THE USE OF NINETEENTH-CENTURY CENSUS DATA TO INVESTIGATE LOCAL MIGRATION

Andrew Hinde

Andrew Hinde is senior lecturer at the Southampton Statistical Sciences Research Institute, University of Southampton, the author of numerous articles on 19th century historical demography, and has recently published *England's population: a history since the Domesday Survey*.

Introduction

In 1968, Richard Lawton published an article in which he examined changes in the population of the registration districts of England between 1841 and 1911.[1] As part of his analysis, he presented some figures (originally calculated by Cairncross more than 50 years ago) which decomposed the change in each registration district into that part due to natural increase (the difference between births and deaths) and that part due to net migration (the difference between in-migration and out-migration). Table 1 shows a summary of these. Although rural to urban migration was common, in towns of all sorts natural increase was more important than net migration as a determinant of population growth. This was even true of resort (or, as Lawton described them, 'residential') towns, such as Bournemouth, which grew especially rapidly in the last two or three decades of the Victorian era. The same pattern can be observed in 'colliery districts', where natural increase contributed five times as much to the overall population growth as did net migration, though given the high fertility of coal miners this is, perhaps, less surprising than the results for urban areas.

The greatest impact of net migration is observed in the rural areas, where its contribution almost matches that of natural increase. The population of rural England would, without net migration, have been 5.3 million more in 1911 than it was in 1841. However, a net out-migration of 4.5 million almost completely cancelled out the excess of births over deaths, so that the actual rise in the rural population was only about 800,000. Possibly because of this 'compensating' effect, demographers have tended not to recognise the great importance of net migration as a determinant of population change in rural England during the Victorian period.

At the local level, it can be shown that changes in migration patterns were often the main cause of variations from decade to decade in population change. For example the population of the Wiltshire village of Berwick St James fell from 284 to 248 between 1851 and 1861, despite an excess of 32 births over

Table 1 Population change in England and Wales, 1841–1911, by type of district (all figures in millions).

Type of district		Population		Natural increase 1841–1911	Net migration 1841–1911
		1841	1911		
All towns		8.7	23.8	12.7	2.6
	London	2.3	7.3	3.8	1.3
	Other large towns	1.5	5.2	2.7	0.9
	Industrial centres	0.9	2.5	1.8	-0.2
	Residential towns	0.9	2.3	0.9	0.5
Colliery districts		1.3	5.3	3.4	0.7
Rural areas		6.2	7.0	5.3	-4.5

Note: The difference between the populations of some types of district in 1841 and 1911 may not exactly equal the sum of the natural increase 1841-1911 and the net migration 1841-1911 because of rounding errors.

Source: R. Lawton, 'Population changes in England and Wales in the later nineteenth century: an analysis of trends by registration districts', *Transactions of the Institute of British Geographers*, **44** (1968), 70, based on figures in A.K. Cairncross, 'Internal migration in Victorian England', *Manchester School*, **17** (1949), 67-87, and A.K. Cairncross, *Home and foreign investment* (Cambridge, 1953), 65-83.

deaths, because of a net out-migration of 68.[2] During the following decade the population stabilised, falling only from 248 to 242, although natural increase was almost the same, at 35.[3] Thus the main reason for the stabilisation of the population total compared with the previous decade was a reduction in net migration. The implication of this is that an understanding of population change at the local level in nineteenth-century England requires the measurement of migration trends. Variations in the rate of population growth (or decline) from place to place, and in the same place over time, were principally due to changes in migration patterns.

This paper presents an analysis of migration between 1851 and 1861 in four small areas of rural England which were characterised by different social and economic conditions. The analysis makes use of data from the census enumerators' books (CEBs) but is aggregative in form, avoiding the extremely time-consuming use of record linkage of individual-level data.[4] The next section introduces the four study areas and describes the differences in their social, economic and occupation structure. Following this, I apply the method used by Lawton to the four areas to establish overall rates of net migration and natural increase. The paper then describes a more detailed approach to the estimation of migration which uses cohort survival probabilities. In the final section the results of this analysis are related to the local economy and society in the four areas.

Previous analyses of migration using the CEBs have tended to focus on lifetime migration as revealed by the data on place of birth.[5] This approach is not well suited to measuring the impact of migration on local populations, as we cannot usually discover when moves occurred, or even how many took place. So, for example, if we know that a man aged 35 years had been born in a parish different from the one in which he was living at the time of a census, we do not know whether he moved into his current parish of residence one year ago or 34 years ago. Neither do we know how many moves he made into and out of his current parish of residence during his first 35 years. It is therefore very difficult to use this approach to relate migration trends to base populations (which change over time). The inability to pin moves down to specific time periods also inhibits the researcher from drawing conclusions about the relationship of migration trends to economic and social changes which are period-specific. The present approach is designed to try to overcome these limitations. It produces estimates of age-specific in- and out-migration to and from local areas during particular decades.

The four study areas

The four study areas used in this analysis are located in the counties of Norfolk, Shropshire, Derbyshire and Yorkshire and consist of groups of contiguous parishes.[6] Their occupational structures are analysed in Table 2. The Norfolk area comprises the parishes of Beeston with Bittering, Kempstone, East and West Lexham, Litcham, Mileham, Weasenham All Saints and Wellingham, which are situated in classical high farming country between East Dereham and Swaffham. Most of the land in the area was owned by a small number of wealthy gentlemen, including Thomas Coke, whose Holkham estate included the whole of the parishes of Weasenham All Saints, Wellingham, West Lexham and Kempstone.[7] The economy of this area was dominated by agriculture, which relied largely on day labour. More than a third of gainfully employed persons were described in the 1851 census as 'agricultural labourers'. Indeed, the area fits almost perfectly Howard Newby's idea of the single 'occupational community', in which everyone was engaged either directly in agriculture or in trades and crafts ancillary to agriculture.[8]

The second study area is in central Shropshire, between Shrewsbury and Much Wenlock, and consists of the parishes of Acton Burnell, Church Preen, Cound, Cressage, Eaton Constantine, Harley, Hughley, Kenley, Leighton, Pitchford, Ruckley and Langley, Sheinton and Wroxeter, which lie in a landscape of isolated farms and tiny hamlets. The occupational structure of this area is similar to that of the Norfolk area, save that about one third of the demand for agricultural labour was satisfied by farm servants who 'lived in' on the farms where they worked and were hired by the year.[9] The agrarian economy of Shropshire was based on mixed farming and farms were typically small,

Table 2 Occupational structure of the four study areas, 1851.

Occupational category	Percentage of gainfully employed people			
	Central Norfolk	Shropshire	White Peak	Upper Nidderdale
Farmers	4.3	6.7	15.1	12.3
Agricultural labourers	37.0	23.4	11.5	6.7
Other agricultural workers	4.4	4.8		
Miners and quarriers			9.0	15.2
Textile workers			6.1	20.5
Farm servants	4.7	11.2	8.1	3.9
Shopkeepers and traders	3.4	2.5	4.3	3.5
Skilled manual workers	16.6	12.9	14.9	14.5
Professional classes	2.4	1.8	2.2	1.9
Domestic servants	15.6	22.2	13.5	8.8
Other labourers	0.2	4.2	4.7	0.9
Other	11.4	10.4	10.5	10.7
Gainfully employed as percentage of total population	41.6	47.5	38.3	40.9
Total population	3,044	3,483	2,384	4,318

Notes: The gainfully employed are defined as all those stated in the census to be occupied, except for 'annuitants' , 'owners' and those stated to be 'of independent means'. Farm servants in this table are persons described in the census as both working in an agricultural occupation and as having the relationship 'servant' to the head of the household in which they were living.

Sources: Census enumerators' books, 1851: The National Archives HO107/1825, 1990–1, 2149 and 2250.

around two thirds being under 50 acres, although farms in the study area were rather larger than the county average.[10]

The third study area lies in the White Peak district of Derbyshire, and consists of the six parishes of Ashford-in-the-Water, Chelmorton, Flagg, Monyash, Sheldon and Taddington. Apart from the village of Ashford, these parishes lie on a windswept limestone plateau which rises to 1,438 feet near Taddington. Farms here in the mid-nineteenth century were small, many employing only family labour. Cheese making was one common activity until around 1870, when a transition to milk production occurred.[11] There were more persons described in the 1851 census as 'farmers' than as labourers in agriculture. Although agriculture was probably the most important component of the economy, secondary activities included lead mining and artificial marble working. The main source of employment in lead mining was Magpie Mine near Sheldon, which operated intermittently between 1851 and 1881.[12] Ashford-in-the-Water was the centre of the artificial marble industry.

Like the White Peak study area, the Yorkshire area had an economy based partly on activities other than agriculture. The area consists of the parishes of Bewerley and High and Low Bishopside, and the townships of Fountain's Earth, Stonebeck Down and Stonebeck Up, all of which lie in upper Nidderdale. The higher reaches of the area consist of bleak moorland, rising to 2,310 ft in the township of Stonebeck Up. Lower down, the area includes the small town of Pateley Bridge. The occupational structure of the area was diverse. Fewer than a quarter of the gainfully employed worked in agriculture, compared with more than half in the central Norfolk area and just under half in the Shropshire area. Small farms predominated (in the parish of High and Low Bishopside only one out of 72 farms of five acres or more exceeded 40 acres), and family labour sufficed on most.[13] The second most important sector was textiles (more accurately, flax mills), which employed about one fifth of those gainfully employed, most of these being young (aged under 30 years) and many being women. Finally, lead mining was concentrated in Bewerley, in and around the township of Greenhow Hill.[14]

We might expect migration patterns in these study areas to vary, although the forces encouraging and discouraging migration were complex. On the one hand, the northern areas of the White Peak and upper Nidderdale were relatively close to major industrial cities which might have drawn people away, but on the other hand they had a more diverse economy than the central Norfolk and Shropshire areas, which meant a greater range of indigenous employment opportunities.

Net migration and population change

Net migration in each of the four study areas between any two censuses may be estimated by applying the demographic accounting equation. For example, if the population in a study area in 1851 was P_{1851} and that in 1861 was P_{1861}, then net migration between 1851 and 1861, $M_{1851–1861}$, is given by the equation

$$M_{1851–1861} = P_{1861} - P_{1851} - (B_{1851–1861} - D_{1851–1861}),$$

where $B_{1851–1861}$ and $D_{1851–1861}$ are, respectively, the numbers of births and deaths during the decade. The population figures for individual parishes can be obtained from census data, but unfortunately decadal numbers of births and deaths are not published at the level of the individual parish. Instead, they must be estimated by assuming that the crude birth and death rates in a study area were the same as those in the registration district (RD) in which the study area lay, and applying these crude birth and death rates to the 'average' study area population during the decade.[15] For the decade 1851–1861, crude birth and death rates can be calculated for every RD in England from the database compiled by David Gatley at the University of Staffordshire.[16] Thus, for example, the central Norfolk study area lies in the RD of Mitford. This RD had, according to the Gatley database, a mean population of 28,705 during the decade 1851–1861, and an average of 885 births and 572 deaths were recorded per year. This gives a crude birth rate of 885/28,705 = 0.0308 (30.8 per thousand) and a crude death rate of 572/28,705 = 0.0199 (19.9 per thousand). Applying these rates to the average population of the central Norfolk study area, obtained for simplicity by taking the arithmetic average of the populations recorded in the CEBs of 1851 and 1861 (see Table 3) produces an estimated average of 0.0308 x 0.5 x (3,044 + 3,026) = 93.5 births per year, or 935 births over the decade, and 0.0199 x 0.5 x (3,044 + 3,026) = 60.4 deaths per year, or 604 deaths over the decade in the study area. Using the demographic accounting equation, therefore, the net migration is given as

$$M_{1851\text{–}1861} = 3{,}026 - 3{,}044 - (935 - 604) = -349.$$

A net migration of -349 persons over the decade is an average of -34.9 persons per year. This may be converted into a rough crude net migration rate by dividing by the average population to give -34.9/(0.5 x (3,044 + 3,026)) = -0.0115, or a net out-migration of 11.5 per thousand per year. This compares to an estimated crude rate of natural increase of 0.0308 - 0.0199 = 0.0109 or 10.9 per thousand per year. In other words, net out-migration was more than compensating for natural increase.

Similar calculations have been performed for the other three study areas (Table 3). Net out-migration was faster in the two purely agricultural study areas, where it just outweighed the natural increase. In the two mixed economy areas, there was a lower rate of net out-migration which did not cancel out the natural increase, so their populations rose during the decade. Thus there is clearly a suggestion that mixed economy areas performed better than purely agricultural areas in retaining their populations during the decade. However, without more detail it is not possible to say a great deal more than this. Net migration is a slippery phenomenon. As one well-known demographer famously remarked: 'no-one ever met a net migrant'.[17] A net migration of -349 may mean that 349 people moved out and no-one moved in, or that 1,349 people moved out and 1,000 people moved in. The latter scenario implies a very different impact of migration on the population compared with the former. In addition, it would be illuminating to know the composition of the migrants, at the very least by age and sex. If we knew this, then the relationship of migration patterns to employment opportunities in these rural areas would become much clearer.

The next section proposes a method which allows the estimation of age- and sex-specific net migration rates, and which can also shed some light on the overall amount of migration, both into and out from an area.

Table 3 Estimation of net migration using the demographic accounting equation: four study areas, 1851–1861.

Study area	Population		Crude birth rate	Crude death rate	Births in decade	Deaths in decade	Net migration	Crude rate of natural increase (per thousand per year)	Crude rate of net migration (per thousand per year
	1851	1861							
Central Norfolk	3,044	3,026	0.0308	0.0199	935	604	-349	10.9	-11.5
Shropshire	3,483	3,471	0.0277	0.0181	963	629	-346	9.6	-10.0
White Peak	2,384	2,441	0.0304	0.0201	733	485	-191	10.3	-7.9
Upper Nidderdale	4,318	4,535	0.0310	0.0193	1,372	854	-301	11.7	-6.8

Note: For explanation, see text.

Sources: Census enumerators' books, 1851 and 1861: The National Archives HO107/1825, 1990–1, 2149 and 2250; RG9/1243, 1861, 1868, 2539, 3192–3; database prepared by David Gatley of the University of Staffordshire (see D.A. Gatley, 'Computerising the 1861 Census and vital registration statistics', *Local Population Studies*, **58** (1997), 37–47).

Age- and sex-specific migration

The method is illustrated using data for males from the central Norfolk study area. In order to apply the method, data must be obtained from the census enumerators' books on the number of people in an area in the two censuses at the beginning and end of the decade over which migration is going to be measured. The method requires the population of the study area in each census to be classified by sex, age (in 10-year age groups) and according to whether or not each person was born in the study area.

Age- and sex-specific survival probabilities for each 10-year age group are then calculated using death registration data for the appropriate registration district for the 1850s. The calculation of these survival probabilities may be described by considering the case of males in the central Norfolk study area (see Table 4). The Registrar General's *Decennial Supplement* gives details of the average male population of the Mitford RD (in which the Norfolk study area lay) during the decade 1851–1861 and the total number of male deaths in the RD during the decade.[18] In the Registrar General's original data, these figures are broken down by age into single years of age at ages under 5 years, then into the age groups 5–9, 10–14, 15–19, 20–24, 25–34, 35–44, 45–54, 55–64, 65–74 and 75–84 years, and 85 years and over. The actual numbers are shown in columns (2) and (3) of Table 4 (after aggregating the figures for those aged under 5 years into a single age group 0–4 years). The age-specific death rate (ASDR) in a given age group is then calculated by dividing the number of deaths by 10, and then dividing the result by the average population in that age group.[19] Thus, for the age-group 0–4 years in Table 4, the ASDR is equal to (1,095/10)/1,815 = 0.0603. The ASDRs for each age group are shown in column (4) of Table 4.

The next stage is to use the ASDRs to evaluate the probability that a male alive at the beginning of any age group will die before reaching the oldest age in the same age group. So, for example, in the case of the age group 25–34 years, we wish to calculate the probability that a man who celebrates his 25th birthday will not be alive to celebrate his 35th birthday. The formula linking the ASDR in a given age group to this probability is:

probability of dying within age group given survival to beginning of age group $= (2 \times n \times \text{ASDR})/[2 + (n \times \text{ASDR})]$,

where the ASDR is the age-specific death rate in the age group, and n is the width of the age group in years.[20] Thus, for example, for males aged 25–34 years, n is equal to 10 and the ASDR is 0.00765. Thus the probability of a man who is alive at exact age 25 years dying before exact age 35 years is

$$(2 \times 10 \times 0.00765)/[2 + (10 \times 0.00765)] = 0.07368.$$

The results of performing this calculation on all the age groups for males in the Mitford RD are shown in column (5) of Table 4.[21]

Table 4 Illustration of the calculation of survival probabilities, using the case of males in the central Norfolk study area, part 1: calculation of numbers of males alive in each age group for age groups used by the nineteenth-century Registrars General.

Age group	Average male population of Mitford registration district during the decade 1851-61	Total number of male deaths in Mitford registration district during the decade 1851-61	Age-specific death rate	Probability of a man alive at the youngest age in an age group dying within the age group	Number of males alive at start of age group per 10,000 born	Number of males alive in each age group assuming 10,000 births per year
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0–4	1,815	1,095	0.06033	0.26212	10,000	43,448
5–9	1,717	119	0.00693	0.03406	7,379	36,265
10–14	1,679	88	0.00524	0.02587	7,127	35,175
15–19	1,451	71	0.00489	0.02417	6,943	34,295
20–24	1,074	105	0.00978	0.04772	6,775	33,068
25–34	1,765	135	0.00765	0.07368	6,452	62,145
35–44	1,564	134	0.00857	0.08216	5,977	57,315
45–54	1,257	115	0.00915	0.08749	5,486	52,460
55–64	1,017	245	0.02409	0.21501	5,006	44,675
65–74	609	286	0.04696	0.38032	3,929	31,820
75–84	269	316	0.11747	0.74005	2,435	15,340
85 and over	44	132	0.30000	1.00000	633	2,108

Note: For explanation, see text.

Source: Database created by R. Woods and obtainable as study number (SN) 3552: Causes of death in England and Wales, 1851–60 to 1891–1900: the Decennial Supplements from AHDS History at the UK Data Archive at the University of Essex (http://www.data-archive.ac.uk/). The population at risk and the decadal numbers of deaths are for males in the Mitford registration district for 1851–60.

Column (6) of Table 4 uses the probabilities in column (5) to calculate the number of males who would remain alive at the beginning of each age group out of a hypothetical 10,000 boys born. So, for example, if 10,000 boys are born, and the chance of dying in the age group 0–4 years is 0.26212, then the chance of surviving to exact age 5 years is 1 - 0.26212 = 0.73788. Therefore 10,000 x 0.73788 = 7,379 boys will still be alive at exact age 5 years. The probability that a boy aged 5 years will die before his 10th birthday is 0.03406, so the probability that a boy aged 5 years will survive until exact age 10 years is 1 - 0.03406 = 0.96594. This means that the number of boys still alive at exact age 10 years will be 7,379 x 0.96594 = 7,127. Similar calculations for the other age groups produce the rest of the figures shown in column (6) of Table 4.

Column (7) of Table 4 imagines a population in which 10,000 boys are born *each year* and the ASDRs are the ones shown in column (4) for the Mitford RD. It can be shown that such a population will have a constant number of males alive in each age group which is approximately equal to n times the average of the number of males alive at the oldest and youngest ages in each (where n is, again, the width of the age group). Thus, for males aged 25–34, for example, the number alive will be approximately equal to 10 x [(6,452 + 5,977)/2] = 62,145. Applying similar calculations for the other age groups produces the rest of the numbers shown in column (7) of Table 4.[22]

All the calculations shown in Table 4 use the age groups favoured by the nineteenth-century Registrars General. However, in order to estimate net migration between two population censuses 10 years apart, it is convenient to work exclusively with 10-year age groups. The survival probabilities are based on the numbers alive in each age group, and so the next stage is to use the figures in column (7) of Table 4 to estimate the numbers alive in each 10-year age group (0–9, 10–19, 20–29 years and so on). Continuing with the example of males in central Norfolk, the number of males alive aged 0–9 years is obtained by adding together the numbers alive aged 0–4 years and 5–9 years to give 43,448 + 36,365 = 79,713. Similarly, the number of males alive aged 10–19 years is the sum of those alive aged 10–14 years and 15–19 years. The number alive aged 20–29 years may be calculated by adding together the number alive aged 20–24 years and half the number alive aged 25–34 years (that is, assuming that half of those alive aged 25–34 years are actually aged under 30 years). Using a similar logic, the other half of those alive aged 25–34 years may be added to half of those alive aged 35–44 years to estimate the number alive aged 30–39 years, and so on for older age groups. The results of these calculations are presented in column (2) of Table 5.[23]

The survival probabilities themselves are then estimated as the ratios of the numbers of males in adjacent age groups. For example, the probability that a male aged 0–9 years in 1851 will survive to be alive (and aged 10–19 years) in 1861 is estimated as 69,470/79,713 = 0.8715. This approach works for all age groups except the youngest (that is, those aged 0–9 years in 1861, who have been born during the decade 1851–1861). To estimate a survival probability for this youngest age group, consider that if there are 10,000 boys born per year,

Table 5 **Illustration of the calculation of survival probabilities, using the case of males in the central Norfolk study area, part 2: calculation of survival probabilities for 10-year age groups.**

Age group	Estimated number of males alive in each age group assuming 10,000 births per year and mortality of the Mitford registration district in the decade 1851–60	Probability of surviving to be alive and in age group in 1861
(1)	(2)	(3)
0–9	79,713	0.7971
10–19	69,470	0.8715
20–29	64,141	0.9233
30–39	59,730	0.9312
40–49	54,888	0.9189
50–59	48,568	0.8849
60–69	38,248	0.7875
70–79	23,580	0.6165
80–89	9,356	0.3968
90–99	422	0.0451
100 and over	0	0.0000

Note: For explanation see text.

Source: Table 4.

then in 10 years there will be 100,000 boys born in total. Column (2) of Table 5 indicates that 79,713 of these will be alive aged 0–9 years at the end of the relevant decade. Therefore, the probability that a male baby born between 1851 and 1861 will still be alive in 1861 is 0.7971 (that is, 79,713/100,000). The complete set of survival probabilities for males in the central Norfolk study area are shown in column (3) of Table 5.

These survival probabilities are used to estimate the expected population of natives and non-natives in 1861 in the absence of migration between 1851 and 1861. In the central Norfolk study area, for example, there were 348 native and 57 non-native males aged 0–9 years in 1851. The probability of survival for males in this age group is 0.8715, so, assuming the mortality of natives and non-natives is the same, the expected numbers of survivors aged 10–19 years in 1861 are 348 x 0.8715 = 303 natives and 57 x 0.8715 = 50 non-natives. The actual populations of native and non-native males aged 10–19 years living in the

Table 6 Illustration of the method for estimating age-specific migration using the male population of the central Norfolk study area.

Age	Population in 1851		Survival probability	Expected population in 1861 assuming no migration between 1851 and 1861		Actual population in 1861		Net migration		
	Native	Non-native		Native	Non-native	Native	Non-native	Native	Non-native	Total
0–9	348	57	0.7971	381	0	310	63	-71	63	-8
10–19	280	59	0.8715	303	50	253	80	-50	30	-20
20–29	177	55	0.9233	258	54	135	65	-123	11	-112
30–39	107	85	0.9312	165	51	124	63	-41	12	-29
40–49	59	61	0.9189	98	78	84	70	-14	-8	-22
50–59	45	68	0.8849	52	54	54	46	2	-8	-6
60–69	30	54	0.7875	35	54	35	55	0	1	1
70–79	13	26	0.6165	18	33	17	29	-1	-4	-5
80–89	3	8	0.3968	5	10	2	6	-3	-4	-7
90–99	0	1	0.0451	0	1	0	2	0	1	1
Total	1,062	474		1,315	385	1,014	479	-301	94	-207

Notes: The survival probabilities alongside each age group refer to the probabilities of surviving to be in that age group in 1861. Thus the figure of 0.8715 for age-group 10-19 years is the probability that a male aged 0–9 years in 1851 would survive to be aged 10-19 years in 1861. The survival probability of 0.7971 in the top row is the probability that a male baby born between 1851 and 1861 would still be alive in 1861.

Sources: See Tables 3 and 4.

study area in 1861 were 253 and 80 respectively. Since if there had been no migration there would have been 303 natives aged 10–19 years in 1861, but in the event there were only 253, then this implies a net out-migration of 50 (that is, 303 - 253) natives. By analogous reasoning, there was a net in-migration of 30 non-natives in this age-group during the decade.

Similar calculations allow the estimation of net migration among natives and non-natives in all age groups except the youngest (those aged under 10 years in 1861). Net in-migration among non-natives in this youngest age group is simply equal to the number of non-natives aged under 10 years in 1861 since these, by definition, were both born during the decade 1851–1861 and not born in the study area. If there had been no migration during the decade 1851–1861, then the number of non-natives in this age group resident in the study area in 1861 should have been zero. To estimate the net out-migration of those born in the study area during the decade we first estimate the total number of births in the study area between 1851 and 1861 by applying the crude birth rate (CBR) of 30.8 per thousand for the Mitford RD during the decade (calculated from the Registrar General's figures) to the average population of the study area during the 1850s. The average population is taken to be the average of the census populations recorded in 1851 and 1861, which is 3,035 persons. A CBR of 30.8 per thousand would lead to an annual total of 93.5 births in the study area during the decade, or 935 births in total. Assuming a sex ratio of 105 male births per 100 female births, 479 of these were boys. The life table implies that the probability that a boy born during the decade would survive to the time of the 1861 census is 0.7971. This means that, in the absence of migration, we should expect 479 x 0.7971 = 382 native boys aged 0–9 years in 1861. The observed population of native males in this age group was 310, implying a net out-migration of 72 between birth and the end of the decade.

Calculations similar to those presented in Tables 4–6 were performed for males and females in the four study areas during the decade of 1851–1861. The resulting net migration figures for natives and non-natives, and the total net migration in each age group, are shown in Tables 7–10. The ages given in these tables are estimates of the approximate age at migration. Thus a net migration figure calculated by comparing the 10–19 year age group in 1851 with the 20–29 year age group in 1861 would relate to an average age at migration of 15–24 years.

The results for all the study areas show that the amount of migration decreases with age, yet once we go beyond this most simple of generalisations, considerable differences between the areas emerge. In central Norfolk (Table 7), the main feature is the massive out-migration of native men aged about 15–24 years. This exceeds the out-migration of native women, and, in contrast with the case of women, is not compensated for to any significant degree by the in-migration of non-natives. The difference between central Norfolk and Shropshire, both almost entirely agricultural areas, is seen mainly in the migration patterns of men. In Shropshire (Table 8) in-migration of non-natives is greater, and out-migration of natives rather less, than in central Norfolk. In

Table 7 Estimated net migration between 1851 and 1861 by natives and non-natives: Central Norfolk study area.

Approximate age at migration	Net migration of males			Net migration of females		
	Native	Non-native	Total	Native	Non-native	Total
2.5–5	-71	63	-8	-40	50	10
5–14	-50	30	-20	-75	55	-20
15–24	-123	11	-112	-88	42	-46
25–34	-41	12	-29	-35	4	-31
35–44	-14	-8	-22	-17	-11	-28
45–54	2	-8	-6	3	-14	-11
55–64	0	1	1	8	-1	7
65–74	-1	-4	-5	-2	-5	-7
75–84	-3	-4	-6	-1	-8	-9
85–94	0	1	1	1	0	1
All ages	-301	94	-207	-246	112	-134

Table 8 Estimated net migration between 1851 and 1861 by natives and non-natives: Shropshire study area.

Approximate age at migration	Net migration of males			Net migration of females		
	Native	Non-native	Total	Native	Non-native	Total
2.5–5	-134	97	-37	-142	88	-54
5–14	-61	69	8	-91	80	-11
15–24	-87	30	-57	-98	46	-52
25–34	-32	-15	-47	-40	-4	-44
35–44	-24	4	-20	-15	-1	-16
45–54	-11	23	12	-6	-17	-23
55–64	7	6	13	6	1	7
65–74	-13	4	-9	5	-6	-1
75–84	-2	0	-2	0	5	5
85–94	3	4	7	-1	4	3
All ages	-354	222	-132	-382	196	-186

Table 9 Estimated net migration between 1851 and 1861 by natives and non-natives: White Peak study area.

Approximate age at migration	Net migration of males			Net migration of females		
	Native	Non-native	Total	Native	Non-native	Total
2.5–5	-54	55	1	-47	56	9
5–14	-73	35	-38	-71	38	-33
15–24	-63	46	-17	-65	14	-51
25–34	-13	29	16	-27	16	-11
35–44	-12	16	4	-12	4	-8
45–54	-2	-6	-8	-8	5	-3
55–64	1	-1	0	-6	-5	-11
65–74	-7	5	-2	2	2	4
75–84	-4	-2	-6	-1	-2	-3
85–94	0	0	0	0	2	2
All ages	-227	177	-50	-235	130	-105

Table 10 Estimated net migration between 1851 and 1861 by natives and non-natives: Upper Nidderdale study area.

Approximate age at migration	Net migration of males			Net migration of females		
	Native	Non-native	Total	Native	Non-native	Total
2.5–5	-29	66	37	-73	71	-2
5–14	-84	38	-46	-120	32	-88
15–24	-125	24	-101	-58	50	-8
25–34	-26	9	-17	-32	12	-20
35–44	-23	1	-22	-23	-3	-26
45–54	-5	1	-4	-1	11	10
55–64	2	5	7	3	-13	-10
65–74	1	-3	-2	-3	3	0
75–84	5	2	7	-5	0	-5
85–94	0	1	1	-1	0	-1
All ages	-284	144	-140	-313	163	-150

Table 11 Out-migration among natives as a proportion of the 1851 native population, and in-migration among non-natives as a proportion of 1861 non-native population.

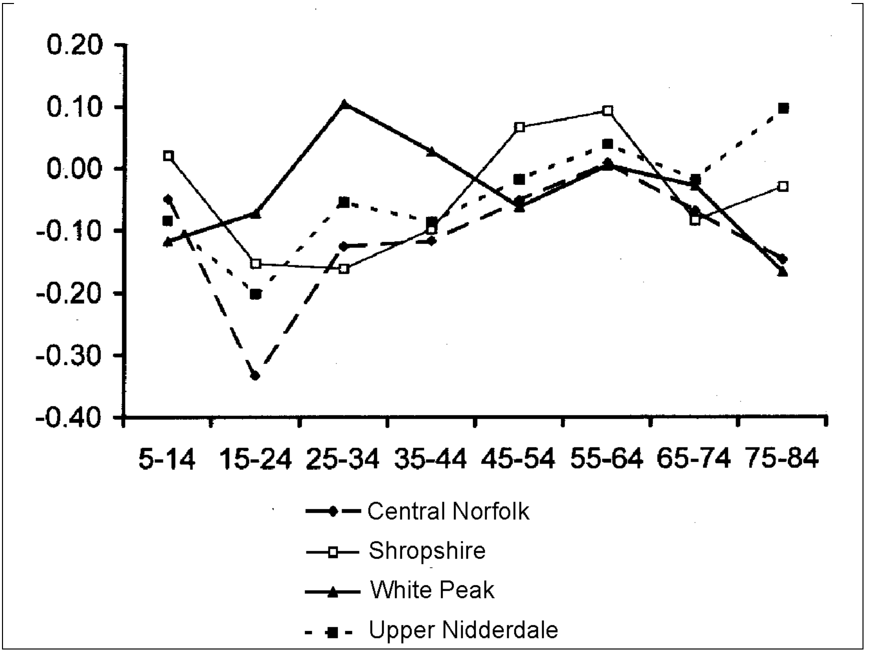
Study Area	Out-migration of natives as a proportion of the 1851 native population		Non-native in-migrants as a proportion of the 1861 non-native population	
	Males	Females	Males	Females
Central Norfolk	-0.28	-0.28	0.20	0.18
Shropshire	-0.34	-0.42	0.27	0.23
White Peak	-0.26	-0.30	0.40	0.31
Upper Nidderdale	-0.16	-0.19	0.28	0.31

Sources: See Table 3 and study number (SN) 3552: Causes of death in England and Wales, 1851–1860 to 1891–1900: the Decennial Supplements from AHDS History at the UK Data Archive at the University of Essex (http://www.data-archive.ac.uk/).

the case of young women, although the net migration is similar in both study areas, the Shropshire area has a greater inflow and outflow than central Norfolk. In the White Peak of Derbyshire (Table 9), migration patterns are quite different from those prevailing in either central Norfolk or Shropshire. For males, the main difference is that net out-migration at ages 15–24 years is lower, and indeed at ages 25–44 years there is net in-migration. The contrast between the White Peak and the purely agricultural areas is less marked for females, though the amount of in-migration of non-natives aged 25–34 years is greater. The upper Nidderdale study area (Table 10) manifests a pattern different again, its main feature being the low rate of net out-migration of women aged 15–24 years, caused by both a lower rate of out-migration of natives and a substantial flow of non-natives moving in.

Because the study areas have different overall populations, and Tables 7–10 deal in numbers of people, variations in overall rates of migration both between males and females and among the study areas are masked. Table 11 shows both the overall proportions of natives living in each study area in 1851 who are estimated to have moved away and the proportions of the non-natives living in each area in 1861 who had moved in during the preceding decade. The overall level of out-migration among natives was highest in Shropshire and lowest in upper Nidderdale. In three of the four areas, rates for females were slightly higher than those for males, and in the other area (central Norfolk) they were roughly the same. For non-natives, there was less variation among the study areas (the rate for males in the White Peak is artificially inflated by a transient local effect described in the next section), although the two purely agricultural areas experienced somewhat lower rates than the other two areas. Neither was there much variation between males and females.

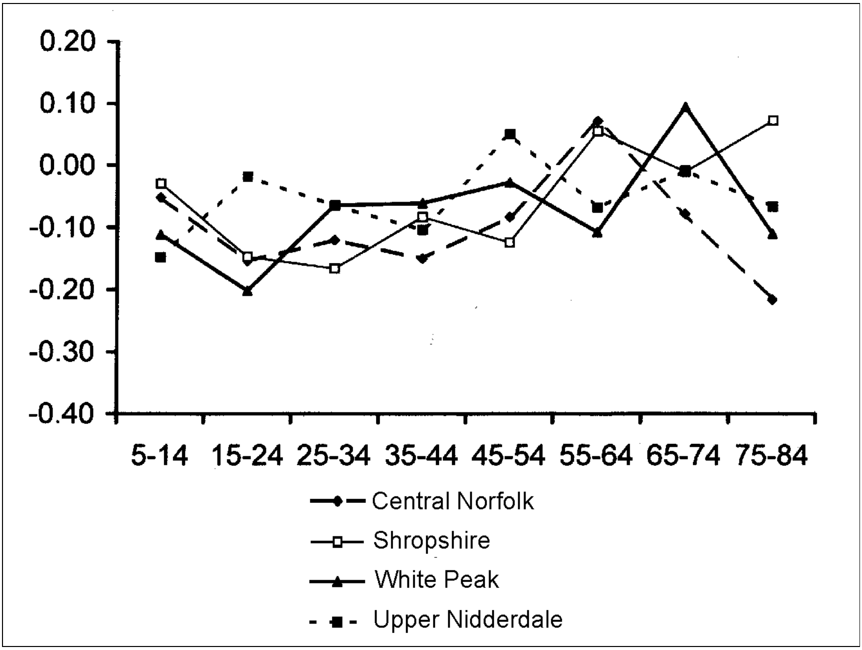
Figure 1 Net migration of males between 1851 and 1861 as a proportion of the 1851 population: four study areas.



Figures 1 and 2 show net migration by age for males and females as a proportion of the 1851 population in the relevant cohort. For example in the White Peak study area in 1851 there were 325 males aged 0–9 years. Net migration among this cohort during the decade was -38, so the proportion of resident males in this cohort who moved away was -38/325 = -0.117. On average, these young men were aged 5–14 years when they moved. Consider first the chart for males (Figure 1). Three of the study areas display a similar age pattern, with the highest rates of net out-migration among young men aged 15–24 years, and decreasing net out-migration among middle-aged men (indeed in the Shropshire area there is net in-migration among men aged 45–64 years). The exception is the White Peak area, in which out-migration rates at ages 15–24 years are lower than in the other areas, and at ages 25–44 years there is net in-migration.

Among females (Figure 2) there is less variation among the areas, with net out-migration at all ages under 45 years in all four. The rates of net out-migration vary considerably, though, with upper Nidderdale generally having the lowest rates, especially at ages 15–24 years. Among women of this age, the White Peak area has the highest net out-migration rates, whereas for men of the same age it had the lowest.

Figure 2 Net migration of females between 1851 and 1861 as a proportion of the 1851 population: four study areas.



Migration and the local economy

The contrasting migration patterns among the four areas can be interpreted in the light of what is known about their local economic conditions. Consider first the central Norfolk area. The main feature of its migration pattern between 1851 and 1861 was the substantial out-migration of young men, and the almost complete absence of any compensating inflow. The 1850s are sometimes seen as a 'golden age' of Victorian agriculture, but it seems that the high-farming economy of this area was not capable of providing a livelihood for all native men. Indeed of those aged 10–19 years in 1851 and born within the study area, 45 per cent had left the area by 1861. This figure is higher than that in the other areas, though not very much so. However, in the other areas the compensating inflow of men aged 15–24 was considerably greater. The pattern of migration for females in central Norfolk is roughly as expected, with substantial out-migration of young native women, partially compensated for by the in-migration of non-native women, many of whom were employed in 1861 as domestic servants.

The picture for females in the Shropshire area is strikingly similar to that in central Norfolk. For males, however, there are significant differences. The out-migration of natives was lower in the age-group 15–24 years and somewhat higher in the age group 35–44 years than in Norfolk, and the in-migration of non-native boys was much higher in Shropshire than in Norfolk. There seems little doubt that this contrast was related to the structure of the agrarian labour force. In Shropshire, male farm service was still common during the 1850s, whereas it had almost died out in Norfolk. Many of the non-native boys moving in to the Shropshire area were arriving to work as farm servants. A substantial proportion of these would have been born rather close to the study area, in neighbouring parishes. It seems, therefore, that the institution of farm service led to a higher level of short-distance circulatory migration in mid-nineteenth century England in those areas where it persisted.

The White Peak study area displays a similar pattern for females as Norfolk and Shropshire, but the pattern for males is markedly different, with much higher in-migration rates for non-native men aged 15–44 than in either of the two purely agricultural areas. An initial interpretation of this might reflect the White Peak's greater occupational diversity, however the main reason was the construction of the railway between Bakewell and Buxton which led to about 100 railway navigators being present in the area (mainly in the parish of Taddington) in 1861. By contrast, the effect of the lead mining industry on migration patterns was, in fact, rather small.

The distinctive features of the migration pattern in the upper Nidderdale study area are mainly seen for females. The male pattern is rather similar to that of central Norfolk. For females, upper Nidderdale is marked out by a lower rate of out-migration among native women aged 15–24 years than the other three areas. The proportions of native women aged 10–19 years in 1851 who moved away during the ensuing decade were 39 per cent in central Norfolk, 48 per cent in Shropshire, 34 per cent in the White Peak, but only 17 per cent in upper Nidderdale. This low out-migration was also associated with a substantial inflow of non-native women in the same age group, which almost compensated for the out-migration of natives. Again, this pattern can be related to the local economy, in which employment for both single and married women was available in the flax mills, which discouraged native-born women from leaving, and encouraged those from nearby parishes and townships to move into the area. The flax mills tended not to employ older women, and it is probably for this reason that the migration pattern for women aged over 25 in upper Nidderdale is similar to that of the other areas.

Conclusion

This paper has proposed a simple approach to measuring the impact of migration on small areas of England and Wales. The method can presently be applied to each decade between 1851 and 1901 except for 1871–1881. For 1871–1881 the Registrar General's *Decennial supplement* does not give mortality data separately for males and females, and so the approach may only be used by combining the two sexes, which makes the interpretation of the results less certain. The method requires only limited data from the census enumerators' books (the population classified by age, sex and whether or not each person was born within the area in question), together with some vital registration data which may be readily obtained in electronic form from the History Data Service at the University of Essex. The availability of the 1881 census enumerators' books (CEBs) in machine-readable format, and the possibility that the 1901 CEBs will eventually be available in a form suitable for local population historians, should further speed up the data collection. By applying the approach to data from four contrasting areas of rural England, this paper has identified both similarities and differences among the areas in their age-specific migration patterns, which can be interpreted in the light of what is known of local economic conditions.

Substantively, the results seem to indicate that female migration by age in the mid-nineteenth century was fairly similar across rural England except in those areas where a secondary sector in the economy employed substantial numbers of women. Patterns of migration among men, however, varied much more, and responded not only to the existence of occupational sectors other than agriculture, but also to the structure of the agrarian labour force, and to periodic rises and falls at the local level in the availability of employment for men.

Acknowledgements

An earlier version of this paper was presented at the annual conference of the British Society for Population Studies, University of Bristol, 10–12 September 2003. I am grateful to those present on that occasion, and to the members of the Editorial Board of *Local Population Studies*, for their helpful comments.

NOTES

1. R. Lawton, 'Population changes in England and Wales in the later nineteenth century: an analysis of trends by registration districts', *Transactions of the Institute of British Geographers*, **44** (1968), 55-74.
2. P.R.A. Hinde, 'The population of a Wiltshire village in the nineteenth century: a reconstitution study of Berwick St James, 1841-71', *Annals of Human Biology*, **14** (1987), 479.
3. Hinde, 'Population of a Wiltshire village', 479.
4. For an example of record linkage, see K. Schürer, 'The role of the family in the process of migration', in C.G. Pooley and I.G. Whyte eds, *Emigrants and immigrants: a social history of migration* (London, 1991), 106-42.
5. For a good example, see N. Goose, *Population, economy and family structure in Hertfordshire in 1851: St Albans and its region* (Hatfield, 2000), 126-45.
6. A fuller description of the four areas is given in P.R.A. Hinde, 'The fertility transition in rural England' (unpublished Ph.D. thesis, University of Sheffield, 1985), 167-88.
7. Susanna Wade Martins, *A great estate at work: the Holkham estate and its inhabitants in the nineteenth century* (Cambridge, 1980), 2-4.
8. See H. Newby, *Green and pleasant land? Social change in rural England* (London, 1979), 156-64.
9. The contrast between the structure of the farm labour force in the central Norfolk and Shropshire study areas, and concomitant differences in household structure and marriage patterns, are explored further in P.R.A. Hinde, 'Household structure, marriage and the institution of service in nineteenth-century rural England', *Local Population Studies*, **35** (1985), 43-51 (reprinted in D. Mills and K. Schürer eds, *Local communities in the census enumerators' books* (Oxford, 1996), 317-25).

10. G.W. Robinson, *A survey of the soils and agriculture of Shropshire* (Shrewsbury, 1910), 69; see also H. Tanner, 'The agriculture of Shropshire', *Journal of the Royal Agricultural Society of England*, **19** (1858), 1-5.
11. J.R. Bond, 'Derbyshire farming past and present', *Journal of the Royal Agricultural Society of England*, **93** (1932), 166-7; H.C.K. Henderson, 'The agricultural geography of north Derbyshire', *Geography*, **42** (1957), 160.
12. For a history of Magpie Mine, see I.J. Brown and T.D. Ford, *The Magpie Mine, Sheldon, Derbyshire* (Peak District Mines Historical Society, Special Publication no. 3), (Sheldon, 1967); for a history of lead mining in Derbyshire in general, see N. Kirkham, *Derbyshire lead mining through the centuries* (Truro, 1968).
13. Pateley Bridge Tutorial Class, *A History of Nidderdale* (ed. B. Jennings), (Huddersfield, 1967), 337.
14. Pateley Bridge Tutorial Class, *A History of Nidderdale*, 298-9.
15. The assumption that 'average' birth and death rates across an entire registration district (RD) can be used to estimate fertility and mortality in a study area which only comprises a part of the RD perhaps needs some additional comment. It is likely to be a reasonably good assumption where the RD is homogeneous (for example entirely rural), but where an RD contains, for example, an urban area and a rural hinterland and the study area is, say, just in the rural part, then substantial differences might emerge, especially with the death rates. The four study areas used in this paper are all rural, and the RDs containing them do not include any large towns so the RD-level birth and death rates probably give a good indication of fertility and mortality in the study areas. Moreover, in the case of upper Nidderdale, the study area comprises more than half the relevant RD (Pateley Bridge).
16. For details of this database, see D.A. Gatley, 'Computerising the 1861 Census and vital registration statistics', *Local Population Studies*, **58** (1997), 37-47.
17. D. Courgeau, 'Measuring flows and stocks of internal migrants: selected statistical issues', *Bulletin of the International Statistical Institute, Proceedings of the 44th Session*, (Madrid, 1983), 1,208.
18. The data from the Registrar General's *Decennial Supplement* have been made available in machine-readable form in a database created by R. Woods and obtainable as study number (SN) 3552: Causes of death in England and Wales, 1851-60 to 1891-1900: the Decennial Supplements from AHDS History at the UK Data Archive at the University of Essex (http://www.data-archive.ac.uk/).
19. The reported number of deaths must be divided by 10 because the deaths are decadal totals. In other words, the number of deaths per year is one tenth of the number reported.
20. For an explanation of this formula, see A. Hinde, *Demographic methods* (London, 1998), 14-5 and 231-2.
21. Note that for the oldest age group (85 years and over) the probability of dying is 1.00000, because the oldest age group is considered to be as wide as is necessary in order to accommodate the oldest age to which anyone survives. Therefore, by definition, everyone who survives to exact age 85 years must die within this age group.
22. The number alive in the oldest age group cannot be calculated in the same way as the other age groups. There are a number of possible approaches to calculating it, described in Hinde, *Demographic methods*, 34. In Table 4, we have assumed that men who attained the age of 85 years lived on average a further 3.33 years, which leads to a population at ages 85 and over of 633 x 3.33 = 2,108.
23. For the age groups 80-89 and 90-99 years, the numbers alive were estimated by assuming that one fifth of those alive at age 85 years were actually aged over 90 years. Thus the number alive in the age group 80-89 years is estimated as the sum of half those alive in the age group 75-84 years (7,670) plus four fifths of those alive in the age group 85 years and over (1,686). The remaining one fifth of those aged 85 years and over are therefore in the age group 90-99 years.