Health Capital and Local Labour Productivity in England: Spillovers Through Commuting Networks

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Extended abstract - Work in progress

1 Main objectives of the study

Understanding the determinants of local productivity remains a major policy challenge in England. While a growing literature highlights the importance of health for economic performance, most evidence focuses either on individuals or national populations. Much less is known about how population health is associated with productivity at a local level.

This study examines the association between local health capital and labour productivity across Local Authority Districts (LADs) in England. We define health capital using the Office for National Statistics (ONS) Health Index, a multidimensional measure capturing health outcomes, health-related behaviours and wider determinants of health. We consider both the overall Health Index and its three domains: Healthy People, Healthy Lives and Healthy Places.

A central motivation of the paper is that the geography of health and the geography of productivity do not necessarily coincide. Productivity is measured where jobs are located, whereas health is measured where people live. Since workers commute across administrative boundaries, productivity in one LAD may depend partly on the health capital of populations residing elsewhere. We therefore model interdependencies between LADs using commuting-flow networks.

The research question is: How is local health capital associated with local labour productivity, and to what extent are these associations transmitted through commuting networks?

This work contributes to the literature on the determinants of local productivity (see Gouma et al. (2023) for a framework of the determinants) and more precisely the place of health as a determinant of local productivity (Bambra et al., 2018). The importance of a spatial approach in studying the determinants of local productivity has been shown in Rice et al. (2006) and confirmed with the difference in agglomeration effects underlined by McCann and Yuan (2022). The spatial approach

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to understand local productivity complements the recent work of Wong and Zheng (2026). While their approach is similar to ours in modelling the spatial connections between LADs by commuting flows, their goal is to explain the regional differences of productivity using a spatial approach, while ours is to show the extent of the role of health, and the different local health capital. The measure of productivity at the local level as been a challenge with studies either at the national or regional level (e.g. Martin et al. (2016), Sunley et al. (2023)), approaching health at local level also has its challenges and we contribute to this by using an unified framework developed by the Office of National Statistics.

2 Methodology

2.1 Data

The analysis focuses on LADs in England in 2019. Labour productivity is measured using Gross Value Added (GVA). The main outcomes are: GVA per job filled; GVA per hour worked.
Health capital is measured using the ONS Health Index (Office for National Statistics, 2023). The index is scaled so that England in 2015 equals 100 and higher values represent better health. The index consists of three domains: Healthy People; Healthy Lives; Healthy Places. Together these domains cover 14 subdomains and 56 indicators.
Commuting-flow data from the 2011 Census are used to construct a spatial weighting matrix linking LADs through labour-market connections. For each destination LAD, weights are defined as the share of workers commuting from each origin LAD in the destination workforce.

2.2 Empirical approach

We check Moran I's statistics to confirm that a spatial modelling is appropriate. We also assess with Lagrange Robust multipliers whether spatial lag of dependent variable and error terms should be included. The results (not shown) indicate that both the spatial lag of the dependent variable and of the error term are appropriate. We then estimate a General Spatial Model (GSM) using commuting flows to define spatial connectivity between areas:

$$y_i = \beta_s X_i^s + \beta_c X_i^c + \eta W X_j + \lambda W y_j + \mu_i \tag{1}$$

$$\mu_i = \rho W \mu_j + v_i \tag{2}$$

where:

- y_i is the logarithm of labour productivity in LAD i;
- X_i^s includes the Health Index (or one of its domains) and population number of individuals of working age;
- X_i^c represents additional control variables: population aged 0 to 14, population older than 65,

qualification index score, employment rate, distribution of employment across sectors ;

- W is the commuting-flow spatial weighting matrix;
- Wy_j is the spatially lagged dependent variable;
- μ_i is the error term.
- $W\mu_j$ is the spatially lagged error term.

The spatial framework allows estimation of:

- **Direct effects**: associations between health capital and productivity within the same LAD;
- **Indirect effects**: associations transmitted through commuting networks;
- **Total effects**: the sum of direct and indirect effects.

Several mechanisms may explain an observed association. First, unobserved characteristics may affect both health and productivity. Second, productivity may influence health through higher incomes and resources. Third, health may influence productivity through labour-force participation and workplace performance. Consequently, the analysis identifies associations rather than causal effects.

3 Results (preliminary)

Tables 1 and 2 present the results from the General Spatial Model for 2019. We report direct, indirect and total effects for the overall Health Index and its three domains (Healthy People, Healthy Lives and Healthy Places), using both log GVA per job and log GVA per hour as measures of labour productivity.

A first notable finding is that the direct effects are generally negative. For GVA per job, significant negative direct effects are observed for the overall Health Index, Healthy Lives and Healthy Places, while the coefficient for Healthy People is not statistically significant. A similar pattern emerges for GVA per hour, although the estimates are smaller in magnitude and less precisely estimated. Healthy Lives remains negatively associated with productivity within the same LAD, while the effects for the overall Health Index, Healthy People and Healthy Places are not statistically significant.

In contrast, the indirect effects reveal evidence of productivity spillovers through commuting networks. For GVA per job, the indirect effects are positive and statistically significant for the overall Health Index, Healthy People and Healthy Lives. This suggests that better health capital in LADs connected through commuting flows is associated with higher productivity in the destination LAD. The largest spillover effects are observed for Healthy People and Healthy Lives. By contrast, Healthy Places does not exhibit positive spillovers and its indirect effect is not statistically different from zero. The coexistence of negative direct effects and positive indirect effects implies that the geography of health capital and the geography of productivity do not necessarily coincide. Productivity measured in a given LAD may be associated less with the health of the resident population and more with the health of workers commuting from connected areas. This interpretation is consistent

with the role of commuting networks in linking residential locations to employment centres. The results for GVA per hour are weaker but broadly point in the same direction. Most indirect effects are not statistically significant, with the exception of Healthy Places, which exhibits a negative indirect effect.

Table 1: General Spatial Model Results 2019 - Log GVA per job

Outcome	Log GVA per job			
Effect	Health Index	Healthy People	Healthy Lives	Healthy Places
Direct	-0.00426**	-.00106	-0.00641***	-0.00403***
	(0.00175)	(0.00024)	(0.00193)	(0.00150)
Indirect	0.00446*	0.00588***	0.00592***	-0.00121
	(0.00250)	(0.00187)	(0.00212)	(0.00227)
Total	0.00020	0.00483**	-0.00049	-0.00524**
	(0.00337)	(0.00229)	(0.00270)	(0.00253)
Obsv.	307	307	307	307

Notes: Standard errors in parentheses. Controls include: working age population, population aged 0 to 14, population older than 65, qualification index score, employment rate, distribution of employment across sectors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: General Spatial Model Results 2019 - Log GVA per hour

Outcome	Log GVA per hour			
Effect	Health Index	Healthy People	Healthy Lives	Healthy Places
Direct	-0.00250	0.00011	-0.00364*	-0.00186
	(0.00166)	(0.00123)	(0.00194)	(0.00135)
Indirect	-0.00066	0.00233	0.00197	-0.00398*
	(0.00317)	(0.00221)	(0.00248)	(0.00242)
Total	-0.00315	0.00244	-0.00167	-0.00585**
	(0.00386)	(0.00258)	(0.00283)	(0.00263)
Obsv.	307	307	307	307

Notes: Standard errors in parentheses. Controls include: working age population, population aged 0 to 14, population older than 65, qualification index score, employment rate, distribution of employment across sectors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Overall, the evidence suggests that health capital is more strongly associated with productivity per job than with productivity per hour. Considering total effects, only two domain-specific associations remain statistically significant. Healthy People is positively associated with GVA per job, reflecting positive spillover effects that more than offset the negative local association. In contrast, Healthy Places exhibits a negative total effect for both productivity measures. The absence of significant total effects for the overall Health Index and Healthy Lives reflects the offsetting nature of their

direct and indirect components. Overall, the findings provide preliminary evidence that health capital is associated with local labour productivity through commuting-linked labour markets. The results suggest that spillovers are particularly important for dimensions of health related to health outcomes and health-related behaviours, while broader place-based determinants of health display a different pattern. These estimates remain preliminary and will be updated following further refinement of the model specification and additional robustness analyses.

4 Discussion and policy implications

This study contributes to the literature by adopting a local and spatial perspective on the relationship between health and productivity. Rather than treating local areas as isolated units, the analysis models the interdependencies created by commuting flows and local labour markets. The use of the ONS Health Index provides a broad measure of health capital that captures health outcomes, health-related behaviours and wider determinants of health. Examining these dimensions separately allows a more nuanced understanding of how different aspects of health may be associated with productivity.

The study has several limitations. It focuses on a single year, provides associational evidence only, and remains sensitive to model specification and the choice of spatial weighting matrix. Despite these limitations, the findings suggest that health capital may be relevant not only for population well-being but also for local economic performance. The spatial results further imply that the potential benefits associated with health improvements may extend beyond administrative boundaries through commuting networks.

We aim to explore further the different subdomains of health, as well as whether the results are stable over the time period covered by the Health Index (from 2015). The short period before Covid (2015 to 2019) limits us in the possibility of using a spatial panel approach though.

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