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IQ and socio-economic development across local authorities of the UK

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ABSTRACT

Cross-regional correlations between average IQ and socio-economic development have been reported for many different countries. This paper analyses data on average IQ and a range of socio-economic variables at the local authority level in the UK. Local authorities are administrative bodies in local government; there are over 400 in the UK, and they contain anywhere from tens of thousands to more than a million people. The paper finds that local authority IQ is positively related to indicators of health, socio-economic status and tertiary industrial activity; and is negatively related to indicators of disability, unemployment and single parenthood. A general socio-economic factor is correlated with local authority IQ at $r = .56$. This correlation increases to $r = .65$ when correcting for measurement error in the estimates of IQ.

1. Introduction

Cross-regional correlations between average IQ and indicators of socio-economic development have been documented in numerous countries: the UK (Lynn, 1979; Carl, 2015; Kirkegaard, 2016); France (Lynn, 1980); Italy (Lynn, 2010; Templer, 2012; Piffer & Lynn, 2014; but see Beraldo, 2010; Cornoldi, Belacchi, Giofrè, Martini, & Tressoldi, 2010; Cornoldi, Giofrè, & Martini, 2013; D'Amico, Cardaci, Di Nuovo, & Naglieri, 2012; Daniele & Malanima, 2011a; Felice & Giugliano, 2011; Daniele, 2015); Portugal (Almeida, Lemos, & Lynn, 2011); Spain (Lynn, 2012); Germany (Roivainen, 2012); Finland (Dutton & Lynn, 2014); Japan (Kura, 2013); China (Lynn & Cheng, 2013); India (Lynn & Yadav, 2015); the US (McDaniel, 2006; Pesta, McDaniel, & Bertsch, 2010; Barnes, Beaver, & Boutwell, 2013; Boutwell et al., 2013); Turkey (Lynn, Sakar, & Cheng, 2015); Brazil (Fuerst & Kirkegaard, 2015), Mexico (Fuerst & Kirkegaard, 2015), and Russia (Grigoriev, Lapteva, & Lynn, 2016). Average IQ is correlated with socio-economic development not only within countries, but also across them (Jones & Schneider, 2006; Meisenberg & Lynn, 2011; Rindermann & Thompson, 2011; Rindermann, 2012; Lynn & Vanhanen, 2012a; Lynn & Vanhanen, 2012b; Wicherts, Borsboom, & Dolan, 2010a).

There is a lively and ongoing debate over the direction of causality between average IQ and socio-economic development. Some have argued that most or all of the causality is from socio-economic development to intelligence (Daniele, 2013; Daniele, 2015; Wicherts et al., 2010a; Wicherts, Borsboom, & Dolan, 2010b; Sternberg, 2013; and see Diamond, 1997; Eppig, Fincher, & Thornhill, 2010; Eppig, Fincher, & Thornhill, 2011). According to this view, certain territories started out with better institutions or geographical circumstances, and as a consequence their populations were able to develop more advanced systems of transport, food-supply, healthcare and education. Since those populations today are healthier and better educated, they tend to score higher on intelligence tests. By contrast, others have argued that at least some of the causality, perhaps most, is from intelligence to socio-economic development (Lynn & Vanhanen, 2012a; Rindermann, Woodley, & Stratford, 2012; Woodley, Rindermann, Bell, Stratford, & Piffer, 2014; Fuerst & Kirkegaard, 2015; Piffer, 2015; and see Murray, 2003; Clark, 2007). According to this perspective, certain populations started out with higher intelligence, and as a result, they gradually built up institutions that were conducive to socio-economic development, such as stable government, secure property rights, and wholesale scientific inquiry. Ultimately, variance in socio-economic development among territories must be decomposable into variance due to initial geographic endowments, variance due to genetic proclivities, and variance due to random contingency.

It is also worth noting that intelligence is, of course, robustly associated with measures of socio-economic status at the individual level—not only education, job performance, occupational prestige and income, but health and longevity as well (Herrnstein & Murray, 1994; Gottfredson, 1997; Strenze, 2007; Deary, 2012). These associations are thought to reflect both a direct effect of intelligence—individuals with greater cognitive ability being better able to synthesise information, draw logical inferences, and solve complicated problems—and a confounding effect of parental socio-economic status—individuals with greater cognitive ability tending to come from families with more economic resources and cultural capital (Strenze, 2007; Deary, 2012). The exact importance of these two effects remains a matter of debate, but

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it is unquestionable that intelligence exerts a sizable impact on a range of socio-economic status measures, not least the most widely-studied measures like education and income.

The present study does not seek primarily to stake out a position in the debate over the direction of causality between intelligence and socio-economic development. Rather, it provides yet further evidence that the two are associated within the UK, via an analysis at the local authority level. It begins by describing the data, along with the statistical methodology. It then briefly examines the distribution of local authorities by average IQ. Finally, it explores the extent to which local authority IQ is associated with, in turn: specific indicators of socio-economic development such as health, unemployment, and tertiary industrial activity; and a general socio-economic factor.

2. Methods

2.1. Data

Following Carl (2015), estimates of average IQ were computed using data from the third wave of Understanding Society—a large, ongoing longitudinal survey of British households (University of Essex, 2013). These data were collected (almost entirely) via face-to-face interviews between January 2011 and April 2013. A general factor, *g*, was obtained by extracting the first principal component from a PCA on six separate measures of cognitive ability (Spearman, 1904): immediate word recall, delayed word recall, serial subtraction, number series, verbal fluency, and numeracy. 46% of the variance across the six measures was explained by this component, which was transformed onto the IQ scale (i.e., set to have a mean of 100 and a standard deviation of 15) prior to further analysis.

For immediate word recall, respondents were required to repeat back as many words as possible from a list of ten that were read out by a computer. For delayed word recall, respondents were required to again repeat back as many of the ten words as possible, but this time after a short delay. For serial subtraction, respondents had to subtract 7 from 100, and then keep subtracting 7 from the answer four more times. For number series, respondents were asked to identify the missing number from each of six sequences; the final three sequences varied depending on the respondent's performance in the initial three. For verbal fluency, respondents were asked to name as many animals as possible in one minute. For numeracy, respondents had to solve up to five brief mathematical puzzles; the final two problems differed depending on the respondent's performance in the initial three. See McFall (2013) for additional details.

Next, average IQ was calculated for each of the 404 local authorities represented in the dataset. It is important to note that information on local authorities was obtained from the UK Data Service via a Special Licence. Therefore making these data available to other researchers is not possible. Information on local authorities are not included in the main Understanding Society dataset due to the fact that some local authorities contain relatively few respondents, which could permit identification of specific individuals. Cross-sectional sampling weights were applied when calculating regional IQs in order to attain representativeness (see Knies, 2014). In the present dataset, weighed *n*'s for IQ estimates range from 5 to 458, with a mean of 96 and a median of 81.

Local authorities are administrative bodies in local government. In England, the largest of the four UK nations, there are five types of local authority: county councils, district councils, unitary authorities, London boroughs, and metropolitan districts (Local Government Information Unit, 2015). These are responsible for such functions as education, highways, social care, housing, planning applications, libraries, and sanitation. Local authorities have three main sources of funding: grants from central government, business rates (taxes on local companies), and council tax (taxes on local households). Around 1.5 million people are employed by local authorities in England alone. The smallest local authority in the UK, West Somerset, has around 35,000 inhabitants; the largest, Birmingham City, has >1,000,000 inhabitants. The average local authority has over 100,000 inhabitants.

Local authority IQs were then matched with data on socio-economic development from the Office for National Statistics, the UK government's statistics agency (ONS, 2012; ONS, 2013; ONS, 2014). 16 separate measures of socio-economic development were utilised: proportion of households in social grades A and B[1]; proportion of residents reporting good or very good health; proportion of adult residents with level 4+ educational qualifications[2]; life expectancy at birth; proportion of adult residents employed in the financial, information, scientific and professional industries; proportion of adult residents employed in the education sector; proportion of households with 2+ cars; average life-satisfaction rating; proportion of adult residents married or in a civil partnership; proportion of households who own their home; average anxiety rating; proportion of households in the social rented sector; proportion of single parent households; proportion of residents whose day-to-day activities are limited a lot; proportion of adult residents employed in semi-routine or routine occupations; and unemployment rate. It was not possible to locate recent, harmonised data on income for all UK local authorities. Crime data were available, but were not harmonised across the four UK nations; these will be analysed in a separate publication. Information on both IQ and all 16 indicators of socio-economic development was available for 392 local authorities.

2.2. Statistical methodology

For examining the distribution of local authorities by average IQ: the histogram is plotted; descriptive statistics are reported; and the variance is decomposed into components within and between, separately, nations and regions of the UK (see Carl, 2015). For exploring the extent to which local authority IQ is associated with socio-economic development, first the Pearson correlation between local authority IQ and each indicator of socio-economic development is calculated, and then the correlation between local authority IQ and a general socio-economic factor. A scatterplot of latter relationship is provided as a visual accompaniment.

3. Results

3.1. Distribution of local authorities by average IQ

Fig. 1 displays a histogram of local authorities by average IQ. The distribution is approximately normal, with a mean of 101, a standard deviation of 3.4, a median of 100, a minimum of 90, and a maximum of 111. Only 4% of the variance in local authority IQ is between the four UK nations (England, Scotland, Wales, Northern Ireland), while 96% is within them. And only 14% of the variance is between the twelve UK regions (East Midlands, East of England, London, North East, North West, Northern Ireland, Scotland, South East, South West, Wales, West Midlands, Yorkshire and the Humber), while 86% is within them. Some evidence for the validity of IQ estimates obtained from Understanding Society was provided by Carl (2015), who reported a very strong correlation between average IQ and average PISA scores across the four UK nations. Unfortunately, the author is unaware of any comparable metric at the local authority level. It is noteworthy, however, that Oxford and Cambridge, the two oldest and most famous university cities within the UK, are both among the top 10 local authorities when ranked by average IQ.

[1] Social grade A comprises higher managerial, administrative and professional occupations, while social grade B comprises intermediate managerial, administrative and professional occupations (NRS, 2015).

[2] Level 4+ educational qualifications comprise certificates of higher education, advanced diplomas, undergraduate degrees and postgraduate degrees (UK government, 2015).

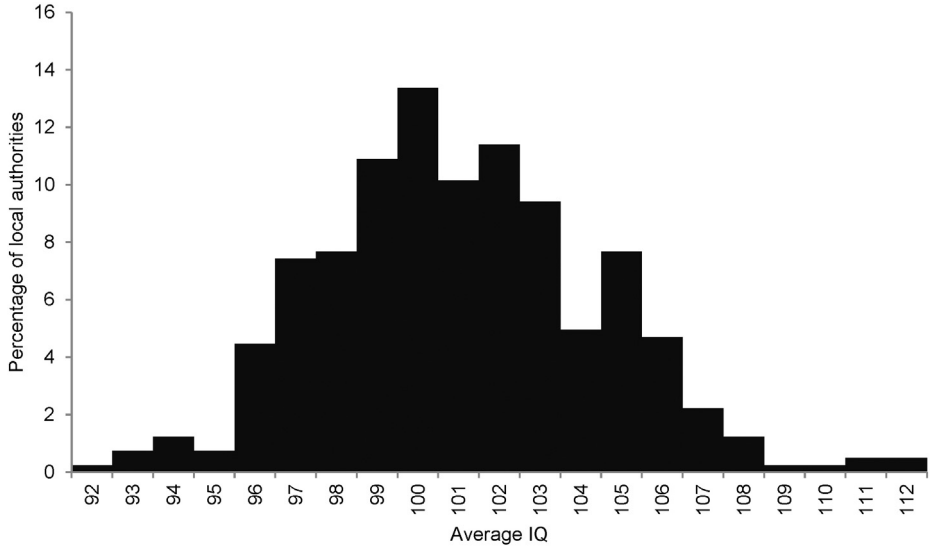

Fig. 1. Histogram of local authorities by average IQ.

3.2. Associations of local authority IQ with indicators of socio-economic development

Table 1 displays correlations between local authority IQ and the 16 indicators of socio-economic development. Values in the first column are unweighted, while values in the second column are weighted by the square root of *n* for the IQ estimate. As noted above, some local authorities contain relatively few respondents, meaning that the estimates of average IQ for those local authorities will have been subject to considerable measurement error. Weighting by the square root of *n* assigns greater statistical importance to local authorities for which average IQ has been estimated more precisely. Local authority IQ is correlated in the expected direction with 15 out of 16 indicators of socio-economic development; it is positively related to indicators of health, socio-economic status and tertiary industrial activity; and is negatively related to indicators of disability, unemployment and single parenthood. The only correlation with an unexpected sign is the one for average anxiety rating, where *r* is positive (though extremely small). Values are slightly higher when correcting for measurement error in the estimates of IQ. Effect sizes range from trivial to large (Cohen, 1988, pp. 24–8).

Table 1
Correlations of socio-economic variables with local authority IQ.

Variable	Unweighted *r*	Weighted *r*
Proportion of households in social grades A and B	.55***	.61***
Proportion of residents reporting good or very good health	.46***	.55***
Proportion of adult residents with level 4+ educational qualifications	.46***	.52***
Life expectancy at birth	.43***	.49***
Proportion of adult residents employed in the financial, information, scientific and professional industries	.34***	.39***
Proportion of adult residents employed in the education sector	.31***	.29***
Proportion of households with 2+ cars	.31***	.38***
Average life-satisfaction rating	.27***	.32***
Proportion of adult residents married or in a civil partnership	.21***	.24***
Proportion of households who own their home	.18***	.23***
Average anxiety rating	0.02	0.02
Proportion of households in the social rented sector	−.24***	−.33***
Proportion of single parent households	−.42***	−.50***
Proportion of residents whose day-to-day activities are limited a lot	−.44***	−.49***
Proportion of adult residents employed in semi-routine or routine occupations	−.45***	−.50***
Unemployment rate	−.48***	−.59***

Notes: Values in the right-hand column are weighted by the square root of *n* for the IQ estimate. For all correlations $n = 392$. Significance levels: *5%, **1%, ***0.1%.

Because many of the indicators were correlated with one another, a general socio-economic factor was obtained by extracting the first principal component from a principal components analysis (see Wicherts et al., 2010a; Carl, 2015; Fuerst & Kirkegaard, 2015). This component explained 44% of the variance, and all component loadings had the expected signs. The unweighted correlation between local authority IQ and the general socio-economic factor is strong, namely $r = .56$ ($p < 0.001$, $n = 392$). This correlation increases to $r = .65$ ($p < 0.001$, $n = 392$) when weighting by the square root of *n* for the IQ estimate. Fig. 2 displays a scatterplot of the (unweighted) relationship, confirming that it is indeed strong, and that the residuals are well behaved. Table 2 displays estimates from multiple regression models of the general socio-economic factor in which nation or country fixed-effects are included alongside average IQ. The association between local authority IQ and the general socio-economic factor is left largely unchanged when controlling for nation fixed-effects, and decreases by only about 10% of a standard deviation when controlling for region fixed-effects (12% when weighting). It is therefore not simply attributable to differences between the various nations or regions of the UK.

4. Discussion

Cross-regional correlations between average IQ and indicators of socio-economic development have been documented in numerous countries (Lynn, 1979; Carl, 2015; Kirkegaard, 2016; Lynn, 1980; Lynn, 2010; Templer, 2012; Piffer & Lynn, 2014; Almeida et al., 2011; Lynn, 2012; Roivaninen, 2012; Dutton & Lynn, 2014; Kura, 2013; Lynn & Cheng, 2013; Lynn & Yadav, 2015; McDaniel, 2006; Pesta et al., 2010; Barnes et al., 2013; Boutwell et al., 2013; Lynn et al., 2015; Fuerst & Kirkegaard, 2015; Grigoriev et al., 2016). Building on the work of Carl (2015), this study has investigated the relationship between average IQ and a range of socio-economic variables at the local authority level in the UK. It has found that local authority IQ is positively related to indicators of health, socio-economic status and tertiary industrial activity; negatively related to indicators of disability, unemployment and single parenthood; and positively related to a general socio-economic factor. To the author's knowledge, this is the first study to have explored the

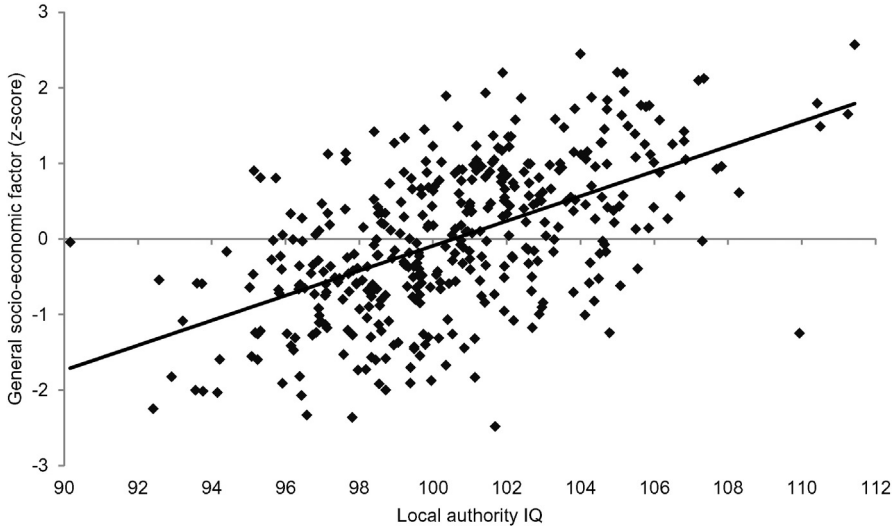

Fig. 2. Scatterplot of local authority IQ against the general socio-economic factor.

relationship between IQ and socio-economic development at the local authority level in the UK.

The correlation between local authority IQ and the general socio-economic factor was $r = .56$ ($r = .65$ when weighting), which is somewhat lower than the correlation of $r = .72$ observed by Carl (2015) across the twelve regions of the UK. One possible reason for this disparity is that slightly different variables were included in the two analyses, those utilised in Carl (2015) being slightly more strongly correlated with average IQ in general. Having said that, several variables (e.g., life expectancy) were included in both analyses, and these generally had higher correlations with average IQ in Carl (2015) than in the present study. Another possible reason is the one put forward by Jones (2015), namely that IQ tends to exert stronger effects at higher levels of aggregation because of its positive spillovers, e.g., people with higher intelligence being more trustworthy and more co-operative. Alternatively, the disparity could simply be due to greater measurement error in the IQ estimates for local authorities which was not fully corrected for by weighting.

There are of course several important limitations to this study. First, the IQ variable was based on only six tests of cognitive ability, none of which was particularly comprehensive. The test of verbal ability was cursory at best, simply requiring respondents to name as many animals as possible in one minute. Second, a number of the effect sizes observed were either trivial or only small in magnitude. For example, local authority IQ was not related to average anxiety rating, and was only weakly associated with proportion of adult residents married or in a civil partnership, and proportion of households who own their home. Third, some of the estimates of average IQ were based on very small samples: in fact, for ~3% of local authorities, less than 20 respondents. In an attempt to address this issue, correlations weighted by the square root of n for the IQ estimate were reported alongside unweighted correlations.

Fourth, it bears emphasising that the present study merely uncovered correlations between average IQ and socio-economic development; no specific evidence that IQ causes socio-economic development was adduced. It is of course possible that adult intelligence largely reflects innate genetic endowment, and that individuals with higher intelligence—who tend to obtain more advanced qualifications, earn higher salaries, and experience better health outcomes—select into local authorities with above average proportions of individuals similar to themselves.[3] I.e., causality might run mostly from IQ to socio-economic development. However, it is by no means implausible that, in actual fact, certain local authorities suffer from high rates of social deprivation (poverty, unemployment, discrimination, single parenthood), and that such deprivation serves to dampen the intelligence of individuals who inhabit or grow up in those local authorities (see Diez Roux, 2001; Gordon & Monastiriotis, 2006; National Equality Panel, 2010, pp. 248–9; Quillian, 2014).[4] I.e., causality might run mostly from socio-economic development to IQ.

Table 2
Standardised effects of average IQ on the general socio-economic factor.

	General socio-economic factor			
	Unweighted β		Weighted β	
Average IQ	0.54**	0.45***	.65**	.53***
Nation dummies	Yes		Yes	
Region dummies		Yes		Yes
n	392	392	392	392
R^2	0.35	0.46	0.39	0.49

Notes: Values in the two right-hand columns are weighted by the square root of n for the IQ estimate. In regressions with nation dummies, standard errors are clustered by nation. In regressions with region dummies, standard errors are clustered by region. Significance levels: *5%, **1%, ***0.1%.

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[3] See Plomin and Deary (2015) for an overview of studies on the heritability of Intelligence. See Jokela (2014) for an analysis of how intelligence impacts individuals' migratory decisions within the United States.

[4] Moreover, in the UK, children are admitted to state schools based on where they happen to live. Since richer parents can afford to buy homes in the catchment areas of the best schools, children from poorer families tend to be disproportionately concentrated in the worst schools.

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