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Implicit Amenity Prices and the Location of Retirees in England and Wales

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Abstract

General equilibrium models in which compensation for local amenities occurs in both housing and labour markets have been widely used to generate implicit amenity prices and regional quality of life indices. An implication and prospective test of such models is that individuals who are outside the labour market have an incentive to locate in regions where amenities are capitalised into wages. In this paper we construct a measure of the extent of amenity capitalisation into wages for each county in England and Wales. We then test the multimarket amenity model by applying this measure to county-level data on the location of retirees. Our results provide strong support for the model.

I. Introduction

In a seminal contribution to the literature on the value of amenities, Roback (1982) demonstrated how, in a general equilibrium setting, differences in amenities across locations are capitalised in both land and labour markets. A central assumption of the model is that workers and firms are mobile so that in equilibrium both utility and production costs are equalised across locations. Thus for workers, locations with good amenities will be characterised by high land prices and/or low wages. The framework has been applied not only to amenity pricing but also to generate regional quality of life indices (see, for example, Blomquist, Berger and Hoehn, 1988, Gyourko and Tracy, 1991, Srinivasan and Stewart, 2004, and Berger, Blomquist and Peter, 2008).

One interesting prediction, and prospective test of the model, concerns the location of individuals that are not in the labour force. As pointed out by Graves and Waldman (1991), such individuals will have an incentive to locate in regions where compensation for amenities occurs mainly in the labour rather than land market. Graves and Waldman test the prediction using US data on the migration of individuals aged 65 and over, and find support for the model. In this paper we apply the model to the location decisions of retirees in England and Wales. Drawing on estimates of amenity prices in Srinivasan and Stewart (2004), we examine variations across counties in the proportion of the population that are retired and migration flows of individuals aged 60 and over. Our findings offer additional support for the model and the associated quality of life indices.

II. Model

Following Blomquist, Berger and Hoehn (1988) and Gyourko and Tracy (1991), we consider a variation of Roback's model in which working households are endowed with one unit of labour and gain utility from a composite good, housing services and local amenities. In equilibrium utility is the same in all locations and can be expressed in terms of the indirect utility function:

$$v(w_k, h_k; a_k) = v^0 \tag{1}$$

where, the subscript k refers to regions, w_k denotes the wage rate, h_k the price of housing, and a_k a vector of amenities.

Firms produce the composite good using labour and land with a constant returns to scale production function. The product is sold at a price normalised to unity and, in equilibrium, unit costs are equal in all locations:

$$c(w_k, r_k; a_k) = 1 \tag{2}$$

where r_k denotes the price of land.

Housing is similarly produced under constant returns to scale, with unit costs equated to the price, h_k:

$$h(w_k, r_k; a_k) = h_k \tag{3}$$

Equations (1), (2) and (3) determine the wage, price of land and price of housing associated with the level of amenities in a particular region. Totally differentiating (1) and using Roy's identity, we obtain the implicit price of an amenity:

$$P_k \equiv \frac{v_a}{v_w} = \theta_k \frac{dh_k}{da_k} - \frac{dw_k}{da_k} \tag{4}$$

where θ_k denotes the quantity of housing.

Estimates of the right hand side terms of (4) can be obtained from cross-section hedonic house price and wage regressions and thus used to generate implicit prices for each amenity, *i*. Summing over the amenities in region *k* then yields its quality of life index value:

$$QOL_k = \sum_i P_i a_{ik} \tag{5}$$

where a_{ik} denotes the amount of amenity *i* in region *k*.

Consider now the situation facing a household that is not in the labour force and happens to live in a hypothetical location with zero levels of each amenity. If this household were to relocate to location *k,* it would experience a gain in utility (in money terms) of

$$-\sum_i a_{ik} \frac{dw}{da_i}. \tag{6}$$

This prediction forms the basis of our test of the model.

III. Data and results

Data on the location of retirees, migration flows and amenities were collected for each of the 55 counties in England and Wales. The retirement location variable is the proportion of the population of pension age or over (60 for women and 65 for men) in each county. This was obtained from Regional Trends. The migration data is based on National Health Service records. When a patient transfers to a new National Health Service doctor in a different Family Health Service Authority, the details are passed to the National Health Service Central Register. This information can be used to generate proxies for migration flows between counties which are published, by broad age groups, in Key Population and Vital Statistics. The data on amenities come from a variety of sources as detailed in the Appendix. The set of amenities and the data period (1994/5) were chosen to be consistent with Srinivasan and Stewart (2004), which is the source of our amenity wage coefficients, (dw/da_i). These coefficients were estimated using a sample of 12,320 from the 1995 Labour Force Survey, with a standard set of controls for personal characteristics. Among the amenities is an indicator of air quality, denoted by PM_{10}. This measures levels of air-borne particulates that are likely to be inhaled into the lungs (small particles are selected preferentially). Predictions of annual mean levels on a 1km grid were generated by

AEA technology on the basis of PM_{10} readings from monitoring sites across the UK. These were then converted into county averages using digitalised boundary data.

To test the multimarket amenity model we focus on the prediction that a household that is not part of the labour force has an incentive to locate in a region where amenities are capitalised in the labour market. Individuals above the retirement age were selected as representative of such a group. As noted earlier, the gain from moving from a hypothetical region with zero amenities to region *k* is given by $-\sum_i a_{ik}\, dw/da_i$. Using data on amenities together with the estimates of dw/da_i referred to above, we calculated, for each county, the amenity wage: $\sum_i a_{ik}\, dw/da_i$. The test of the model is then whether a negative relationship exists between the presence of retirees in a county (retirees as a proportion of the total population) and the amenity wage. The results of a least squares regression for the 55 counties are presented column (1) of Table 1, where it can be seen that the coefficient on the amenity wage (AMWAGE) is negative and statistically significant at the 1% level. This constitutes the main result of the paper.

[Table 1 here]

An alternative test, employed by Graves and Waldman (1991), would be to examine the relationship between migration flows and AMWAGE for retirees and to compare it with that of working age individuals. Unfortunately the age threshold in the migration data is 60 for both women and men, which for the latter does not represent the normal retirement age. Nevertheless, one might consider the age range 15-59 to be a very rough proxy for individuals in the labour force and the group aged 60 and over as a rough proxy for retirees. We therefore regressed the annual net migration flows of both groups on AMWAGE. The results for the 60 and over age group are shown in columns (2) and (3) of Table 1, and those for 15-59 the group in columns (4) and (5). In each case, one of the specifications incorporates the population level in the destination county (POPULATION) as a control variable. The estimates suggest a clear distinction in the behaviour of the two groups. For the 15-59 age group, the coefficients on AMWAGE are positive but statistically insignificant, whilst for the 60 and over group they are negative and significant. To the extent that the groups represent reasonable proxies for workers and retirees respectively, these findings constitute additional support for the model.

In the light of the above findings, we report, in Table 2, the amenity wage for each county together with their QOL ranking (see equation (5)), given in Srinivasan and Stewart (2004). The amenity wages have been normalised on a hypothetical county with the mean level of each amenity, and the counties are listed in ascending order of this index.

[Table 2 here]

Counties with a low amenity wage tend, not surprisingly, to have a high overall QOL. Generally speaking, counties towards the top of the table enjoy good air quality – in terms of the level of airborne particulates discussed above - but are fairly diverse in other respects. One notable exception to the pattern is Cleveland, which is 10^{th} in

terms of amenity wage but ranked 45th for QOL. This can be explained, in part, by the fact that Cleveland experiences a high crime rate – an amenity for which compensation occurs in the housing rather than labour market.

IV. Conclusions

In this paper we have employed Roback's (1982) general equilibrium amenity pricing model to examine the location decisions of retirees in England and Wales. The results strongly support the prediction that retirees will be attracted to counties where amenities are capitalised in the labour market. An analysis of the migration flows of different age groups provides some further support for the model. These findings are consistent with those of Graves and Waldman (1991) and Gabriel and Rosenthal (2004) for the US. From a policy standpoint, the results offer not only a method of predicting the location choices of retirees but also, through investments in amenities, of influencing their decisions. More generally, the results provide support for amenity prices and regional quality of life rankings based on the Roback framework.

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Appendix

[Table A1 here]

Table 1. Regression results for the proportion of retirees in the population and net migration flows by age group

Variable	Prop. Retired	Net Migration Inflow			
		Aged 60 and over		Aged 15-59	
	(1)	(2)	(3)	(4)	(5)
AMWAGE	-0.1317**	-8.7768**	-7.0577**	2.8875	4.2828
	(-3.42)	(-2.47)	(-2.44)	(0.70)	(1.12)
POPULATION			-1.1362**		-.9222**
			(-5.36)		(-3.29)
Constant	1.4615**	84.6300*	74.6580**	-27.8520	-35.9503
	(3.94)	(2.47)	(2.69)	(-0.70)	(-.98)
RMSE	0.0241	2.0580	1.6615	0.4890	2.2002
F-Stat	11.73	6.10	19.07	2.06	5.69
R^2	0.18	0.10	0.43	0.01	0.18
Observations	55	54	54	54	54

Notes: Explanatory variables are in logs. *t-ratios* in parentheses. * and ** denote significance at the 5% and 1% level respectively (one-tailed for AMWAGE, two-tailed otherwise).

Table 2. County rankings by amenity wage and quality of life

County	Amwage rank	Amwage Index	QOL rank	County	Amwage rank	Amwage Index	QOL rank
Gwynedd	1	-2852	3	Avon	29	-164	20
Dyfed	2	-2268	1	Greater Manchester	30	-87	21
Cumbria	3	-2025	4	W Yorkshire	31	-20	35
Northumberland	4	-1820	16	Dorset	32	143	14
Powys	5	-1744	2	E Sussex	33	188	30
W Glamorgan	6	-1653	5	Isle of Wight	34	207	29
Mid Glamorgan	7	-1512	13	Leicestershire	35	304	47
Durham	8	-1402	18	Lincolnshire	36	317	44
Somerset	9	-1104	6	Northamptonshire	37	401	38
Cleveland	10	-1022	45	Warwickshire	38	565	36
Merseyside	11	-958	22	Kent	39	652	42
Clwyd	12	-958	11	Wiltshire	40	666	26
Cornwall	13	-958	12	W Midlands	41	732	28
Nottinghamshire	14	-880	46	Oxfordshire	42	938	31
Devon	15	-853	8	Cambridgeshire	43	940	39
Lancashire	16	-690	9	Essex	44	1002	51
S Glamorgan	17	-658	7	Norfolk	45	1087	52
Humberside	18	-639	40	Hampshire	46	1149	37
Hereford and Worcs	19	-619	10	Buckinghamshire	47	1207	43
Gwent	20	-594	25	Bedfordshire	48	1363	55
Shropshire	21	-509	17	W Sussex	49	1469	32
Derbyshire	22	-486	34	Hertfordshire	50	1557	48
Cheshire	23	-476	15	Suffolk	51	1559	53
N Yorkshire	24	-422	19	Berkshire	52	1604	41
Tyne and Wear	25	-322	24	Surrey	53	2352	49
Staffordshire	26	-257	33	Outer London	54	3766	54
S Yorkshire	27	-238	50	Inner London	55	4229	27
Gloucestershire	28	-206	23				

Table A1. Variable descriptions and sources

Variable name	Variable description	Source	Mean	Wage coefficient
Prop. Retired	Proportion of retirees in total population	Key Population and Vital Statistics 1995	19.47	
Net migration inflow aged 60 and over	Net annual inflow of people aged 60 and over	Key Population and Vital Statistics 1995	0.84	
Net migration inflow aged 15-59	Net annual inflow of people aged 15-59	Key Population and Vital Statistics 1995	1.59	
PM_{10}	Particulates, micrograms per cubic meter	AEA Technology	17.10	486.35
Sunshine	Average annual sunshine hours 1961-90	Climatic Research Unit, UEA	1427	2.28
Crime	Notified violent crimes per thousand population	Home Office	5.15	-123.14
Unemployment	Claimant unemployment rate (%)	Regional Trends 1995, Employment Gazette 1995	8.44	-228.35
Pupil-teacher	Average pupil-teacher ratio in primary and secondary schools	Regional Trends 1996	19.72	341.07
Nursery	Day nursery places, per 1000 population aged under 5	Regional Trends 1996	38.35	-11.75
Pop. density	Population density per square km	Key Population and Vital Statistics 1994, Regional Trends 1995	569.81	0.24
London	Dummy variable: 1 if Greater London, 0 elsewhere	Regional Trends 1995		2107.16
AMWAGE	Calculated amenity wage		15462	