



WORKING PAPER SERIES

Voting with Your Feet in the United Kingdom: Using Cross-Migration Rates to Estimate Relative Living Standards.

Howard J. Wall

Working Paper 1999-006A
<http://research.stlouisfed.org/wp/1999/99-006.pdf>

PUBLISHED: Papers in Regional Science, 2001, 80, pp. 1-23.

FEDERAL RESERVE BANK OF ST. LOUIS
Research Division
411 Locust Street
St. Louis, MO 63102

The views expressed are those of the individual authors and do not necessarily reflect official positions of the Federal Reserve Bank of St. Louis, the Federal Reserve System, or the Board of Governors.

Federal Reserve Bank of St. Louis Working Papers are preliminary materials circulated to stimulate discussion and critical comment. References in publications to Federal Reserve Bank of St. Louis Working Papers (other than an acknowledgment that the writer has had access to unpublished material) should be cleared with the author or authors.

Photo courtesy of The Gateway Arch, St. Louis, MO. www.gatewayarch.com

Voting with your feet in the United Kingdom: Using cross-migration rates to estimate relative living standards*

Howard J. Wall¹

¹ Research Division, Federal Reserve Bank of St. Louis, P.O. Box 442, St Louis, MO 63166-0442, USA (e-mail: wall@stls.frb.org, phone: (314)444-8533, fax: (314)444-8731)

submitted August 1998, revised May 1999

Summary. This paper reexamines and extends the literature on the use of migration rates to estimate compensating differentials as measures of regional quality of life. I estimate an interregional migration regression for the UK and use the results to measure regional quality of life and standard of living. The results suggest a North-South divide within England, and that Scotland and Wales have relatively high levels of both. The results also lead to a rejection of regional standard-of-living equivalence (long-run regional equilibrium) in the UK.

Keywords and Phrases: Interregional migration, Standard of living, Quality of life

JEL Classification Numbers: J61, R23

Running Head: Migration and standard of living

* The views expressed are those of the author and do not necessarily represent official positions of the Federal Reserve Bank of St. Louis, nor of the Federal Reserve System. I am grateful to Strat Douglas and two referees for their helpful comments and suggestions.

1 Introduction

The focus of much of regional economics has been on the determination and distribution of living standards across regions or other geographical units. The 'standard of living' in any geographical unit is broadly defined as the level of well-being of a typical resident, and is determined by many factors, although it is common to use per capita income as a proxy. There is a sizable literature that tries to broaden the measurement of living standards to include labor-market conditions and 'quality of life'. The purpose of this paper is to reexamine and extend the literature using migration rates to measure relative quality of life and living standards. I apply the standard and extended methods to the regions of the United Kingdom.¹

The convention used here is to define 'amenities' as all components of the standard of living other than income and labor-market conditions, and to define 'the quality of life' as the overall utility-value of amenities.² The standard method for measuring quality of life is the hedonic approach of Rosen (1979), which estimates the compensating differentials that people are willing to pay for differences in amenities.³ This approach is based on the assumption of a long run Tiebout-type voting-with-your-feet equilibrium in which voter/consumers are optimally allocated, implying that the standard of living is equivalent across locations.⁴ Under standard-of-living equivalence, any differences in the quality of life across regions are compensated for by differences in income. Income differentials then provide direct measures of the value of a location's quality of life in terms of the income that people are willing to forgo. Although this

¹ The focus in the UK has been on regional differences in labor-market opportunities. In particular, there has been a great deal of discussion of the North-South divide wherein Northern regions suffer from persistently lower incomes and higher unemployment relative to Southern regions. See Gudgin (1995) for a recent discussion.

² Note that the literature provides no consistent definitions of these terms.

³ The hedonic approach has been applied to cities in the US by Roback (1982), Blomquist, Berger, and Hoehn (1988), Gyourko and Tracy (1991), and Kahn (1995). To my knowledge, it has not been applied to the UK.

approach is intuitively appealing, the assumption of long run equilibrium has not met with universal approval.⁵

In an influential paper applied to states in the US, Greenwood, Hunt, Rickman, and Treyz (1991) propose a method for determining compensating differentials without having to assume that all regions are in long run equilibrium. They posit that a region is in long run equilibrium, and hence has the same standard of living as the rest of the country, when it has zero net gross-migration.⁶ They first estimate the relationship between regional gross-migration rates and per capita income relative to the national average, which they then use to calculate the level of income that would be necessary for a region to have zero net gross-migration.⁷ The difference between this and the national per capita income is the region's quality of life in dollar terms.

Greenwood, *et al*'s method is an important contribution because it does not rely on the assumption of standard-of-living equivalence, and because it suggests a straightforward method for using migration rates to estimate quality of life. However, as argued by Douglas (1997) and Douglas and Wall (1996), their implicit theoretical model is one in which potential migrants respond to the standard of living of their present region relative to that of the rest of the country, instead of to that of each potential destination. As a consequence, they measure a region's standard-of-living by its gross-migration rate, a measure that cannot be derived within a reasonable utility-maximization framework.

An alternative to Greenwood, *et al* (1991) that also uses migration data to measure standard of living has been developed by Douglas and Wall (1993) and Douglas (1997). Theirs

⁴ Tiebout (1956).

⁵ See the surveys of Evans (1990) and Hunt (1993).

⁶ Net gross-migration is total migration from a region to the rest of the country net of total migration from the rest of the country to the region.

is a non-parametric 'rational' approach which uses net cross-migration flows to construct standard-of-living indices. This method is based on the premise that because people make utility-maximizing locational choices when deciding where to live, net cross-migration directly reveals the standard-of-living ranking of any two locations.⁸ The researcher needs only to collect the pairwise comparisons of the regions to construct a single standard-of-living ranking.

So as to use the empirical method of Greenwood, *et al*'s model, while avoiding its conceptual problems, I use a model based on the rational approach of Douglas and Wall (1993) and Douglas (1997). The model extends Douglas and Wall (1996) in three important ways: it treats labor-market conditions separately from other amenities;⁹ it relaxes the assumption that moving costs between two locations are independent of the direction of the move; and it controls for the effects of migration between contiguous regions. I apply the model to interregional migration in the UK for the years 1982-92.

2 Interregional migration in the UK: A selective survey

Although the motivation for this paper is to measure the relative quality of life and standard of living across the regions of the UK, the results can be considered separately as a contribution to the literature on UK internal migration. Existing studies have used a variety of theoretical models and data sets, and my results are comparable to those such as Molho (1982, 1984), Pissarides and McMaster (1990), and Jackman and Savouri (1992, 1996), which also use

⁷ Porell (1982) had a similar idea, but his objective was to measure the influence of amenities on migration flows.

⁸ Net cross-migration is the net migration between two regions.

⁹ Rosen (1979) categorizes labor-market conditions as an amenity; and Greenwood, *et al* (1991) and Douglas and Wall (1996) estimate them as such.

aggregate regional migration data.¹⁰ The ten regions are North, Yorkshire and Humberside, East Midlands, East Anglia, South East, South West, West Midlands, North West, Wales, and Scotland. Refer to Figure 1 for a map of the standard regions of the UK. Note that as of 1999, the UK government divides the country into ‘unitary authorities’ whose borders do not correspond to those of the pre-1999 regions.

Although previous studies differ greatly in their theoretical bases and their objectives, the sets of independent variables used in these studies are very similar. Each includes fixed effects to control for differences in amenities and other fixed determinants of migration; each includes income or wages to determine the effects of remunerative opportunities; and each includes regional unemployment rates and/or regional vacancy rates to determine the effects of labor-market opportunities. Important differences include the inclusion of house prices by Molho (1984) and Jackman and Savouri (1992, 1996), and contiguity and distance measures by Molho (1982) and Jackman and Savouri (1996).

What is surprising about these studies is how different their *dependent* variables are from one another. Molho (1982, 1984), using a traditional gravity model, measures a region's rate of migration to another region as the number of out-migrants as a percentage of the product of the populations of the two regions. Pissarides and McMaster (1990), like Greenwood *et al* (1991), do not look at migration between regions, but between a region and the rest of the country. Their migration rate is out-migration from a region to the rest of the country as a percentage of the region's population. Jackman and Savouri (1992, 1996) do not take account of the migration opportunities available in the destination region, so their migration rate is the number of migrants

¹⁰ See also the studies surveyed by Molho (1982). Studies such as Pissarides and Wadsworth (1989) and Hughes and McCormick (1987, 1994) use micro-data sets and are not directly comparable, although they inform the analysis

from one region to another as a percentage of the population of the origin destination only.

The most important difference between my empirical model and that of previous studies of the UK is the way in which I measure the interregional migration rate. Firstly, as discussed above, it models migration as occurring between two regions, instead of between a region and the rest of the country. Secondly, through the aggregation of individual location choices to the regional level, my migration rate includes the number of migration opportunities available in destination regions. And thirdly, as a means of netting out structural problems such as distance and the effect of alternative locational options, I use *net* cross-migration instead of gross (one-way) migration used in traditional gravity models. Unlike the previous literature, I construct a model starting from an individual utility-maximizer's locational choice problem, and the migration rate arises directly from the model and an aggregation of individual decisions to the regional level.¹¹

3 The theoretical model

3.1 Individual migration decisions

Divide the country into many locations, each capable of being inhabited. Regions differ in size according to the numbers of locations and residents they have. The relevant unit of migration for an individual agent is then at the location level, and the level of regional migration is simply the aggregate of the many location decisions. As discussed in detail later, this is a crucial distinction, and it leads to a very different measure of aggregate regional migration rates than used in previous studies of the UK.

throughout. Coleman and Salt (1992) and Rees and Stillwell (1990) describe UK interregional migration.

¹¹ See Plane (1993) and Douglas (1997) for discussions of the appropriate measure of the migration rate.

In order for *the* standard of living to have any meaning, there must be some commonality in individuals' assessments of locations. As is standard in random-utility models such as Smith and Clayton (1978), Ben-Akiva and Watanatada (1981), and Douglas (1997), assume that an individual's assessment of the standard of living in a location has a component common to all, and an individual-specific component. Specifically, individual k 's evaluation of the standard of living in location i is

$$U_i^k = u(\mathbf{A}_i, Y_i, X_i) + \varepsilon_i^k; \quad (1)$$

where \mathbf{A}_i is a vector of amenities, Y_i is real per capita income, and X_i is a measure of general labor market conditions. The standard of living is measured by $u_i = u(\cdot)$, and ε_i^k is a stochastic term that captures those factors that are specific to individual k . These factors include anything that leads k to place a different value on \mathbf{A}_i , Y_i , and X_i than would be expected of a person selected randomly from the country's population. For each location, the expected value (over the country's population) of the individual-specific component is zero. This is by definition, since any systematic non-zero component is included in the common component u_i . Define C_{ij} as the one-time utility cost incurred by any individual when she migrates from location i to location j , exclusive of her change in standard of living. Any individual-specific moving costs are included in ε_i^k .

Define a random variable M_{ij}^k such that $M_{ij}^k = 1$ if individual k migrates from location i to location j , and $M_{ij}^k = 0$ otherwise. For individual k to migrate from location i to location j (and not to any other location r), the move must lead to a higher perceived personal standard of living, and must mean that there were no alternative moves that would have provided a larger

improvement. Thus, the probability that a randomly selected resident of i will migrate to j can be expressed as a function $F(\cdot)$ that is increasing in the expected standard of living difference between j and i (net of moving costs), and in the expected standard-of-living differential between j and each alternative location r (net of the difference in the costs of moving from i):

$$\Pr(M_{ij}^k = 1) = F(u_j - u_i - C_{ij} + \Delta_{ji}^i, \dots, u_j - u_r - C_{ij} + C_{ir} + \Delta_{jr}^i, \dots). \quad (2)$$

In (2), Δ_{ji}^i denotes the difference in the expected values of i and j 's idiosyncratic components, drawing from the population of location i only: $\Delta_{ji}^i \equiv E(\epsilon_j^k | \text{resident of } i) - E(\epsilon_i^k | \text{resident of } i)$.

This measures the degree to which residents of i , relative to the tendency of residents of the country as a whole, tend to prefer (or have a distaste for) j to i .

If the distribution of the idiosyncratic components was the same for all locations, both terms in Δ_{ji}^i would be zero. This is because the randomly selected resident of each location would have the same expected preferences as the randomly selected resident the country as a whole. Although this assumption would eliminate the need to control for differences in the distribution of preferences across locations, it is stronger than necessary for present purposes. Instead, make the weaker assumption that the differences in the expected values of the idiosyncratic components are symmetric; i.e. $\Delta_{ji}^i = \Delta_{ij}^j$. In other words, if the residents of i tend to have a relative distaste or preference for location j , the feeling on the part of j 's residents towards i is exactly mutual.

To make (2) operationally useful, assume that $F(\cdot)$ is linear in all arguments and symmetric in the comparisons to alternative locations. Specifically, where ℓ_{ij} denotes the set of all locations other than i and j ,

$$\Pr(M_{ij}^k = 1) = \beta(u_j - u_i - C_{ij} + \Delta_{ji}^i) + \delta \sum_{r \in \ell_{ij}} (u_j - u_r - C_{ij} + C_{ir} + \Delta_{jr}^i). \quad (2')$$

Expression (2') is difficult to use empirically to estimate the decision to migrate between i and j because it includes terms on locations other than i and j . Because these other terms are correlated with the standard-of-living differential between i and j , not accounting for them will bias any estimates. In this model the problem is handled by considering *net* cross-migration between i and j , which, given the linear approximation of $F(\cdot)$, eliminates the need to consider other regions.

Define μ_{ij} as the difference in the probabilities of a randomly-selected residents of i and j migrating to the other location: $\mu_{ij} = \Pr(M_{ij}^k = 1) - \Pr(M_{ji}^h = 1)$. Assume that no location has an overall advantage in terms of the idiosyncratic components, i.e. $\sum_{r \in \ell_{ij}} \Delta_{jr}^i = \sum_{r \in \ell_{ij}} \Delta_{ir}^j$, and, following Douglas (1997), assume that i has no overall moving-cost advantage or disadvantage over j , i.e. $\sum_{r \in \ell_{ij}} (C_{ir} - C_{jr}) = 0$. Use (2') and rearrange to obtain

$$\mu_{ij} = \omega(u_j - u_i) + \rho(C_{ji} - C_{ij}); \quad (3)$$

where $\omega = 2\beta + \delta(n-2)$, and $\rho = \beta + \delta(n-2)$.

Previous variants of this model assume that moving costs are symmetric ($C_{ij} = C_{ji}$), meaning that they are independent of the direction of the move between any two regions. In Douglas and Wall (1993) and Douglas (1997), this assumption allows for the direct application of net cross-migration rates to standard-of-living ranks because the direction of net migration reveals preference of one region over the other. When constructing such a non-parametric ranking, any differences in the costs of moving into a region may be of minor consideration.

However, when using a regression to quantify the effects of income and labor-market opportunities, it may be necessary to control for them, even if they not important enough to change the direction of net cross-migration. This is likely to be particularly important for the UK, where, as argued by Evans (1993), mobility is asymmetrically constrained.

3.2 Aggregating individual migration decisions

Expressions (2) and (3) refer to the migration probability of a resident drawn randomly from a single location, of which there are many in a region. In order to aggregate to the regional level across the locations within the source region, it is necessary to assume that the standard of living is the same across the locations within a region, although the individual-specific evaluations may differ. Assuming that locations i and j are in different regions, the number of migrants from location i 's region (hereafter referred to as region i) to location j is the sum of the probabilities for the N_i residents of region i .

$$E(M_{ij}) = L_j \sum_{k=1}^{N_i} \Pr(M_{ij}^k = 1). \quad (4)$$

With a large number of residents in region i , this approaches $L_j N_i \Pr(M_{ij}^k = 1)$. Rearrange this to obtain

$$\Pr(M_{ij}^k = 1) = E(m_{ij}). \quad (5)$$

The appropriate migration rate to reflect the preferences revealed by individual migration decisions is therefore cross-migration as a percentage of migration *opportunities* that the residents of i have across the locations of j : $m_{ij} \equiv M_{ij}/N_i L_j$.

Without the second aggregation across locations within the regions, I would arrive at the gross-migration rate used by Jackman and Savouri (1992, 1995). However, such a migration rate yields only a measure of the rate of migration from region i to one of the many locations in another region, in effect equating a region with a single location. Such a measure does not provide a meaningful regional-level aggregation of the utility-maximizing decisions made at the locational level. Models that do not take into account that large regions attract more migrants bias the measure of migration rates towards large regions, with this bias becoming more severe the more diverse the regions are in size. For example, if the percentage of East Anglia's population that moves to the South East is larger than the percentage of the South East's population that moves to East Anglia, this may only reflect that there are many more places to move to in the South East, not that there is a difference in standard of living.

Combine (5) with (3) to obtain¹²

$$E(m_{ij} - m_{ji}) = u_j - u_i + \rho(C_{ji} - C_{ij}). \quad (6)$$

As represented by (6), expected net cross-migration between two regions, in terms of migration opportunities, increases in the standard-of-living differential. Also the present model shows instead that standard-of-living equivalence is indicated by zero net *cross*-migration between two regions (ignoring differences in moving costs for the moment). This is in contrast to Greenwood, *et al* (1991) in which standard-of-living equivalence is indicated by zero net *gross*-migration to the rest of the country.

¹² Since standard of living is solely an ordinal measure, ignore ω .

4 The empirical model

4.1 Contiguity and moving costs

Assume that moving costs are $C_{ij} = H_j + g(d_{ij})$, where H_j is the cost of finding accommodation in the destination region, independent of distance. The distance between the origin and destination is d_{ij} , and $g' > 0$. In previous studies, the distance component of moving costs has been captured as a fixed effect in the migration equation, but Jackman and Savouri (1995) separate the effect of distance from other fixed effects by measuring the distance between regions as the physical distance between the two regions' largest cities. Although it is common to use physical distance as a proxy for moving costs, Plane (1984) finds that physical distance is not necessarily even a good measure of relative functional distance as perceived by migrants. Fortunately, the present model avoids having to make such an approximation because the distance component disappears from the cross-migration equation below. However, this does not help to control for contiguity effects.

As Molho (1982) and Jackman and Savouri (1996) argue, distance is not an appropriate measure of moving costs when people can move to contiguous regions, facing very different costs from those who move to non-contiguous regions. A migrant between contiguous regions may only be changing his place of residence across a regional border, but keeping the same jobs and friends, thus avoiding the information costs faced by others. Molho (1982) and Jackman and Savouri (1996) both use the length of the border to control for contiguity effects, which would disappear from the cross-migration equation used here. However, it is not simply the length of the border that matters, but the number of people near the border. To control for contiguity effects, I instead use a measure of the number of residents of a region in the border area with

each of the other regions. Using b_{ij} to denote the length of the border between regions i and j , $Z_{ij} \equiv b_{ij}N_i$ is an approximation of the number of people in i who can potentially make moves to j within the border area.

4.2 Empirical specification

For the purposes of estimation, specify the standard-of-living function as

$$u(\mathbf{A}_i, Y_i, X_i) = \alpha' \ln \mathbf{A}_i + \gamma \ln Y_i + \phi \ln X_i; \quad \alpha, \gamma, \phi > 0. \quad (7)$$

Substitute (7) and the above specification for moving costs into (6). Control for contiguity effects and allow for measurement and other error to obtain

$$m_{ij} - m_{ji} = \lambda_j - \lambda_i + \gamma \ln \left(\frac{Y_j}{Y_i} \right) + \phi \ln \left(\frac{X_j}{X_i} \right) + \rho(H_i - H_j) + \theta(Z_{ij} - Z_{ji}) + \eta_{ij}. \quad (8)$$

The quality of life is measured by $\lambda_i = \alpha' \ln \mathbf{A}_i$, the utility value of amenities. Note that because the distance-related moving costs disappear when net cross-migration is considered, the remaining components of moving cost are the regional difference in the difficulty finding accommodation and the contiguity effects.

The general contributions of the present paper to the hedonic pricing literature and to the study of UK interregional migration are readily illustrated with regression equation (8). As with Douglas and Wall (1996), the standard-of-living differential is here measure by net cross-migration between two regions, as derived from the ‘rational’ approach. This is in contrast with Greenwood, *et al* (1991), who use net out-migration to the rest of the country, and have only the relative per capita income on the right-hand-side. The important advances of the present model on Douglas and Wall (1996) are: separating labor-market conditions from other amenities;

allowing for asymmetric moving costs between regions, as represented by asymmetric difficulties in finding accommodation; and controlling for the effects of migration between contiguous regions.

The most important advance of equation (8) on other models of UK interregional migration is that the migration rate is in terms of the migration opportunities in the destination region, as in classical gravity models. This migration rate is a more accurate reflection of the individual-level decisions of migrants. Also, by using cross-migration between two regions, the need to model difficult fixed variables like distance-related moving cost is eliminated. The contiguity variable used in equation (8), while not perfect, is an advance on previous measures, which do not consider the number of potential migrants along the border, but only the length of the border.

5 Data and variables

Unless otherwise noted, all data are obtained from various issues of *Regional Trends*. Cross-migration data are derived from the National Health Service Central Register, which is described and discussed by Coleman and Salt (1992), and is also used by Molho (1984) and Jackman and Savouri (1992, 1996). There are various difficulties and biases with this data, but it is generally considered to be a reliable measure of interregional movements in the UK. For reference, these data are summarized by Table 1, which provides the total net cross-migration between the ten regions for 1982-1992, as well as net-in-migration for each region.

Because of the obvious difficulty in measuring the number of locations in a region, it is

commonly measured by the region's population.¹³ The dependent variable is then the net number of cross-migrants between regions i and j , divided by the product of the regions' populations: $m_{ij} - m_{ji} = (M_{ij} - M_{ji}) / N_i N_j$. This net migration rate is the net cross-migration version of classical gravity models, although it is arrived at from an entirely different direction. In classical gravity models such as Zipf (1946), destination population is included to control for the gravitational attraction of populous locations. In the model used here it is derived through the aggregation of individual migration decisions to the regional level.

The regional price indices (actually percentage changes and differences in required income to purchase a fixed bundle, including housing) are from the Reward Group (1995). This data set was also used by Jackman and Savouri (1992, 1996) and Hughes and McCormick (1994). See Borooah, McGregor, McKee, and Mulholland (1996) for an analysis.

I measure a region's employment opportunities by its vacancy rate, the yearly average of the number of vacancies at Job Centres as a percentage of the labor force. Because of regional differences in long-term unemployment, the vacancy rate is likely to be a better measure of labor-market opportunities for potential migrants than is the unemployment rate. However, for the sake of comparison, I substitute the vacancy rate with the unemployment rate in one version of the empirical model.

In the UK, the difficulty in finding accommodation can differ across regions because large and differing portions of the housing stock are owned by local councils, and the number of units available for private rental is relatively small. Hughes and McCormick (1987, 1994) and Evans and McCormick (1994), among others, outline the problems this creates for potential

¹³ This is from Feeney (1973) who argues that the number of locations is linear homogenous in the population, which

migrants, and argue that it is an important constraint on the mobility of the British population. Because of this, I measure the difficulty in finding accommodation by the share of the housing stock that is owned by the local council. The one-time cost of finding accommodation for home-buyers may also differ across regions [see Bover, Meullbauer, and Murphy (1989)]. For potential migrants to a region with high house prices, the down payment required may be substantial. Because of this, I also measure the cost of finding accommodation by the average down payment. Data on the national average down payment for first-time buyers are from Pannel (1995), which I multiply by the regional average house prices from *Regional Trends*, deflated by the regional price index. The lengths of the borders of contiguous regions are from Table A3 of Jackman and Savouri (1996), and are measured in map millimeters. The contiguity variable is the length of the border times the population of the origin region (measured in thousands).

6 Regression results

6.1 The basic model

The estimates are for the ten standard regions of the UK (excluding Northern Ireland) for 1982-92, assuming that the quality of life for each region was fixed over the entire period. With ten regions and eleven years, I have 495 observations. To prevent perfect collinearity, the fixed effects are estimated under the restriction that they sum to zero.

The least squares regression results for Model I are summarized by the first column of Table 2. The first ten coefficients are the estimates of the regional fixed effects, which sum to unity, and which represent the regions' quality of life relative to the national average (zero).

Plane (1993) refers to as the 'interactance hypothesis'.

There are four regions with estimated quality of life above the national average (two significantly above), and six regions with estimates below the national average (three significantly below). The South West, Wales, South East, and East Anglia have above-average quality of life, and Scotland, Yorkshire and Humberside, East Midlands, West Midlands, North West, and North have below-average quality of life.

The coefficients on per capita income and the vacancy rate have the expected signs, and both are statistically significant. The difference in council-ownership is not a statistically significant determinant of cross-migration, while average down payment and the extent of regional contiguity are, both having the expected signs.

6.2 Contiguity and unemployment

The contiguity effect is particularly important in determining the estimates of the relative quality of life of the regions, in particular for the South East and neighboring regions. Notice from the migration data summarized by Table 1 that net migration from the South East to East Anglia and the South West dwarfs that between any two other regions. However, this is not an accurate reflection of the standard of living differential because the densely populated South East shares a long border with these two sparsely populated regions. Many of these net migrants are likely to be making moves within the same general area of their original home, but which happen to cross the border between two regions. Because there are so many more people likely to make this move from the South East to contiguous regions, not controlling for this contiguity effect would severely bias its estimated quality of life downward.

Refer to the second column of Table 2, which contains the regression results for Model II,

which is identical to Model I except that the coefficient on the contiguity variable is restricted to be zero. With this model, the South East would have the lowest estimated quality of life, instead of the second highest, as in Model I. The important differences between the results of Models I and II are in the quality of life estimates for the South East and its neighboring regions: the South West and East Anglia. Further, a log-likelihood test easily rejects the null hypothesis that the coefficient on the contiguity variable can be restricted to zero.¹⁴

In Model I labor-market opportunities were measured by the vacancy rate instead of the unemployment rate. Because other studies have the unemployment rate as an independent variable, it is useful compare how this choice affects the results. Strangely, the results for the model which uses the unemployment rate, Model III, suggest that people tend to move *towards* regions with *high* unemployment, and *away from* those with *low* unemployment. Pissarides and Wadsworth (1989) and Hughes and McCormick (1994) use micro-data and have also obtained seemingly perverse effects of the unemployment rate, although studies using aggregate regional data have not.

One might reasonably expect that because vacancy and unemployment rates are negatively related across the UK and within any region, that the estimated coefficients on the two variables would have opposite signs. However, this relies on the relationship between vacancy and unemployment rates (the Beveridge curve) being the same for all regions. As detected by Jackman and Kan (1988), this became increasingly untenable after 1984, and is clearly inaccurate for the period studied presently. Wall and Zoega (1997) estimate regional Beveridge curves and find significant differences in their position across regions due to significant differences in

¹⁴ This is with $\chi^2(1) = 212.2$ and a critical value of 3.84.

regional steady-state unemployment rates. Also, to illustrate this within the present context, refer to the last two columns of Table 3, which provide the ranking of the regional vacancy rate and the inverse ranking of regional unemployment rates averaged over the period. Clearly these rankings are not closely related, and the Spearman rank correlation coefficient between them is statistically no different from zero. Regions with relatively high vacancy rates are no more likely to have low unemployment than are regions with low vacancy rates.

6.3 Two-way fixed effects

Although the variables used presently are in terms of their real values, it is possible that the results for Model I are biased due to the exclusion of time-specific variables. If migration rates are correlated with time, and time is correlated with the independent variables, exclusion of time effects would lead to biased results. To test for this possibility, Model IV is a two-way fixed effects model that includes time dummies assumed to be fixed cross-sectionally. Note that the dummy for 1982 is excluded to prevent collinearity, meaning that the time effects are measured relative to that of 1982.

As reported in the last column of Table 2, there are several minor differences in the results for Models I and IV, and the only time dummy that is statistically different from zero is that for 1985. The most notable difference between the models is that the coefficients for the region-specific effects of the North and of the South West are not significant at the 10% level when time dummies are included. There is a similar difference for the coefficient on the average down payment. Despite these differences, a likelihood ratio test cannot reject the null hypothesis

that Models I and IV are statistically the same.¹⁵ Further, although Model IV has the higher \bar{R}^2 , Model I is preferred on the basis of having lower values for the Akaike information criterion and the Amemiya probability criterion, which place higher penalties on the addition of regressors.

7 Standard of living

To obtain a measure of the standard of living in each region, substitute into (7) the actual values of per capita income and the vacancy rate, along with the estimated quality of life and the coefficients on income and the vacancy rate from Model I. The ranking of the estimated eleven-year average regional standards of living are provided by Table 3, in decreasing order, along with the corresponding rankings of quality of life, per capita income, vacancy rate, and unemployment rate.

Although per capita income and the vacancy rate are found to be statistically significant, the standard of living ranking correlates most closely with the quality of life ranking. Referring to Table 4, which provides the Spearman rank-correlation coefficients between standard of living and its components, notice that the standard of living and the quality of life are the most highly correlated rankings. Note also that the income ranking is negatively correlated with those of standard of living and of quality of life, although not significantly so. This a particularly interesting result given that relative income is the most common means of ranking regions' standards of living. The vacancy rate ranking, on the other hand, is positively correlated with those of quality of life and standard of living, and is negatively correlated with the income ranking. For comparison sake, note also that the rankings of the standard of living and its three

¹⁵ This is with $\chi^2(10) = 12.74$ and a critical value of 18.31.

components are *positively* correlated with the unemployment rate ranking, although none are statistically significant. However, this does illustrate that very different results can be obtained depending on the measure of labor-market conditions that is chosen.

A tangible measure of the relative standard of living can be obtained by calculating the compensating differential paid for the regional differences in quality of life. The value of the non-income components of the standard of living can be stated in terms of the level of income that individuals would be willing to forgo so that a region's standard of living is the same as elsewhere. To compare region j with the national average, first define RX_j as j 's vacancy rates relative to the national average. For reference, the relative vacancy rate averaged over the period are provided in the first column of Table 5. Recalling (8), solve the following expression for, RY_j^* , the relative per capita income that would equate the standard of living in j with the national average:

$$\hat{\lambda}_j + \hat{\gamma} \ln RY_j^* + \hat{\phi} \ln RX_j = 0. \quad (9)$$

Note that the contiguity effect and differences in moving costs can now be ignored. An approximate solution, taking the estimated coefficients to be their true values, is

$$RY_j^* = e^{-(\hat{\lambda}_j + \hat{\phi} \ln RX_j) / \hat{\gamma}}. \quad (10)$$

The second column of Table 5 presents the average RY_j^* for each region over the eleven-year period, which can be compared to the actual relative income RY_j , presented in the third column. If $RY_j^* < RY_j$, a region's standard of living is higher than the national average, and vice versa. This is true for the top-four ranked regions, and the opposite is true for the lowest-six ranked

regions. Using the approximation (10) and again taking $\hat{\phi}$ and $\hat{\gamma}$ as true values, RY_j^* Low and RY_j^* High are the lower and upper bounds of the 95% confidence interval for RY_j^* .

Because the actual relative income is within the 95% confidence interval for all regions except the West Midlands and the North West, only those two can be said to have a standard of living statistically different from the national average. This is despite the fact that the quality of life for six of the ten regions is statistically different from the national average. This indicates that quality-of-life differentials are to some extent compensated for by differences in income and labor-market opportunities. Note that this is also a test of whether or not the regions are in long run equilibrium, although a comprehensive test would require comparisons of all of the pairwise combinations of regions to see if regions are statistically different from each other. However, statistically significant differences from the national average are necessary and sufficient to reject the hypothesis that the regions are in long run equilibrium and have the same standard of living.

The results summarized in Tables 3-5 suggest a North-South divide in the standard of living in England, although the divide runs East-West in the Midlands. Wales and Scotland, which are normally lumped with northern regions when referring to income and unemployment, are among the regions with the highest standard of living. This is due to their relatively high estimated quality of life and to their high vacancy rates.

8 Alternative migration models

As mentioned above, the major difference between the present study and those done previously for the UK is in my definition of the migration rate. So as to illustrate how the choice of migration rate affects the migration regression, I estimated the identical model for two alternative

migration rates that can be derived within the present theoretical structure, but under alternative assumptions. Also, so as to compare the present methodology with that of Greenwood, *et al* (1991), I estimate the model under their assumptions, and use the results to calculate the regional compensating differentials.

8.1 Traditional gravity model

The first alternative migration rate is the gross cross-migration rate used by Molho (1982, 1984) and most gravity models: $M_{ij} / N_i N_j$. This can be obtained within the present theoretical structure by assuming that the decision to migrate between locations i and j is independent of the standard-of-living differentials between j and all other regions (i.e. by assuming that δ in (2) is zero). This eliminates the need to use cross-migration rates to eliminate the comparison to other regions, although the distance-related cost of moving now has to be considered. Keeping the rest of the theoretical structure the same, and assuming that moving costs are linear in distance, the empirical model becomes

$$m_{ij} = \lambda_j - \lambda_i + \gamma \ln \left(\frac{Y_j}{Y_i} \right) + \phi \ln \left(\frac{X_j}{X_i} \right) + \rho H_j + \tau d_{ij} + \theta Z_{ij} + v_{ij}. \quad (11)$$

I measure the distance between regions as the distance, in degrees, between the regions' largest cities, although for regions with two comparable large cities, I use the average of the distances.¹⁶ Keeping in mind the crudeness of distance as a measure of moving costs, as well as the other problems discussed by Plane (1984), the results are summarized by the first column of Table 6.

There are no priors as to the direction of the differences between these results and those of Model I, but they differ in many respects. Explaining the differences is complicated by the

necessary inclusion of the distance variable in the traditional model. As apparent from a comparison of Tables 2 and 6, the estimates of regional quality of life are somewhat similar, although there are some notable differences. In particular, Scotland has by far the lowest estimated quality of life with this model. Also, although the estimated coefficient on per capita income is nearly identical between the two models, that on the vacancy rate is now statistically no different from zero. The effects of council housing and the average down payment in the destination region both have the ‘wrong’ sign, and are statistically significant. Distance and origin-contiguity have the expected signs and are statistically significant.

The very different results obtained using net and gross cross-migration rates might be due solely to the inclusion of the distance variable. If so, then even if it is reasonable to assume that one can safely ignore the comparison of the destination to all other regions (i.e. that $\delta=0$), using net cross-migration at least eliminates the need to consider distance, a variable of dubious accuracy in measuring moving costs.

8.2 *Out-migration rate model*

The second alternative migration rate is gross out-migration as a percentage of origin population, and was used by Jackman and Savouri (1992, 1996): M_{ij} / N_i . This rate can be obtained by assuming that $\delta=0$, and by assuming that each region can be considered as a single location, thus eliminating the summation across the locations of the destination region. The right hand side of this empirical model is the same as in (11). Because this migration rate does not take account of the number of opportunities in the destination region, it will bias the estimated relative quality of life towards populous regions. This is the most notable difference between the

¹⁶ These distances are available on request.

results of Model I and those summarized by the second column of Table 6. The estimated quality of life for the South East (by far the most populous region) is far and away the highest, and that of East Anglia (by far the least populated region) is easily the lowest. Additionally, the coefficients on per capita income and the vacancy rate are both statistically no different from zero.

8.3 Greenwood, et al model

Greenwood, *et al* (1991) have a simpler estimation method than any of those used here. They assume that for potential migrants in a region, each of the potential destination regions is small relative to the country as a whole so that their conditions can be approximated by the conditions in the country as a whole. They also use the region's aggregate out-migration rate as an indicator of the standard of living difference between the region and the rest of the country. They also do not consider moving costs, distance, or labor market factors. More precisely, they assume that when the region is in long-run equilibrium when its aggregate out-migration rate is zero. With minor differences, the Greenwood, *et al* model is

$$\frac{1}{N_i} \sum_{\substack{j=1 \\ j \neq i}}^{10} M_{ij} = \lambda_j + \gamma \ln RY_j + \varepsilon_{ij}. \quad (12)$$

This has a practical advantage in that it requires knowing only the aggregate out-migration rates for the regions, rather than all of the regional cross-migration rates, which are less readily available. However, the countervailing practical disadvantage is the dramatic reduction in the number of observations, from 495 to 110 in the present study. Also, the assumption that conditions in potential destinations can be approximated by national conditions is not likely to be

tenable for countries smaller than the US.¹⁷

The last column of Table 6 presents the estimation results when the present data are applied to the Greenwood, *et al* estimation method. For a model to be useful for calculating standard-of-living differentials, it must provide accurate estimates of the responsiveness of migration to income differences. However, with this model, the coefficient on relative per capita income is far from being statistically different from zero. It is not clear if this is due to the small number of observations, or because its theoretical bases make it an inadequate model of interregional migration in the UK.

Leaving aside the estimation difficulties, if we assume that the point estimate of the coefficient on relative per capita income is correct, we can easily calculate the standard-of-living differentials and test for long-run equilibrium. These calculations are presented in Table 7, where RY_j^{**} is the income level that would equate the standard of living in region j with that of the country as a whole, and the regions are listed in order of their estimated standard-of-living ranking. The table also presents the 95% confidence intervals and, for reference, the actual relative per capita incomes.

As with the standard-of-living calculations I derived from Model I, standard-of-living equivalence is rejected here, although with an entirely different set of regions found to be out of long-run equilibrium: South West and East Anglia with Greenwood, *et al*; South East, West Midlands, and North West for Model I. Also, as shown in the last column, on average, RY_j^* and RY_j^{**} differ in absolute terms by 11.3 percent, with RY_j^{**} being about 22 percent and 31 percent lower for South West and East Anglia, and 23 percent higher for Scotland. It is therefore clear

¹⁷ See Douglas (1997) for a comparison of cross-migration and aggregate migration rates.

that Model I and Greenwood, *et al*'s model are not close substitutes for one another.

9 Concluding remarks

The objective of this paper was to reexamine the literature on using migration rates to estimate relative standard of living. This was done by separating labor market conditions from other amenities, relaxing the assumption of symmetric moving costs, and controlling for the effect of contiguity. The model uses the net cross-migration rate as a measure of the difference in the standard of living between the two relevant regions. Applying the model to interregional migration in the UK, I estimated regional relative quality of life and standard of living, and tested the hypothesis of standard-of-living equivalence. The paper is also a contribution to the literature on the determinants of internal UK migration.

The results suggest that there is a North-South divide in relative quality of life and standard of living within England, and that Scotland and Wales have relatively high levels of both. The regional rankings of quality of life and standard of living are highly correlated with each other, and neither is highly correlated with the ranking of real per capita income, the most common measure of well-being. The rankings of quality of life and standard of living are, however, highly correlated with the ranking of regional vacancy rates. Oddly perhaps, these rankings are positively correlated with the ranking of unemployment rates, although not significantly so. I attribute this to regional differences in steady-state unemployment rates.

As one might expected, migrants tend to move to regions with high per capita income and high vacancy rates, although they also tend to move towards regions with high unemployment. Differences in council housing do not seem to be important determinants of regional migration

rates, although differences in the size of the average down payment on housing purchases do seem important. Also, migration is increased by the extent of regional contiguity, which, if not accounted for, would bias the results of the migration regression.

The model can also be used to test the hypothesis that regions are in long run equilibrium, and therefore have the same standard of living. Although the standard of living for eight of the regions is statistically no different from the national average, that of two regions is statistically lower than the average. This is a sufficient condition to reject regional standard-of-living equivalence for the UK.

The most obvious course for further study is to use this model to calculate the value of specific amenities, rather than on the entire set of amenities as done here. This would involve selecting amenities that are thought to be valued by the population, and including them in the migration regression. Although this would be a large undertaking in terms of data collection, it is conceptually straightforward. With specific amenities included in the regression, the regional fixed effect would be the utility value of all amenities not otherwise specified. The pound-value of each of the specified amenities could be obtained much in the way that the value of the set of amenities was obtained above.

References

- Ben-Akiva M, Watanatada T (1981) Applications of a continuous spatial choice logit model. In: Manski C, McFadden D (eds) Structural analysis of discrete data with econometric applications. MIT Press, Cambridge, Mass
- Blomquist GC, Berger MC, Hoehn JP (1988) New estimates of the quality of life in urban areas. American Economic Review 78: 89-107
- Borooah VK, McGregor PPL, McKee PM, Mulholland G (1996) Cost-of-living differences between regions of the United Kingdom. In: Hills J (ed) New inequalities. Cambridge University Press, Cambridge
- Bover O, Meullbauer J, Murphy A (1989) Housing, wages, and UK labor markets. Oxford Bulletin of Economics and Statistics 51: 97-136
- Coleman D, Salt J (1992) The British population. Oxford University Press, Oxford
- Douglas S (1997) Estimating relative standards of living in the United States using cross-migration data. Journal of Regional Science 37: 411-436
- Douglas S, Wall HJ (1993) 'Voting with your feet' and the quality of life index: A simple non-parametric approach applied to Canada. Economics Letters 42: 229-236
- (1996) Using migration data to estimate relative amenities. Working paper, Department of Economics, Birkbeck College, University of London
- Evans AW (1990) The assumption of equilibrium in the analysis of migration and interregional differences: A review of some recent research. Journal of Regional Science 30: 515-531
- (1993) Interregional equilibrium: A transatlantic view. Journal of Regional Science 33: 89-97

- Evans P, McCormick B (1994) The new patterns of regional unemployment: Causes and policy significance. *The Economic Journal* 104: 633-647
- Feeney G (1973) Two models for regional population dynamics. *Environment and Planning A* 5: 31-43
- Greenwood MJ, Hunt GL, Rickman DS, Treyz GI (1991) Migration, regional equilibrium, and the estimation of compensating differentials. *American Economic Review* 81: 1382-1390
- Gudgin, G (1995) Regional problems and policy in the UK. *Oxford Review of Economic Policy* 11: 18-63
- Gyourko J, Tracy J (1991) The structure of local public finance and the quality of life. *Journal of Political Economy* 99: 774-806
- Hughes G, McCormick B (1987) Housing markets, unemployment and labor market flexibility in the UK. *European Economic Review* 31: 615-645
- (1994) Did migration in the 1980s narrow the North-South divide? *Economica* 61: 509-527
- Hunt GL (1993) Equilibrium and disequilibrium in migration modeling. *Regional Studies* 27: 341-349
- Jackman R, Kan B (1988) Structural unemployment: A reply. *Oxford Bulletin of Economics and Statistics* 50: 83-87
- Jackman R, Savouri S (1992) Regional migration in Britain: An analysis of gross flows using NHS central register data. *The Economic Journal* 102: 1433-1450
- (1996) Regional migration in Britain, 1975-1992: A re-examination of distance and contiguity effects. In: Schettkat R (ed) *The flow analysis of labour markets (Studies in the modern world economy, vol. 3)*. Routledge, London and New York

- Kahn ME (1995) A revealed preference approach to ranking city quality of life. *Journal of Urban Economics* 38: 221-235
- Martin R (1993) Remapping British regional policy: The end of the North-South divide? *Regional Studies* 27: 797-805
- Molho I (1982) Contiguity and inter-regional migration flows in Great Britain. *Scottish Journal of Political Economy* 29: 283-297
- (1984) A dynamic model of interregional migration flows in Great Britain. *Journal of Regional Science* 24: 317-337
- Pannell B (1995) Affordability. *Housing Finance* 27: 16-29
- Pissarides C, McMaster I (1990) Regional migration, wages and unemployment: Empirical evidence and implications for policy. *Oxford Economic Papers* 42: 812-831
- Pissarides C, Wadsworth J (1989) Unemployment and the inter-regional mobility of labor. *The Economic Journal* 99: 739-755
- Plane DA (1984) Migration space: Doubly constrained gravity model mapping of relative interstate separation. *Annals of the Association of American Geographers* 74: 244-256
- (1993) Requiem for the fixed-transition-probability migrant. *Geographical Analysis* 25: 211-223
- Porell FW (1982) Intermetropolitan migration and quality of life. *Journal of Regional Science* 22: 137-158
- Rees P, Stillwell J (1990) The United Kingdom. In: Nam CB, Serow WJ, Sly DF (eds) *International Handbook on Internal Migration*. Greenwood Press, Westport, Conn and London

- Reward Group (1995) Cost of Living Report. The Reward Group, Staffordshire
- Roback J (1982) Wages, rents, and the quality of life. *Journal of Political Economy* 90: 1257-1278
- Rosen S (1979) Wage-based indexes of urban quality of life. In: Mieszkowski P, Straszheim M (eds) *Current Issues in Urban Economics*. Johns Hopkins Press, Baltimore
- Smith TR, Clayton C (1978) Transitivity, spatially separable utility functions, and United States migration streams, 1935-70. *Environment and Planning A* 10: 399-414
- Wall HJ, Zoega G (1997) The British Beveridge curve: A tale of ten regions. Centre for Economic Policy Research Discussion Paper No. 1771
- Zar JH (1972) Statistical testing of the Spearman rank correlation coefficient. *Journal of the American Statistical Association* 67: 578-580
- Zipf GK (1946) The P_1P_2/D hypothesis: On the intercity movement of persons. *American Sociological Review* 11: 677-686.

Table 1. Net regional cross-migration (thousands), 1982-1992. Destination on side, origin on top

	North	Yorks & Humb'side	East Midlands	East Anglia	South East	South West	West Midlands	North West	Wales	Scotland	<i>Net In-Migration</i>
North	0	-9	-2	-4	-28	-6	1	4	0	-1	-45
Yorks & Humb'side	9	0	-20	-2	-18	-10	1	8	-1	-2	-35
East Midlands	2	20	0	0	66	-14	15	5	-4	1	91
East Anglia	4	2	0	0	130	-2	5	9	-2	4	150
South East	28	18	-66	-130	0	-236	24	69	-21	34	-280
South West	6	10	14	2	236	0	39	33	0	2	342
West Midlands	-1	-1	-15	-5	-24	-39	0	4	-15	-9	-105
North West	-4	-8	-5	-9	-69	-33	-4	0	-33	-6	-171
Wales	0	1	4	2	21	0	15	33	0	2	78
Scotland	1	2	-1	-4	-34	-2	9	6	-2	0	-25

Source: Regional Trends

Table 2. Regression results: dependent variable = net cross-migration in terms of migration opportunities

	I	II	III	IV
North	-0.355 [†] (0.210)	-0.297 (0.263)	-0.160 (0.200)	-0.255 (0.218)
Yorks. & Humberside	-0.114 (0.081)	-0.146 (0.102)	-0.212* (0.073)	-0.077 (0.089)
East Midlands	-0.178 (0.133)	0.022 (0.166)	-0.331* (0.119)	-0.209 (0.136)
East Anglia	0.104 (0.177)	0.408 [†] (0.221)	-0.017 (0.172)	0.021 (0.180)
South East	0.256 (0.161)	-0.488* (0.193)	0.174 (0.158)	0.172 (0.164)
South West	0.535 [†] (0.280)	0.814* (0.351)	0.237 (0.287)	0.420 (0.285)
West Midlands	-0.230* (0.063)	-0.256* (0.079)	-0.321* (0.069)	-0.220* (0.066)
North West	-0.415* (0.090)	-0.479* (0.113)	-0.563* (0.117)	-0.431* (0.094)
Wales	0.393* (0.165)	0.459* (0.207)	0.253 (0.205)	0.369* (0.171)
Scotland	-0.005 (0.631)	-0.036 (0.792)	0.940 (0.625)	0.209 (0.642)
ln(per capita income)	3.023* (0.655)	3.017* (0.822)	2.761* (0.753)	3.429* (0.683)
ln(vacancy rate)	0.419* (0.152)	0.427* (0.191)	—	0.454* (0.156)
ln(unemployment rate)	—	—	0.369* (0.314)	—
% council housing	0.005 (0.029)	-0.004 (0.036)	0.047 (0.030)	-0.016 (0.029)
down payment (£1000s)	-0.104 [†] (0.059)	-0.109 [†] (0.074)	0.077 (0.062)	-0.083 (0.060)
regional contiguity	0.034* (0.002)	—	0.034* (0.002)	0.034* (0.002)
1983 dummy	—	—	—	0.041 (0.106)
1984 dummy	—	—	—	0.073 (0.106)
1985 dummy	—	—	—	0.284* (0.107)
1986 dummy	—	—	—	0.154 (0.107)
1987 dummy	—	—	—	-0.045 (0.106)
1988 dummy	—	—	—	-0.014 (0.106)
1989 dummy	—	—	—	-0.003 (0.106)
1990 dummy	—	—	—	-0.010 (0.107)
1991 dummy	—	—	—	-0.045 (0.107)
1992 dummy	—	—	—	-0.124 (0.108)
\bar{R}^2	0.608	0.384	0.603	0.610
log-likelihood	-480.13	-592.87	-463.27	-473.76
Akaike Info. Crit.	1.996	2.448	2.009	2.011
Amemiya Pr. Crit.	0.431	0.677	0.437	0.438

Standard errors are in parentheses. *, [†] - significant at 5%, 10% level, respectively.

Table 3. Standard of living rankings for the UK, 1982-1992

	Standard of living	Quality of life	Real income per capita	Vacancy rate	Unemp. rate
South West	1	1	9	2	3
South East	2	3	5	4	2
East Anglia	3	4	2	5	1
Wales	4	2	10	1	8
Scotland	5	5	6	3	7
East Midlands	6	7	1	9	4
Yorkshire & Humberside	7	6	3	10	5
North	8	9	4	7	10
West Midlands	9	8	8	8	6
North West	10	10	7	6	9

Table 4. Spearman rank correlation coefficients

	Quality of life	Income per capita	Vacancy rate	Unemp rate
Standard of living	0.952*	-0.224	0.721*	0.539
Quality of life		-0.309	0.709*	0.576
Income per capita			-0.649*	0.345
Vacancy rate				0.042

* - different from zero at 5% level. Critical value 0.648, Zar (1972).

Table 5. Standard of living relative to the mean

	<i>RX</i>	<i>RY*</i>	<i>RY</i>	<i>RY*Low</i>	<i>RY*High</i>
South West	1.19	0.82	0.96	0.68	0.98
Wales	1.23	0.85	0.92	0.77	0.95
South East	1.08	0.91	1.02	0.82	1.01
East Anglia	1.04	0.96	1.04	0.86	1.08
Scotland	1.18	0.98	0.99	0.65	1.47
East Midlands	0.86	1.08	1.05	0.99	1.18
Yorkshire & Humberside	0.73	1.09	1.03	1.03	1.14
West Midlands	0.82	1.11	0.98	1.07	1.16
North	0.94	1.14	1.02	0.99	1.30
North West	0.93	1.16	0.98	1.09	1.23

Table 6. Regression results using alternative migration models

	Traditional gravity model $\frac{M_{ij}}{N_i N_j} \times 1.0E + 6$	Out-migration rate model $\frac{M_{ij}}{N_i} \times 1000$	Greenwood, <i>et al</i> (1991) model $100 \times \frac{1}{N_i} \sum_{j=1}^{10} M_{ij}$
North	-0.300* (0.090)	-0.401* (0.080)	-0.138 (0.107)
Yorks. and Humberside	0.084 (0.111)	0.081 (0.099)	-0.108 (0.109)
East Midlands	0.055 (0.103)	-0.307* (0.092)	0.021 (0.113)
East Anglia	-0.084 (0.094)	-1.114* (0.084)	0.352* (0.111)
South East	0.112 (0.097)	2.480* (0.086)	-0.002 (0.107)
South West	0.192† (0.103)	-0.498* (0.092)	0.384* (0.112)
West Midlands	-0.110 (0.092)	-0.072 (0.081)	-0.063 (0.109)
North West	0.068 (0.086)	0.196* (0.076)	-0.123 (0.107)
Wales	0.627* (0.129)	-0.288* (0.115)	0.183 (0.135)
Scotland	-0.644* (0.109)	-0.077 (0.097)	-0.163 (0.106)
ln (income per capita)	2.928* (0.842)	0.853 (0.748)	0.863 (0.911)
ln (vacancy rate)	0.220 (0.206)	0.168 (0.183)	-
dest'n % council housing	0.066* (0.005)	0.006 (0.004)	-
dest'n down payment	0.572* (0.024)	0.352* (0.021)	-
origin contiguity	0.066* (0.003)	0.052* (0.002)	-
distance	-0.692* (0.043)	-0.152* (0.038)	-
observations	495	495	110
\bar{R}^2	0.534	0.619	0.247
log-likelihood	-1675.70	-1559.09	-35.04
Akaike Info. Crit.	3.416	3.180	0.837
Amemiya Pr. Crit.	1.782	1.408	0.135

Standard errors are in parentheses. *, † - significant at 5%, 10% level, respectively.

Table 7. Standard of living relative to the mean; Greenwood, *et al* (1991) method

	<i>RY**</i>	<i>RY</i>	<i>RY**High</i>	<i>RY**Low</i>	$\frac{RY^*-RY^{**}}{RY^*}$
South West	0.64	0.96	0.82	0.50	-21.8
East Anglia	0.66	1.04	0.85	0.52	-30.9
Wales	0.81	0.92	1.03	0.64	-5.3
East Midlands	0.98	1.05	1.26	0.76	-9.9
South East	1.00	1.02	1.29	0.78	9.8
West Midlands	1.08	0.98	1.37	0.84	-3.2
Yorks & Humberside	1.13	1.03	1.47	0.88	4.4
North West	1.15	0.98	1.57	0.85	-0.6
North	1.17	1.02	1.50	0.92	3.3
Scotland	1.21	0.99	1.51	0.97	23.4