SERC DISCUSSION PAPER 40

Local Human Capital and its Impact on Local Employment Chances in Britain

Ioannis Kaplanis (SERC, Department of Geography and Environment, London School of Economics)

January 2010

This work was part of the research programme of the independent UK Spatial Economics Research Centre funded by the Economic and Social Research Council (ESRC), Department for Business, Enterprise and Regulatory Reform (BERR), the Department for Communities and Local Government (CLG), and the Welsh Assembly Government. The support of the funders is acknowledged. The views expressed are those of the authors and do not represent the views of the funders.

Local Human Capital and its Impact on Local Employment Chances in Britain

Ioannis Kaplanis*

January 2010

* SERC, Department of Geography & Environment, London School of Economics

Acknowledgements

I would like to thank Steve Gibbons, Diane Perrons, Vassilis Monastiriotis, Ian Gordon, Andreas Georgiadis, Alessia Matano, Alan Manning and Philip McCann for useful discussions and comments on drafts of this paper. At various stages of my research I have benefited from comments from members of the Economic Geography Cluster of LSE and SERC, as well as from session participants at the Regional Science Association International congress in São Paulo (2008), the European Regional Science Association conference in Liverpool (2008), Spatial Econometrics conference in Barcelona (2009) and European Association of Labour Economists conference in Tallinn (2009). I would also like to thank the organisers of the RSAI world congress in São Paulo for supporting me financially to participate to the congress. Last but not least, I would like to thank Birgit Austin at the UK Data Archive and Tom Knight at ONS for assisting me with data provision. For this research, I have been funded as a PhD scholar from the State Scholarships Foundation (IKY, Greece).

Abstract
This paper examines how high human capital in a locality is associated with the employment outcomes of individuals. A probit model is used to examine how the employment probability of otherwise similar working age males is associated with changes in the share of degree holders in the local area. Different econometric specifications are employed in order to shed light on the positive effect found and its possible causes. The paper discusses three main accounts, referring to the consumption demand, productivity spillovers and production complementarities. For Britain, it is found that the share of high skill *residents* in a locality has a strong positive impact on the local employment chances of men with no qualifications. The effect on the local employment chances of the other educational groups is either insignificant or significant negative. These results are consistent with the consumer demand hypothesis that the presence of high educated, high income individuals in a locality boosts the demand for local low skill services. On the other hand, when the share of skilled *workers* is used, the results hint on possible simultaneous effect of production complementarities and productivity spillovers. However, the analysis points to the existing limitations of successfully isolating the consumption demand and the production function mechanisms and calls for further research.

Keywords: local labour markets; employment; consumer demand; human capital externalities
JEL Classifications: J21; J24; R23

I. Introduction

Needless to say, employment is vital for the well being of an individual but also for the society as a whole. Although economic conditions are quite different from the post-war reconstruction era, one of the main economic policy goals is to deliver an economy that offers employment opportunities and at the same time has a highly qualified, skilled labour to access them. In that respect, education and skills acquisition is crucial for fostering growth and delivering employment. There exists an important literature on human capital and how it affects growth at the national or regional level. This paper looks at the effects of high human capital at the very localised level for Britain. Specifically, it examines whether the increasing presence of university graduates in a locality affects positively the employment chances of its residents.

Using data for the British travel-to-work-areas (TTWAs) in 2006, a simple scatter plot shows a clear positive association between the share of degree holders in the area and the employment rate of its working age resident population (Figure 1). More educated areas have higher employment rates. This association appears to hold but is weaker when looking at the Local Authority level, mainly due to the London Boroughs having high shares of degree holders together with low employment rates (Figure 2). In any case, this positive relationship suggests that educated areas are associated with higher employment rates. Of course, the causality can go either way. It is quite possible that educated individuals migrate to the areas with higher employment rates. This paper will try to examine whether a greater number of educated individuals in an area might affect the employment chances of the residents of the area. Assuming an

upward sloping supply curve, such employment effect might come from a positive shift in labour demand due to the higher human capital in the local area.

A positive shift in labour demand from higher human capital in an area might arise for reasons that can be broadly divided to production driven and consumption driven ones. The former refers to the vast literature on agglomeration economies and human capital externalities (Marshall, 1890; Rauch, 1993, Glaeser and Mare, 2001; Moretti, 2004). While the latter focuses on the increased demand for local consumer services by an expanding high-income, high-educated urban workforce. Although economic research has turned less attention to consumption driven explanations compared to production driven ones, the relevant literature has been expanding recently (Glaeser et al. 2001; Manning, 2004; Shapiro, 2006; Kaplanis, 2007; Mazzolari and Ragusa, 2007). These different mechanisms are not mutually exclusive and can take place at a local labour market simultaneously. In that respect, relevant research can inform policy albeit with a different focus for each account; the workplace for the production related and the neighbourhood for the consumption related. Agglomeration economies and productivity spillovers can be said to provide the economic rationale for governments' efforts to affect business location decisions. Notable example is the creation of technological parks. On the other hand, the consumption driven account can be said to lie behind area regeneration projects. These projects encourage mixed uses of land and aim to attract young professionals in the deprived neighbourhoods of the metropolitan areas in order to revitalise their local economic base.

Using microdata from the Annual Population Survey for the period 2004-6, this paper examines how greater presence of degree holders in a local area in Britain might

increase the employment chances of otherwise similar individuals. Potential ways to disentangle between production driven and consumption driven explanations are discussed although attempts for empirical verification are inconclusive[1].

The next Section II offers a brief overview of the literature and sets the contextual background within which the analysis is based. Section III presents the empirical strategy employed and describes the data. Section III discusses the empirical results and various robustness tests. The final Section IV concludes.

II. Literature review and contextual background

High human capital in a locality can have a beneficial impact on the local employment rate due to a production related or a consumption related mechanism (or both). I first consider the consumption driven mechanism.

Consumer demand account

In a nutshell, high-income, high-educated residents spend more in absolute terms, but also spend a greater share of their income, compared to the other income and educational groups, for services that are not necessities, like leisure activities and personal services, that are income and education elastic. Albeit not all, most of these services share three main characteristics: they are non-traded, human labour is

[1] Assuming a non-elastic labour supply, the positive shift of the labour demand would also cause positive wage effects that are examined in Kaplanis (2009).

irreplaceable by technology in their provision and they are generally regarded to be relatively low-skilled. Notable examples are cleaning and security services as well as services that require personal contact e.g. bar staff, sales assistants and care workers. This hypothesis predicts that a proliferation of high income, high educated population in a local area would boost the demand for low-skill local consumer service jobs. Given an upward sloping supply curve, wages and employment in these service jobs would increase for these areas.

The question that arises is what may cause spatially differentiated growth of high-skilled individuals in different areas of the country. A plausible response is to think that cities attract high-skilled workers due to the urban amenities and the productivity benefits that they offer[2]. As the respective literatures are presented later in this section, here I restrain discussion to the relevant points. The urban or cultural amenities that cities offer might attract high-educated individuals that value them higher than other educational groups and this might generate a spatial sorting of human capital in the country. From another standpoint, agglomeration economies might operate in cities or local labour markets that enhance the productivity of high-skilled workers more than elsewhere and thus raise their relative labour demand. As a result, there is going to be an increased influx of high-skilled individuals in these areas due to the higher returns to human capital and increased employment opportunities that they offer. Besides influxes of high-skilled migrants, spatial differentiation in human capital can come from local youth cohorts acquiring greater levels of education and entering high-skilled, high-paid occupations. For example,

[2] It has also been argued that tolerance and openness to diversity in a city might be important for attracting high-skilled, talented individuals to it (Florida et al., 2008).

increasing individual returns to human capital in an area might encourage local youth cohorts to receive higher education and attend university.

Let's see now the characteristics of these low-skilled service jobs that might be demanded by the growing numbers of the high-skilled in an area. While, they are conveniently referred as 'low skilled', a caveat should be placed here as some require great skill like care occupations. In any case, it is less debatable that they are poorly paid and employ to a large extent workers with low or no qualifications. Although skill requirements are low for these jobs, the great advances in technology in the recent decades have not made them obsolete yet. Human labour still forms the main part of their activity, since technology has not managed to replace labour for tasks that require hand-eye-foot coordination like cleaning or services that require personal contact like bartendering. These are the non-routine tasks found in low-paid manual jobs that Autor et al. (2003) and Goos and Manning (2007) examine in their analysis of the impact of technological progress on task composition. There is also a parallel line with the so called "technologically non-progressive" sectors of Baumol (1967), that have limited scope for productivity increases. Their survival in the economy lies on a price inelastic/income elastic demand for them (e.g. the retail sector) or on government support (e.g. hospitals). In that case, they would attract a growing share of the labour force if their relative output is to be maintained.

Besides referring to jobs that are irreplaceable by technology, the other crucial factor for the consumption driven mechanism to work is that they are non-traded. Most of these consumption services need to be consumed and produced locally and therefore require physical proximity between the consumers and the producers. In that respect,

globalisation has not impacted yet on dislocating them to low labour cost countries in the developing world. Good examples are cleaning services, security and services offered by bar staff, sales assistants. Future improvements in technology and change in social habits might impact on their potential for outsourcing but there might still be a large share that would have to be delivered and consumed on spot. For example, e-shopping might become increasingly popular in the future but it might not wither away the pleasure some people derive from shopping down a street with small boutique shops or visiting a mall. As long as this is the case, the demand for sales assistants will still be there.

Table 1 attempts to summarise how technological improvements and the non-traded nature of the services interact with each other in the context of the consumer demand mechanism. The top left shaded cell refers to the jobs that we are interested in. According to the consumer demand hypothesis, a rise in the share of high-income high-educated individuals in a locality will boost demand for these low-skill services that are consumed and produced locally. Given an upward sloping labour supply curve, we should expect an increase in wages and employment for these jobs and this is going to be empirically investigated in Chapters 4 and 5. Let's look now at the jobs that fit in the other cells of Table 1. Bottom left corner includes jobs that technology cannot substitute for successfully and that are traded. Think of the increasing amount of services provided by call centres, which are labour intensive. They require communication and personal skills that technology has not made redundant yet, but improvements in telecommunication have led to their outsourcing to low labour cost countries or regions. Top-right corner includes jobs that technology has substituted for human labour but they are non-traded. Examples are petrol stations and vending

machines that sell soft-drinks or snacks. Although the consumption is localised, automation has reduced human labour in these sectors of the economy. Finally, the bottom right corner considers sectors of the economy that are traded and human labour plays an increasingly minor part (e.g. manufacturing, e-shopping).

An interesting relevant discussion is offered by a number of papers in the urban economics literature (Glaeser et al. 2001; Glaeser and Saiz, 2004; Glaeser and Gottlieb, 2006; Shapiro, 2006). Although, they do not explicitly make an argument like the one discussed here, they still raise interesting points. Glaeser et al. (2001) offer an important theorisation of the rise of city as a centre of consumption. Their main aim is to investigate the economic success of cities and argue that their role as consumption centres in an era of rising incomes has been crucial for the demand for cities and the recent urban resurgence. Urban areas provide a large variety of services and consumer goods (like theatres and restaurants) that are non-traded and therefore attract increasingly rich workers. Attracting richer and better educated workers increases the productive capacity of the city and contributes to employment growth.
Glaeser and Gottlieb (2006) provide empirical evidence from a US large sample life style survey that college graduates are more keen to visit a museum, go to a restaurant or a concert or similarly make use of the available urban amenities than other educational groups. Shapiro (2006) makes similar arguments when he investigates the positive relationship between the concentration of human capital in a metropolitan area and its employment growth. One of the explanations that he examines refers to the expansion of consumption amenities in areas with more educated populations. Specifically, he finds that metropolitan areas with higher human capital concentrations experienced higher growth of restaurants per capita in the 1990s in US.

Researchers in areas other than economics have offered informative accounts that are relevant to the consumer demand hypothesis. Numerous contributions in the urban geography and sociology disciplines theorise in a powerful way the rise of 'world cities' and cities' changing role in an era of deindustrialisation and globalisation (Friedman and Wolf, 1982; Mollenkopf and Castells, 1991; Sassen, 2001; Perrons, 2004). Services form the dominant economic activity in a radical transformation of the urban economy. Financial business services and the new economy sectors experience a boom in the recent decades and become the economic engines of the cities economies. The labour force that works in these sectors gains significantly and forms part of an expanding 'consumer class'. This expanding consumer class has led to "high income residential and commercial gentrification [that] is labor intensive and raises the demand for maintenance, cleaning, delivery, and other types of low-wage workers" (Sassen, 2001, p. 286).

More recently, economists have conducted research along similar lines and found supporting empirical results of a consumption demand mechanism or 'consumption spillovers' (Manning, 2004; Mazzolari and Ragusa, 2007). Manning (2004) considers a simple model with two types of labour, skilled and unskilled, and two sectors, a traded and a non-traded housework sector, that predicts increased employment prospects and wages in cities with higher shares of skilled workers. Skilled workers can either do the housework themselves or employ someone to do it. A higher share of skilled workers in the city would generate increased demand for non-traded services. Similarly, higher wages of skilled workers (e.g. due to SBTC) would mean higher purchasing power and therefore higher demand for non-traded services. The

model then predicts that a rise in demand for non-traded services by the skilled labour would raise the wages of the unskilled and hence the employment of unskilled labour in the non-traded sector.

Manning (2004) provides empirical support for the predictions of this model using data from US and UK. For both countries, low skill labour has been employed increasingly in the non-traded sector and decreasingly in the traded one over the last two decades. Furthermore, in a panel of US cities for 1994-2002, he finds that the employment rate of the less-educated group depends positively on the share of college graduates in the city. This impact declines for the employment rate of the medium educated groups and turns to zero for the highly educated themselves. Finally, higher shares of college graduates in a city affect positively the employment of the less-educated in the non-traded sector and negatively in the traded sector. This pattern is not documented for medium and higher educational groups.

Mazzolari and Ragusa (2007) build on Manning's approach and discern a 'home services' sector in order to investigate "consumption spillovers" from skilled workers in US. In their account, skilled workers' rising wages in the recent decades have increased their value of time and led to greater outsourcing of home production activities. In support of that, they present consumer expenditure data showing that the more educated or the richer is a household, the greater its budget share spent on home services. Additionally, employing a panel of US cities they find a positive relationship between the growth of relative wages at the bottom and the growth of relative wages at the top of the distribution. This association rises with the share of low-wage workers employed in home services but not with the share employed in other non-

traded sector activities. This is interpreted as evidence in favour of the outsourcing of housework services approach rather than a more general income effects approach. Furthermore, the association between the growth of the relative wages at the top and the bottom of the distribution does not increase with the share of college graduates in the city, as the authors would have anticipated in the presence of human capital externalities.

Kaplanis (2009) considers the consumer demand hypothesis and finds empirical support from British data on travel-to-work-areas. Employing wage regressions, that paper provides evidence that individuals' wages are positively associated with changes in the shares of high-paid occupation workers in the TTWAs for the late 1990s. As this is the case for low-paid occupation workers like waiters and cleaners but not for the middle-paid occupation workers, the paper argues that consumer demand effects might be in place.

Production side accounts

Let us now consider in more detail the alternative explanations that are production related and can give also rise to the local labour demand, affecting this way the local employment chances of individuals. The first pertains to human capital externalities explanations and the second to production complementarities between low skill and high skill occupations.

Research on human capital externalities has been very central in economics. Following Lucas (1988), economists have examined external effects of human capital that operate at the aggregate level and generate productivity increases for individuals above their individual characteristics (Rauch, 1993; Acemoglu and Angrist, 2000; Moretti, 2003, 2004; Ciccone and Peri, 2006). Lucas pointed that research should look in cities in order to examine the nature of the interactions between workers that generate these external effects. In order to capture empirically human capital externalities, most researchers use wage regressions controlling for individual education and experience and include the aggregate educational level at the city or state level as an additional variable. There is a parallel link of this literature with the agglomeration literature that examines how firms agglomerate in space in order to gain productivity benefits from economies of scale (see Duranton, 2006 for such an argument[3]).

Marshall (1890) was the first to observe that firms agglomerate in space in order to gain productivity benefits from agglomeration economies that arise through local input sharing, local market pooling and knowledge spillovers. Subsequently, a substantive literature has emerged that examines the productivity benefits from agglomeration and the nature of the interactions between firms/workers in the workplace or the city level that generate these productivity benefits (Ciccone and Hall, 1996; Duranton and Puga, 2004; Rosenthal and Strange, 2004; Combes and Overman, 2004; Combes et al., 2008).

[3] Halfdanarson et al. 2008 have a relevant interesting discussion while their main focus is on the linkages between the literature on human capital externalities and the 'urban wage premium' one.

Specifically, it is argued that firms may face lower costs for specialised non-traded inputs that are shared locally in a geographical cluster. Furthermore, firms can gain from reduced labour acquisition and training costs in thick local labour markets with abundant specialised labour force. The precise mechanism through which knowledge spillovers between firms and individuals are transmitted and foster innovation and productivity is not entirely clear and a large stream of literature attempts to shed light on it (Krugman, 1991; Porter 1990; Gordon and McCann, 2005). It is argued that face-to-face contact can enable knowledge spillovers through increases in the intensity of the interactions with other firms or individuals (Storper and Venables, 2004; McCann and Simonen, 2005). In that respect, geographical proximity is crucial in fostering face-to-face contacts and interactions and can give rise to distinct spatial patterns of agglomeration.

But the sources of human capital externalities can be argued to come through the same routes that generate these agglomeration economies (local input sharing, local market pooling and knowledge spillovers). In that respect, although human capital concentration is not the same with sectoral/urban agglomeration, as Duranton (2006) argues, it might give rise to the same sort of externalities. It can be expected that areas with high human capital concentration offer increased provision of local specialised inputs and better labour market matching due to the availability of specialised high-skilled labour. Besides that, human capital externalities can emerge via a knowledge spillovers mechanism and empirical evidence has shown that cities with high human capital concentration favour communication interactions, that advance productivity (Charlot and Duranton, 2004).

There is a clear link of the human capital externalities account with the empirical investigation of this paper, since an increase in the productivity of workers would shift the labour demand for them and thus increase the corresponding wages and employment given an upward labour supply curve.

Productivity spillovers from human capital concentration should affect all educational groups to some degree. However, if low and high-skilled individuals are considered to be imperfect substitutes, then productivity benefits may emerge even in the absence of human capital externalities and cause the shift in the labour demand curve. In a standard neoclassical model of perfect competition with two types of labour, skilled and unskilled, a rise in the numbers of skilled labour can increase productivity for the unskilled simply because of production complementarities (for relevant discussion see Moretti, 2004; Ciccone and Peri, 2006).

Moretti (2004) offers an empirical approach to distinguish between productivity spillovers and production complementarities. He finds that the wage premium that individuals gain in cities with higher shares of college graduates decreases when one moves up the educational ladder. In that respect, low skilled workers benefit the most from larger numbers of college graduates in the city, while medium and high skilled workers gain less. He explains this as the simultaneous effect of productivity spillovers and production complementarities. For the lower skilled groups, productivity spillovers and production complementarities work in the same direction, raising their productivity and inducing a positive wage effect. For the higher skilled groups, productivity spillovers induce a positive wage effect while the higher supply

of the skilled workers has a countervailing negative wage effect as predicted by a downward sloping labour demand curve.

III. Empirical strategy and data used

Data

The data used for this paper comes from the Annual Population Survey (APS) of the UK Office for National Statistics (ONS). At the time accessed, data with information on fine geographies were available through a special license only for the years 2004-2006 and thus this is the time period of the analysis. The APS uses data from the Labour Force Survey together with an additional sample boost for urban areas of England. As the APS boost ceased in 2005 due to financial constraints, the analysis in this chapter is restricted to the APS without the boost. Essentially this leaves the dataset with information from the LFS and its annual boosts, which was known as ALALFS for the years before 2004 (Annual Local Area Labour Force Survey). LFS is the largest continuous household survey with information on labour statistics in UK. It covers approximately 57,000 private households that are contacted each quarter. Each household is contacted for five quarters and then drops from the sample. In order to construct an annual representative survey with each household included only once, information from four consecutive quarters is aggregated keeping only households who are interviewed for the first and the fifth time. This design delivers an annual database for UK known as the LADB (Local Area Database). Adding to this

database annual local LFS boost samples for England (LLFS), Wales (WLFS) and Scotland (SLFS), gives us a very large survey with about 365,000 individuals every year. This is the survey used for the analysis below.

Model specification

The main empirical task of this paper is to investigate the relationship between high human capital in a local area and the corresponding employment rate. For that reason, a probit model is used to examine how the employment chances of otherwise similar individuals are affected by the presence of degree holders in the locality. The probability of employment of an individual is examined by a probit model that includes the share of degree holders in the local area and a number of personal controls. The probit model used is shown below:

$$y_{iat}^{*} = X'_{it}\beta + r * HC_{at} + d_t + u_{iat} \qquad \text{(i)}$$

$$Prob(y_{iat} = 1) = Prob(y_{iat}^{*} > 0) = F(X'_{it}\beta + r\ HC_{at} + d_t)$$

$$y = 1 \quad \text{if} \quad y^{*} > 0$$

$$= 0 \quad \text{otherwise}$$

The dependent latent variable y^{*} is associated with employment and not observed in the data; rather what we observe in the data is a dummy variable y that takes value 0 if the individual is unemployed or inactive and 1 if employed. The subscript t refers to the relevant year and a to the local area that the individual is based. X_{it} is a vector that

controls for personal characteristics- age, educational level, marital status, number of children and foreign born status. The specification includes year dummies d_t to control for economic cycles in the national economy. The error term u is assumed to be independently and identically distributed following a normal distribution. Finally, *HC* is the variable of interest that stands for the share of university degree holders in the local area and varies yearly. This local area could refer to either the workplace or the residence area and this is an important issue that will be investigated later in more detail.

Dealing with potential sources of bias

A potential source of bias for the model in equation (i) arises from unobserved area characteristics that are correlated with the share of high educated individuals in the area but also affect local employment chances in the area. For example, dynamic areas that experience a boom due to industrial mix or historic reasons might offer increased employment opportunities while at the same time attract increasingly educated workers due to the urban amenities they offer. In order to account for time-invariant unobserved area characteristics, I add area dummies d_a to the model.

$$y_{iat}^* = X_{it}\beta + r\ HC_{at} + d_t + d_a + u_{iat} \qquad \text{(ii)}$$

Since there is no longitudinal information in the APS (unlike LFS), it is not possible to control for unobserved individual characteristics, like individual ability. In that

respect, a potential source of bias arises for my model if there is a non-random sorting of high ability individuals across areas[4].

An important concern for the empirical exercise of this paper refers to possible emergence of reverse causality. It is possible that university degree holders move to the areas with high employment rate and this generates the positive association that is observed. Although an instrumental variable approach would be needed to address this issue, it has been difficult to find an adequate instrument. The number of first degree qualifications awarded by local universities in the previous year has been tried as an instrument for the number of university degree holders in the local area, though with limited success due to weak instrument concerns. The assumption behind this instrument is that choice of university and the admissions procedure for undergraduates take place 4 years before the current year and are not affected by contemporaneous local labour market conditions. There is relevant empirical evidence from UK that choice of university mainly concerns university specific characteristics rather than the local employment conditions of the university region upon graduation (Faggian and McCann, 2006). The empirical analysis part of the paper offers a brief discussion and suggests that the concern for reverse causation might be less of an issue for the purposes of this research than it might have first appeared. As discussed in the following subsection, the main part of the empirical investigation applies the preferred probit model to different educational groups. In that respect, it will be seen

[4] A possible account is that high-ability individuals might move to the areas with growing numbers of degree holders (due to higher returns to ability or the urban amenities they offer). Since higher ability individuals might have increased employment probability compared to lower ability individuals with similar observed characteristics, a positive bias might arise for my variable of interest *HC*. Since the probit model is applied to different skill groups, this issue might be more of a concern for the high-skilled group than the others.

that reverse causality is more of a concern for the high-educated group and less so for the other educational groups.

Theoretical discussion

As discussed in the previous section, all in all there are three main accounts that come from the relevant literature, referring to consumer demand, productivity spillovers and production complementarities. The first refers to the consumption side, while the other two to the production function. These accounts are not mutually exclusive and what we observe in the local labour market could be their combined outcome. Ideally, we would like to discern the effect of each of the three accounts.

As the consumption driven account refers more to the residential area and the production driven ones to the workplace, this gives a starting point for the empirical strategy to follow. In that respect, the variable of interest *HC* in the econometric specification above would be residence based or workplace based respectively. Investigating the impact to the local labour market from higher shares of educated residents would shed light mainly to the consumer demand story. Similarly, investigating the impact from educated workers would inform on productivity spillovers and/or production complementarities.

The other crucial factor that would aid identification is looking at the effect of the share of degree holders to the employment chances of different educational groups. While the productivity spillovers mechanism should affect equally all educational

groups, the same does not apply for the consumption demand and the production complementarities accounts.

Let's look at each of the accounts one by one. The consumer demand account suggests that higher shares of educated residents would raise labour demand for local low skilled consumer services. Therefore increased employment chances for low qualification residents but not for the other educational groups would be consistent with this account. Regarding the productivity spillovers mechanism, it is expected that the effect would be similar for the different educational groups. High human capital in the local area is suggested to raise the productivity of the average worker of each skill group above the level that educational and other personal characteristics would dictate. The increased productivity of workers shifts the labour demand curve up and rightward and depending on the elasticity of the labour supply, wages and/or employment would increase. Assuming an upward sloping labour supply curve that is not perfectly inelastic, employment opportunities in the locality should increase via this productivity spillovers mechanism.

Finally, even in the absence of human capital externalities, productivity increases could arise due to production complementarities. In a standard neoclassical model, where skilled and unskilled labour are assumed to be imperfect substitutes, a rise in the numbers of skilled workers would raise the productivity of unskilled workers and the relevant demand for them. Therefore in our case, an increase in the share of educated workers would mean increased employment opportunities in low skill jobs. Looking at the differential effect of our variable of interest to the different educational

groups could inform on the combined effect of production complementarities and/or productivity spillovers. Table 2 summarises this discussion.

However, there are some important caveats that we have to acknowledge. Firstly, an increase in local low-skill job opportunities does not necessarily mean that local residents would benefit from them. It might as well be the case that commuters from elsewhere are attracted to the locality in order to work. If this is the case, the dependent variable in specification (i) would miss the increased employment opportunities and the probit results would give an underestimate of the effect of the share of degree holders (*HC*). In a parallel fashion, some residents of the locality might get a job in another locality. In that case, the dependent variable erroneously captures employment opportunities in neighbouring areas and the results give an overestimate of the effect of *HC*. There are two ways this study employs in order to deal with these problems. The first one is to amend the sample in order to capture in a meaningful way the 'local employment chances'. Therefore, I exclude from the sample individuals who live in one area and commute for work to another one. This way the dependent variable y_{iat} in (i) takes the value 0 for a workless resident of locality *a* and the value 1 for a resident who works and lives in locality *a* [5]. The second way is to apply the analysis for 'travel-to-work-areas' (TTWAs). TTWAs are constructed by definition so that the bulk of their resident population also work within the same area. Therefore, they correspond to the best definition we can get of local labour markets and are preferable to administrative spatial entities with arbitrary boundaries (like the local authorities (LAs)).

[5] When we restrict the sample as described and the analysis is done at the Local Authority level, we should note that we capture not only 'local employment chances' but also the capability of residents to find employment in the locality that they live. Therefore, this specification is more restricted than probably needed.

The second problem refers to the way the variable of interest, the share of educated individuals in the local area, is constructed. Earlier we suggested a residence vis-à-vis workplace distinction in order to shed some light in this investigation. Nevertheless, it would not be possible to isolate a consumption related rather than a production related effect, unless the educated residents do not work in the same area. Therefore, in order to isolate the consumption demand effect we want the variable of interest to refer to the share of degree holders in the locality who are residents that commute to other localities for work[6]. Similarly, when considering the production driven mechanisms, we would want educated workers who live in another area and commute for work to the locality we are examining. The problem with pursuing such analysis is twofold. In the theoretical level, the likelihood of commuting depends on urban rents, urban amenities, employment opportunities and wages. In that respect, examining how the share of the educated amongst all inward commuters impacts on the local labour market would not be so straightforward. In the practical level, the sample sizes fall substantially and introduce noise in our variable of interest.

Finally, there is a third problem that is more conceptual than the other two and blurs the distinction between the three accounts. The best way to illustrate this problem is to consider an example. Think of a banker who buys food for his lunch-break. If he goes out of the office and has lunch at the local sandwich shop, then this transaction should probably best fit the consumer demand account. Therefore, although the induced rise

[6] An alternative way would be to restrict the sample to those who are over working age so as to capture the retired (as Manning, 2004). However, this is not possible as information on educational attainment for the over working age population exists in APS only for those who are employed, roughly 10% in 2006. Also, considering workless residents would be problematic since they might not have income to spend on services, unless the educated workless people are particularly wealthy; which is unlikely to be true for the vast majority of them.

in the local labour demand for sandwich makers would show in a workplace-based consideration of my econometric specification, the account points to the consumption story rather than the production one. On the other hand, if he prefers to go to the café of his workplace for lunch, then the induced increase in labour demand might be considered part of a production complementarities explanation[7]. In this case, demand for sandwich-makers, which is a relatively less-skilled job, would come from the employment of more bankers in that workplace. In that respect, there is not a clear cut distinction to judge whether the source of the effect is consumer demand driven or driven by production complementarities, even if one successfully separated residents and workers in the variable of interest as discussed earlier. Nevertheless, this is mainly a concern for the econometric specification that uses high-skill workers in the variable of interest (*HC*) and aims to capture production side effects but might also capture unintentionally consumer demand effects for the low-skilled sample.

IV. Empirical results

Samples used and descriptive statistics

The sample is restricted to males so that we do not complicate the discussion of the labour supply with issues like the child-bearing role of women or partner's income. However, the variable of interest *HC*, the share of educated individuals in the area, includes both men and women. In any of the three accounts, female residents or workers are expected to have similar effect in the local labour market as male ones.

[7] Although even for that case some would argue to be part of a consumer demand story since the sandwich maker and the banker do not work in the production of the same product.

Therefore, the empirical investigation examines how the share of educated men and women in an area affects the local employment chances of men. The sample of the probit model includes men of working age, so age group 16-64. The sample includes the self-employed as self-employment status is common for specific low-skill services. The sample excludes the retired, the unpaid family workers and students who did not seek and did not want employment. The variable of interest *HC* considers both men and women over the age of 16. Variations of the latter in terms of age groups and the resident/worker status have been tried but data limitations restricted the potential of these approaches. This is discussed in more detail in a later section.

Summary statistics for the educational/skill groups used in the analysis are presented in Table 3. The APS variable used classifies the qualifications of the individuals to 7 broad categories, corresponding to the National Vocational Qualification levels structure (NVQ). NVQs are work-related, competence based qualifications that reflect the skills and knowledge of the individuals. There is a correspondence of the various academic and vocational qualifications that exist in UK to NVQ level equivalent (see Appendix A). This way individuals are classified in five broad educational groups, ranked here in descending order: 'level 4 and above', 'level 3', 'level 2', 'below level 2' and 'no qualifications'. Then there is a sixth group that contains individuals who have acquired 'trade apprenticeships'. It is conveniently placed between NVQ level 2 and 3, although its specific nature will caution on easy conclusions when comparisons are discussed in the next section. Finally, the seventh group consists of those with 'other qualifications'. This group includes qualifications that cannot be classified in any other group, many of which are non-accredited foreign qualifications (roughly 44% of those with 'other qualifications' are foreign born).

The employment rate for the whole sample of 291,547 men is 84.0%. As expected, there is a rising pattern for the employment rate as we move up the educational ladder. The 'no qualifications group' has the lowest employment rate at 60.9%, while the 'level 4+' group has the highest at 92.8%.

Spatial level examined

The analysis is conducted for two different spatial levels, local authorities (LAs) and travel-to-work-areas (TTWAs). The finest geographical detail available at the dataset is for Local Authorities, which are administrative units. Dropping the City of London due to small sample sizes (17 observations), there are 406 local authorities in Britain. The average sample size of an LA is 235 males and the standard deviation 189 (median 124 males). For all individuals in our sample, there is information on the local authority of their residence and also the local authority of their workplace if they are employed.

As it was discussed earlier in the empirical strategy, we would like to control for commuting when examining the 'local employment chances'. Since there are many individuals who happen to live in one area and work in another, I repeat the analysis for an alternative geographical disaggregation, the 'travel-to-work-areas'. TTWAs are defined in such a way by the Office for National Statistics so that most workers living in an area also work in the same area (75%) and most people who work in an area also live there (75%). The algorithm that constructs the TTWAs applies also a minimum threshold of working age population of 3,500. Nevertheless, many especially those

that refer to the city metropolitan areas are quite larger than that, with London and the surrounding area forming one TTWA which represents 15.5% of the total population in 2006. TTWAs correspond to the best definition of self-contained local labour markets we can get.

ONS has defined 243 TTWAs for UK using information from the 2001 Census. Since our analysis excludes Northern Ireland, we are left with 232 TTWAs that cover Britain. Information on TTWAs is not available in the APS dataset and therefore we have to construct a mapping of the LAs to TTWAs. Since some LAs correspond to more than one TTWA, the approach followed was to simply allocate an LA to the TTWA that makes up the largest share of it. This way some TTWAs are lost and we end up with 186 'customised TTWAs'. Although we lose some detail, the definition is still valid to a large extent and the bulk of their resident population also work within the same area. For simplicity, we refer to our customised set of areas as 'TTWAs'.

Distribution of HC

The category 'NVQ level 4 or above' is quite broad and includes both higher education and further education. The subcategory that refers only to the higher education is considered for the variable of interest *HC* so that we capture only the top educated. Then *HC* is the share of degree holders in the local area and changes across areas and years.

Considering its distribution for the 406 LAs in 2006, the median area had 16.9% of men and women over 16 years old with a degree. The standard deviation of *HC* across

areas is 7.5%. The top 1% of areas have a share of degree holders above 42.9% and the bottom 1% of the areas a share below 6.1%. Table 4 presents broadly similar figures for the full set of 1,118 LAs over the three year period. Regarding the 186 customised TTWAs in 2006, the share of degree holders for the median area was 16.1%. The standard deviation of *HC* across areas was 5.2%. The lowest percentile is below that for the LAs and stands at 2.5%. Similarly, the top percentile for *HC* is 32.8%, which is about ten percentage points below the one for LAs.

Probit model results- educated residents of the area

The empirical strategy that was presented earlier aims to inform on the impact of the presence of educated individuals on the local employment chances. In a nutshell, I try to get meaningful results by considering two different versions of the variable of interest, one with the share of educated residents and one with educated workers. Secondly, the impact of the local human capital on the different educational groups of the locality is considered. Thirdly, we attempt to capture the 'local employment chances' by refining the sample and/or using TTWAs.

Table 5 presents probit estimates for males residing in 406 local authorities of Britain between 2004-6. The probability of employment status of a working age male is examined by a probit model that includes the share of degree holders in the local area (*HC*) and a number of personal controls. The controls used are a full set of dummies for 5-year age bands, for the number of children, for the educational level, marital status and whether foreign born. Year dummies are included to account for the cycles

of the national economy. In all econometric specifications of the analysis, the standard errors are corrected for the grouped nature of the data (area-year clusters).

Column 1 shows the probit model results for all individuals in the simple model specification (i). It is shown that higher shares of degree holders in a locality are associated with higher employment probability for the local residents. I report the elasticity of the employment probability with respect to the share of degree holders at the sample mean to facilitate interpretation. For the simple model (i) the elasticity is positive and significant at the 5% significant level albeit of a small magnitude. Column 2 adds regional dummies to the specification as in the model specification (ii). Both the magnitude of the elasticity and its significance rise substantially. The regional dummies capture time invariant regional characteristics that affect local employment chances. The variable of interest *HC* varies across local authorities and thus captures within regions variation of the levels of *HC*.

Nevertheless, when a specification with area dummies rather than regional ones is examined the coefficient of the share of degree holders becomes insignificant. The area dummies capture all the variation and render *HC* insignificant. This is not the case when the sample is restricted to the no qualifications groups. The simple and the regional dummies specifications give positive significant results for the coefficient of *HC*, with small elasticities around 0.054 and 0.075 respectively (Columns 4, 5). These elasticities are almost four times higher than the respective one for the whole sample. Furthermore, the specification that controls for model area effects now gives strongly positive significant results (Col.6). This specification controls for time-invariant unobserved area characteristics. Essentially the identification arises from changes in

the shares of the degree holders in the area over time and how it affects the employment probability of the residents of the area. Since there are 406 LAs over 3 years, the identification for *HC* comes from 1218 effective values (in this specific case 1215 since a local authority is dropped from the sample as it predicts success perfectly). The elasticity rises now to 0.131 and is significant at the 1% level. Finally, we exclude from the sample residents who commute to other local areas for work. Then in the model (ii), the dependent variable gets the value 0 if the resident is inactive/unemployed and 1 if he works in the same area. The elasticity remains at the same level and its significance is reduced but still significant at the 5% level (Col.7). This is our preferred specification for this study.

Table 6 presents results of the preferred probit specification for samples of the different educational groups. The no qualifications group has the elasticity with the highest magnitude than all other groups. 'Level 2' and 'Level 3' have also significicant coefficients for the coefficient *HC*, although the elasticity is negative and of smaller magnitude. It is not straightforward to interpret these negative elasticities. The most intuitive account could be that middle-skilled individuals compete for the same jobs with the degree holders and therefore face adverse employment prospects from a rise in the supply of the latter group. The remaining educational groups give insignificant results. The strong positive elasticity for the no qualifications group is consistent with the consumer demand story. A rise in educated residents in a locality boosts the demand for local low skill services and thus positively affects the local employment chances of males with no qualifications.

Tables 7 and 8 present results for the same analysis on my customised travel-to-work-areas. TTWAs are the closest we can get to local labour markets and therefore more suitable for this analysis. The results in Table 7 are qualitatively the same with the results for LAs (Table 5), albeit the elasticities and the significance levels are much stronger. This is the case for both sets of estimates, of the whole sample and of the no qualifications group. Our preferred specification that excludes the commuters (Col.7) gives a 0.212 elasticity of employment probability of the low-skilled men with respect to the share of degree holders, which is significant at the 1% level. In Table 8 the signs of the elasticities for the various educational groups are the same with Table 6 (except for 'Trade Apprenticeships'). However, this time the coefficients of *HC* are insignificant for all other groups except for the 'no qualifications' one.

Probit model results- educated workers of the area

The analysis above examines how the share of educated *residents* in a local area impacts on the employment chances of men in the same locality. We have tried a similar analysis replacing the variable of interest *HC* with the share of high skill *workers* in the local area. Now *HC* stands for the share of 'managers and senior officials' out of the employed workforce that work in the local area. This is the top occupational group in terms of skill out of the 9 major groups of the ONS standard occupational classification (SOC2000) and includes 'corporate managers' and 'managers and proprietors in agriculture and services' (see Table 4 for its distribution over areas and years).

Table 9 presents the results of the analysis for different educational groups with *HC* varying in the local authority level. The elasticity for the no qualifications group is significant positive as with the educated residents' specification (see Table 6 for comparison). However, there are now three other educational groups with significant positive elasticities. The 'below level 2' and 'level 2' qualification group exhibit elasticities of 0.100 and 0.069 respectively. The highest skill group ('level 4+') has a low elasticity of 0.036, which is still significant positive. According to our empirical strategy, the impact of skilled workers on the local employment chances would inform predominantly on the production complementarities and/or productivity spillovers accounts. What is striking is that the elasticities for 'level 2' and 'level 3' that were both significant negative have now changed to significant positive and to zero respectively. The 'below level 2' and 'level 4+' groups have also changed from close to zero to significant positive. These results could be attributed to productivity spillovers raising the productivity and demand for these groups. Production complementarities reinforce this effect for the low skill groups and this might explain that the elasticities are stronger as we move down the educational ladder. However as discussed earlier, managers might still consume at the local area of their workplace (e.g. at lunch breaks) and therefore the results might capture a consumer demand effect as well. More research is needed to shed light in this area.

When similar workplace analysis is conducted at the TTWA level (Table 10), the coefficients do not change much compared to the local authority level. The mid-low and lower skill groups increase slightly their elasticities; though the no qualifications group elasticity is now weakly significant. Remarkably, the elasticity of the 'NVQ level 4+' now drops to zero, which is puzzling. An initial suggestion could be that

supply side effects might apply to this broader labour market level and where not applicable to the local authority level before. Of course, further investigation would be useful to inform on this issue.

Let's try now to summarise our empirical findings through the prism of the empirical strategy proposed earlier. When the share of educated residents is considered, then we get a strong positive impact on local employment chances of the low skilled. The effect on the local employment chances of the other groups is either insignificant or significant negative. These results are consistent with the consumer demand hypothesis that the presence of high educated, high income individuals in a locality boosts the demand for local low skill services. On the other hand, when the share of skilled workers is used, the results suggest the simultaneous effect of production complementarities and productivity spillovers. Nevertheless, a caveat arises due to the difficulty of successfully isolating the consumption demand and the production function mechanisms as discussed in the empirical strategy.

Robustness checks and IV attempts

Finally, time varying area characteristics are added to the econometric specification (ii) for the no qualification group as additional controls. The specifications include either the unemployment rate or the inactivity rate in the locality (see Table 4 for their distribution over areas-years). The unemployment rate is measured as the claimant count rate of unemployment benefits in the local area. The data is provided by Job Centre Plus unemployment offices and since it is administrative it is exclusive. The inactivity rate is calculated as the percentage of the individuals who do not work or

actively seek job in the local area (so that to meet the criteria of ILO definition 'unemployed') out of the working age population. The results are shown in Tables 11 and 12. These results should be viewed in juxtaposition with the respective results without the time varying area characteristics; columns 5 to 7 of Table 5 for LAs and columns 5 to 7 of Table 7 for TTWAs. Both the unemployment and the inactivity rate have negative coefficients as expected and reduce the employment chances of males in the locality. In the specification that has regional dummies, the unemployment rate has positive significant elasticity while it renders the *HC* effect insignificant (Column 1/Table 11). Since regional dummies are included, the unemployment rate captures the within regions variation and reflects the general demand conditions in the LA. However, when area dummies are included, the unemployment rate is insignificant and the share of degree holders *HC* retains its significance (Columns 3 & 5). This is consistent with the well documented fact of unemployment persistence over time. The results are similar for TTWAs as with LAs, although for TTWAs the share of degree holders remains significant at the regional effects specification (Table 12). We now turn our attention to the specifications with inactivity rate as an additional control. The elasticities of the employment probability with respect to inactivity rate are much stronger than earlier with the unemployment rate and remain significant in both regional and area fixed effects specifications. They also have a greater impact in reducing the *HC* elasticities. The reduction in the *HC* elasticities is less profound in the TTWAs specifications compared to the LAs.

As discussed in the previous section, an important caveat for the empirical exercise of the paper is the issue of reverse causation and an instrumental variable approach would help in this direction. I instrumented the number of resident degree holders in

TTWA *a* in year *t* with the number of first degree qualifications awarded by universities[8] in TTWA *a* in the previous year (*t-1*). It can be expected that a large number of undergraduates will stay in the TTWA of their university upon graduation. It is also assumed that choice of university and undergraduate admissions that took place in year (*t-4*) were not affected by local employment opportunities in year *t*. The sample had to be restricted to the 68 TTWAs that had presence of a university in the period of study 2004-2006. This instrumental variable approach gives a strong positive association between the share of resident university degree holders and the employment probability of males with no qualification. However, first stage results pose a caveat in the analysis, since the F-statistic of the excluded instrument is around 5.9 and fails to reject the null hypothesis of a weak instrument.

The issue of reverse causation is more relevant for the probit model that is applied to the high-skilled group ('level 4+'). University degree holders might move to the areas where the employment rates of the high-skilled are higher. In that respect, it should be expected a positive bias for the elasticity of the variable of interest (*HC*) in the model that refers to the 'level 4+' skill group. However, the results do not show a significant positive elasticity for the 'level 4+' sample (except for Table 9). Intuitively, it is less likely to expect that degree holders would move to areas where the employment probability of individuals with 'no qualifications' is improving, while their movement would not be associated with the employment chances of the other skill groups. Of course, future research will try to address this issue more fully. The discussed instrument of first degree qualifications will be interacted with distances from

[8] This data is taken by the Higher Education Statistics Authority (HESA).

universities for each TTWA so that the model is applied for all 186 TTWAs and try to improve the first stage results.

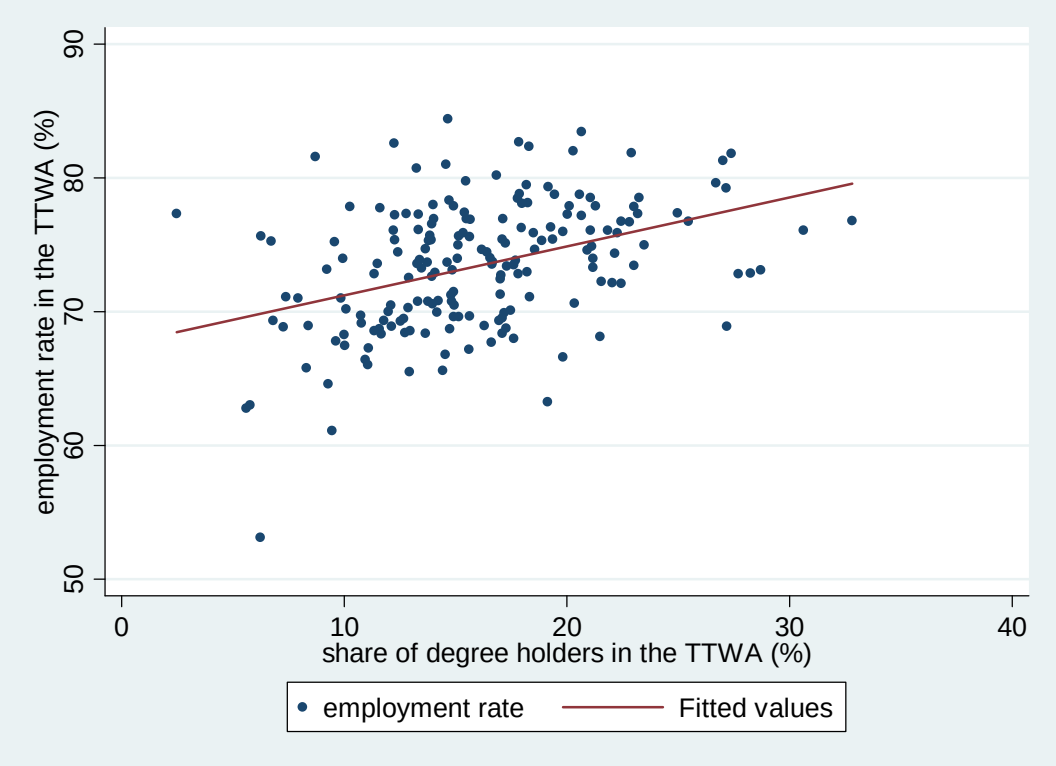
V. Concluding remarks

This paper examines how high human capital in a locality affects the local employment chances of individuals. A probit model is used to examine how the employment probability of otherwise similar working age males is affected by the share of degree holders in the local area. Different econometric specifications are employed in order to shed light on the positive association found and its possible causes. The paper discusses three main accounts, referring to the consumption demand, the productivity spillovers and production complementarities. Furthermore, it presents an empirical strategy to capture their effect. The analysis is repeated for different educational groups and for two different spatial scales, Local Authorities and customised travel-to-work-areas. Additionally, the share of the high skilled is investigated at both residence-based and workplace-based level. When the share of high skill residents is considered, then I get a strong positive impact on local employment chances of men with no qualifications. The effect on the local employment chances of the other groups is either insignificant or significant negative. These results are consistent with the consumer demand hypothesis that the presence of high educated, high income individuals in a locality boosts the demand for local low skill services. On the other hand, when the share of high skilled workers is used, the results hint on possible simultaneous effect of production complementarities and productivity spillovers. However, a caveat arises due to the difficulty of successfully

isolating the consumption demand and the production function mechanisms as discussed in the empirical strategy. The result that appears more robust across all the econometric specifications employed is that the elasticity of the employment probability with respect to the share of the high skilled in the local area is stronger for the no qualifications group. The elasticity is 0.212 in the econometric specification that examines the share of degree holder residents in the travel-to-work area. In that respect, further research would be needed to disentangle between the consumption demand account and the production complementarities that both appear to feed into this effect.

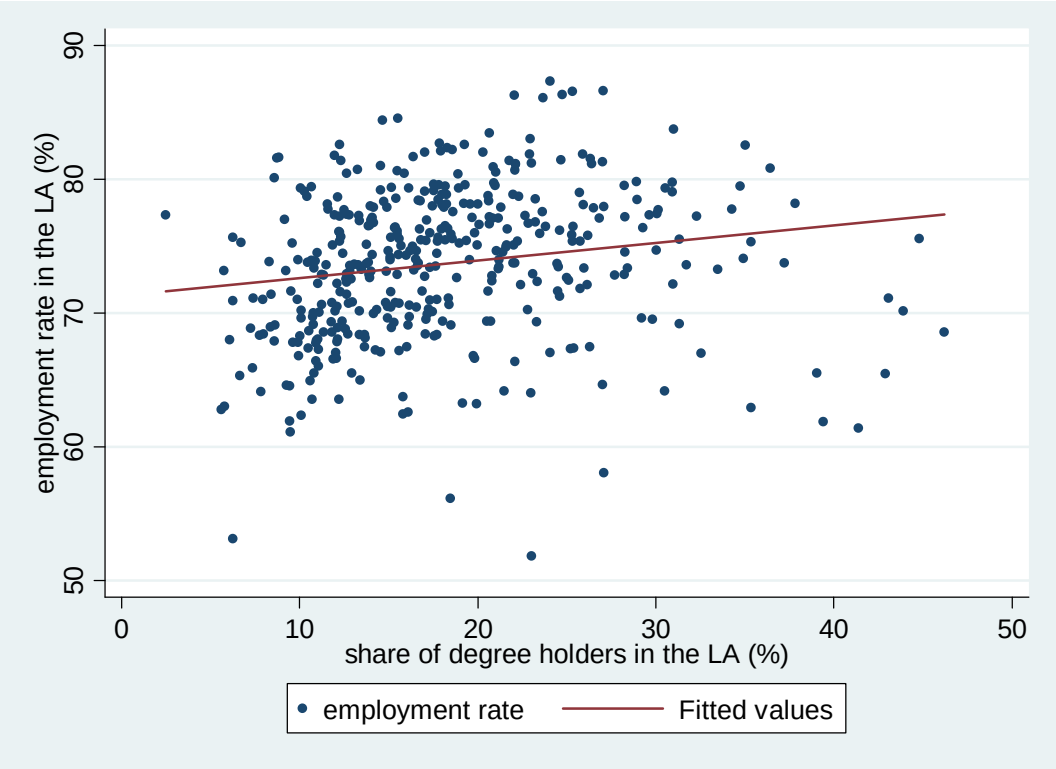
FIGURES

Figure 1. Association between employment rate of working age population and share of degree holders in the travel-to-work-area



Source: APS, 2006

Figure 2. Association between employment rate of working age population and share of degree holders in Local Authority



Source: APS, 2006

TABLES

Table 1. Trade and technology: classifying occupations

	Labour is irreplaceable (labour dominant in the activities performed)	**Labour is replaceable** (technology substitutes for human labour)
Non-traded	Cleaners; Care work; Bar staff	Petrol pump forecourt attendants; vending machines
Traded	Call centre staff	Manufacturing; E-shopping

Table 2. Synopsis of the three accounts that are examined in the study

	Mechanism	**Local manifestation**	**Impacts on**
Consumption story	Consumption	Residence area	Low skilled
Production complementarities	Production	Workplace area	Low skilled
Productivity spillovers	Production	Workplace area	All

Table 3. Employment rates for the different educational groups (2004-6)

Educational Group	**Sample size**	**Employment rate** (%)
All working age males	291,547	84.0
No qualifications	41,544	60.9
Below level2	35,399	82.1
Level 2	36,195	85.1
Trade apprenticeships	31,306	85.9
Level 3	46,287	88.6
Level 4+	76,119	92.8
Other qualifications	24,697	82.4

Source: APS
See Appendix A for detailed description of educational groups.

Table 4. Distributions of time-varying area characteristics for 2004-6

Variable/ Spatial level	Mean	Standard deviation	1%	50%	99%
LAs					
(406x3=1,118 effective obs.)					
Different HC definitions:					
% Share of:					
degree holders	17.4	7.3	5.7	15.9	41.4
managers & senior officials	14.3	3.6	7.0	13.8	24.3
Controls used:					
Claimant count rate %	2.1	1.1	0.6	1.8	5.2
Inactivity rate %	37.0	4.8	25.9	37.1	48.5
TTWAs					
(186x3=558 effective obs.)					
Different HC definitions:					
% Share of:					
degree holders	15.5	5.1	5.5	14.8	28.7
managers & senior officials	13.7	3.0	7.0	13.4	22.1
Controls used:					
Claimant count rate %	2.1	0.9	0.7	2	4.7
Inactivity rate %	38.0	4.4	27.9	38.2	50.1

Source: APS

1. 'Share of degree holders' in the local area refers to the share of individuals who have a qualification equivalent to first degree or NVQ Level 5 (see Appendix A relevantly).

2. 'Managers and senior officials' is the top occupational group in terms of skill out of the 9 major groups of the ONS standard occupational classification (SOC2000) and includes 'corporate managers' and 'managers and proprietors in agriculture and services' (APS data extracted from NOMIS).

3. The unemployment rate is measured as the claimant count rate of unemployment benefits in the local area (Job Centre Plus data provided by NOMIS).

4. The inactivity rate is calculated as the percentage of the individuals who do not work and are not 'unemployed' according to the ILO definition ("currently not working but willing and able to work for pay, currently available to work, and have actively searched for work") out of the total working age population of the local area.

Table 5. Probit model for Local Authorities [Residence analysis]

Probit specification	ALL MALES Simple	ALL MALES Region dummies	ALL MALES Area dumm.	NO QUALIFICATIONS Simple	NO QUALIFICATIONS Region dumm.	NO QUALIFICATIONS Area dumm.	NO QUALIFICATIONS Area dumm. Live+ Work
	1	2	3	4	5	6	7
HC (elasticity)	**0.010**	**0.017**	**-0.004**	**0.054**	**0.075**	**0.131**	**0.131**
t-stat	2.34	3.98	-0.51	3.04	4.22	2.90	2.02
Year Dummies	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***
Region dummies		***YES***			***YES***		
Area dummies			***YES***			***YES***	***YES***
N	291,530	291,530	291,530	41,544	41,544	41,523	33,573
Pseudo R^2	0.14	0.15	0.16	0.07	0.09	0.11	0.12

Source: APS
Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of degree holders in the local area and a number of personal controls. Personal controls: 5 year age band dummies, number of children dummies, year dummies and qualification dummies (for all males sample).
HC presents the elasticity of employment probability with respect to *HC*.
T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

Table 6. Educational groups- Local Authorities [Residence analysis]

Probit specification	No qual.	Below level 2	Level 2	Trade Apprent.	Level 3	Level 4+	Other qual.
HC (elasticity)	**0.131**	**0.011**	**-0.095**	**0.041**	**-0.088**	**0.009**	**-0.091**
t-stat	2.02	0.23	-2.33	0.92	-2.52	0.43	-1.57
Area dummies	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***
N	33,573	24,225	23,892	21,322	28,938	38,733	16,407
Pseudo R^2	0.12	0.14	0.11	0.15	0.13	0.11	0.12

Source: APS
Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of degree holders in the local area and a number of personal controls. Personal controls: 5 year age band dummies, number of children dummies, year dummies.
HC presents the elasticity of employment probability with respect to *HC*.
T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

Table 7. Probit model for TTWAs [Residence analysis]

Probit specification	ALL Simple	ALL Region dummies	ALL Area dumm.	NO QUALIFICATIONS Simple	NO QUALIFICATIONS Region dumm.	NO QUALIFICATIONS Area dumm.	NO QUALIFICATIONS Area dumm. Live+ Work
	1	2	3	4	5	6	7
HC (elasticity)	**0.022**	**0.024**	**-0.007**	**0.087**	**0.086**	**0.216**	**0.212**
t-stat	2.32	4.57	-0.52	2.77	3.75	3.30	2.76
Year Dummies	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***
Region dummies		***YES***			***YES***		
Area dummies			***YES***			***YES***	***YES***
N	291,547	291,547	291,547	41,544	41,544	41,544	37,020
Pseudo R^2	0.14	0.15	0.15	0.07	0.08	0.09	0.09

Source: APS

Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of degree holders in the local area and a number of personal controls. Personal controls: 5 year age band dummies, number of children dummies, year dummies and qualification dummies (for all males sample).

HC presents the elasticity of employment probability with respect to *HC*.

T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

Table 8. Educational Groups- TTWAs [Residence analysis]

Probit specification	No qual.	Below level 2	Level 2	Trade Apprent.	Level 3	Level 4+	Other qual.
HC (elasticity)	**0.212**	**0.023**	**-0.046**	**-0.046**	**-0.047**	**0.003**	**-0.091**
t-stat	2.76	0.5	-1.01	-1.03	-1.37	0.18	-1.54
Area dummies	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***
N	37,020	28,835	28,946	25,164	35,653	53,646	20,326
Pseudo R^2	0.09	0.11	0.08	0.13	0.10	0.09	0.08

Source: APS

Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of degree holders in the local area and a number of personal controls. Personal controls: 5 year age band dummies, number of children dummies, year dummies.

HC presents the elasticity of employment probability with respect to *HC*.

T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

Table 9. Educational groups- Local Authorities [Workplace analysis]

(Elasticities for the Share of 'managers and senior officials')

Probit specification	**No qual.**	**Below level 2**	**Level 2**	**Trade Apprent.**	**Level 3**	**Level 4+**	**Other qual.**
HC (elasticity)	**0.123**	**0.100**	**0.069**	**-0.003**	**-0.007**	**0.036**	**0.066**
t-stat	2.37	2.91	2.12	-0.10	-0.29	2.02	1.39
Area dummies	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***
N	33,573	24,225	23,892	21,322	28,938	38,733	16,407
Pseudo R^2	0.12	0.14	0.11	0.15	0.13	0.11	0.12

Source: APS

Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of 'managers and senior officials' in the local area and a number of personal controls.

Personal controls: 5 year age band dummies, number of children dummies, year dummies.

HC presents the elasticity of employment probability with respect to *HC* (the share of 'managers and senior officials' in the area).

T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

Table 10. Educational Groups- TTWAs [Workplace analysis]

(Elasticities for the Share of 'managers and senior officials')

Probit specification	**No qual.**	**Below level 2**	**Level 2**	**Trade Apprent.**	**Level 3**	**Level 4+**	**Other qual.**
HC (elasticity)	**0.131**	**0.130**	**0.096**	**0.031**	**-0.021**	**-0.006**	**0.055**
	1.91	3.33	2.78	0.94	-0.69	-0.32	1.06
Area dummies	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***	***YES***
N	37,020	28,835	28,946	25,164	35,653	53,646	20,326
Pseudo R^2	0.09	0.11	0.08	0.13	0.10	0.09	0.08

Source: APS

Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of 'managers and senior officials' in the local area and a number of personal controls.

Personal controls: 5 year age band dummies, number of children dummies, year dummies.

HC presents the elasticity of employment probability with respect to *HC* (the share of 'managers and senior officials' in the area).

T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

Table 11. Robustness Checks for the 'no qualifications group'- LAs
[Residence analysis]

Probit specification	Region dummies	Region dummies	Area dummies	Area dummies	Area dummies **Live+ Work**	Area dummies **Live+ Work**
	1	2	3	4	5	6
HC (elasticity)	**0.009**	**0.020**	**0.131**	**0.117**	**0.132**	**0.117**
t-stat	0.58	1.08	2.89	2.59	2.03	1.80
Unemployment rate (elasticity)	**-0.168**		**-0.007**		**0.032**	
t-stat	-12.38		-0.12		0.39	
Inactivity rate (elasticity)		**-0.517**		**-0.319**		**-0.323**
t-stat		-9.44		-3.13		-2.24
Region dummies	***YES***	***YES***				
Area dummies			***YES***	***YES***	***YES***	***YES***
N	41,523	41,523	41,523	41,523	33,573	33,573
Pseudo R^2	0.09	0.09	0.11	0.11	0.12	0.12

Source: APS

Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of degree holders in the local area and a number of personal controls. Personal controls: 5 year age band dummies, number of children dummies, year dummies. T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

Table 12. Robustness Checks for the 'no qualifications group'- TTWAs [Residence analysis]

Probit specification	Region dummies	Region dummies	Area dummies	Area dummies	Area dummies **Live+ Work**	Area dummies **Live+ Work**
HC (elasticity)	**0.052**	**0.014**	**0.212**	**0.207**	**0.209**	**0.200**
t-stat	2.06	0.58	3.23	3.20	2.71	2.62
Unemployment rate (elasticity)	**-0.157**		**-0.040**		**-0.024**	
t-stat	-6.30		-0.53		-0.27	
Inactivity rate (elasticity)		**-0.564**		**-0.382**		**-0.488**
t-stat		-7.22		-2.58		-2.74
Region dummies	***YES***	***YES***				
Area dummies			***YES***	***YES***	***YES***	***YES***
N	41,544	41,544	41,544	41,544	37,020	37,020
Pseudo R^2	0.09	0.09	0.09	0.09	0.09	0.09

Source: APS

Each column is a separate probit specification. The employment probability of the individual is examined by a probit model that includes the share of degree holders in the local area and a number of personal controls. Personal controls: 5 year age band dummies, number of children dummies, year dummies. T-statistics reported. St.Errors adjusted for the grouped nature of the data (area-year level).

APPENDIX A

This study uses the APS variable "levqua2", derived from variable "hiqual5" that reports the individual's highest qualification attained. Below the different qualifications that individuals self-report are shown. Table 14 follows that shows the correspondence of the different qualifications to 7 broader educational groups that are equivalent to National Vocational Qualification Level. NVQs are work-related, competence based qualifications that reflect the skills and knowledge of the individuals. This correspondence is taken from the derived variable "levqua2" of the APS. The category 'level 4 or above' is quite broad and includes both higher education and further education. The subcategory that refers only to the 'higher education' is considered for the variable of interest *HC* so that I capture only the top educated.

Table 13. Variable HIQUAL5 - Highest qualification/trade apprenticeship

(1) Higher degree
(2) NVQ level 5
(3) First degree/foundation degree
(4) Other degree
(5) NVQ level 4
(6) Diploma in higher education
(7) HNC/HND/BTEC higher etc
(8) Teaching – further education
(9) Teaching – secondary education
(10) Teaching – primary education
(11) Teaching – foundation stage
(12) Teaching – level not stated
(13) Nursing etc
(14) RSA higher diploma
(15) Other higher education below degree
(16) NVQ level 3
(17) Advanced Welsh Baccalaureate
(18) International Baccalaureate
(19) GNVQ/GSVQ advanced
(20) A-level or equivalent
(21) RSA advanced diploma
(22) OND/ONC/BTEC/SCOTVEC National etc
(23) City & Guilds Advanced Craft/Part 1
(24) Scottish 6 year certificate/CSYS
(25) SCE higher or equivalent
(26) Access qualifications
(27) AS-level or equivalent
(28) Trade apprenticeship
(29) NVQ level 2 or equivalent
(30) Intermediate Welsh Baccalaureate
(31) GNVQ/GSVQ intermediate
(32) RSA diploma
(33) City & Guilds Craft/Part 2
(34) BTEC/SCOTVEC First or General diploma etc
(35) O-level, GCSE grade A*-C or equivalent
(36) NVQ level 1 or equivalent
(37) GNVQ/GSVQ foundation level
(38) CSE below grade 1, GCSE below grade C
(39) BTEC/SCOTVEC First or General certificate
(40) SCOTVEC modules
(41) RSA other
(42) City & Guilds foundation/Part 1
(43) YT/YTP certificate
(44) Key skills qualification
(45) Basic skills qualification
(46) Entry level qualification
(47) Other qualification
(48) No qualifications
(49) Don't know

Table 14. Mapping of different qualifications to NVQ Level equivalent
(i.e. mapping of ‘hiqual5’ to ‘levqua2’)

Level 4 or above		Level 3	Trade Apprent.	Level 2	Below level 2	No qual.	Other qual.
Higher Education *(HC)*	**Further Education**						
1-4	5-15	16-23 25-27	28	20, 24, 25, 27 29-35	35-46	48	24 47

REFERENCES

Acemoglu, D. and Angrist, J. (2000) 'How Large Are Human Capital Externalities? Evidence from Compulsory Schooling Laws', in: Bernanke, B. and K. Rogoff, (eds.) *NBER Macroeconomics Annual*, pp.9-58, MIT Press, Cambridge, Mass

Angrist, J.D. and Pischke, J.-S. (2008) *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press

Autor, D.H., Katz, L.F. and Kearney, M.S. (2006) 'The Polarization of the US Labor Market', *American Economic Review Papers and Proceedings*, 96(2), pp.189-194

Autor, D.H., Levy F. and Murnane, R.J.(2003) 'The Skill Content of Recent Technological Change: An Empirical Exploration', *Quarterly Journal of Economics*, 118(4), pp.1279-1333

Baumol, W.J. (1967) 'Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis', *American Economic Review*, 57, pp.415-26

Buck, N., Gordon, I., Hall, P. and Kleinman, M. (2002) *Working Capital: life and labour in contemporary London*, Routledge: London

Charlot, S. and Duranton, G. (2004) 'Communication Externalities in Cities', *Journal of Urban Economics*, 56, pp.581-613.

Cheshire, P., Gibbons, S. and Gordon, I. (2008) 'Policies for 'mixed communities': A critical evaluation', *SERC Policy Papers*, No.2, June

Ciccone, A. and Hall, R.E. (1996) Productivity and the density of economic activity, *American Economic Review*, 86, pp. 54–70.

Ciccone, A. and Peri, G. (2006) 'Identifying human capital externalities: Theory with applications', *Review of Economic Studies*, 73, pp.381–412

Clark, C. (1957) *The Conditions of Economic Progress*, London: Macmillan

Combes, P.P. and Overman, H.G. (2004) 'The spatial distribution of economic activities in the European Union', in: Henderson, V. and Thisse, J. F., (eds.) *Handbook of regional and urban economics: cities and geography*. North Holland, pp. 2845-2910

Duranton, G. (2006) 'Human Capital Externalities in Cities: Identification and Policy Issues' in: Arnott, R. and McMillen, D. (eds.) *A Companion to Urban Economics*. Oxford: Blackwell Publishing Ltd.

Duranton, G. and Puga, D. (2004) 'Microfoundations of urban agglomeration economies' in Vernon Henderson and JacquesFrançois Thisse (eds.) *Handbook of Regional and Urban Economics*, volume 4. Amsterdam: NorthHolland, 2063–2117.

Faggian, A. and McCann, P. (2006) 'Human Capital and Regional Knowledge Assets: a Simultaneous Equation Model', *Oxford Economic Papers*, Vol.58, No. 3, pp. 475-500

Florida, R., Mellander, C. and Stolarick, K. (2008) 'Inside the Black Box of Regional Development', *Journal of Economic Geography,* 8 (5), pp.615-649

Friedman, J. & Wolf, G. (1982) 'World City formation. An agenda for research and action', *International Journal of Urban and Regional Research*, 6, pp.309-344.

Gibbons, S. (2002) 'Neighbourhood effects on educational achievement', *Centre for Economics of Education*, DP0018, London School of Economics.

Gibbons, S., Green A., Gregg, P. and Machin, S. (2005), 'Is Britain Pulling Apart? Area Disparities in Employment, Education and Crime', in Pearce N. and Paxton W. (eds.) (2005) *Social Justice: Building a Fairer Britain London*, Politico's IPPR, London

Glaeser, E. and Gottlieb, J.D. (2006) 'Urban Resurgence and the Consumer City,' *Urban Studies* 43(8):1275-1299.

Glaeser, E. and Mare, D. (2001) 'Cities and Skills,' *Journal of Labor Economics* 19(2), pp.316-342.

Glaeser, E. and Saiz, A. (2004) 'The Rise of the Skilled City,' *Brookings-Wharton Papers on Urban Affairs 5* (2004): 47-94.

Glaeser, E., Kolko J. and Saiz, A. (2001) 'Consumer City,' *Journal of Economic Geography* 1: 27-50.

Goos, M. and Manning, A. (2007) 'Lousy and Lovely Jobs: The Rising Polarization of Work in Britain', *Review of Economics and Statistics*, 89, 118-133

Gordon, I.R. and Kaplanis, I. (2009) 'Accounting for Big City Growth in Low Paid Occupations: Immigration and/or Service Class Consumption', Mimeo.

Gordon, I.R. and McCann, P. (2005) Innovation, agglomeration and regional development, *Journal of Economic Geography*, 5, pp.523–43.

Halfdanarson, B. and Heuermann, D. and Suedekum, J. (2008) 'Human Capital Externalities and the Urban Wage Premium: Two Literatures and their Interrelations', *IZA Discussion Paper*, No.3493

Jacobs, J. (1969) *The Economy of Cities*, New York: Vintage.

Kaplanis, I (2007) 'The Geography of Employment Polarisation in Britain', *Institute for Public Policy Research*, IPPR, London.

Kaplanis, I. (2009) 'Wage effects from changes in local human capital in Britain', *SERC Discussion Paper*

Kaplanis, I. (2009) *Spatial occupational structure and local human capital spillover effects in Britain*, unpublished PhD Thesis, London School of Economics.

Krugman, P. (1991), Increasing returns and economic geography, *Journal of Political Economy*, 99, pp.483–499

Leonardi, M. (2008) 'Product Demand Shifts and Wage Inequality', Mimeo.

Lucas, R. (1988), On the Mechanics of Economic Development, *Journal of Monetary Economics* 22: 3-42

Machin, S. (2008) 'An Appraisal of Economic Research on Changes in Wage Inequality', Labour (Special Issue), No.22, pp.7-26

Manning, A. (2004) 'We Can Work it Out: The Impact of Technological Change on the Demand for Low-Skill Workers', *Scottish Journal of Political Economy*, 51(5), pp.581-608

Marshall, A. (1890) *Principles of Economics*, Macmillan, London

Mazzolari, F. and Ragusa, G. (2007) 'Spillovers from High-Skill Consumption to Low-Skill Labor Markets', *IZA Discussion Papers, No.3048*, September 2007.

McCann, P., and Simonen, J. (2005) 'Innovation, Knowledge Spillovers and Local Labour Markets', *Papers in Regional Science* , 84.3, 465 -485

Mollenkopf, J. & Castells, M. (Eds.) (1991) *Dual City – Restructuring New York*, Russell Sage Foundation, New York

Monastiriotis, V. (2002**) '**Human capital and wages: evidence for external effects from the UK regions', *Applied Economics Letters*, 9 (13), pp.843-846

Moretti, E. (2003) 'Human Capital Externalities in Cities' (chapter 8), in J. Vernon Henderson and Jacques-Franois Thisse (Eds.), *Handbook of Urban and Regional Economics,* North Holland–Elsevier

Moretti, E. (2004) 'Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data,' *Journal of Econometrics* 121:1–2, 175–212.

Perrons, D. (2004) *Globalization and social change. People and places in a divided world,* Routledge, London

Porter, M.E. (1990) *The Competitive Advantage of Nations*. New York: The Free Press

Rauch, J.E. (1993) 'Productivity gains from geographic concentration of human capital: evidence from the cities,' *Journal of Urban Economics,* 34, pp.380–400.

Roback, J., (1982) 'Wages, rents and the quality of life', *Journal of Political Economy*, 90 (6), pp.1257–1278

Rosenthal, S.S. and Strange, W.C. (2004) 'Evidence on the Nature and Sources of Agglomeration Economies' in: J.V. Henderson and J-F. Thisse (eds.) *Handbook of Regional and Urban Economics* vol. 4: Cities and Geography. Amsterdam: Elsevier-North Holland

Sassen, S. (2001) *The Global City: New York, London, Tokyo*, second revised edition (first ed., 1991), Princeton University Press, Princeton and Oxford

Shapiro, J. (2006) 'Smart Cities – Quality of Life, Productivity, and the Growth Effects of Human Capital,' *Review of Economics and Statistics* 88: 324-335

Storper, M. and Venables, A.J. (2004) Buzz: face-to-face contact and the urban economy. *Journal of Economic Geography* 4: 351–370

Spatial Economics Research Centre (SERC)
London School of Economics
Houghton Street
London WC2A 2AE

Tel: 020 7852 3565
Fax: 020 7955 6848
Web: www.spatialeconomics.ac.uk

SERC is an independent research centre funded by the Economic and Social Research Council (ESRC), Department for Business, Enterprise and Regulatory Reform (BERR), the Department for Communities and Local Government (CLG) and the Welsh Assembly Government.