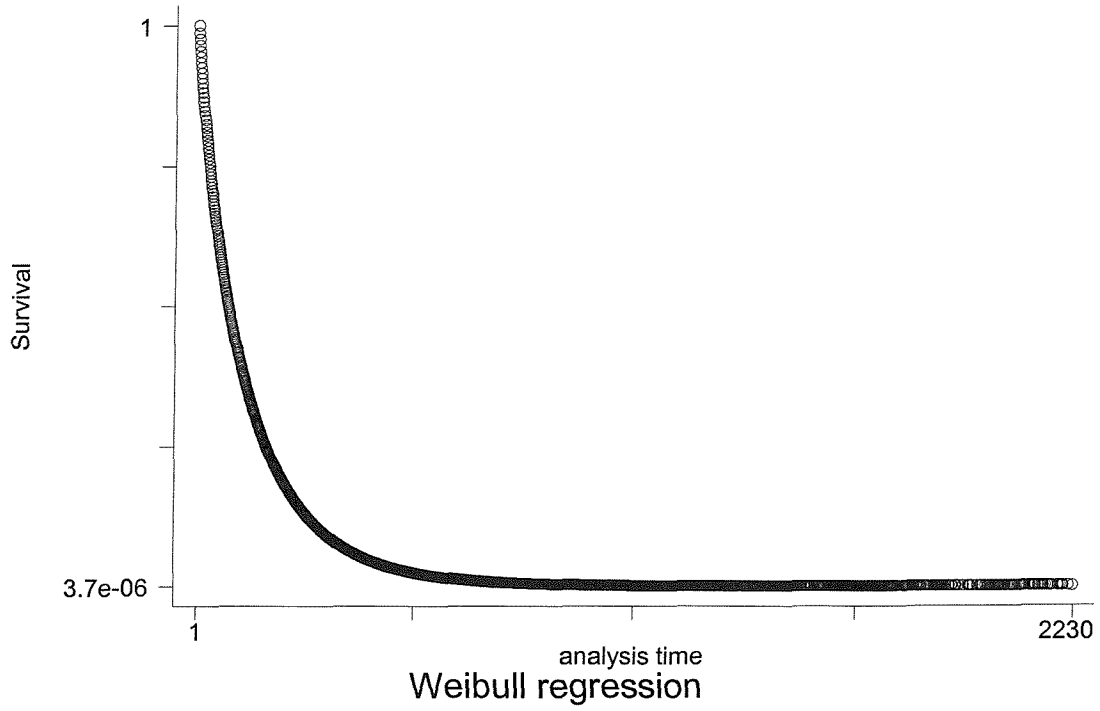


Figure 3:



The second specification in table 3 adds housing price. The rationalisation is that it may minimise the problems caused with regard to interpretation of the coefficients by the possibility that individuals may independently select themselves into a certain neighbourhood. As we would expect, the second specification does not cause the coefficients on the individual characteristics to change much, although many do increase or decrease by 0.01. However, the same cannot be said for the neighbourhood characteristics, on which the coefficients all fall, with some variables being statistically insignificant after the addition of the housing price variable. In particular the qualification variable and the council housing variable do not appear in the second specification presented in the table. As for the remaining coefficients we can see that the coefficient on the employment variable has fallen from 0.83 to 0.5, and now indicates that a 1% increase in the proportion of economically active agents in full time employment within the LA leads to a 0.5% increase in the probability of leaving unemployment. The coefficient on the ethnicity variable has fallen from -1.14 to –0.82, now indicating that a 1% in the proportion of non-whites within the LA is associated with a 0.9% decrease in the probability of exiting unemployment. Similarly, the coefficient on the workless household variable has fallen from -1.04 to -0.82, now indicating that a 1% fall in this proportion leads to a 0.9% decrease in the probability of leaving unemployment. The coefficient on the single parent family variables has fallen from -1.2 to -1.02, now indicating that a 1% increase in this proportion leads to a 1% fall in the probability of leaving

unemployment. Finally, the coefficient on the long term unemployment variable has fallen from -1.06 to -0.72, now indicating that a 1% increase in this proportion is associated with a 0.7% fall in the probability of leaving the state of unemployment. Note that the duration dependence parameter is the same, and that the coefficient on the house price variable is very small and positive. Clearly if house prices are picking up the selectivity effect we would expect the positive coefficient.

5.2 Semi-parametric results.

Table 4: Piecewise constant exponential (PCE) results.

	Coefficient	Std. Error	Coefficient	Std. Error
Age 26-30	-0.19	0.01	-0.19	0.01
Age 31-40	-0.28	0.01	-0.27	0.01
Age 41-50	-0.30	0.01	-0.30	0.01
Age 51-60	-0.32	0.01	-0.31	0.01
Single	-0.15	0.01	-0.15	0.01
Usual (1)	0.25	0.01	0.26	0.01
Usual (2)	0.3	0.01	0.31	0.01
Usual (3)	0.22	0.01	0.22	0.01
Usual (4)	0.2	0.01	0.2	0.01
Usual (5)	0.25	0.01	0.26	0.01
Usual (6)	0.2	0.01	0.21	0.01
Usual (7)	0.12	0.01	0.13	0.01
Usual (9)	0.13	0.01	0.13	0.01
Usual (10)	0.05	0.01	0.05	0.01
Employment	0.75	0.05	0.44	0.05
Ethnic	-1.08	0.02	-0.76	0.03
Single Parent	-1	0.14	-0.79	0.14
Workless	-1.1	0.14	-1.02	0.15
Council	-0.04	0.01		
Long term	-0.94	0.05	-0.92	0.12
House Price			0.001	0.0004
Duration dummies	Included		Included	
Constant	-3.96	0.12	-3.8	0.13
Log L	-402,702		-402,511	
Sample	258,337		258,337	

As mentioned earlier, we would like to see how using a more flexible method of dealing with duration dependence could affect the results. The results here follow the same

pattern as in table 3, with 2 specifications, and the second adding housing prices. We will mainly deal with some key differences in these results as compared to those in table 3. The first thing to note is that the coefficients on the age dummies have all fallen, with the most marked fall in the coefficient for those aged 51-60. The results still suggest that this age group is the least likely to exit, everything else being equal, but now there are only 27.4% less likely to exit at a given point than individuals in the omitted category, whereas before they were 33.7% less likely. Similarly the same figure for those aged 41-50 has dropped from 32.3% to 26%. Those aged 31-40 experienced a fall in the equivalent number from 29.5% to 24.4%, and those aged 26-30 experienced a fall from 21.3% to 17.7% in the probability of exiting at any given point as compared to the omitted category, holding other variables constant. The coefficient on the marital status variable now shows that unmarried persons are 14% less likely to exit at any given point, down from 15.7% before.

Moving on to the neighbourhood characteristics, we can see that the coefficients on all but the council housing variable fall slightly, with no really marked falls. Once again the variable measuring proportion of economically active individuals that work in a managerial or professional capacity was not significant, and this time neither was the qualification variable. Looking at the second specification we can see once again that there are only very slight changes in some of the coefficients of the individual characteristics, with many remaining exactly the same as in the first specification in table 4. However, once again we observe falls in the coefficients of the neighbourhood characteristics once the house prices variable is added, and once again the council housing variable is insignificant in this specification. The coefficient on the variable measuring proportion of economically active agents in full time employment falls from 0.75 to 0.44. Considering the effect of a 1% increase in the variables like before, the fall in the coefficient from 0.75 to 0.44 implies a 1% increase in the variable leads to 0.4% increase in the probability of exiting unemployment, rather than the 0.8% before the house price variable was added. The coefficient on the variable measuring proportion of non-whites in the local authority falls from –1.08 to –0.76, indicating the effect of a 1% increase in this proportion now leads to a 0.8% decrease in the probability of exiting unemployment, down from 1%. Moving on, the coefficient on the variable measuring proportion of single parent families falls from –1 to -0.79, indicating the effect of a 1% increase in this proportion now leads to a 0.8% decrease in the probability of exiting unemployment, down from 1% in the first specification. Note the size of all these falls as the house price variable is added reflect the falls in these coefficients between the first and second specifications in table 3, something which is not true of the final two coefficients. In particular the coefficient on proportion of workless households with dependent children falls from –1.1 to –1.02, indicating a 1% increase in this proportion leads to a 1% decrease in the probability of exiting unemployment, down from 1.1% in the initial specification. Finally the

coefficient of the variable measuring proportion of long term unemployed falls very slightly, from –0.94 to –0.92. This leaves the effect of a 1% increase in this proportion unchanged at a 0.9% decrease in the probability of exiting unemployment.

Table 5: Mixed proportional hazard with PCE.

	Coefficient	Std. Error	Coefficient	Std. Error
Age 26-30	-0.19	0.01	-0.2	0.01
Age 31-40	-0.28	0.01	-0.28	0.01
Age 41-50	-0.30	0.01	-0.30	0.01
Age 51-60	-0.32	0.01	-0.33	0.01
Single	-0.15	0.01	-0.15	0.01
Usual (1)	0.24	0.01	0.25	0.01
Usual (2)	0.3	0.01	0.31	0.01
Usual (3)	0.22	0.01	0.22	0.01
Usual (4)	0.2	0.01	0.2	0.01
Usual (5)	0.25	0.01	0.25	0.01
Usual (6)	0.21	0.01	0.21	0.01
Usual (7)	0.12	0.01	0.12	0.01
Usual (9)	0.13	0.01	0.13	0.01
Usual (10)	0.05	0.01	0.05	0.01
Employment	0.75	0.05	0.44	0.05
Ethnic	-1.08	0.02	-0.76	0.03
Single Parent	-1.00	0.14	-0.79	0.14
Workless	-1.1	0.15	-1.03	0.17
Council	-0.03	0.01		
Long term	-0.94	0.04	-0.92	0.12
House Price			0.001	0.0003
Duration dummies	Included		Included	
Constant	-3.4	0.12	-3.96	0.12
Log L	-402,702		-402,511	
Sample	258,337		258,337	

The results in table 5 are to address whether or not unobservable heterogeneity could be biasing the results. This is of particular importance for this chapter since there may be concerns that any unobservable personal characteristics could be characteristics driving the selectivity effect mentioned throughout the chapter. Obviously the house price variable will help in this regard, but it is not a strict identification and so concern remains. However, we can see from the mixed proportional hazard (MPH) results in table 5 that in both specification both the coefficients of individual and neighbourhood characteristics remain almost unchanged. What is more, this result holds using the other mixing distributions offered in Stata also. The result that the coefficients remain unchanged is not the case when applying

this procedure to the less flexible weibull model, with coefficients in that case being pushed towards the results in table 4.

Table 6 shows us the coefficients on the duration dummies for all PCE specifications. These do not appear earlier to keep the tables of manageable size. There was no change in these results between the first and second specifications in either table 4 or table 5, so the results appear only once for each model. They are in fact almost identical anyway.

Table 6: Duration dependence dummies.

	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9
PCE	0.01	-0.21	-0.28	-0.37	-0.5	-0.43	-0.51	-0.6
MPH	0.01	-0.21	-0.29	-0.37	-0.5	-0.44	-0.52	-0.6

	Period 10	Period 11	Period 12	Period 13	Period 14	Period 15	Period 16
PCE	-0.65	-0.81	-0.87	-1.01	-1.41	-1.93	-2.2
MPH	-0.65	-0.8	-0.87	-1.01	-1.41	-1.93	-2.2

We can see that the general pattern is the same as that suggested by the weibull model parameter, as shown in figure 3. However, it is common in duration analysis for the hazard to increase slightly over the early part of the time in the state before duration dependence kicks in and the hazard declines with survival time. This is of course not possible to find within the weibull framework, but appears here (and in the initial non-parametric analysis), with the coefficient for period 2 being 0.01. Note the interpretation of these coefficients is the same as the categorical dummies earlier, with the omitted category in this case being the first month in the state. The chosen cutpoints are at monthly intervals for the first year then annual intervals thereafter.

5.3 Interactions.

So far we have implicitly assumed that location affects all individuals in the same way. However, for the purposes of this piece it is useful to see how effects may differ for certain key subsamples. This section thus provides some results in tables 7 and 8 based upon interacting the locational characteristics with occupational type. We can use these results to ascertain which groups are more sensitive to changes in local labour market conditions and to spillover effects. We only use the piecewise constant exponential model for these results.

Once again we have two specifications in both the following tables, with one including the house price variable.

Table 7 below shows the results with the long term unemployment variable interacted with professional and unskilled manual occupation. Starting with the individual characteristics we can see the results are similar to those obtained in previous subsections, although the coefficients on the usual occupation dummies are shaken up a little by the interaction procedure, which isn't entirely unexpected. In particular the coefficient for professional individuals is 0.42, which is much higher than in any previous specifications. Moving on to the locational characteristics the interesting result is of course the coefficients on the interacted variable, which are –0.67 and –1.19 for professional and unskilled manual workers respectively. This difference implies any change in this variable (like the 1% change considered before) has approximately a 50% higher negative effect for unskilled manual workers. The other coefficients are largely close to what was found with previous PCE models, though the coefficients of the full time employment and workless household variables are a little higher. The introduction of the house price variable in the second specification causes a marked drop in all of the coefficients, as before. The difference between the coefficient on the long term unemployment variable for professionals and unskilled manual workers remains reasonably constant.

Table 7:

	Coefficient	Std. Error	Coefficient	Std. Error
Age 26-30	-0.20	0.01	-0.20	0.01
Age 31-40	-0.29	0.01	-0.29	0.01
Age 41-50	-0.31	0.01	-0.31	0.01
Age 51-60	-0.33	0.01	-0.33	0.01
Single	-0.15	0.00	-0.15	0.00
Usual (1)	0.24	0.01	0.25	0.01
Usual (2)	0.42	0.02	0.41	0.02
Usual (3)	0.24	0.01	0.23	0.01
Usual (4)	0.2	0.01	0.21	0.01
Usual (5)	0.25	0.01	0.25	0.01
Usual (6)	0.18	0.01	0.18	0.01
Usual (7)	0.1	0.01	0.12	0.01
Usual (9)	0.12	0.01	0.1	0.01
Usual (10)	0.04	0.01	0.03	0.01
Employment	0.93	0.05	0.51	0.04
Ethnic	-1.04	0.03	-0.74	0.03
Single Parent	-0.97	0.14	-0.75	0.09
Workless	-1.24	0.16	-1.02	0.14
Pro/long	-0.67	0.12	-0.59	0.12
Man/long	-1.19	0.11	-1.07	0.12
House Price			0.001	0.0001
Duration dummies	Included		Included	
Constant	-4.11	0.12	-3.69	0.13
Log L	-407,760		-407,062	
Sample	258,337		258,337	

Table 8 interacts professional and unskilled manual status with the workless household variable. Once again the coefficients on the individual characteristics are not particularly noteworthy, and the coefficients on the remaining locational characteristics familiar. However, this time the difference between the coefficients on the workless household variable for the two occupational groups is much more marked, with the average of the 2 coefficients not being consistent with the overall coefficient found earlier. The values are -0.97 and –1.85 for professionals and unskilled manual workers respectively, implying a 1% increase in this variables causes a 1% fall in the probability of exiting unemployment for professionals, but a 1.8% fall in the same probability for unskilled manual workers. Adding the house price variable in the second specification reduces the gap between the two

coefficients, and reduces the coefficient for unskilled manual workers in particular. However, the values still suggest a marked difference between the two occupational groups. Note that similar results those in tables 7 and 8 interacting the employment variable also produced a difference between the two occupational groups, but the magnitude of the difference was small. Neither of the other locational characteristics exhibited a different effect for the 2 groups.

Table 8:

	Coefficient	Std. Error	Coefficient	Std. Error
Age 26-30	-0.19	0.01	-0.19	0.01
Age 31-40	-0.28	0.01	-0.27	0.01
Age 41-50	-0.31	0.01	-0.31	0.01
Age 51-60	-0.33	0.01	-0.33	0.01
Single	-0.15	0.00	-0.15	0.00
Usual (1)	0.24	0.01	0.24	0.01
Usual (2)	0.38	0.02	0.37	0.02
Usual (3)	0.23	0.01	0.22	0.01
Usual (4)	0.2	0.01	0.2	0.01
Usual (5)	0.25	0.01	0.25	0.01
Usual (6)	0.19	0.01	0.19	0.01
Usual (7)	0.11	0.01	0.11	0.01
Usual (9)	0.12	0.01	0.12	0.01
Usual (10)	0.04	0.01	0.04	0.01
Employment	0.81	0.04	0.48	0.03
Ethnic	-0.99	0.03	-0.91	0.03
Single Parent	-1.09	0.11	-0.72	0.1
Pro/workless	-0.97	0.06	-0.89	0.04
Man/workless	-1.85	0.21	-1.45	0.2
Long Term	-1.01	0.08	-0.71	0.08
House Price			0.001	0.0001
Duration dummies	Included		Included	
Constant	-3.51	0.11	-3.68	0.12
Log L	-407,105		-407,087	
Sample	258,337		258,337	

5.4 Simulations.

It is not always easy to compare the effect of different sets of characteristics when using a model such as the one used here. The results discussion so far has focused on

individual coefficients, so we would like to go further. In this section we consider a baseline case and show how the overall hazard is affected in a variety of circumstances using the coefficients estimated in the models in this section. Fortunately the coefficients are reasonable stable in the various specifications. Obviously we need to pick one set of estimates from tables 7 and 8 for the coefficients on the non-interacted location variables. Where there is a discrepancy we choose the one consistent with the earlier PCE estimations. Note we use coefficients from specifications including the house price variable only.

		6 month Hazard (Pro)x100	6 Month Hazard (Unsk. manual)x100
Baseline		1.18	0.68
51-60		0.85	0.49
Married		1.37	0.79
Emp – 3%		1.16	0.67
Emp+3%		1.2	0.69
Ethnic –7%		1.12	0.65
Ethnic +2%		1.2	0.69
Single Parent –2%		1.16	0.67
Single Parent +2%		1.2	0.69
Workless –1.5%		1.17	0.67
Workless +1.5%		1.19	0.69
Long term –4%		1.15	0.66
Long term +4%		1.21	0.7

The baseline hazards are calculated by picking one group for each of the dummy variables, then setting the location characteristics at their mean values. In this case the baseline person is aged 18-24 and unmarried. Clearly the difference in parameters between the 2 occupational groups has 2 effects here. In percentage terms it increases the effect of changes in the variables on the conditional probability of leaving after 6 months. It also increases the gap between the baseline hazards from the 46% that would be expected using the earlier PCE results to almost 74% here. When analysing the changes in the location characteristics we have chosen values consistent with the 25^{th} and 75^{th} percentiles for the variable in question. In all but one case this leads to an even change in both directions. Overall the results show how marked the difference between the 2 groups can get when the coefficients are allowed to vary between groups. Since it is quite feasible that unskilled manual persons may live in an area with detrimental values for all variables it is clear that the overall effect can be a very large one.

6. Conclusion

We have seen throughout this chapter that characteristics of the location at which one resides do affect the duration of unemployment spells. Though the magnitudes of the effects are certainly altered, the inclusion of average house prices within the local authority does not change the result. The variables that are consistently significant are proportion of economically active males within the LA who are in full time employment, proportion of non-whites within the LA, and proportion of households headed by a single parent, either male or female. Also consistently significant is proportion of the population living in a workless household and having dependent children, and proportion of unemployed individuals within the LA counted as long term unemployed by census definitions. We interact several location characteristics with occupational groups and find that unskilled manual workers are more responsive to changes in the neighbourhood characteristics.

It is argued in this piece that these effects could be observed as a consequence of the potential independence of local labour markets even if they are characterised by different demand side conditions in terms of wages and available job opportunities. A low geographical mobility of labour can be responsible for this. This also suggests that at least in part we can interpret the locational characteristics as proxies for previous shocks to a certain area. Equally, we also must acknowledge the interdependence of agents' actions. It is often suggested that imitation effects may exist, and that expectation formation depends crucially on observed outcomes from both one's own choices and that of others. The fact that we find here that unskilled manual workers are more responsive to the characteristics of the location at which they reside is consistent with both results such as those in Topa (1997), who argues that negative spillover effects are stronger for agents with low human capital, and McCormick (1998), who argues that unskilled workers are less mobile and hence more susceptible to location based shocks.

From a broader policy perspective the results are of interest. Although in aggregate the UK economy can be said to have performed well in recent years, worklessness at the individual and household level is increasingly concentrated on certain geographic areas. Understandably much concern has developed about how concentrations of the disadvantaged matter in relation to the persistence and durability of their poor labour market outcomes. Equally the role of geographic mobility can clearly not be ignored. Employment based strategies for promoting social inclusion, particularly the more focused ones, are, we think, worth pursuing further, but the susceptibility of the relevant groups to locational characteristics and the reasons for this sensitivity require a greater emphasis in further analysis.

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