Consumption and Health-based Indicators of Well-being for Lower Tier Local Authorities in England[1].

Martin Weale[2]
King's College, London

April 2023

[1]This work contains statistical data from ONS which are Crown Copyright. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

[2]ESCoE and King's College, London. martin.weale@outlook.com

Introduction

- Produce indicators for English local authorities of well-being which reflect consumption patterns, health status and survival.
- Draw on methodology of Jones and Klenow "Beyond GDP" *Americcan Economic Review*, 2016
- Use a utility function which depends on public and private consumption and health status.
- Calibrate the function using an estimate of the value of a road death averted.
- Compare each local score with the average for England

‘

Instantaneous Utility and Life-cycle Utility

$$U(c_t, \tilde{l}_t, h_t) = h_t \left\{ \bar{u} + \alpha \log c_t^{priv} + (1-\alpha) \log c_t^{pub} - \frac{\theta\varepsilon}{1+\varepsilon}(1-\tilde{l}_t)^{\frac{1+\varepsilon}{\varepsilon}} \right\} \tag{1}$$

Utility is assumed to increase in the logarithm of consumption, with a unit elasticity of substitution between public and private consumption. $\tilde{l}_t$ is leisure time as a fraction of total time ε is the constant Frisch elasticity of labour supply and θ is the utility weight on leisure or home production. $\bar{u}$ measures the joy of living for a healthy individual. $0 < h_t \leq 1$ is health status
The utility function is extended to produce a value for life-time utility as

$$U^{life-time} = \sum_{t=0}^{t_{max}} \beta^t \rho_t U(c_t, \tilde{l}_t, h_t). \tag{2}$$

Here β is the discount factor and ρ_t is the probability of surviving from year 0 to year t.

Life-cycle Utility (cont)

$$U^{life-time}$$

$$= \sum_{t=0}^{t_{\max}} \beta^t \rho_t h_t \left\{ \bar{u} + \alpha \log c_t^{priv} + (1-\alpha) \log c_t^{pub} - \frac{\theta \varepsilon}{1+\varepsilon} (1-\tilde{l}_t)^{\frac{1+\varepsilon}{\varepsilon}} \right\}$$

Assume no discounting and no growth in consumption *per capita*.

Life-cycle Utility (cont)

Take account of different survival rates of men and women, again assuming these do not change- as with interim life tables.
Private consumption is measured on household basis and it is not possible to distinguish men from women. Use household consumption adjusted for household size indexed by the age of the household head.
Work from age 20 since it is not easy to identify consumption of children.
Also assume that the discount factor is 1 and that there is no *per capita* growth. With assumptions about the parameters, $\alpha, \beta, \varepsilon, \theta, \bar{u}$ it is possible to evaluate life-cycle welfare.

Women and Men

Assume that both consumption and leisure age effects are the same in all local areas. Calculate the variation in private consumption in each area needed to align welfare in that area with the population-weighted average for England, given as:

$$U^{Eng} =$$

$$\sum_k \omega_k \left\{ \frac{\sum_{\tau=0}^{\tau_{\max}} L_{kt}^f h_{kt}^f \left\{ \bar{u}_k^f + \alpha \log c_\tau^{age} - \left(\frac{\theta\varepsilon}{1+\varepsilon} (1 - \tilde{l}_\tau^f)^{\frac{1+\varepsilon}{\varepsilon}} \right)^{age} \right\}}{2} \right.$$
$$\left. + \frac{\sum_{\tau=0}^{\tau_{\max}} L_{kt}^m h_{kt}^m \left\{ \bar{u}_k^m + \alpha \log c_\tau^{age} - \left(\frac{\theta\varepsilon}{1+\varepsilon} (1 - \tilde{l}_\tau^m)^{\frac{1+\varepsilon}{\varepsilon}} \right)^{age} \right\}}{2} \right\}$$

Here $\bar{u}_k^f$ and $\bar{u}_k^m$ represent the age-independent components of women's and men's life-time utility respectively in each LTLA k; these include the constant in the utility term, the regional and area random effects for $\log c_t^{priv}$ and the two labour supply terms, and the utility derived from public consumption.

Relative Measures

Express well-being in each local area in terms of the change in log private consumption needed to align it with the average for England.

$$U^{Eng}(\lambda_k) =$$

$$= \quad U^{Eng} + \alpha \log(\lambda_k) \sum_k \omega_k \frac{\sum_{\tau=0}^{\tau_{\max}} \left\{ L_{kt}^f h_{kt}^f + L_{kt}^m h_{kt}^m \right\}}{2}$$

so that

$$\log(\lambda_k) = \frac{U^k - U^{Eng}}{\alpha \sum_n \omega_n \frac{\sum_{\tau=0}^{\tau_{\max}} \left\{ L_{nt}^f h_{nt}^f + L_{nt}^m h_{nt}^m \right\}}{2}}$$

This gives a measure of the change in private consumption needed to compensate for differential survival and health effects as well as differences in consumption.

Data and Small Area Estimation

Three main sources of data

- The Living Costs and Food Survey for 2015/2016. 4028 households in England.
- The Annual Population Survey for 2015/16. This provides data on work and leisure.
- Life expectancies by age and sex for each local authority in England
- Covariates for each LTLA: log average electricity consumption, log average house price and log average income (covering benefits, self-employment and earnings subject to PAYE) adjusted for household size. We use the covariates to model log household consumption and leisure time, using the fitted values in our subsequent calculations.

Parameter Values

- α, the coefficient on private consumption in the utility function can be taken as the share of private consumption in total consumption at 0.81.
- To evaluate the labour terms, we consider the static optimisation problem for a man and a woman in a household. They optimise the allocation of their time between paid work and domestic activities in the light of the wage rates they face and the utility they derive from consumption. We also set ϵ=1.

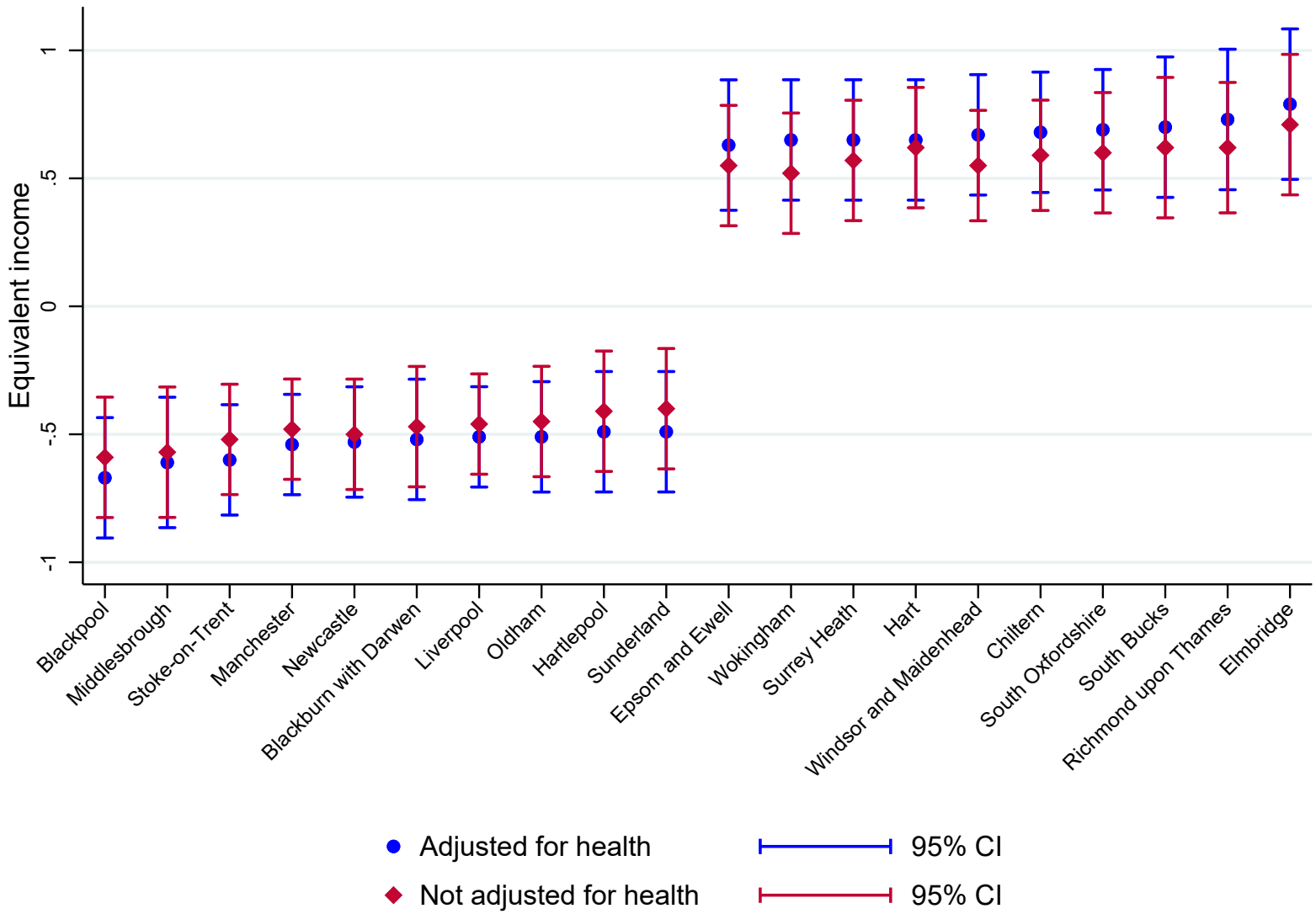
The Value of Good Health and the Value of a Life Year

- The health data allow us to distinguish those who describe their health as excellent, very good or good as a proportion of the total. Setting h_t to 1 if that is the case and 0.75 otherwise gives a figure for expected QALYS at age 20 which aligns with the figures provided by Palmer *et al* (2021)
- We follow Murphy and Topel (2006) who show a life year can be valued as the ratio of utility to the marginal utility of consumption and net saving. Thomas (2018) suggests that, in 2016 prices, a prevented fatality is valued at £1.83mn. Equating the value of remaining life at age 40 to this gives a value of $\bar{u} = -8.7$. This implies that consumption needs to be above about £5,000 p.a. for utility to be positive.

Estimation of Consumption and Labour Input Models

	log(Consn)	Work: men	Work: women
Fixed Effects			
mean log(net income)	0.908***	0.0581***	0.0364***
	(9.72)	(15.22)	(13.78)
log(mean electricity use)	0.343***	0.0479***	0.00348
	(4.52)	(15.49)	(1.65)
log(mean house prices)	0.103**	-0.00146	0.00199*
	(2.83)	(-1.09)	(2.20)
Constant	0.570	-0.867***	-0.370***
	(0.64)	(-21.67)	(-13.85)

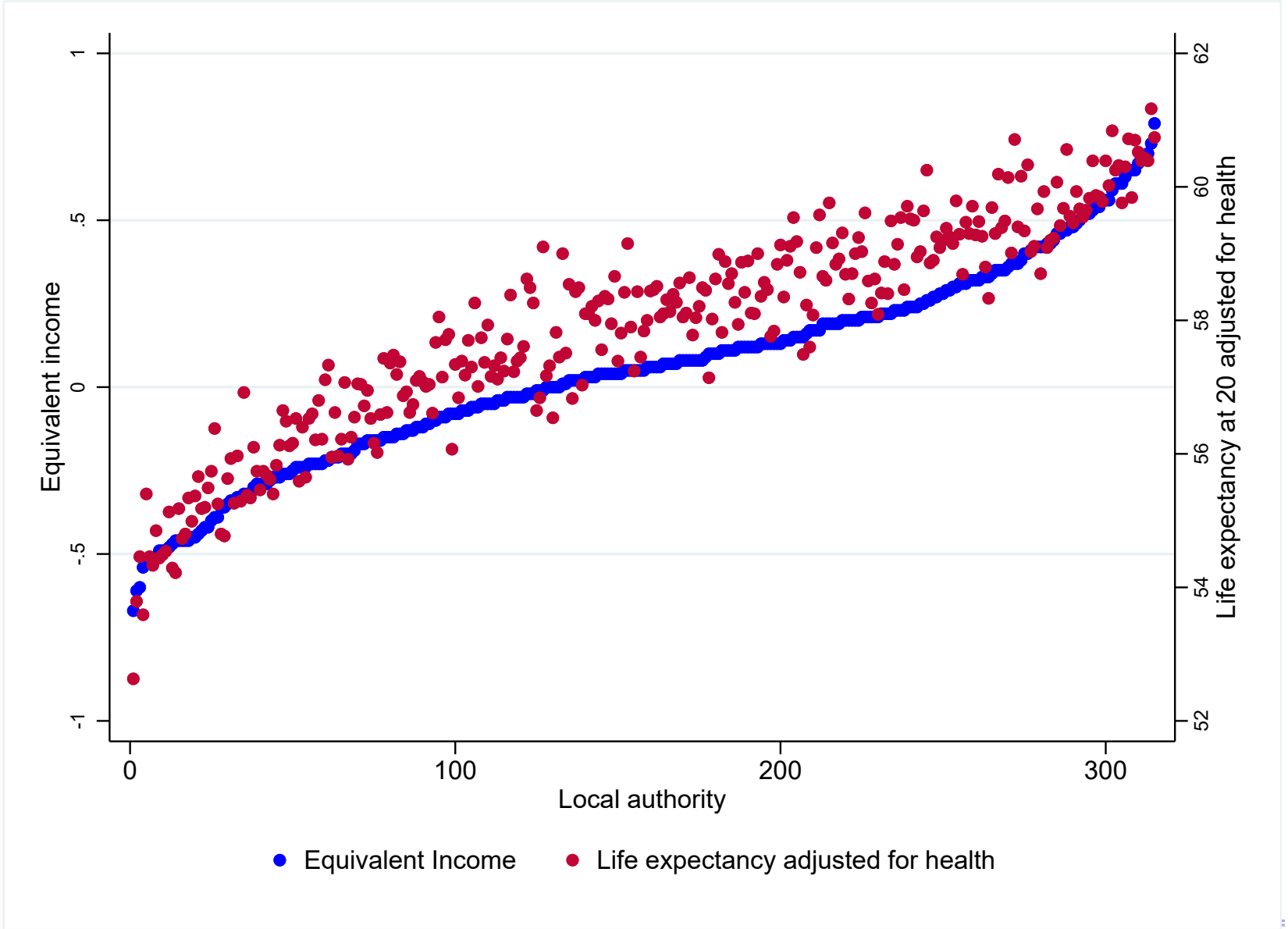
Figure: Equivalent income: top and bottom 10 local authorities



Source: Authors' calculations from ONS and HMRC data.

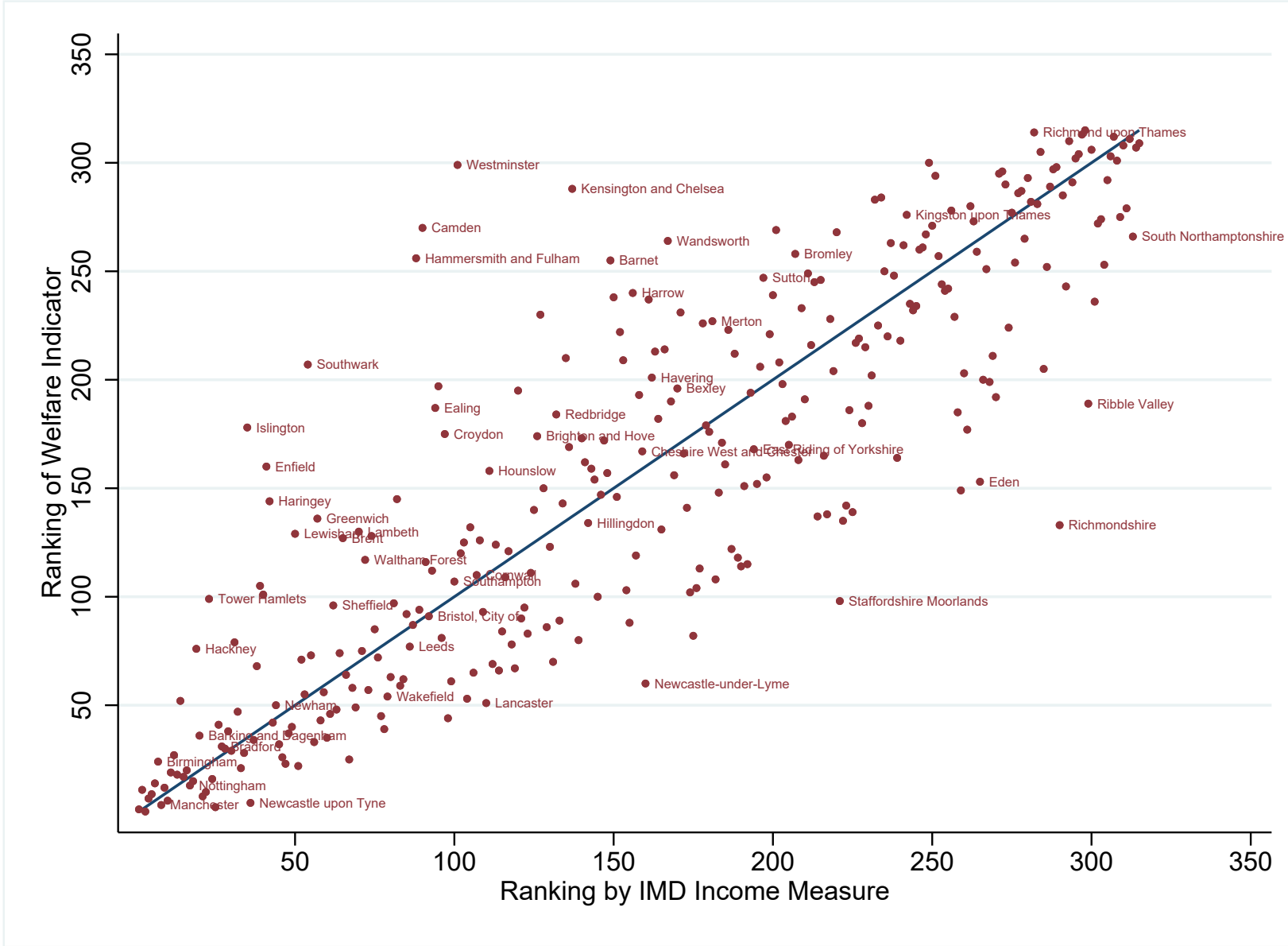
Note: Top and bottom 10 local authorities ranked by equivalent income

Figure: Life Expectancy and the Well-being Indicator



Source: Authors' calculations from ONS and HMRC data.

Figure: Income from the IMD dataset and the Measure of Well-being



Source: Authors' calculations from ONS and HMRC data.

Future Work: The Impact of Natural Capital and the Environment on Measures of Well-being

- These estimates assume current consumption levels are sustainable. Once depletion of natural capital is taken into account it is not clear that this is possible.
- They also need to take account of the local environment. Work is starting on looking at three local aspects, i) NO_2, ii) Distance from a main road and iii) Distance from green space in urban areas.