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A SPATIAL DEMOGRAPHIC ANALYSIS
OF INDIANS IN BRADFORD

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ABSTRACT

The population originating in India but living in Bradford and its offspring grew by about 60 per cent over the 1971-81 decade and underwent significant redistribution. This paper attempts to assess how the growth and redistribution patterns of the Indian community are likely to change over the next 30 years, as a result of declining mortality and fertility, of directly observed migration patterns, and of the lessening of migration flows from outside Bradford. The paper includes a review of models used to forecast ethnic populations and full details of the model and data estimation used in the forecast for Bradford's Indian community.

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1. INTRODUCTION: INDIANS IN BRADFORD

When people think of Bradford many images suggest themselves - a woollen textile town full of multistorey mills, many working, many not; a town pioneering attempts to make the legacy of the industrial revolution in Northern England a tourist attraction; a town housing one of the largest Pakistani immigrant communities in the country. The images, of course, are linked: the demand for labour in the textile mills in the 1950s and early 1960s encouraged large numbers of males to migrate from Mirpur in northern Pakistan to Bradford.

What is probably less familiar is that some 42 per cent (as of 1981) of the New Commonwealth and Pakistan (NCWP) origin population in Bradford is not of Pakistani origin, but derives from India, the Caribbean, Bangladesh, East Africa and elsewhere. Of these smaller NCWP communities the most important is that originating in India. Some 12,428 persons were living, at the time of the 1981 Census, in households headed by a person born in India, making up 2.8% of the population of the city and 24.6% of the NCWP population (head of household definition, OPCS 1983a).

As with most NCWP communities, the last decade and a half has seen substantial population growth for the Indian group through natural increase and immigration of dependants (Table 1). By 1981 the Indian community was 60% more populous than it had been in 1971, an annual rate of growth of 4.8%. Growth in the 1980s was slower and is estimated at only 2.9% per annum.

Along with growth in the community has come redistribution

TABLE 1. Estimates of the size of the Indian community of Bradford, 1971-86

Year	Bradford M.D.		'inner' Bradford (17 wards)		
	Electors	Population estimate	Electors	Population numbers	estimate ratio to 1971
1971	d 3,853	d 7,748	a 3,791	d 7,373	100
1981	b 6,181	c 12,428	b 6,082	c 11,829	160

Sources:

- a. Ram 1984 from the Register of Electors, Bradford County Borough.
- b. Ram 1983 from the Register of Electors, Bradford Metropolitan District.
- c. OPCS 1983, Table 11, p.5.

TABLE 2. Indices of dissimilarity for Indians and other groups in Bradford, 1971 and 1981

Type of data	Group one	Year	Group two	Year	IOD
Census, place of birth tables	Born in India	1971	Rest of population	1971	50.8
	Born in India	1981	Rest of population	1981	39.4
	Born in India	1971	Born in India	1981	19.2
Register of Electors	Indian electors	1971	Rest of electors	1971	55.6
	Indian electors	1981	Rest of electors	1981	47.9
	Indian electors	1971	Indian electors	1981	17.8
	Indian electors	1981	Other Asians	1981	21.5
	Indian electors	1981	Non-Asian electors	1981	50.1
	Other Asians	1981	Rest of electors	1981	53.1
	Other Asians	1981	Non-Asian electors	1981	53.8
	Non-Asians	1981	Rest of electors	1981	47.9
Estimates (Census, POB head)	Indians	1981	Rest of population	1981	40.2
	Indians	1981	Rest of NCWP pop.	1981	18.7
	Indians	1981	Non-NCWP pop.	1981	46.1

Notes

1. IOD = index of dissimilarity (half the sum over all wards of the absolute differences in the percentages of groups one and two living in a ward). The index ranges from a minimum of 0 (no dissimilarity in distributions) to a maximum of 100 (complete dissimilarity of distributions). All IODs are calculated for a study area comprising 17 wards (see Figure 1).
2. The IODs are computed from data given in Tables A.1 and A.2.

among the wards of inner Bradford (Figure 1). Figure 2 documents the spatial changes that took place. Figures 2A to 2C are based on counts of electors with Indian names (Ram 1983, 1984) which provide a more reliable guide to the changing group distribution over the 1971-81 decade than the place of birth statistics of the Census (which overall for inner Bradford show a gain of only 2.6% over the decade, compared with a 60.4% gain in Indian electors).

In 1971 the Indian community was concentrated in University and Bradford Moor wards, 'centres of the Gujarati Hindu and Punjabi Sikh communities respectively, with smaller numbers in Little Horton, Bowling and Toller wards. In 1981 these wards were still important areas of Indian settlement although only Bradford Moor had grown at more than the average rate. However, numbers have increased spectacularly in Bolton and Great Horton, wards and substantially in all other wards. Whereas in 1971 four wards registered no Indians at all, and two wards only one household each, all wards in 1981 had Indian households living in them.

The geography of Indians in 1971 and 1981 can be compared rather more precisely using the index of dissimilarity (ID). Previous work (Rees and Birkin, 1984) on the ethnic geography of Leeds and Bradford using place of birth statistics showed a decrease in the index of dissimilarity comparing those born in India with the rest of the population of 11.4 points (from 53.7 to 42.3) using a 19 ward definition of Bradford. Employing our 17 ward definition the similar ID shifts from 50.8 to 39.4, again 11.4 points lower (Table 1).

However, although the definition of the Indian group by place



FIGURE 1. The wards and zones of inner Bradford

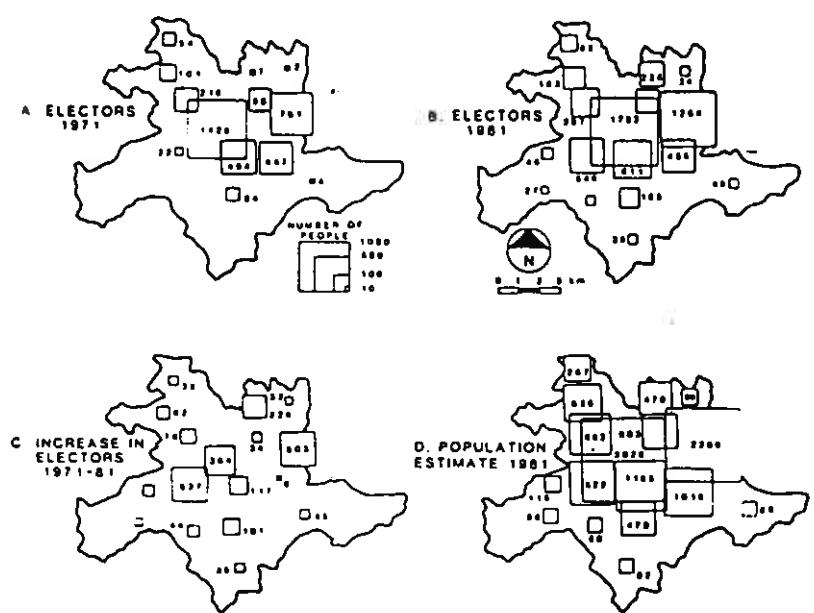


FIGURE 2. The changing distribution of Indians in Bradford, 1971-81

of birth is the same in 1981 as in 1971, the meaning of the statistic changes drastically. In particular, in 1981 those born in India represented a much smaller proportion of the community than in 1971. Statistics from the Register of Electors, although confined to those 16 years and 8 months of age and older (Ram, 1983), are fairly comparable in 1971 and 1981, and have the advantage of eliminating the "white Indian" element (whites born in India during the pre-1947 imperial period principally) in the birthplace statistics. The index of dissimilarity is higher in both 1971 and 1981 at 55.6 and 47.3 respectively, and the decrease not quite as marked at 7.7 points. The difference between the 1971 and 1981 distributions was substantial at 19.2 points (Census birthplace statistics) and 17.8 (Register of Elector statistics).

What are the reasons for the substantial growth and spatial shift of the Indian community in Bradford? Overall population growth is a result of continued immigration of dependants and fiancees (highest in the middle of the 1970's - Policy Unit, Bradford, 1983) in the process of family reunification and rapid natural growth due to high fertility rates and the favourable age composition of the population (see Brass, 1982 for a discussion for the NCWP group in Britain as a whole). The spatial shift has been effected mainly through migration internal to Bradford rather than by changes in the destination of immigrants to Bradford. Of 711 respondents in a household survey (Ram 1985) only 28 had immigrated to Bradford since 1976, 131 had moved between wards and 40 within wards.

Ram and Phillips (1985) have shown that the migration of

Indian households within Bradford has been associated with a substantial improvement in the quality of dwelling type. Indian households have shifted from living in back to back and terraced dwellings to living in terraced and semi-detached houses. This improvement in housing quality occupied reflects upward socioeconomic mobility (at least over the 1971-81 period) of the Indian community.

How is the spatial distribution of the Indian community likely to evolve in the future? Is the strong trend of demographic growth likely to persist? Is the moderate trend of spatial dispersion going to continue? These questions are of interest to the community itself, to planners of public services in the city, and to geographers. The remainder of the paper is addressed to an attempt at forecasting the spatial evolution of the Indian community in Bradford.

In the next section we review attempts to carry out such forecasts in other contexts. These have a long history though the number of quantitatively specified models and projections is small. In section three of the paper the design of the model used to project the Indian population is explained. A long section four spells out the details of the procedures used in estimating model inputs, the length of the section being justified by the intrinsic interest of the demographic characteristics of the Indian and Bradford populations thus revealed. Section five reports on the principal results and contrasts in the projections carried out, and the final section, six, evaluates the projections as a guide to the spatial evolution of the community.

2. MODELS FOR FORECASTING ETHNIC POPULATIONS

Although there have been a large number and long history of studies of ethnic populations in cities (see Peach 1975, Peach, Robinson and Smith 1981, and Coleman 1982 for recent collections), rather few have attempted to forecast explicitly how such groups would evolve in the future. Among these few three types of study may be distinguished:

- (i) demographic forecasts (Thomas 1970; King 1974; Rees, Smith and King, 1977; Woods 1977a; Immigrant Statistics Unit 1979; Frey 1979; Brass 1982; Drew and Simpson 1982),
- (ii) spatial simulations (Morrill 1965; Hansell and Clark 1970; Woods 1981), and
- (iii) Markov chain projections (Berry 1971; Woods 1977b).

Each of these types of study is considered in turn.

2.1 Demographic forecasts

The detailed demographic forecast involves use of the standard component-cohort survival model applied to an ethnic population broken down by age and sex together with the addition of a migration component. The component-cohort survival model entails the multiplication of a set of age-sex disaggregated populations by corresponding survival rates (derived directly or indirectly from mortality rates) to yield survived populations in the next age group at the end of the time interval. To these survivors are added the net number of surviving immigrants to yield the end of

period population. The population at risk of women in age groups in the fertile age range (computed from the initial and survived populations) is multiplied by age-specific fertility rates to give the number of infants added to the population, and these are then survived by application of an infant survival rate.

The migration component is normally represented as a vector of net immigrants, except in King 1974 and Rees, Smith and King 1977 where a vector of gross surviving immigrants is used and emigration is accounted for by reducing the level of survival rates by the level of estimated emigration. The demographic models are almost all based on quinquennial age groups and five year projection intervals - finer disaggregation by age or time is disallowed by the small population numbers involved.

Demographic forecasts of ethnic groups have been carried out for country wide populations (Thomas 1970, Immigrant Statistics Unit 1979, Brass 1972) or for city wide populations (King 1974, Rees, Smith and King 1977, Woods 1977a, Drew and Simpson 1982) or occasionally for systems consisting of metropolitan regions and the rest of the country (Frey 1979, 1983).

Attention in these demographic forecasts of ethnic groups has been focussed mainly on fertility and immigration. Ethnic group fertility for the groups studied has usually been above the level of the host population, although most authors have found evidence of convergence over time (King 1974, Thompson 1982, Brass 1982).

Variant projections have been carried out based on a continuance to replacement level or host population fertility or declining ethnic group fertility or on a slower rate of such decline. The future course of immigration is clearly a crucial variable in determining the future population of an immigrant ethnic group. In the British studies the future level is generally assumed to be lower than in the past, to consist mainly of dependants or the affianced of existing immigrants, and in some projections to trend to nil on a net basis (already true of migration to and from the West Indies).

Mortality in most British forecasts has been assumed to be the same as that for the whole population of the study region, principally because of the difficulty of measuring reliable mortality rates for small populations. The available evidence (Benjamin 1982) suggests that immigrants to the UK have lower age-specific mortality rates than the population in general because immigrants select themselves or are selected on health grounds. Benjamin (1982, p.61) speculates that this selection effect wears out over time as immigrants change dietary habits and experience the environmental mortality factors of the host country. In the American situation, wide differences between the mortality experiences of blacks and whites persist: life expectancies of blacks are 6 to 7 years less than those of whites for both sexes in 1980 (US Bureau of the Census 1983, Table 102, p.73).

If the study region for which an ethnic group population is being forecast is a subnational unit, then migration of ethnic

group members to and from the rest of the country becomes important. King (1974) and Rees, Smith and King (1977) pay particular attention to out-migration from the study region (Leeds) to the rest of the country and the rest of the world, but neglect migration to Leeds from the rest of the UK: the in-migrant component of their model is based purely on an extrapolation of immigration experience. In Drew and Simpson's (1982) study of "Bradford's black population" internal migration streams are ignored and emigrant streams are assumed, because of a lack of data, to be nil in number. In Frey's (1979) investigation of "white flight and central city loss" in three US metropolitan areas (Cleveland, Dayton and Dallas) all intra-USA migration streams are incorporated in the analysis, but external migration is ignored.

What kinds of ethnic groups have been analyzed in this first type of forecasting model? Researchers working at the national scale in the UK (Thomas 1970, Immigrant Statistics Unit 1979, Brass 1982) have only reported in detail on their projections of the New Commonwealth and Pakistan origin population as a whole, and although they have carried out projections for three broad constituent groups (West Indians, those from the Indian sub-continent, those from elsewhere in the NCWP) the authors are coy about reporting their results, despite the growing evidence that the immigrant groups from different origins are not only culturally distinct, but have very different demographic characteristics. For example, West Indian fertility levels have dropped to those of the indigenous population (OPCS 1980a, 1984b, 1985) while Pakistani and

Bangladeshi fertility rates remain high, with Indian fertility rates intermediate in position.

In city region studies (King 1974, Rees, Smith and King 1977, Woods 1977a, Drew and Simpson 1982) researchers have been less shy of projecting the populations of individual ethnic groups. King (1974) reports on projections for West Indians, Indians and Pakistanis as well as for the NCWP group as a whole. Drew and Simpson (1982) give projections for the Pakistani and Indian groups as well as for the NCWP ("black") group as a whole.

All ethnic group projections face the difficulty of arriving at reliable estimates of the base population from available statistics. The census provides estimates of persons born abroad in a particular country, and estimates of those persons plus native born members of their community. Thus, the US census provides counts of the foreign stock: those born abroad plus those born in the USA to parents one or more of whom was born abroad. The UK census in 1971 gave tabulations of persons born in the NCWP plus persons at least one of whose parents was born in the NCWP. In 1981 this parental birthplace question was dropped, and tabulations of persons by place of birth of the head of the household were substituted. None of these definitions is fully satisfactory (see Immigrant Statistics Unit 1977, 1979, OPCS 1983a and Rees and Birkin 1984 for a fuller discussion). All demographic forecasts give this issue careful consideration.

However, only the Immigrant Statistics Unit (1979) study considers a problem peculiar to the projection of ethnic groups, that of ethnic intermixture. The current proportion of mixed marriages in the UK among marriages involving at least one non-white partner is substantial: in 1981 the Labour Force Survey found that 25.4% of such marriages involved one white and one non-white partner, 3.7% involved non-white partners from different ethnic groups (computed from Table 5 in Coleman 1985 derived from OPCS 1982). In future years the offspring of these marriages will be 25-30% of mixed ethnicity. The Immigrant Statistics Unit (1979), however, simply work with the mixed population as just another ethnic group, and add the projected numbers from a closed projection of this group to those of the population of wholly NCWP origin. A clear deficiency in all ethnic group forecasts (including that reported in this paper) is a failure to develop a method of handling mixed ethnicity, which must include the addition of a marriage model to the standard component-cohort model.

To sum up, the clear advantages of demographic models are that they provide a detailed picture of the age and sex structure of ethnic group populations at future time points. The consequences of the current, immigration affected age and sex structures can be worked out (Brass 1982, p.109) and a variety of assumptions about fertility and immigration behaviour can be tested. However, if we are interested in the degree to which an ethnic group assimilates, then the demographic approach is deficient in not taking into account ethnic intermarriage (as discussed above) and in not taking

into account the way the distribution of the group evolves spatially (Frey's 1979 model being the exception).

2.2 Spatial simulations

Geographers have attempted to remedy this deficiency through the use of "Monte Carlo" methods of simulating the evolution of an ethnic group in a city across a large number of spatial units (Woods 1981, for example, uses 914 units). Monte Carlo methods incorporate an element of chance in their projections.

Morrill (1965) carried out the first, seminal study in simulating the development of the northern edge of the Negro ghetto in Seattle, USA. The model included natural increase of the black population, an in-migration rate and a method of assigning in-migrants to locations based on the existing population distribution, a mechanism based on a grid of probabilities that fall away from the centre for allowing mobile persons to move from current residences to new ones, resistances to movement in targetted areas which varied with housing value and host group reactions, and a limit to the number of people that a housing block would hold. The model was run for ten two year periods between 1940 and 1960, and evaluated by comparison with the distributions revealed by the censuses of 1950 and 1960. A predictive simulation was run for 1960-62 and 1962-64, but "no prediction from 1964 [was] attempted, because of the risk of misinterpretation by the residents of the area" (Morrill 1965, p.169 in Peach 1975).

Hansell and Clark (1970) constructed a similar simulation model for the Negro ghetto of Milwaukee using an existing computer program for spatial diffusion in which all residents migrated in each two year period (rather than the more realistic 20% in Morrill's study) and experienced a variety of barriers due to housing value or the resistance of other ethnic groups. Natural increase appears not to have been considered and in-migration was not incorporated into the model. However, because the whole of the Milwaukee ghetto was modelled, cognizance was taken of the loss of housing units due to the encroachment of non-residential land uses consequent on the expansion of the Milwaukee Central Business District. The mechanism for intra-Milwaukee migration was the same as in Morrill's model, involving a grid of probabilities derived from a previous study of the moves of Negroes due to highway displacement (whereas Morrill's observations of migration distances are undocumented). Again the simulations were compared with observed distributions in 1960, and predictions were avoided.

Woods (1981) has developed some five alternative simulation models (models 1, 2a, 2b, 3a and 3b) for three ethnic populations in Birmingham, UK, namely New Commonwealth immigrants, West Indian born immigrants and immigrants born in India-Pakistan-Ceylon. The study area included the whole of Birmingham County Borough divided into 914 quarter-square-kilometre areas. The probability grid (called "mean information field" or MIF by most authors) is based on a study of marriage distances and the annual number of new

immigrants to the city is estimated using both national and local data. The rate of change of residence each year was assumed to be 5% (cf. Morrill's 20% over two years and Hansell and Clark's 100% also over two years).

No account appears to be taken in Woods' models of either mortality or fertility. The population is restricted to that of immigrants (born outside the UK) so that technically no births are involved. But over the 30 years of his eventual simulation mortality would have an impact, though he is careful to refer to the relative distribution of the groups rather than the absolute.

Woods' model 1 he refers to as a "strict segregation" model in which new immigrants are assigned to "cells with a probability related to the proportion of the total city immigrant population in a cell at the end of year zero" (Woods 1981, p.1422) although "every cell was given some probability of being 'hit' even when there was no pre-existing immigrant occupancy" (we are not told, however, on what basis this latter probability was calculated). Once newcomers had been distributed a new MIF was constructed for distribution of next year's newcomers.

Model 2a (Woods 1981) incorporates internal movement of the immigrant population using a fixed probability grid in which the probability of relocation decayed away from 5 sub-centres of the immigrant distribution in 1961. Model 2b used a floating probability grid (Morrill's approach) of 5 by 5 cells. For some

reason in all these simulation studies relocation within the same cell is not allowed, making the movement rates in the three studies dependent on the size of areal unit used and therefore non-comparable.

Models 3a and 3b used the same internal migration mechanisms as models 2a and 2b, but modified the assignment of immigrant newcomers to include the influence of the distribution of dwelling let for multioccupation (lodging houses), favoured by the single male working migrant that characterized the immigration streams to the UK in the first half of the 1960s.

To avoid extreme solutions in the simulation process, the models were run 100 times for each year and the results averaged before the simulation for the next interval was run. Such a procedure reveals, of course, that all simulation models have a deterministic base. Each of the 5 models were run for the three immigrant groups and carefully evaluated. The results are summarized in Table 3.

The largest differences in the table are between the coefficients of determination for West Indians and for the Asian immigrant group. A possible reason for the difference is the role of housing tenure. The MIF mechanism in the model allows migration to a cell irrespective of the tenure characteristics of the housing contained therein. However, Asians have generally shown strong preferences against entering public housing (in Bradford Ram's

TABLE 3. A reinterpretation of the results of Woods' (1981) simulations of immigrant populations in Birmingham 1961-71

Immigrants from:	Model 1		Model 3b		Model 2b		Model 3a		Model 2a	
	'Piling up'	Lodging effect	Short distance movers	No lodging house effect	Long distance movers	Lodging house effect	Long distance movers	No lodging house effect	Long distance movers	No lodging house effect
New Commonwealth	66.7	70.6	70.1	69.6	65.9					
West Indies	67.9	71.6	70.2	70.6	69.2					
India, Pakistan and Ceylon	49.3	56.3	50.3	54.3	48.4					

Immigrants from:	Short distance effect		Long distance effect		Lodging house effect	
	2b minus 1	2a minus 1	3b - 2b	3a - 2a		
New Commonwealth	3.4	-0.8	0.5	3.7		
West Indies	2.3	1.4	1.4	1.4		
India, Pakistan and Ceylon	1.0	-0.9	6.0	5.9		

Source: derived from Woods 1981, Table 2, p.1424.

social survey revealed no Indian council tenants), while West Indian families have accepted council tenancies. Thus, migration to vacancies within council estates would be avoided by Asian households, but generated by the model. This would also explain the overrepresentation of Asians in the model simulation in the inner area, an area of redeveloped council housing.

A second reason for the difference must lie in the stage which the respective immigrations of West Indians and Asians had reached in the 1960s. West Indians were well into the phase of family reunification and would be seeking suitable family homes. This phase begins only in the late 1960s for Asians. The lodging house effect (Table 3B), or the improvement in explanation effected by including a lodging house attractiveness term in the newcomer allocation submodel, is much stronger for Asians than West Indians, and the intra-Birmingham migration effects stronger for West Indians than Asians.

The superior explanation afforded by the models allowing only migration over short distances (Models 2b, 3b) compared with those allowing longer distance moves (Models 2a, 3a) suggests the need to use migration information specific to the group being simulated.

Our discussion has revealed several distinct advantages for simulation models: they provide a detailed picture of the way an ethnic community evolves spatially, they provide a vehicle for incorporating fruitful hypotheses about residential relocation, and

their practitioners have taken care to evaluate their results (a care somewhat absent from the demographic forecasting work reviewed earlier). However, as Woods (1981) himself points out (p.1428), because they use age aggregated populations a proper evaluation of the results of natural increase is not possible, and because, in the British case, place of birth statistics are used (in order to effect comparisons between 1961, 1966 and 1971 distributions), a proper enumeration of the respective ethnic group populations has not been possible. There is also the need, in order to assess fully what the simulation results mean, to simulate as well the distribution of the rest of the population. Thus, Woods' 1991 map of New Commonwealth immigrants would have been easier to interpret if he had known what the ethnic composition of the "expanded horse-shoe shaped belt" of immigrant settlement was.

2.3 Markov chain projections

The final class of studies that attempt to forecast quantitatively the evolution of ethnic groups are those involving simple application of Markov chain theory in which a row vector of "population", classified by degree of ethnicity, is multiplied by a matrix of probabilities of change to yield a new vector of "population". The "population" is that of either schools (Berry 1971; Woods 1977b) or census areas (Woods 1977b). The ethnicity categories in which the school or area falls are classes of the percentage of the ethnic group: 0-10, 11-20, ... , 91-100 in Berry's analysis and 20 categories giving a detailed coverage at

the bottom end of the percentage spectrum in Woods' analyses.

Although these models are attractively simple and give interesting results for a short period, they suffer from several disadvantages. The transition matrices on which they are based capture behaviour at the point of maximum relative growth in the ethnic populations, unlikely to be sustained demographically into the future. The transition probability matrices "are absorbing in character and therefore unrealistic in a forecasting sense" (Woods 1977b, p.484). That is, every unit (area or school) ends up in the highest ethnicity classes in the long run, although the same objection also applies to demographic forecasts where the population ends up being dominated by the highest growth population unless natural increase and net immigration are trended to replacement levels or all ethnic groups have disappeared into a mixed population.

More important is the drawback that the Markov chain model fails to provide a projection for the individual units, unless some further information (a random number even) is added: Berry's claim that "from this we developed our 'future ghetto' maps" (Berry 1971, p.105) is not substantiated in the paper. The model, as it stands, does not provide forecasts of ethnic group numbers living in particular areas.

2.4 Lessons

From this review of models for forecasting ethnic populations emerge a number of clear paths for future development.

- (i) The model should be disaggregated by age and sex and incorporate mortality and fertility components.
- (ii) The model should be spatially disaggregated.
- (iii) The model should include both migration within the study region and migration between the study region and the rest of the world.
- (iv) The intra-study region migration sub-model should take into account the distance-decay effect, differing host group resistances, the variable attraction of different types and values of housing stock to migrants. Empirical measurement of migration activity in the ethnic group poulation should be carried out in order to calibrate the migration model properly.
- (v) The model should consider ethnic groups homogeneous in character (West Indians, Indians, Pakistanis separately rather than as a NCWP group) and attempt to model all groups (including the host population) simultaneously to solve the problem of mixed ethnicity, to make possible the comparison of ethnic spatial distributions (in order to assess whether dispersion or concentration is taking place) and to introduce inter-ethnic competition for different housing market vacancies.
- (vi) The model should be capable of being evaluated historically and of being used for projection.

This is an ambitious programme, only some of which we are able to incorporate in a model for projecting the Indian population of Bradford. It will serve as a reference frame for our modelling efforts (and a stick with which to belabour our efforts). The model design is described in the next section of the paper. Essentially, our model is a generalization to many zones of the demographic forecasting model, which focusses on a single ethnic group and is based on as much empirical measurement of the components of change as possible. The methodology adopted is that of a deterministic disaggregated demographic model: as a consequence the spatial system has to be restricted to a very small number of zones. For this type of model a flexible computer program already existed and was used to implement the demographic model. The development from scratch of software for a microsimulation model incorporating elements (iv) and (v) above was considered too ambitious a task in the context of a broader project on the geography of the Indian community in Bradford (Ram 1985).

3. DESIGN OF A MODEL

3.1 Characteristics of the system being modelled and associated data base

Some five attributes of the system being analyzed have to be specified when constructing a demographic model (Rees and Willekens, 1981, 1985; Rees and Woods, 1985): (i) the concepts used in defining the population stocks and flows, (ii) the age-time framework adopted, (iii) the spatial framework used, (iv) the accounting framework employed, and (v) the temporal framework utilized.

3.1.1 Concepts used

The main choice of concept concerns the migration components of the model: should the "transition" or the "movement" concept be used (Rees 1984). Since the intra-city migration components used in the model derive from a retrospective survey, it was only possible to measure transitions in the surviving population: the moves of households not captured in the survey because of outmigration or dissolution were lost, so that it was not possible to measure all moves. The usual residence concept was used for the base population stocks from the 1981 census and for births and deaths.

3.1.2 Age-time frameworks adopted

Five year age groups were the most detailed age breakdown feasible for the small population (11,800 in 1981) being modelled, and therefore a five year time interval was needed for both the

base and future periods in the projections. The age disaggregation was extended (Table 4) to age 75 and over, so as to produce estimates in the future of the older elderly, more in need of family and community support (Craig 1983).

3.1.3 The spatial framework used

Since there were roughly 34 variables (17 age transitions for 2 sexes) in our spatial demographic variable for every 1 variable in the spatial simulation models (section 2.2), it was not possible to adopt a fine zoning system. Even the 17 wards used in previous descriptions of 1971-81 change (Ram 1984) were too fine a mesh. The analysis was restricted to four internal zones, two of which were wards and two aggregates of wards (Figure 1).

Zone 1 was University ward, the heart of the Gujarati Hindu community and zone 2 was Bradford Moor, centre of the Punjabi Sikh community (Ram 1984). Zone 1 was very much an inner city ward of mainly terraced housing and a few back to backs located just beyond the Central Business District; zone 2 was displaced about 1 kilometre from the centre of Bradford and was an area of terraces grading into semi-detached housing. Zone 3, Inner Bradford, consisted of the wards immediately adjacent to the first two core zones, and zone 4, Outer Bradford, consisted of wards from 2 to 6 kilometres from the centre of Bradford beyond the inner wards. The rest of Bradford Metropolitan District was not used as an internal zone in the model because the wide scattering of the small numbers of Indians in these wards (Ram 1984, p.50) made inclusion of them

TABLE 4. Age groups used in the demographic model

Age transition	Initial age group	Final age group	Age transition	Initial age group	Final age group
0	Birth	0- 4	9	40-44	45-49
1	0- 4	5- 9	10	45-49	50-54
2	5- 9	10-14	11	50-54	55-59
3	10-14	15-19	12	55-59	60-64
4	15-19	20-24	13	60-64	65-69
5	20-24	25-29	14	65-69	70-74
6	25-29	30-34	15	70-74	75-79
7	30-34	35-39	16	75+	80+
8	35-39	40-44			

in the household survey infeasible, and because it was suspected that the census tables overestimated the true size of the group in this area (Ram 1984).

The external zone in the model therefore consisted of the rest of the United Kingdom outside the 17 ward definition of "Indian Bradford" plus the world outside the United Kingdom. Separate estimates or guestimates were made of flows to and from these two parts of the "rest of the world".

3.1.4 The accounting framework employed

Figure 3 sets out the population accounts framework for one age transition used in the model. The cells in the table have been labelled with letters according to which component of the account they fall into. Each component of the account can either be input as data or estimated by an externally or internally specified submodel. The combination of choices for handling the components constitutes the accounts based model for the task in hand. A wide variety of different data bases and modelling needs can be handled within such a flexible framework.

Full details of the modelling system are given in Rees 1981, but a short illustration of how it works is given here. Suppose we knew for the whole Indian population the number of surviving migrants between the model zones within Bradford for 1981-86. These would be entered directly in the appropriate cells, labelled IM. For the next projection period for which we did not know these

INITIAL STATE	FINAL STATE	SURVIVAL AT END OF INTERVAL		DEATH IN TIME INTERVAL						END OF INTERVAL		
		UN	EM	IR	OB	RW	UN	EM	IR	OB	RW	UN
UNIVERSITY (UN)	SS	IM	IM	IM	IM	IM	NS	NS	NS	NS	NS	IP
BRAFORD MOOR (EM)	SS	IM	IM	IM	IM	IM	NS	NS	NS	NS	NS	IP
INNER BRADFORD (IR)	IM	IM	IM	IM	IM	IM	NS	NS	NS	NS	NS	IP
OUTER BRADFORD (OB)	IM	IM	IM	IM	IM	IM	NS	NS	NS	NS	NS	IP
REST OF THE WORLD (RW)	EM	EM	EM	EM	EM	EM	O	NS	NS	NS	NS	IP
TOTALS							FP	FP	FP	T	D	PAR

FIGURE 3. The accounting framework for an age transition

Key

- SS = surviving stayers
- ia = internal surviving migrants
- em = external surviving migrants
- nss = non-surviving stayers
- nsm = non-surviving migrants
- ip = initial population
- fp = final population
- d = deaths
- t = totals computed endogeneously
- par = population at risk

numbers, we would compute the migration rates from the 1981-86 accounts (the IM terms divided by their corresponding initial populations or IPs) and apply them to the appropriate initial populations estimated for 1986 (the final populations or FPs for the previous account). In fact, because we have to rely on a sample survey of the Indian population it is more appropriate to estimate the rates of migration between zones using the sample information (see section 4) and enter these rates into the account to be multiplied by the 1981 initial population (based on the census) to produce an estimate of the internal surviving migrants in the account.

3.1.5 Temporal framework utilized

Ideally, all stock and flow components of the accounting model for the base period of a projection should refer to the same time interval, and should contain internal consistency checks (both initial and final populations, for example). The less than ideal situation for our model of the Indian population of Bradford is shown in Figure 4. Births, deaths and immigration information was available from local sources for the calendar years 1979-83, and the base population derived from the 1981 census adjusted for age (see section 4.1) was entered as the mid-period population at risk (an alternative in the modelling system to using initial or final or average populations), which it was, approximately. Internal migration rates could be estimated from a household survey of the Indian community carried out by Ram (Ram 1985) in mid-1984, but, because the sampling frame was derived from the 1981/82 electoral

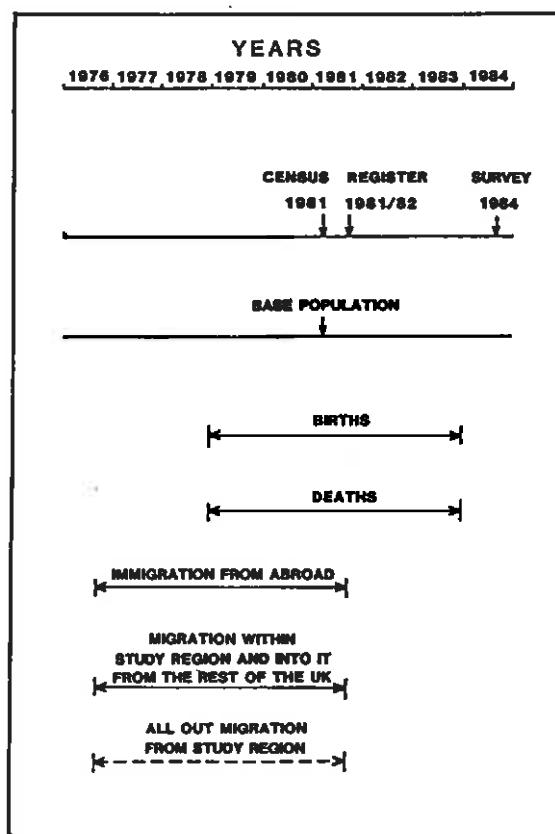


FIGURE 4. Time specification of the data components of the spatial demographic model

register, migration rates could be measured only prior to this date over the period 1976 to 1981. Finally, the pecked line for all out-migration from the study area indicates that this component had to be guestimated.

3.2 The schema of projections

3.2.1 Time periods

Each projection involved seven time periods (Table 5). The first was the base period 1979-83 for which data was available to estimate most components of the model. Then the 1981 base populations were input afresh and information for the other components (as appropriate) was input based on extrapolation and assumption (see section 4), or in the case of intra-study area migration the 1979-83 migration rates were used. From 1986-91 to 2006-11 the model was rolled forward in the normal manner, using the previous period's final populations as the next period's initial populations.

3.2.2 Variability of components over space and time

Some four projections in all were carried out to assess in an orderly way the effect of introducing spatial and temporal variability into the forecasts. Table 6 sets out the array of possible projections in which the ones actually implemented are set.

Projection 1 simply involves applying the same birth and death

TABLE 5. How the components are modelled in each projection run

Run	Period	Initial population	Internal migration	Immigration	Emigration	Deaths & Births
1	1979-83 1981-86 1986-91 to 2006-11	estimated census model	set to 0 set to 0 set to 0	set to 0 set to 0 set to 0	set to 0 set to 0 set to 0	rates input old rates old rates
2	1979-83 1981-86 1986-91 to 2006-11	estimated census model	set to 0 set to 0 set to 0 set to 0	set to 0 set to 0 set to 0 set to 0	set to 0 set to 0 set to 0 set to 0	rates input old rates old rates old rates
3	1979-83 1981-86 1986-91 to 2006-11	estimated census model	rates input old rates old rates	flows input old flows old flows	flows input old rates old rates	rates input old rates old rates
4	1979-83 1981-86 1986-91 to 2006-11	estimated census model	rates input old rates old rates	flows input old flows old flows	flows input old rates old rates	rates input new rates new rates

TABLE 6. The schema of projections of the Indian population
of Bradford showing those selected for analysis

Natural increase only		Migration included	
Vital rates constant over space	Vital rates variable over space	Vital rates variable over space	Migration constant over time
Vital rates constant over time	Projection 1	Projection 2	Projection 3
Vital rates variable over time			Projection 4

rates to the 1981 zonal populations of Indians. It is a natural increase only projection.

Projection 2 also only involves the fertility and mortality components, but introduces estimated variation in fertility rates by zone and guestimated variation in mortality rates by zone.

Projection 3 introduces both intra-study region migration and external migration, employing spatially variable vital rates. Migration within the study region is modelled using migration rates (incorporating survival and so not equivalent to either the rates used in the spatial simulation models or the probabilities used in the Markov chain models - see section 2). Flows (number of persons in the migration stream) are entered for both emigration and immigration streams in the base period, but thereafter emigration is modelled using constant rates and immigration by constant flows.

The final projection, 4, adds extrapolated fertility and mortality rates to the forecast and is thus the most realistic of the projections.

A comparison of projections 1 and 2 will show the effect of varying vital rates across intra-city zones for an ethnic population; a comparison of projections 2 and 3 will yield an estimate of the effect of introducing migration to the forecasts; and an estimate of the effect of trending fertility and mortality rates is available from a comparison of projections 3 and 4.

Projections 3 and 4 also provide, it turns out, a high and a low fertility forecast of the Indian population.

4. DATA: ESTIMATION, PATTERNS AND TRENDS

4.1 Estimation of zonal populations

Base populations of Indians are only available in the 1981 census on a birthplace of head basis (equivalent to Table 37 in the Small Area Statistics or SAS which provides such figures for the whole NCWP group only) from expensive special tabulations. Therefore, rough estimates were made by multiplying the populations of each sex in each ward who were born in India (available in SAS Table 4 from the information system of Birkin and Rees 1982) by the ratio of persons living in households with a head born in India to the number of persons born in India for Bradford M.D. as a whole available in County Report (CR) Table 10 and 11 (see Table A.3 for the detailed figures). The estimated Indian population for each sex was then added up to form estimates for the model zones, and these figures were disaggregated by age using statistics for Bradford M.D. giving the age breakdown of each sex for persons living in households with a head born in India (a small part of OPCS special tabulation DT1833 given in Table A.4).

Thus, we assume that the overall age structure of Indians in Bradford (Figure 5) applies to each zonal population, and, that, roughly, the ratio of first to second generation Indians remains constant across the wards (and zones) of Bradford. The resulting estimates are gathered together in Table 7. For entry as

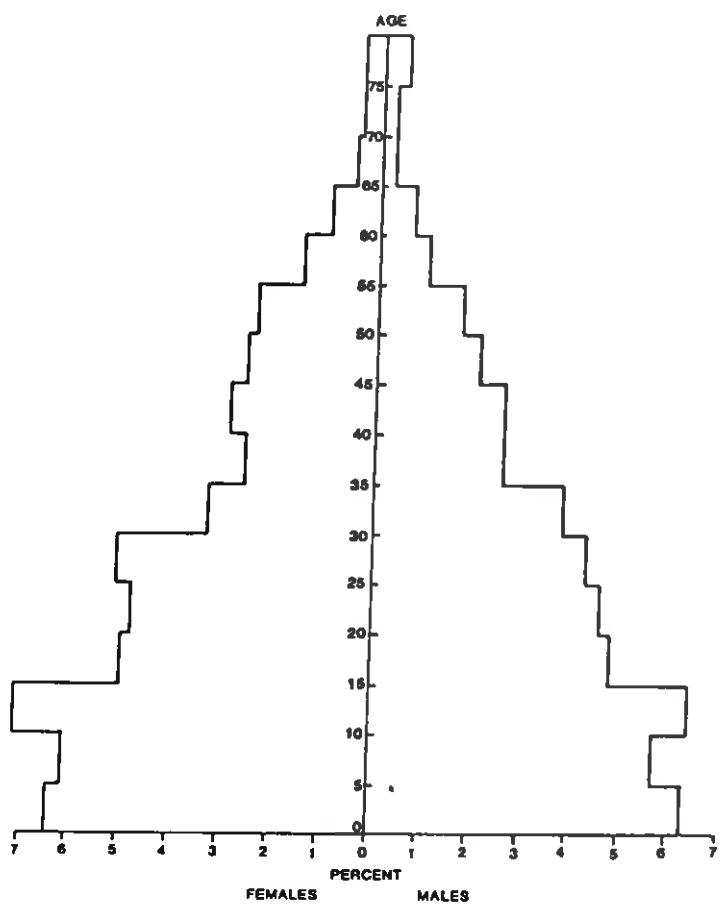


FIGURE 5. The distribution by age and sex of persons living in households whose head was born in India, Bradford M.D., 1981

**TABLE 7. Estimated number of Indians by age and sex
for zones in Bradford M.D., 1981**

Age group	Zone 1		Zone 2		Zone 3		Zone 4		Rest of	
	University ward		Bradford Moor		Inner Bradford		Outer Bradford		Bradford	
	M	F	M	F	M	F	M	F	M	F
0- 4	193	190	144	146	301	290	115	117	36	41
5- 9	185	173	138	132	289	264	111	106	34	37
10-14	215	194	161	149	336	296	129	119	40	41
15-19	152	145	114	111	238	221	91	89	28	31
20-24	146	140	109	107	228	214	87	86	27	30
25-29	153	129	114	99	239	197	91	79	28	27
30-34	100	115	74	88	155	175	59	71	19	24
35-39	80	80	60	61	125	122	48	49	15	17
40-44	89	79	67	60	139	120	53	49	17	17
45-49	79	64	59	49	124	97	47	39	15	14
50-54	72	52	54	40	112	80	43	32	13	11
55-59	45	31	34	24	71	48	27	19	8	7
60-64	31	22	23	17	48	33	18	13	6	5
65-69	16	9	12	7	25	14	9	5	3	2
70-74	12	8	9	6	19	13	7	5	2	2
75+	13	14	9	11	20	21	8	8	2	3
Total	1582	1446	1183	1107	2470	2205	945	888	294	308

Notes

1. M = males F = females.
2. Source: computed from special census tabulations for Bradford M.D. and place of birth statistics for wards. See Tables A.3, A.4.
3. See Figure 1 for zone boundaries.

populations at risk in the base period of the projections, 1979-83, the age group estimates must be adjusted through interpolation to intermediate age groups two and a half to seven and a half and so on rather than 0 to 4, 5 to 9 and so on. For 1981-86 the populations for zones 1 to 4 are entered in the model as shown in Table 7.

The age-sex structure of the Bradford Indian population is a youthful one with considerable potential for further growth at replacement fertility levels.

4.2 Mortality estimates and assumptions

In common with other demographic forecasters (section 2.1), we make the assumption that mortality rates for the whole population apply to Indians. Mortality rates are computed using local statistics for Bradford M.D. rather than through applying standardization factors to national rates (Drew and Simpson 1982).

The process of converting the available death statistics into mortality rates suitable for input to the projection model's base period accounts is a straightforward if somewhat lengthy process. A brief sketch is given here.

Deaths in Bradford for each sex for the period 1979-83 are available for age groups 0-4 and 75 and over and for ten year age groups in between (Table A.5). These statistics must be

deconsolidated, initially, to five year age groups. The deconsolidation is achieved in two stages (Table A.6). The first involves multiplying the 1981 census population in Bradford by five times the mortality rates for England and Wales (Table A.8). These estimated deaths are then multiplied by adjustment factors that ensure they add up the deaths observed over ten years (Table A.7). These estimates are, then deconsolidated into the constituent age transitions employed (Table A.9), and then re-aggregated by cohort (Table A.10). For example, deaths that occur in age group 20-24 can be broken down into those that happen to persons aged 15-19 at the start of the 5 year time interval and those aged 20-24. The latter deaths are combined with those at 25-29 years of age that happen to persons aged 20-24 at the start of the time interval to yield estimates of all deaths occurring to those aged 20-24 at the start of the interval irrespective of age at death. Rees and Woods (1985) provide a detailed discussion of the estimation principles involved. The factors used in deconsolidating deaths by age at death are one half in both cases, except for the 0-4 and 75 and over age groups where national deaths classified by age within these age groups are used to construct more realistic estimates. Mortality rates for "cohorts" for Bradford M.D. (Table A.11) are then computed by dividing the estimated deaths by populations interpolated from the 1981 census age group populations from the County Report (OPCS 1983).

These rates are the mortality rates used in the base period, 1979-83, for all projections, and for all projection periods in

projection 1. In projections 2 to 4, however, we introduce variation in the mortality rates for the different zones. These are crude estimates based on the kind of mortality rate variation observed in the neighbouring city of Leeds (Hirschfield and Rees 1984). Standardized mortality ratios for the wards of Leeds exhibit a range from 80 (outer suburbs) to 120 (inner city) for males and 85 to 115 for females, where 100 represents the city average. The zones of our Bradford study area we considered fall in the range from the city average to the maximum. Our guesses for males and females respectively in Bradford were that mortality rates in University ward should be multiplied by 1.20 and 1.15 respectively; in Bradford Moor the multiples should be 1.15 and 1.12, in Inner Bradford 1.10 and 1.08, and in Outer Bradford 1.00 for both sexes (Table A.12 shows the calculations). These spatially variable mortality rates were used in projections 2 and 3.

Mortality rates, however, have continued to improve, even over recent years. A regression analysis was carried out on annual data for a set of death rates for broad age groups for Bradford M.D. from 1975 to 1983 (Table A.13). Most age groups showed a declining slope for the regression line of the logarithm of the death rate against time (Figure 6), with slightly faster improvement for females than males. These negative exponential declines were applied to the zonal mortality rates computed by the procedure outlined previously to yield gently declining mortality rates (Table A.14). Figure 7 shows graphically what these mortality

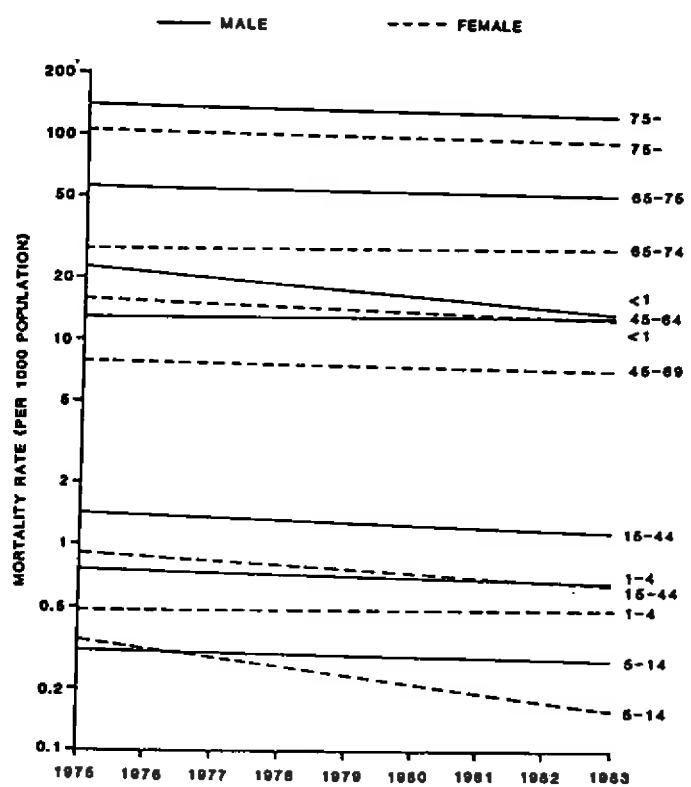


FIGURE 6. Trends in mortality rates in Bradford, 1975-83

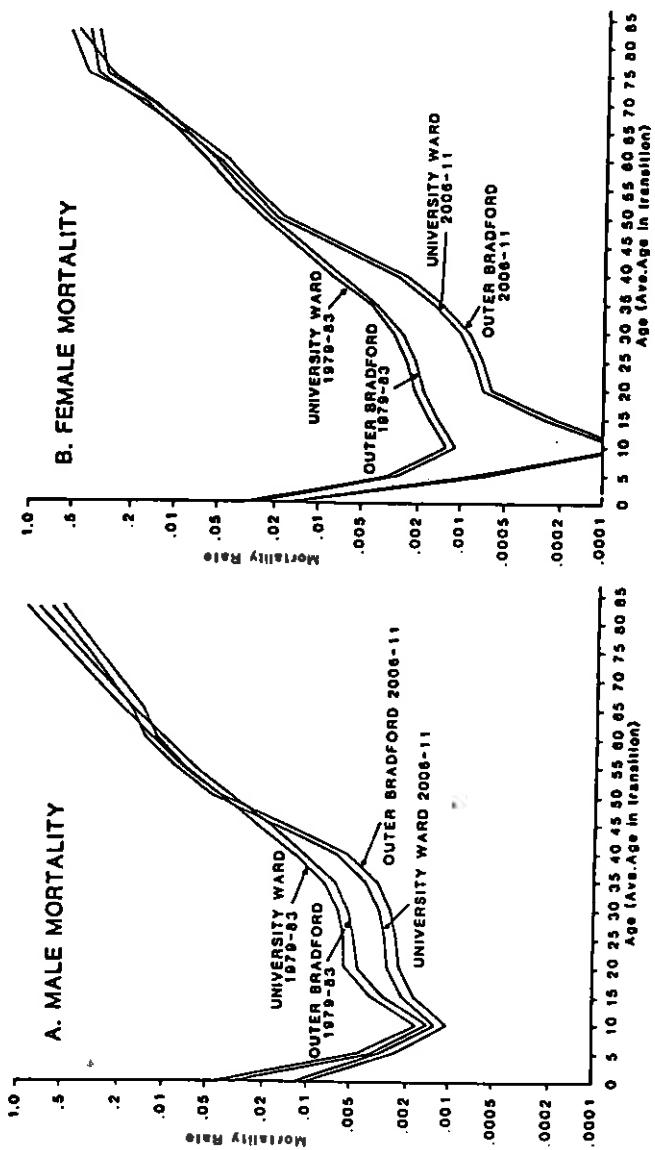


FIGURE 7. Mortality rates for males and females, 1979-83 and 2004-11, for University ward and Outer Bradford

forecasts mean for the least favoured zone (University ward) and the most favoured (Outer Bradford). The relative shifts are greatest for ages 20 to 40 for men, and for ages 10 to 40 for women. The meaning of these mortality trends is probably best appreciated in life expectancy terms (Table A.15). The estimations and projections imply that a life expectancy of 70.6 years for males and 75.4 years for females in University ward in 1979-83 will increase by 2006-11 to 72.7 and 77.4 years respectively, and the equivalent statistics for Outer Bradford will be 72.5 for men and 76.5 for women in 1979-83, and 74.3 for men and 78.2 for women in 2006-11. Even in another quarter of a century of "progress", we are saying life expectancies in a northern industrial city will not have reached those current in Scandinavia or Japan.

4.3 Fertility estimates and assumptions

Because the place of birth of the mother is recorded on the birth certificate, statistics listing the number of births by mother's age at maternity are available for mothers born in India, both nationally (OPCS 1984a, 1984b and 1985) and locally (Table A.16). Conventional total fertility rates (TFRs) can be computed from these statistics using the 1981 census female populations aged 15-44 (Table 7), and these show (Table A.17) that the TFR for Indian women varied between 2.49 and 3.45 with an average of 2.85. These rates are considerably lower than those measured by King (1974) for the Leeds Indian community for 1969-72 (Table A.18), when the average TFR was 4.11, but higher than a simple linear

extrapolation from King's figures. The Immigrant Statistics Unit (1979) forecasts of TFR in 1981 for the NCWP group as a whole were 2.80 (lower) and 3.20 (higher). The national TFRs for Indians (OPCS 1984a, 1984b and 1985) for 1981-83 are slightly higher and show a consistent downward trend (Table A-18).

So, the evidence suggests that Indian fertility levels in Bradford were, in the early 1980s, just below the average for the nation and the average for the NCWP group as a whole, lower than those for the Pakistani and Bangladeshi groups but higher than West Indian and white fertility levels. The pattern of temporal change in TFR since the early 1970s has been one of decline of perhaps one child over the decade, steeper in the early 1970s and shallower in the 1979-83 period.

To convert the conventional births statistics into a form suitable for the calculation of age-specific fertility rates classified by the mother's initial age in the 1979-83 period, the form needed in the projection model, a sequence of deconsolidations and consolidations is carried out. These are set out in Figure 8. Births by mother's age group at maternity for annual periods are divided into figures for the appropriate age transition by applying the geometric coefficients shown in the figure key. Then the disaggregated numbers are summed by mothers' initial age groups. Using these births figures fertility rates are worked out (Table A.19) and used in projection 1. To estimate fertility rates for the four zones used in the projection period, counts of all births

BIRTHS BY
AGE GROUP AT
MATERNITY

	45	44	43	42	41	40	
45	1	1	0	1	1	1	32
44	1	2	1	3	5		
43	9	7	4	3	1		
42	10	10	9	9	10	109	
41	1	3	5	6	9		
40	23	31	18	9	4		
39	26	44	37	29	37	333	
38	3	13	19	20	33		
37	78	83	47	27	10		
36	87	119	94	91	95	612	
35	9	36	47	69	85		
34	136	120	66	36	12		
33	151	172	131	121	116	405	
32	15	52	65	85	104		
31	37	22	18	5	2		
30	40	31	35	18	18	59	
29	4	9	17	13	16		

BIRTHS BY
INITIAL
AGE GROUP

FIGURE 8
Estimation of births to
Indians in Bradford by
age transition, 1979-83

COEFFICIENTS FOR

DECONSOLIDATING BIRTHS

x+5	.9	.7	.5	.3	.1
AGE	.1	.3	.5	.7	.9
x					
T+5					

30	78	83	47	27	10	
AGE	87	119	94	91	96	
25	9	36	47	64	85	

BIRTHS TO MOTHERS AGED 25-29 AT JAN. 1, 1979 AND AGED 25-29 AT MATERNITY

BIRTHS TO MOTHERS AGED 25-29 AT MATERNITY

BIRTHS TO MOTHERS AGED 20-24 AT JAN. 1, 1979 AND AGED 25-29 AT MATERNITY

by Indian mothers recorded by postal district are converted to a ward basis and then aggregated to projection zones. These zonal estimates are then used to adjust the overall fertility rates to yield zonal estimates (Tables A.20 and A.21). These are displayed in Figure 9. Higher than average fertility is observed in University ward (TFR, 3.36), Bradford Moor (TFR, 3.27) and Inner Bradford (TFR, 2.96) with levels in Outer Bradford well below average (TFR, 2.36). Fertility in the rest of Bradford (Table A.20) is very low with a GFR of 42, below that of the whole population of Bradford. This confirms our suspicions that the Indian population of this zone is exaggerated by the census statistics (see Ram 1984 and Rees and Birkin 1984, p.1555-7 for further discussion). These zonal fertility rate schedules are used in projections 2 and 3.

To project these fertility rates into the future the trends for individual annual age specific fertility rates (converted to an initial age group of mother basis) are measured over the 1979-83 period and then extrapolated into the future (Figure 10). Limits are set to each rate using fertility rates for the population of West Yorkshire for 1976-81 (TFR, 1.85). Steep declines in fertility are observed in the youngest age transition (15-19 to 20-24 and 20-24 to 25-29); shallower declines in the older age transitions, as the Indian population shifts its fertility pattern towards the British one. These trends are applied (Table A.22) to the zonal fertilities through to 2006-11. Indian fertility in University ward and Bradford Moor still just exceeds replacement at

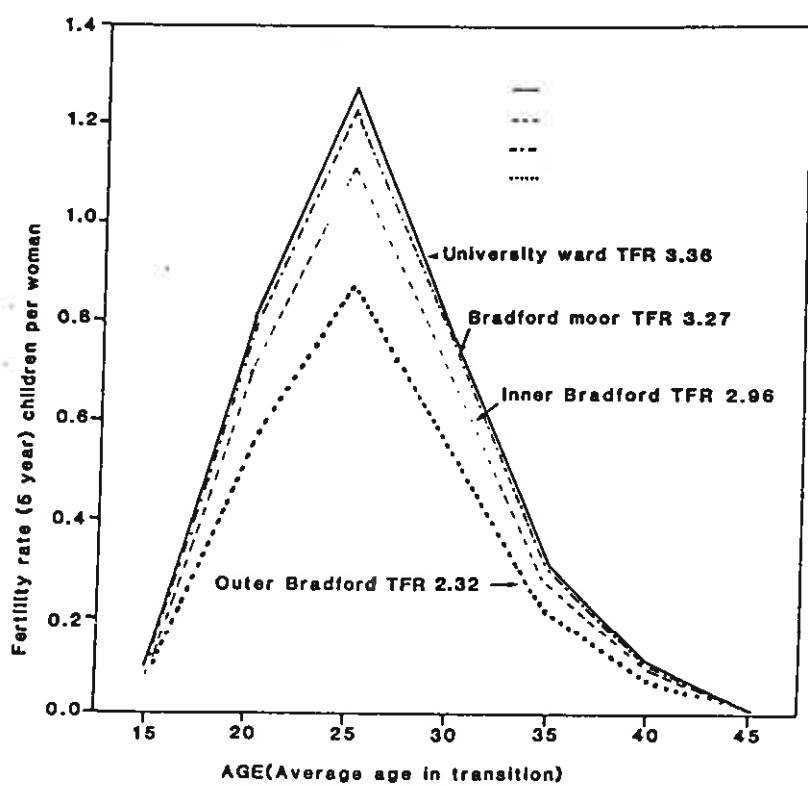


FIGURE 9. Fertility rates for the Indian population of four Bradford zones, 1979-83

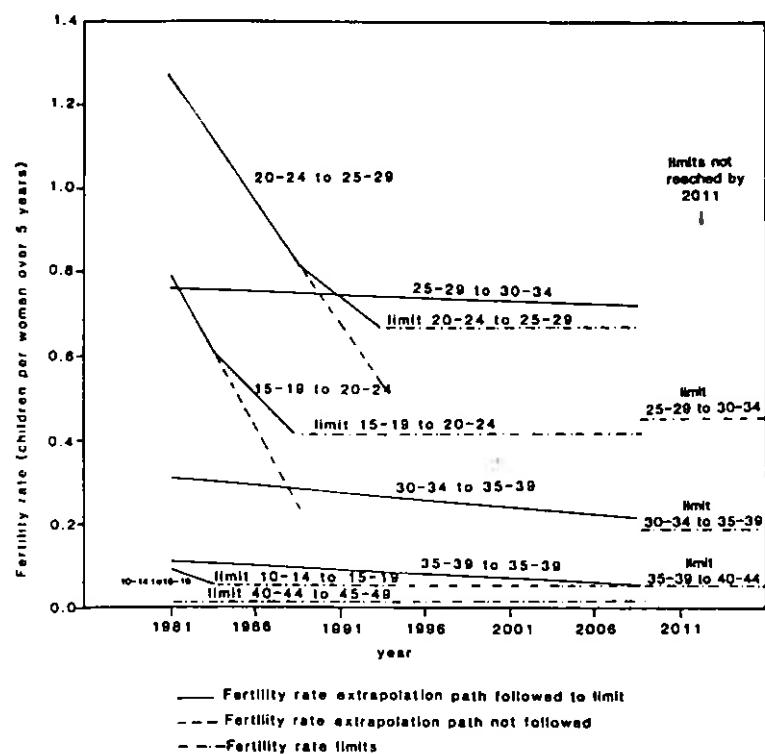


FIGURE 10. The method of extrapolation applied to University ward fertility rates

TFRs of 2.15 and 2.12 respectively, while the TFRs for Inner and Outer Bradford at 2.03 and 1.88 are below replacement, but still just above the West Yorkshire 1976-81 figure. These trended fertility rates are used in projection 4.

4.4 Migration within Bradford

Although tabulations of inter-ward migration from the 1981 Census have recently become available, these are not cross-classified by ethnicity and refer only to the single year prior to the census. In order to gather information on the migration of Indians within Bradford questions on the migration history of households and individuals were included in a sample survey of the community (Ram 1985). From this survey, it was possible to extract tables of migration over 5 years (1976-81) between the 17 wards of inner Bradford (Figure 1). Virtually all the migrations in this matrix can be described by mapping the inflows and outflows from five selected wards (Figure 11).

Bowling, University and Little Horton are wards that lose as a result of migration in the sample households. Bradford Moor and Great Horton are wards that gain migrants on a net basis. The largest flows are out of Bowling ward to Bradford Moor and out of University ward to Great Horton. Both flows are outward from the inner city and involve families seeking to improve their housing situation (Ram 1985, Chapter 8). Both Bradford Moor and Great Horton serve as the preferred destinations of immigrants from

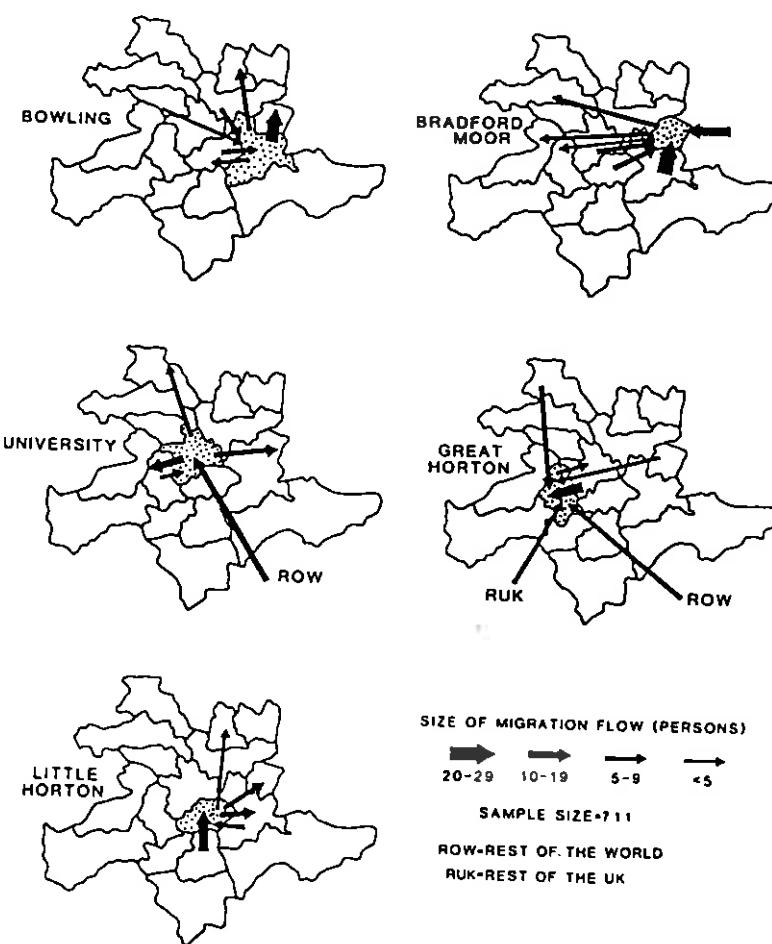


FIGURE 11. Migration by Indians to and from selected wards, 1976-81, from a 1984 survey

either abroad or the rest of the UK, although two households in the sample entered University ward. There are a small number of migrations outwards to other wards - to Bolton, Heaton, Shipley West and Clayton, and one flow inwards from Odsal to Little Horton.

There is a clear association of this migration pattern with housing tenure. All households in the sample bar one were currently owner occupiers and were seeking such property in their moves. The losing wards of Little Horton and Bowling have less than the average proportion of owner occupied dwellings; the gaining wards of Bradford Moor, Great Horton and Bolton have higher than average proportions of owner occupied housing. University ward has an average proportion of owner occupied dwellings but of poorer quality than Great Horton ward to which many Indian families are moving. Outer wards with higher than average proportions of council housing (Tong, Eccleshill, Wyke) are avoided by Indian families, although this is also true of southern wards with higher than average proportions of owner occupied housing (Odsal, Wibsey).

For projection purposes the inter-ward migration matrix from the sample survey was aggregated to a 6 by 4 inter-zone matrix (Table A.23), with 4 origin and destination zones within Bradford and two additional external origin zones, the Rest of the UK and the Rest of the World. Even in this collapsed matrix 7 out of 24 cells are empty. Since the migration rates input to the model (projections 3 and 4) are derived from this sample matrix, caution must be exercised later in our interpretation.

The migration rates computed by dividing the off-diagonal elements of the inter-zone matrix must be firstly, disaggregated by age and sex, and secondly, corrected for survival, that is, converted from migration rates conditional on survival to joint migration and survival rates. The age profile of both male and female migration rates (including in this case all intra- and inter-ward migrants in order to increase the sample size), plotted on Figure 12, matches that observed for UK migrants in general (see Rees 1979) until the older ages are reached when very small sample numbers make the rates vary erratic. Two decisions were made on the basis of these plots: male and female information was pooled, and migration rates beyond age 50 were held constant at an average level for the 50 and over age group. The migration age schedule was turned into ratio form by dividing through by the average migration rate (column 3 in Table A.25 gives the ratios used). Survival rates (column 4 in Table A.25) were worked out from the zonal mortality rates. The migration rates for entry to the projections (3 and 4) were computed thus (Table A.25)

$$\text{migration and } = \frac{\text{migration} \times \text{survival}}{\text{survival rate}} \times \frac{\text{all age rate}}{\text{age ratio}} \times \frac{\text{for age transition}}{\text{of migration given survival}}$$

The intra-zone elements in the migration rates array were entered into the projections as zeroes as they are computed as residuals in the accounting model used (see Rees 1981).

The overall migration rates derived from the sample are given in Table 8. They show strong migration streams from University

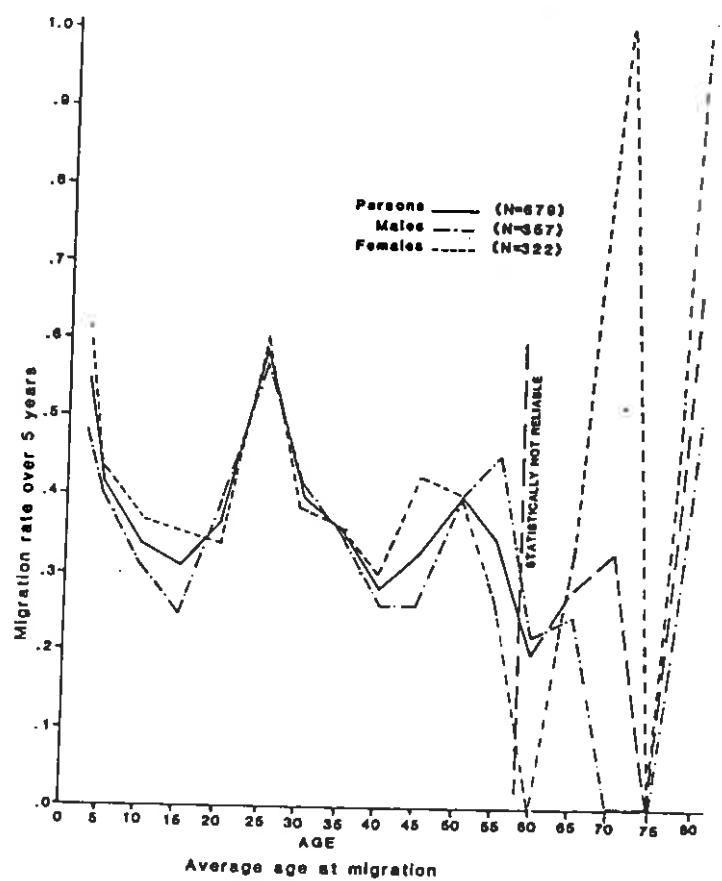


FIGURE 12. Schedule of migration rates by age for Indians in Bradford, 1976-81, from a 1984 survey

TABLE 8. Migration rates (conditional on survival) between zones, Bradford, 1976-81 (1984 survey)

Origin zone 1976	Destination zone 1981			
	University Ward	Bradford Moor	Inner Bradford	Outer Bradford
University ward	-	.0455	.0960	.0202
Bradford Moor	.0000	-	.0336	.0840
Inner Bradford	.0100	.0967	-	.0067
Outer Bradford	.0000	.0000	.2879	-

Source: 1984 survey (Ram 1985): sample size = 711.

ward to Inner Bradford, from Bradford Moor to Outer Bradford, from Inner Bradford to Bradford Moor and from Outer Bradford to Inner Bradford. Migration into University ward is virtually absent. On the basis of this matrix we should expect University ward and Outer Bradford to lose population shares and Bradford Moor and Inner Bradford to gain. No forecasts of these rates are attempted - the sample is too small to yield a time series of migration rates.

4.5 External migration

From a practical point of view it was necessary to estimate not just the two sets of external flows shown in the Figure 3 accounting framework but four sets: flows to and from the rest of the UK as well as flows to and from countries outside the UK. The only firm information is that concerning immigration from overseas by Indians to Bradford (based on Immigration Advice Notices sent to Bradford Area Health Authority, made available by the Policy Unit, Bradford M.D.). This information suggests that 809 immigrants came to Bradford from India in the 1976-81 period (Table A.26A). The reverse flow was estimated by assuming the same ratio of emigration to immigration as recorded in the International Passenger Survey, namely, .243, giving an emigration flow of 197 persons. Migration from the rest of the UK was crudely estimated by applying the survey in-migration rate, .0113, to the 1981 census population of Indians in Bradford M.D. to yield an estimate of 140 in-migrants over 1976-81. In the absence of any other evidence, an equal reverse flow was assumed (Table A.26B).

These four flow totals were disaggregated by age and sex by applying proportions (Table A.26C) derived, in the case of immigration from abroad, from the Health Authority Immigration Advice notes and in the case of migration from the rest of the UK from the 1984 survey (Ram 1985) to give external migration estimates by age and sex for the whole of Bradford (Table A.27). These estimates had then to be allocated to zones on the following basis: immigration from abroad and in-migration from the rest of the UK were allocated according to the distribution of these two inflows across zones observed in the survey. Emigration overseas and out-migration to the rest of the UK were combined and allocated to zones on the basis of the distribution of intra-Bradford out-migrants from each zone observed in the sample survey. Finally, the estimates were adjusted from an age group in 1981 basis to an age transition basis (Table A.28).

The estimated totals for external migration are shown in Table 9. The positive balance into University ward will compensate in part for losses due to intra-Bradford migration. Outer Bradford exhibits net losses (to the next ring of suburbs perhaps). Bradford Moor gains strongly and Inner Bradford moderately from both immigration and internal migration from the rest of the UK.

In other demographic forecasts (discussed in section 2.1), the authors usually trended net immigration to zero in their projections. This we have not as yet done. Trends for migration

TABLE 9. External migration flows to zones, Bradford, 1976-81

Sex and migration stream	Destination or origin zone						Annual equiv.
	University ward	Bradford Moor	Inner Bradford	Outer Bradford	Total		
Male							
In-migration	86	172	156	0	414	83	
Out-migration	60	26	64	35	185	37	
Female							
In-migration	116	233	186	0	535	107	
Out-migration	49	22	52	29	152	30	
Persons							
In-migration	202	405	342	0	949	190	
Out-migration	55	48	116	64	337	67	
Net-migration	+147	+357	+226	-64	+612	+123	

from India to Bradford have been variable, numbers having risen to a peak in the mid-1970's before falling back to 1973 levels by 1983 (Policy Unit, Bradford, 1983). Table 9 indicates that the Bradford Indian population gains about 123 persons per year through external migration, so that our projections will perhaps add 3,690 more to the population (not allowing for increased emigration and the natural increase accruing to immigrants) over the 30 year projection time horizon than would a conventional assumption. However, because we carry out a natural increase only projection, we will, in effect, have placed a lower bound on the growth of the population.

5. RESULTS OF THE PROJECTIONS

The data, the estimation of which was described in the previous section (and details of which are laid out in Tables A.3 to A.28), were entered into four computer files (under the generic name INDEMO) and four projections were carried out using the ABM transition accounts program (Rees 1981) on the University of Leeds Amdahl 580 computer. For each projection it is possible to request detailed demographic accounts for each period showing all of the components listed in Figure 3 (a summary of which is given for the base period in Table A.29). However, for present purposes discussion of the results will focus on the projected populations alone.

5.1 Projected zonal numbers and shares

The distribution of Indians across the four model zones in 1981 and 2011 is shown for each of the four projections in Figure 13 (and the detailed figures are given in Table A.30). Figure 14 plots the time path of population for each zone on the four projections. In 1981 the Indian population of 11.8 thousand was split between the zones as follows: 25% lived in University ward, 19% in Bradford Moor, 40% in Inner Bradford and 15% in Outer Bradford. Under spatially and temporally constant natural increase (projection 1), the Indian population grows to 20.5 thousand by 2011 distributed, because of the constancy assumption, in exactly

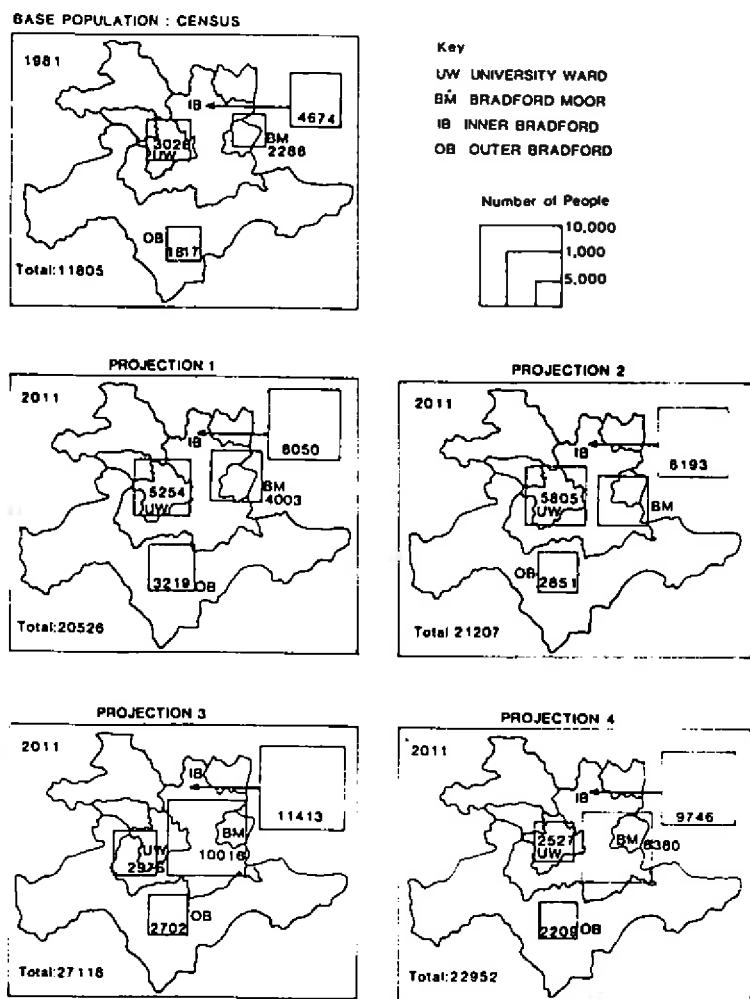


FIGURE 13. Observed and projected distributions of Indians by zone in Bradford, 1981 and 2011

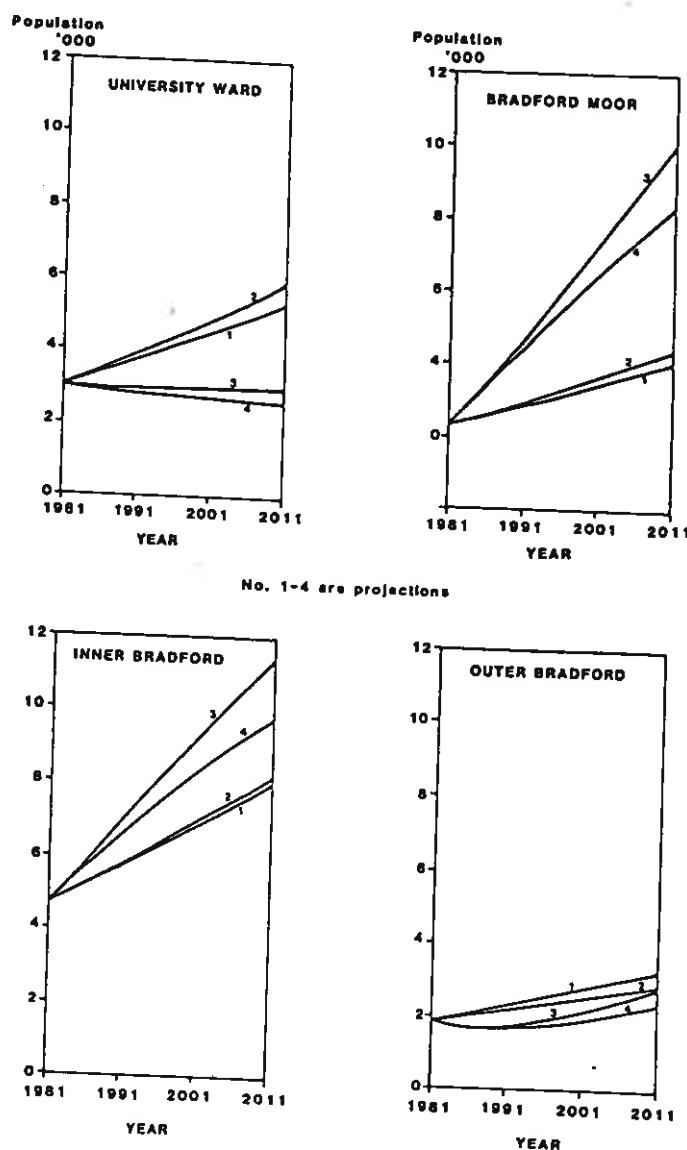


FIGURE 14. Projected numbers of Indians, Bradford zones, 1981-2011

the same fashion as in 1981. Introducing spatial variation in fertility and mortality rates raises the projected population to 21.2 thousand (projection 2). The two higher fertility zones gain more than they lose through being also zones of higher mortality. In 2011 University Ward's share of the Indian population has risen to 27% and that of Bradford Moor to 21%.

If migration is then added to the projection process (projection 3), two effects occur. Firstly, there is a net overall gain due to migration from outside Bradford. Secondly, redistribution of the population within Bradford occurs. The net overall gain from external sources is due principally to immigration from overseas, since we have assumed that initially migration to and from the rest of the UK was in balance and out-migration to the rest of UK grows in line with the population while the corresponding inflows are fixed. Earlier net in-migration from abroad over the 30 years of the projection was estimated at 3.7 thousand persons. The gain registered in projection 3 compared with projection 2 is, however, 5.9 thousand, the additional 2.2 thousand representing the retained natural increase attributable to the net surplus of immigrants. So, under the assumptions of projection 3, the Indian population of Bradford grows to 27.1 thousand.

The second effect of adding migration to the projection is redistribution of the population within Bradford. The main loser is University ward which sees a small absolute loss in population

comparing 1981 with 2011 and a massive loss in share. From housing just over a quarter of the Indian community in 1981 it is projected to house only 11% in 2011 if present intra-Bradford migration patterns persist. The ward will have, in effect, decanted most of its natural increase southwestwards into the neighbouring ward of Great Horton (see Figure 11).

Bradford Moor will have, by contrast, gained massively through external and internal migration in both population and share. By 2011 its Indian population will have more than quadrupled to 10 thousand on present migration and natural increase levels and patterns, and its share will have almost doubled, although it is difficult to believe in a scenario that takes the Indian community to a 60% majority in the Bradford Moor population by 2011. Migration more than doubles Bradford Moor's population share while halving that of University ward.

Inner Bradford, under projection 3, shows a gain of nearly one and a half times its 1981 population by 2011, the gains being the result of a slight balance of in-migration (to Bolton, Great Horton and Heaton wards) over out-migration (from Bowling and Little Horton) together with a larger net immigration from abroad and the rest of the UK. Its share of the Bradford Indian population increases from 40 to 42%.

The effect of introducing migration into the projection on Outer Bradford, which receives no external migrant, is rather

small: the projected 2011 population is 149 less than in projection 2.

The forecast numbers in projection 3 are undoubtedly too high, for two reasons. The first is that the balance of external migration is likely to trend to zero over the next decade and the second is that fertility rates are likely to continue to diminish to replacement level and beyond. The second trend is built into projection 4, which predicts an Indian population of 23 thousand by 2011 rather than the 27 thousand of projection 3. From the former forecast we can probably subtract about half the total "effect" of migration (the difference between projection 2's total and projection 3's) or about 3 thousand to give an estimate of approximately 20 thousand for the Indian population in 2011 (though this will have to be confirmed in a fifth projection). Trending of natural increase, with the reduction in fertility rates dominant, affects the zones equally so that the zonal shares of the total population are roughly the same in projection 4 as they were in projection 3 with University ward and Outer Bradford housing 11% and 10% respectively while Bradford Moor holds 36.5% and Inner Bradford 42.5%.

Careful inspection of Figure 14 reveals some interesting characteristics of the population trajectories under each of the projections. Projections 1. and 2 show monotonic increase which rise in absolute extent with time - typical exponential curves in other words. The curves for both projections 3 and 4 for Outer

Bradford and for projection 3 for University ward show first decreases and then increases. Such curves are typical of multiregional systems evolving under fixed regimes of migration rates. What happens is that when the projections start the schedule of inter-zone migration rates multiplied by the base or second interval population results in losses to these zones, but later as the other zones increase in population so do the outflows from them under fixed rate conditions so reducing the losses due to migration in the less favoured zones.

5.2 Projected sex and age structures

One of the main purposes of carrying out a demographic forecast rather than a spatial simulation is to gather information about the sex and age structure of the ethnic population being studied (the full set of results is given in Table A.31 to A.34).

In 1981 the Indian population of Bradford is still male biased (52.3% male, 47.7% female) though there is relatively little interzonal variation. In the natural increase projections it takes a long time for this bias to shift even in 2011 the female population is still in a minority (49.3 or 49.4%). With the introduction of migration to the forecast, and in particular because of the female surplus in immigration (Table A.27) from India, the female population moves into a majority by 1996 and makes up 50.9% of Indian population in 2011. Improving life

expectancy and reducing birth levels (in which there is a natural male surplus) raises the female proportion in the population to 51.3%, and female surpluses (of widows) are beginning to appear in the elderly in the 21st century under the assumptions of projection 4.

The age-sex structures of the zonal populations achieved in 2011 under the four projections are shown in Figure 15, along with the population pyramid for 1981, which shows the same relative structure for all zones (because of the method used to estimate zonal base populations - see section 4.1 and Figure 5). In all zones the pyramids based on natural increase are simply the 1981 distribution shifted on 30 years and reduced by mortality, with the addition, below 30 years of age, of new cohorts at either uniform rates (projection 1) or zonally sensitive rates (projection 2). The migration based projections, as well as changing the total size of each zonal pyramid, also subtly affect its shape over and above the natural increase effects. However, the biggest change is that between projection 3 and 4 at younger ages, a product of reducing fertility levels progressively over the projection horizon in the latter projection. Thus, Bradford Moor's pyramid under projection 3 resembles that of a developing country, while under projection 4 the pyramid has adopted a shape more typical of a developed country that has recently undergone the demographic transition. Such a transition is, in effect, being forecast in projection 4, and Bradford's school authorities will be relieved, for example, to know that 26 less classrooms will be needed for Indian pupils aged

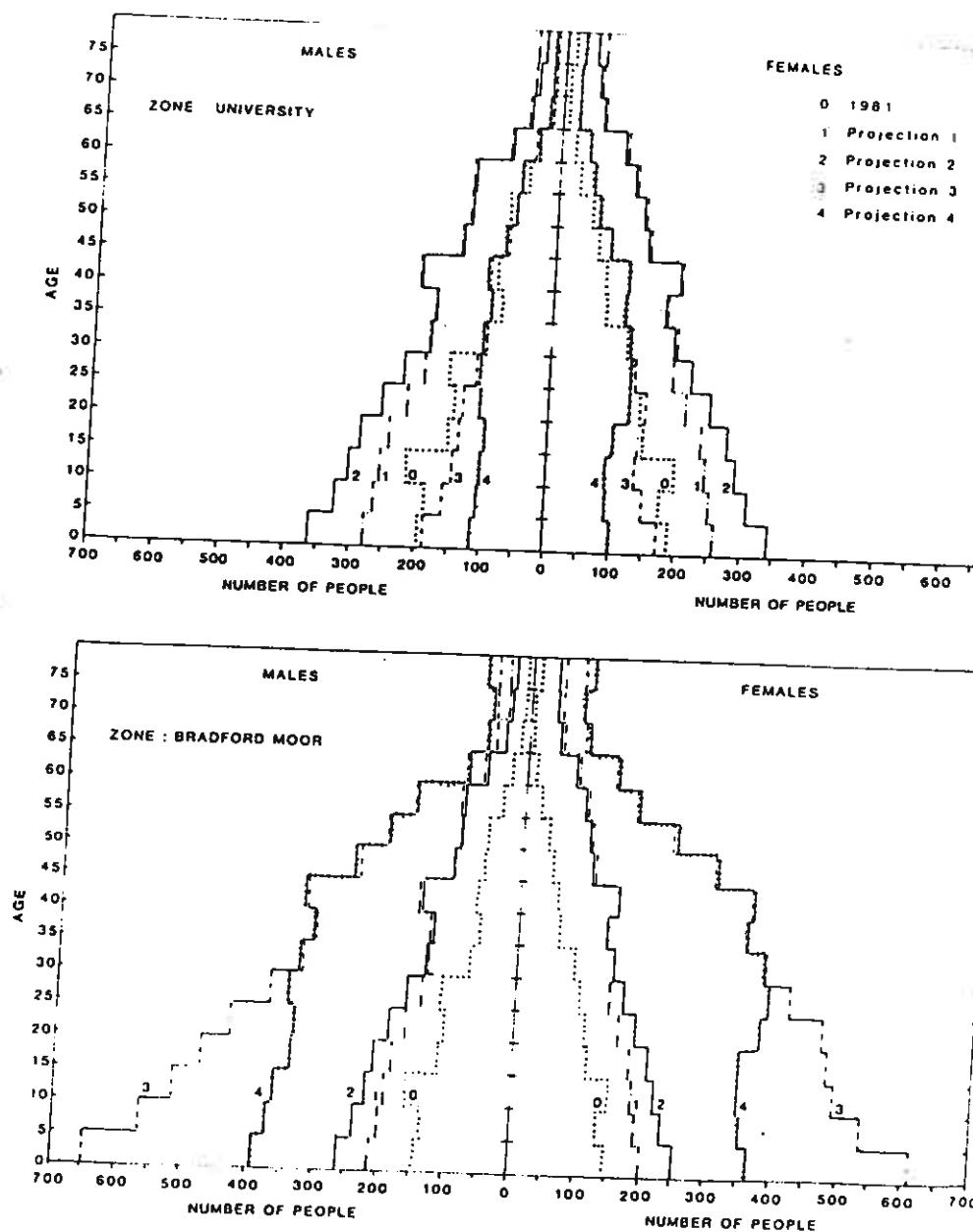


FIGURE 15. Projected detailed age-sex structures of the Indian population, Bradford zones, 1981 and 2011

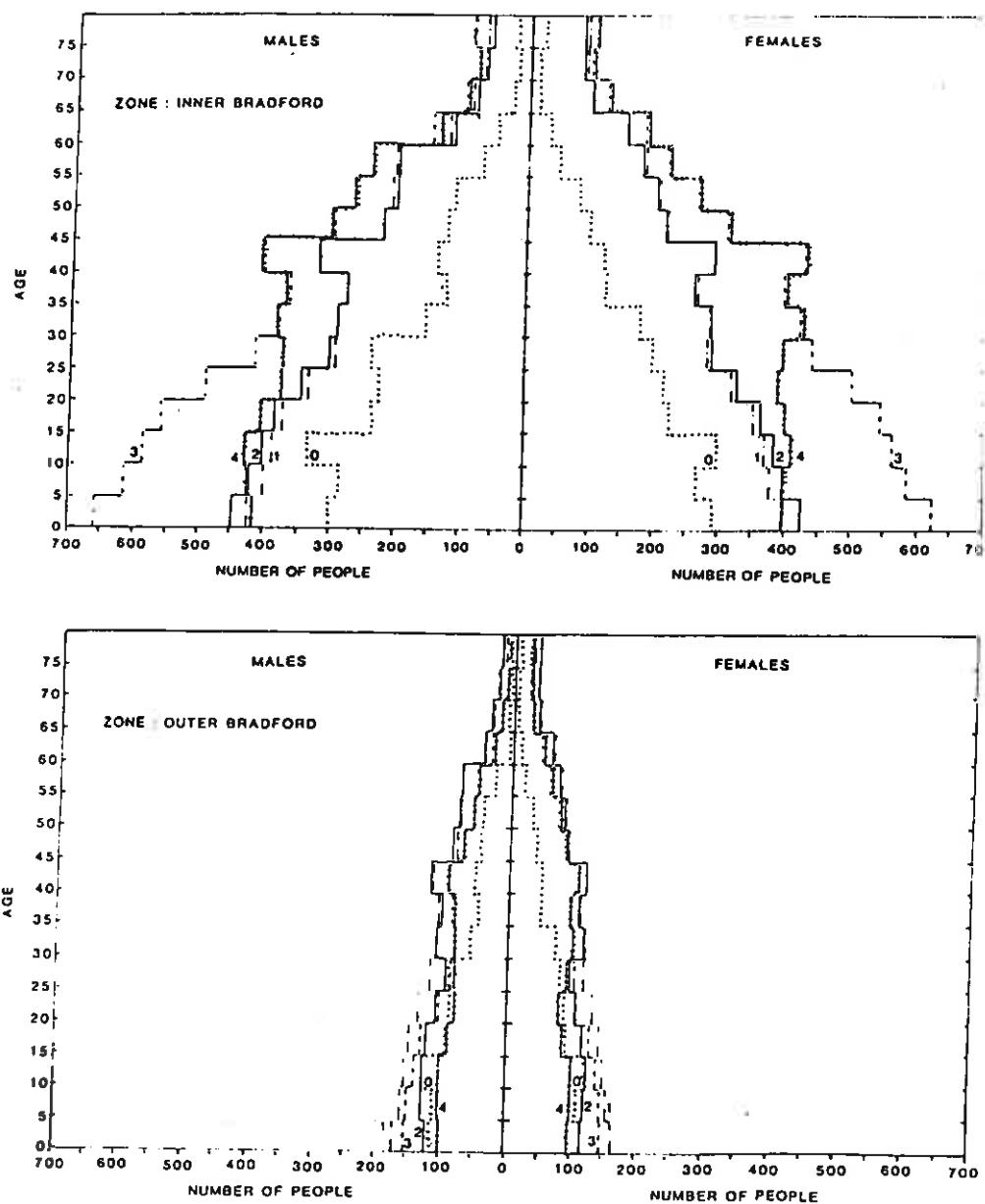


FIGURE 15. Continued

5-14 in Bradford Moor alone by 2011.

The dependency burden implied by these projected age structures is deduced by summarizing the populations by broad age groups (Table A.36 and Figure 16). The broad age groups chosen - up to 20 years of age, 20-59 and 60 and over - are meant to reflect the lengthening periods of both education and retirement in British society. All projections show an improvement in all zones in the ratio of those of working age to those not, with the most realistic projection (4) seeing the percentage in the working ages rising to 57% compared with 48% in 1981. However, there is a redistribution within the dependent ages with the elderly posting great relative gains from 4% of the Indian population to 9% by 2011, although this latter figure is still well short of the percentage for the whole population.

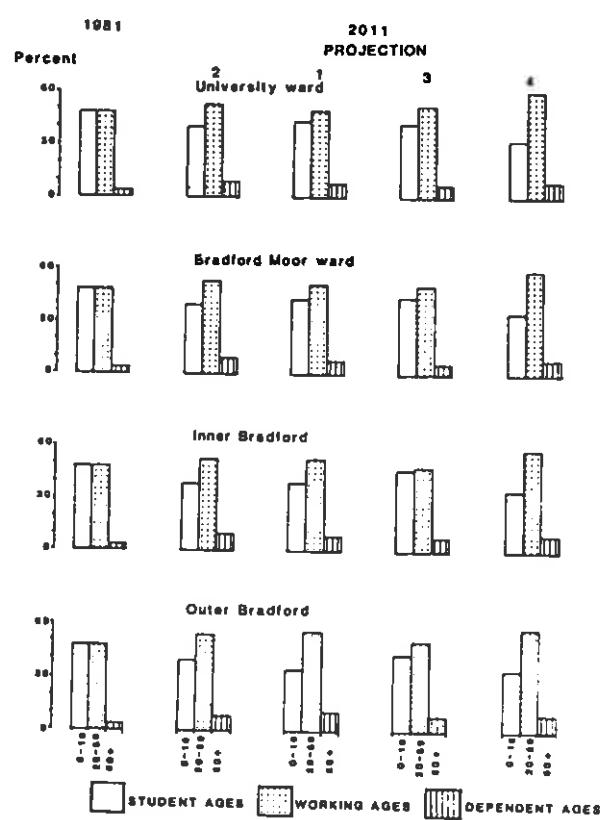


FIGURE 16. The broad age structure of the Indian population, Bradford zones, 1981 and 2011

6. EVALUATION OF THE PROJECTIONS

The results of any projection of an ethnic population need to be evaluated carefully in several ways. We need to assess the likelihood of the projections turning out to be true; we need to assess what they reveal about the context of residential choice and constraint within which they are set; and we need to evaluate our model in comparison with the alternatives reviewed earlier (section 2).

Of the four projections carried out, it is clear from the discussion in the previous section that the fourth projection, involving migration and trended natural increase, was the most likely. However, the observation was also made that the population levels would probably be reduced by a further 13% if a fifth projection that trended externally migration downwards were carried out. The true pattern of migration within Bradford is also likely to differ from the projected on both because the real migration pattern will be smoother than the one estimated on the basis of a sample and because housing limits will operate to displace migration from one area to another. Just as University ward is exporting Indian families to Great Horton currently, so is it likely that out-migration from Bradford Moor will rise as it fills up with Indian families. Thus, there is likely to be migration to the northern wards of the study area from Bradford Moor and perhaps from Bradford Moor into Pudsey North ward in Leeds where access to

community facilities and family and friends would still be easy.

In the introduction to the paper the 1981 and 1971 distributions of Indian electors were compared and clear evidence of deconcentration with respect to the rest of the population was established. The same analysis can be carried out for the 2011 distribution if we assume that the ward total populations remain the same. Table 10 gives the indices of residential segregation for each of the projections on this assumption. In each case the Indian population becomes more residentially separate from the rest of the population. When natural increase is added to each zonal population "in situ" in projections 1 and 2, slight increases of 1.0 and 3.6 points in the index of dissimilarity occur because, under our assumption of population limits in each ward, the non-Indian population is displaced. When migration is added to the analysis in projections 3 and 4, the indices increase by 8.4 and 7.6 points respectively. The main contribution to increased residential dissimilarity is the increase in Bradford Moor's share of the Indian population balanced in part by University ward's decreased share. In so far as our projections overestimate the gains in Bradford Moor then the level of residential segregation will be lower.

Does this evidence of increasing concentration point to a diminution of choice for Indian families or the operation of constraints (discrimination) in the housing market? Although subjective questions about discrimination were not included in the

TABLE 10. Indices of residential dissimilarity, Indians, 1981 and 2011, projections 1 to 4

Source	Details	Areas	IOD
Census, 1981	Est. from place of birth tables	17 wards	40.2
Census, 1981	Est. from place of birth tables	4 zones	38.1
Projection 1	Natural increase only, spatially constant	4 zones	39.1
Projection 2	Natural increase only, spatially variable	4 zones	41.7
Projection 3	Migration included, natural increase constant over time	4 zones	46.5
Projection 4	Migration included, natural increase trended over time	4 zones	45.7

Notes

1. IOD = index of dissimilarity between Indians and the rest of the population. The distribution of the rest of the population is estimated by subtracting Indians from the total population assumed to be fixed for each zone over time.

sample survey (Ram 1985), the objective picture of migration (see Figure 11) suggests that Indians move freely between two thirds of the wards of inner Bradford and the avoidance of southern wards is a result of their distance from the immigrant cores and the presence of undesired council housing. However, Indian families are found in all wards (Figure 2B), and also in most of the ards of the rest of Bradford M.D., albeit in small numbers. The main motives for moving reported by Indian households were the classic factors of inadequate space in the "old" house and more and better space in the "new" home (Ram 1985, Chapter 8). That is not to deny that living in a community of relatives, friends and cultural institutions was important to Indian families, but rather to say that such a life could be achieved in a fairly wide geographical spread across Bradford.

Finally, how do our projections and the model underpinning them stand in relation to the lessons extracted from the review of previous attempts at modelling ethnic populations? Certainly there are features of the spatial simulation models (point iv in section 2.4) which might have been incorporated in our model, and the empirical data (such as move distances, housing types and tenures, socioeconomic attributes of the migrants) are available from the survey (Ram 1985). Certainly, the four zone system did not capture the full richness of the distribution or migration patterns of the population under study. However, expansion of the demographic projection methodology to incorporate these features was not a feasible strategy because of the small number problem. Two other

possible strategies suggest themselves for future work. The first would be to marry the spatial simulation approaches of previous authors with the more ambitious microsimulation methods developed by Clarke (1985) and others. This would involve simulating the characteristics and spatial behaviour of the whole of the Indian population in Bradford. The second approach might be to couple a more detailed spatial projection for an aggregate population with an age-sex disaggregated projection for individual zones following suggestions made by Rogers (1976).

The present model and projections did not attempt to tackle the point (point v in section 2.4) that all ethnic groups be modelled simultaneously. The focus of this paper has been one ethnic community and to have met this critique would have required another major research effort.

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APPENDIX: DETAILED TABLES OF STATISTICS

TABLE A.1 Estimation of the Indian population of inner Bradford wards, 1971-81

Ward name	Census		Change 1971-81 3	Register		Change 1971-81 6
	1971 1	1981 2		1971 4	1981 5	
Bolton	22	241	219	7	236	229
Bowling	685	521	-164	447	455	8
Bradford Moor	992	1175	183	751	1254	503
Clayton	8	59	51	0	46	46
Eccleshill	25	51	26	2	34	32
Great Horton	48	422	374	22	549	527
Heaton	215	276	61	101	163	62
Little Horton	761	608	-153	494	611	117
Odsal	108	241	133	64	165	101
Queensbury	10	45	35	0	27	27
Shipley West	94	137	43	54	93	39
Toller	24	44	20	4	49	45
Undercliffe	368	258	-110	198	232	34
University	2114	1554	-560	1428	1792	364
Wibsey	16	46	30	0	44	44
Wyke	12	42	30	0	35	35
Total	5917	6070	153	3791	6082	2291
Bradford M.D.	6136	6379	243	-	6181	-

Sources:

1. All persons born in India. Census 1971 (from Ram 1984, p.15).
2. All persons born in India. Census 1981 (from Ram 1984, p.15).
3. Change in persons born in India: from columns 1 and 2.
4. Electors with Indian names. 1971 Electoral Register (from Ram 1984, p.62).
5. Electors with Indian names. 1981 Electoral Register (from Ram 1984, p.62).
6. Change in the number of electors (from columns 4 and 5).

TABLE A.2 Ethnic composition of selected wards in Bradford, 1981

Ward name	Est.	Rest of	Rest of	Total	% of ward population		
	Indians 1981	NCWP 1981	popn. 1981	popn. 1981	Indian 5	Rest of NCWP 6	Rest of popn. 7
	1	2	3	4	5	6	7
Bolton	470	394	12,067	12,931	3.6	3.0	93.3
Bowling	1,015	2,491	14,299	17,803	5.7	14.0	80.3
Bradford							
Moor	2,289	3,916	10,229	16,434	13.9	23.8	62.2
Clayton	115	235	13,908	14,258	0.8	1.6	97.5
Eccleshill	99	203	14,902	15,204	0.7	1.3	98.0
Great							
Horton	822	972	13,059	14,853	5.5	6.5	87.9
Heaton	538	2,708	12,862	16,108	3.3	16.8	79.8
Little							
Horton	1,185	3,887	12,980	18,052	6.6	21.5	71.9
Odsal	470	811	15,212	16,493	2.8	4.9	92.2
Queensbury	88	111	15,037	15,236	0.6	0.7	98.7
Shipley							
West	267	871	14,275	15,413	1.7	5.7	92.5
Toller	682	4,220	10,756	15,658	4.4	27.0	68.7
Tong	86	341	15,568	15,995	0.5	2.1	97.3
Under-							
cliffe	503	2,166	12,219	14,888	3.4	14.5	82.1
University	3,018	9,820	6,153	19,001	15.9	51.7	32.4
Wibsey	90	166	13,923	14,179	0.6	1.2	98.2
Wyke	82	140	16,070	16,292	0.5	0.9	98.6
Total	11,829	33,452	223,517	268,798	4.4	12.4	83.2
Remainder							
of M.D.	601	4,543	175,942	181,086	0.3	2.5	97.2
Bradford							
M.D.	12,430	37,995	399,459	449,884	2.8	8.4	88.8

Notes

1. The population estimates are based on Census 1981 place of birth and head of household birthplace tables (Small Area Statistics).

TABLE A.3 Estimates of the Indian population of model zones
using place of birth of individual and place of
birth of head of household statistics.

Zone	Ward	Persons born in India ^a		Estimated Indian populat	
		Males	Females	Males	1981 Females
1.	University	812	742	1582	1446 ..
2.	Bradford Moor	607	568	1183	1107
3. Inner Bradford	Bolton	119	122	232	238
	Bowling	291	230	567	448
	Great Horton	215	207	419	403
	Little Horton	327	281	637	547
	Toller	182	168	355	327
	Undercliffe	134	124	261	242
		<u>1268</u>	<u>1132</u>	<u>2470</u>	<u>2205</u>
4. Outer Bradford	Clayton	31	28	60	55
	Eccleshill	28	23	55	45
	Heaton	140	136	273	265
	Odsal	126	115	245	224
	Queensbury	25	20	49	39
	Shipley W.	69	68	134	132
	Tong	21	23	41	45
	Wibsey	20	26	39	51
	Wyke	25	17	49	33
		<u>485</u>	<u>456</u>	<u>945</u>	<u>888</u>
5 Periphery	Baildon	9	13	18	25
	Bingley	9	9	18	18
	Bingley Rural	9	12	18	23
	Craven	11	8	21	16
	Idle	7	15	14	29
	Ilkley	14	15	27	29
	Keighley N.	14	15	27	29
	Keighley S	7	10	14	19
	Keighley W	22	18	43	35
	Rombalds	15	18	29	35
	Shipley E.	17	15	33	29
	Thornton	13	8	25	16
	Worth Valley	4	2	8	4
		<u>151</u>	<u>158</u>	<u>294</u>	<u>308</u>

Sources. a. From the Small Area Statistics Table 4 Census 1981.

b. The numbers of persons born in India was multiplied by the ratio of persons living in households with the head born in India to persons born in India. This ratio for Bradford M.D. was $12,428/6,379 = 1.948268$

TABLE A.4 Members of households whose heads were born
in India by age and sex - Bradford M.D., 1981

Age group	Males		Females	
	Numbers	%	Numbers	%
0-4	770	12.20	805	13.16
5-9	738	11.70	731	11.95
10-14	859	13.61	822	13.44
15-19	608	9.64	614	10.04
20-24	582	9.24	593	9.69
25-29	610	9.67	546	8.92
30-34	397	6.29	486	7.94
35-39	320	5.07	339	5.54
40-44	356	5.64	334	5.46
45-49	317	5.02	270	4.41
50-54	287	4.55	222	3.63
55-59	181	2.87	133	2.17
60-64	123	1.95	92	1.50
65 +	162	2.57	131	2.14
Total	6,310	100.0	6,118	100.0

Source: Derived from unpublished OPCS Table DT 1833, Census 1981,
made available through the good offices of Roger Ballard,
Department of Social Policy, University of Leeds.

TABLE A.5 Deaths in Bradford M.D. by sex by age by year.

Age group (years)	1979		1980		1981		1982		1983	
	M	F	M	F	M	F	M	F	M	F
0 - 4	70	42	81	60	66	49	63	56	63	47
5 - 14	9	10	11	13	14	5	9	4	10	6
15 - 24	26	10	42	17	41	13	36	16	21	10
25 - 34	38	16	28	19	36	19	31	12	38	17
35 - 44	64	36	62	29	42	32	41	49	59	31
45 - 54	185	124	192	114	180	114	165	107	147	96
55 - 64	498	289	489	267	455	257	533	279	498	259
65 - 74	976	720	871	674	882	614	901	639	819	619
75 +	1048	1830	1046	1788	1032	1874	1072	1959	1009	1871
Total	2914	3097	2822	2981	2748	2977	2851	3121	2664	2956

Notes

M = Male F = Female

Source: Calculated from the statistics provided by the Policy Unit, Bradford
Metropolitan District, Bradford.

TABLE A.6 Estimated deaths in Bradford M.D. by five year age groups, 1979 - 83.

Age group	Population in Bradford		Estimated deaths over 5 years		Adjusted deaths over 5 years	
	Males	Females	Males	Females	Males	Females
0 - 4	17,093	15,986	264	187	343	274
5 - 9	17,109	15,980	23	15	24	17
10 - 14	19,564	18,130	28	18	29	21
15 - 19	19,426	18,296	80	29	87	32
20 - 24	17,357	17,349	72	30	79	34
25 - 29	16,304	15,423	68	33	79	34
30 - 34	16,682	16,183	78	48	91	49
35 - 39	12,462	12,457	83	43	96	65
40 - 44	12,438	12,233	149	75	172	112
45 - 49	12,352	12,279	267	135	304	196
50 - 54	12,590	12,760	495	248	564	359
55 - 59	13,290	13,558	925	514	1110	594
60 - 64	10,256	11,329	1,136	654	1363	756
65 - 69	9,373	11,784	1,680	1,083	1974	1272
70 - 74	7,270	10,970	2,107	1,674	2475	1983
75 +	7,537	18,378	4,569	8,240	5207	9322

Notes

1. Estimated deaths = population in Bradford x England & Wales mortality rates.
2. Adjusted deaths = estimated deaths x adjustment factor for ten year age group.

Sources

1. England & Wales mortality rates: Table A.8
2. Adjustment factors: Table A.7

TABLE A.7 Adjustment factors for estimated deaths in Bradford by ten-year age groups, 1979-83.

Age group	Estimated deaths (Aggregated)		Observed deaths		Adjustment factors	
	Males	Females	Males	Females	Males	Females
0 - 4	264	187	343	274	1.299242	1.465247
5 - 14	51	33	53	38	1.039216	1.151515
15 - 24	152	59	166	66	1.092105	1.118644
25 - 34	146	81	171	83	1.171233	1.024691
35 - 44	232	118	268	177	1.155172	1.500000
45 - 54	762	383	869	555	1.140420	1.449086
55 - 64	2061	1168	2473	1351	1.199903	1.156678
65 - 74	3787	2757	4449	3266	1.174809	1.184621
75 +	4569	8240	5207	9322	1.139637	1.131310

Notes

1. Estimated deaths are aggregated from those in Table A.6
2. Adjustment factor = Observed deaths/Estimated deaths.

TABLE A.8 Mortality rates for England and Wales, 1981

Age group	DEATHS		Total population (1000)		Mortality rates	
	Males	Females	Males	Females	Males	Females
0 - 4	4770	3431	1,542.0	1463.5	3.093	2.344
5 - 9	447	302	1,642.0	1554.3	0.272	0.194
10 - 14	573	368	1,996.6	1892.1	0.287	0.194
15 - 19	1739	650	2,114.4	2015.4	0.820	0.322
20 - 24	1576	642	1,896.4	1847.3	0.831	0.347
25 - 29	1427	718	1,700.1	1671.4	0.839	0.430
30 - 34	1754	1103	1,869.0	1845.8	0.938	0.597
35 - 39	2143	1090	1,605.9	1579.4	1.334	0.690
40 - 44	3392	1716	1,418.0	1392.7	2.392	1.232
45 - 49	5920	2979	1,370.0	1352.7	4.321	2.202
50 - 54	10969	5507	1,393.8	1415.2	7.870	3.891
55 - 59	19688	11268	1,414.5	1486.8	13.919	7.580
60 - 64	27170	15943	1,226.8	1379.9	22.147	11.553
65 - 69	40298	25100	1,124.4	1365.5	35.840	18.381
70 - 74	51891	37662	895.4	1233.8	57.953	30.525
75 +	115270	177426	950.8	1978.4	121.235	89.682

Sources

1. Deaths: OPCS (1984a)
2. Population: Mid-year estimate from REF.PP1 84/3, OPCS (1984b)
3. Mortality
rates = (death/population) X 1000

TABLE A.9 Deconsolidation by age transition of estimated deaths in Bradford M.D., 1979-83.

Age group a	Males			Females			Total * a
	Younger Transition a - 1 a	Older Transition a a	Total * a	Younger Transition a - 1 a	Older Transition a a	Total * a	
0 - 4	293	50	343	242	32	274	
5 - 9	12	12	24	8	9	17	
10 - 14	14	15	29	10	11	21	
15 - 19	43	44	87	16	16	32	
20 - 24	39	40	79	17	17	34	
25 - 29	39	40	79	17	17	34	
30 - 34	45	46	91	24	25	49	
35 - 39	48	48	96	32	33	65	
40 - 44	86	86	172	56	56	112	
45 - 49	152	152	304	98	98	196	
50 - 54	282	282	564	179	180	359	
55 - 59	555	555	1110	297	297	594	
60 - 64	681	682	1363	378	378	756	
65 - 69	987	987	1974	636	636	1272	
70 - 74	1237	1238	2475	992	991	1983	
75 +	1151	4056	5207	2591	6731	9322	

Source: Total figures from the last column of Table A.6

TABLE A.10 Aggregation of the deconsolidated deaths by cohort, Bradford M.D. 1979-81.

Age group a	Males				Females			
	Younger Transition		Older Transition		Younger Transition		Older Transition	
	a	a	a	a+1	a	a	a	a+1
Birth	-	293	293	-	-	242	242	-
0 - 4	50	12	62	32	8	44	44	
5 - 9	12	14	26	9	10	19	19	
10 - 14	15	43	58	11	16	27	27	
15 - 19	44	39	83	16	17	33	33	
20 - 24	40	39	79	17	17	34	34	
25 - 29	40	45	85	17	24	41	41	
30 - 34	46	48	94	25	32	57	57	
35 - 39	48	86	134	33	56	89	89	
40 - 44	86	152	238	56	98	154	154	
45 - 49	152	282	434	98	179	277	277	
50 - 54	282	555	837	180	297	477	477	
55 - 59	555	681	1236	297	387	675	675	
60 - 64	682	987	1669	378	636	1014	1014	
65 - 69	987	1237	2224	636	992	1628	1628	
70 - 74	1238	1151	2389	991	2591	3582	3582	
75 +	4056	-	4056	6731	-	6731	6731	

TABLE A.11 Estimated mortality rates for Bradford N.D. by sex by age.

Cohort Initial age	Final age	Deaths	Males Population at risk	Mortality rates	Females Population at risk	Mortality rates
Birth	0 - 4	293	19997*	.015343	242	.017884*
0 - 4	5 - 9	62	17701	.003626	44	.005983
5 - 9	10 - 14	26	18337	.001418	19	.001114
10 - 14	15 - 19	58	19955	.002975	27	.001482
15 - 19	20 - 24	83	18591	.004513	53	.001852
20 - 24	25 - 29	79	16831	.004694	34	.002075
25 - 29	30 - 34	85	16493	.005154	41	.002594
30 - 34	35 - 39	94	14572	.006451	57	.003380
35 - 39	40 - 44	134	12450	.010763	89	.007209
40 - 44	45 - 49	238	12395	.019201	154	.012565
45 - 49	50 - 54	454	12471	.034801	277	.022125
50 - 54	55 - 59	837	12940	.064683	477	.036249
55 - 59	60 - 64	1236	11773	.104986	675	.12443
60 - 64	65 - 69	1669	9814	.170063	1014	.11557
65 - 69	70 - 74	2224	8322	.267243	1628	.11377
70 - 74	75 - 79	2389	5899	.404984	3582	.9935
75 +	80 +	4056	5273	.769202	6731	.483271

* Livebirths 1979 - 83

Table A.12 Estimated mortality rates for Bradford M.D. by zone, 1979-83

Age transition		Bradford M.D.	Zone 1 University ward	Zone 2 Bradford Moor ward	Zone 3 Inner Bradford	Zone 4 Outer Bradford	
a	a + 1	a =	1.00	1.20	1.15	1.10	1.00
MEN							
Birth	0-4	.015343	.016412	.017644	.018877	.019343	
0-4	5-9	.003626	.004351	.004170	.005989	.005626	
5-9	10-14	.001418	.001702	.001631	.001560	.001418	
10-14	15-19	.002975	.003570	.003421	.003272	.002975	
15-19	20-24	.004513	.005416	.005190	.004964	.004513	
20-24	25-29	.004694	.005653	.005398	.005163	.004694	
25-29	30-34	.005154	.006185	.005927	.005669	.005154	
30-34	35-39	.006451	.007741	.007419	.007096	.006451	
35-39	40-44	.010765	.012916	.012377	.011839	.010765	
40-44	45-49	.019201	.023041	.022081	.021121	.019201	
45-49	50-54	.034801	.091761	.040021	.038281	.034801	
50-54	55-59	.064683	.077620	.074305	.071151	.064683	
55-59	60-64	.104906	.125983	.120734	.115485	.104906	
60-64	65-69	.170063	.204076	.195573	.187069	.170063	
65-69	70-74	.267293	.320692	.307329	.293967	.267243	
70-74	75-79	.403904	.485981	.465732	.445482	.404964	
75+	80+	.769202	.923042	.884502	.846122	.769202	
Life expectancy		72.45	70.60	71.05	71.50	72.45	
WOMEN							
	a =	1.00	1.15	1.12	1.08	1.00	
Birth	0-4	.013532	.015562	.015156	.014615	.013532	
0-4	5-9	.002753	.003166	.003083	.002973	.002753	
5-9	10-14	.001114	.001281	.001248	.001205	.001114	
10-14	15-19	.001482	.001704	.001660	.001601	.001482	
15-19	20-24	.001852	.002130	.002074	.002000	.001852	
20-24	25-29	.002075	.002396	.002324	.002241	.002075	
25-29	30-34	.002394	.002903	.002905	.002802	.002394	
30-34	35-39	.003980	.004577	.004458	.004298	.003980	
35-39	40-44	.007209	.008290	.008074	.007786	.007209	
40-44	45-49	.012565	.014450	.014073	.013570	.012565	
45-49	50-54	.022125	.025444	.024780	.023995	.022125	
50-54	55-59	.036249	.041686	.040599	.039149	.036249	
55-59	60-64	.054247	.062384	.060757	.058587	.054247	
60-64	65-69	.087739	.100900	.098268	.094750	.087739	
65-69	70-74	.143096	.164560	.160268	.154544	.143096	
70-74	75-79	.260544	.314626	.303809	.289388	.260544	
75+	80+	.483871	.555762	.541264	.521935	.483871	
Life expectancy		76.45	75.37	75.59	75.67	76.45	

Notes: = = multiplier

TABLE A.13 Mortality rates (per 1000 population). Bradford M.D.
1975-83.

Year	Age at death						Total	
	Under 1	1 - 4	5 - 14	15 - 44	45 - 64	65 - 74	75+	
MALES								
1975	22.79	1.08	0.32	1.36	13.77	54.26	137.54	12.62
1976	22.79	0.52	0.32	1.50	14.95	56.41	153.19	13.58
1977	18.54	0.74	0.25	1.25	10.04	54.53	131.20	12.66
1978	18.82	0.53	0.36	1.53	11.88	52.95	121.04	12.40
1979	16.44	0.69	0.23	1.38	13.66	54.43	132.32	13.01
1980	17.39	0.98	0.29	1.40	13.82	48.58	127.41	12.57
1981	13.22	0.94	0.38	1.23	12.78	51.79	130.47	12.15
1982	14.44	0.76	0.25	1.10	14.27	53.95	130.73	12.60
1983	15.14	0.48	0.28	1.19	13.14	50.25	124.57	11.79
FEMALES								
1975	14.74	0.29	0.37	0.83	7.61	27.26	103.27	12.60
1976	13.14	0.53	0.29	0.97	8.05	27.11	105.94	13.02
1977	17.73	0.55	0.18	0.92	7.50	28.29	98.42	12.57
1978	15.16	0.69	0.35	0.72	7.91	29.30	101.37	13.08
1979	16.42	0.50	0.27	0.68	7.96	29.57	97.65	12.99
1980	14.96	0.49	0.36	0.71	7.47	28.04	93.47	12.48
1981	10.24	0.85	0.15	0.68	7.25	26.08	97.96	12.47
1982	13.43	0.67	0.12	0.80	7.72	28.27	99.44	13.09
1983	12.57	0.22	0.18	0.60	7.13	28.79	93.55	12.43

TABLE A.14 Projected mortality rates, Bradford zones, 2006-11

Age transition a a+1	Regression slope (exp(bt))	Mortality rates 2006-11			
		Zone 1 University Ward	Zone 2 Bradford Moor Ward	Zone 3 Inner Bradford	Zone 4 Outer Bradford
MALES					
birth	-.03942	.006227	.005968	.005708	.005189
0 - 4	-.01350	.003002	.002877	.002752	.002501
5 - 9	-.01088	.001262	.001209	.001156	.001051
10 - 14	-.01792	.002181	.002090	.001999	.001817
15 - 19	-.02496	.002726	.002613	.002499	.002272
20 - 24	-.02496	.002835	.002717	.002599	.002363
25 - 29	-.02496	.003113	.002984	.002854	.002594
30 - 34	-.02496	.003897	.003734	.003572	.003247
35 - 39	-.02496	.006502	.006231	.005960	.005418
40 - 44	-.00989	.017554	.016823	.016092	.014629
45 - 49	.00518	.048155	.046148	.044142	.040129
50 - 54	.00518	.089503	.085774	.082044	.074586
55 - 59	.00518	.145271	.139218	.133165	.121059
60 - 64	-.00559	.174996	.167705	.160413	.145830
65 - 69	-.00861	.253080	.242535	.231990	.210900
70 - 74	-.01123	.356860	.341991	.327122	.297384
75 +	-.01385	.630681	.604403	.578124	.525567
life expectancy		72.67	73.06	73.46	74.29
FEMALES					
birth	-.01268	.010980	.010694	.010312	.009548
0 - 4	-.04932	.000816	.000794	.000766	.000709
5 - 9	-.09891	.000084	.000082	.000079	.000073
10 - 14	-.06903	.000255	.000249	.000240	.000222
15 - 19	-.03914	.000726	.000707	.000682	.000631
20 - 24	-.03914	.000813	.000792	.000764	.000707
25 - 29	-.03914	.001017	.000990	.000955	.000884
30 - 34	-.03914	.001560	.001519	.001465	.001357
35 - 39	-.03914	.002826	.002752	.002654	.002457
40 - 44	-.02386	.007497	.007302	.007041	.006519
45 - 49	.00858	.020096	.019572	.018873	.017475
50 - 54	-.00858	.032925	.032066	.030921	.028630
55 - 59	-.00858	.049272	.047987	.046273	.042845
60 - 64	-.00314	.092553	.090138	.086919	.080481
65 - 69	-.00230	.175305	.170732	.164634	.152439
70 - 74	-.00449	.366464	.356904	.344158	.318665
75 +	-.01127	.407652	.397018	.382839	.359480
life expectancy		77.37	77.54	77.76	78.23

TABLE A.15 Life expectancies resulting from the
mortality rate projections, Bradford
Zones, 1979-2011

Sex and Zone	1979-83	1981-86	Period 1986-91	1991-96	1996-01	2001-06	2006-
MALE							
University Ward	70.60	70.86	71.33	71.74	72.09	72.40	72.67
Bradford Moor Ward	71.05	71.30	71.76	72.15	72.50	72.80	73.06
Inner Bradford	71.50	71.75	72.19	72.58	72.92	73.21	73.46
Outer Bradford	72.45	72.68	73.10	73.46	73.78	74.05	74.29
FEMALE							
University Ward	75.37	75.62	76.07	76.45	76.79	77.09	77.37
Bradford Moor Ward	75.59	75.83	76.26	76.64	76.97	77.27	77.54
Inner Bradford	75.87	76.11	76.53	76.89	77.22	77.51	77.76
Outer Bradford	76.45	76.67	77.07	77.41	77.72	77.99	78.23

TABLE A.16 Birth statistics for Indians, Bradford M.D. 1979-83.

Age of mother at time of maternity.	1979	1980	1981	1982	1983	Total
15 - 19	39	31	35	18	18*	141
20 - 24	146	169	129	120	115	679
25 - 29	84	117	92	90	94	477
30 - 34	25	43	36	29	37	170
35 - 39	10	10	9	9	10	48
40 - 44	1	2	1	3	5	12
45 +	0	0	0	0	0	0
Unknown	11	6	6	2	2	27
Total	316	378	308	271	281	1554

* includes 1 birth to a mother 15 years age.

Source: Birth registration records of the Policy Unit, Bradford Metropolitan District

TABLE A.17 Fertility rates for Indians, Bradford M.D., 1979-83
Individual years.

Initial Age	Final Age	1979	1980	1981	1982	1983
10-14	15-19	.1393	.1072	.1212	.0627	.0627
15-19	20-24	.7960	.8425	.6932	.4755	.5555
20-24	25-29	1.0491	1.2772	.9912	.9298	.9246
25-29	30-34	.5465	.7888	.6357	.5833	.6415
30-34	35-39	.2184	.3277	.2791	.2306	.2840
35-39	40-44	.0831	.0890	.0742	.0890	.1128
40-44	45-49	.0066	.0166	.0066	.0132	.0397
Total		2.8391	3.4489	2.8012	2.4941	2.6207

Note

1. These rates are measured using a constant population at risk measured in 1981 at the Census. This means that the rates for 1979 and 1980 are slightly underestimated and those for 1982 and 1983 are slightly overestimated.

TABLE A.18 Total fertility rates (TFRs) for women born in India and other groups, various estimates

Year	Indian women	NCWP women	UK born women	All women England & Wales
	(1)			(6)
1969	4.77			2.48
1970	4.49			2.38
1971	3.98			2.37
1972	3.18			2.19
1973				2.02
1974				1.89
1975				1.78
1976				1.71
1977				1.66
1978	(2)			1.73
1979	2.84			1.84
1980	3.45	(3)	(4)	(5)
1981	2.80	3.11	2.93	1.71
1982	2.49	3.07	2.92	1.68
1983	2.62	2.85	2.84	1.68
1984				1.76
1985				1.75
				1.81 (est.)

Sources & notes

- (1) Indian women, 1969-72: King, 1974 for Leeds County Borough.
- (2) Indian women, 1979-83: this study for Bradford Metropolitan District.
- (3) Indian women, 1981-83: OPCS (1984a, 1984b, 1985), Table 9.4 for England and Wales.
- (4) NCWP women, 1981-83 : OPCS (1984a, 1984b, 1985), Table 9.4 for England and Wales.
- (5) UK born women, 1981-83: OPCS (1984a, 1984b, 1985), Table 9.4 for England and Wales.
- (6) All women, 1970-85 : OPCS (1985) for England and Wales.

TABLE A.19 Fertility rates for Indians, Bradford M.D., 1979-83

Initial age	Final age	"Initial" population 1981	"Final" population 1981	Population at risk	Births	Fertility ra
10-14	15-19	822	614	718	59	.0822
15-19	20-24	614	593	603	405	.6733
20-24	25-29	593	546	570	612	1.0754
25-29	30-34	546	486	516	333	.6453
30-34	35-39	486	339	412	109	.2646
35-39	40-44	339	334	337	32	.0950
40-44	45-49	334	270	302	4	.0132
Total		3,734	3,182	3,458	1,554	.48490

TABLE A.20 Births to Indians by zone, Bradford, 1979-83

Zones	1979	1980	1981	1982	1983	Total 1979-83	Female Population 15-44	GFR
University ward	90	118	85	71	71	435	688	126
Bradford Moor ward	68	82	52	61	61	324	526	123
Inner Bradford	117	132	123	102	105	579	1,049	111
Outer Bradford	35	38	42	34	36	185	423	87
	6	8	6	3	8	31	146	42
Total	316	378	308	271	281	1,554	2,832	110

Note:

GFR = General fertility rate per 1,000 population, annual equivalent.

Table A.21 Estimated Indian fertility rates by zone, Bradford, 1979-80

Initial age	Final age	University Ward	Bradford Moor Ward	Inner Bradford	Outer Bradford
10-14	15-19	.0971	.0944	.0856	.0670
15-19	20-24	.7939	.7717	.6994	.5474
20-24	25-29	1.2692	1.2336	1.1181	.8750
25-29	30-34	.7628	.7415	.6720	.5259
30-34	35-39	.3127	.3040	.2755	.2156
35-39	40-44	.1122	.1091	.0989	.0774
40-44	45-49	.0157	.0152	.0138	.0108
Total		3.3637	3.2694	2.9633	2.3191

Note

1. These estimated rates are obtained by applying the overall fertility rates (Table A19, last column) to female populations at risk for each zone (derived from Table A31, estimates) to obtain predictions of the numbers of births in each zone. These are compared with the observed number and the overall fertility rates are adjusted by the ratio of observed to expected births to yield the estimates in this table.

Table A.22 Fertility for Indians by zone, 1979-83 to 2006-11

Fertility rates for Indians in Bradford Scenario 3, total fertility rate = 1.8 (Current British level) Zone = University									
age	stage	period	period						
transition		1	2	3	4	5	6	7	
		1979-83	1981-86	1984-91	1991-96	1998-01	2001-06	2006-11	
10-14to15-19	-0.01978	0.0071	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	
15-19to20-24	-0.07479	0.7239	0.6669	0.6183	0.6183	0.6183	0.6183	0.6183	
20-24to25-29	-0.05860	1.2697	1.1227	0.8209	0.6676	0.6676	0.6676	0.6676	
25-29to30-34	-0.00155	0.7626	0.7599	0.7515	0.7635	0.7357	0.7280	0.7202	
30-34to35-39	-0.00346	0.5122	0.5042	0.2872	0.2532	0.2362	0.2192	0.2192	
35-39to40-44	-0.00280	0.1122	0.1072	0.0972	0.0872	0.0772	0.0672	0.0572	
40-44to45-49	0.00000	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	
total fertility rate	3.3048	2.9718	2.4344	2.2576	2.2229	2.1881	2.1534		
<hr/>									
Fertility rates for Indians in Bradford Scenario 3, total fertility rate = 1.8 (Current British level) Zone = Bradford Moor									
age	stage	period	period						
transition		1	2	3	4	5	6	7	
		1979-83	1981-86	1984-91	1991-96	1998-01	2001-06	2006-11	
10-14to15-19	-0.01978	0.0066	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	
15-19to20-24	-0.07479	0.7239	0.5847	0.6183	0.6183	0.6183	0.6183	0.6183	
20-24to25-29	-0.05860	1.2336	1.0871	0.7941	0.6676	0.6676	0.6676	0.6676	
25-29to30-34	-0.00155	0.7612	0.7576	0.7508	0.7221	0.7143	0.7066	0.6988	
30-34to35-39	-0.00346	0.2060	0.2955	0.2785	0.2615	0.2445	0.2275	0.2105	
35-39to40-44	-0.00280	0.1071	0.1041	0.0941	0.0841	0.0761	0.0661	0.0541	
40-44to45-49	0.00000	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	
total fertility rate	3.2702	2.8709	2.3058	2.2244	2.1898	2.1549	2.1281		
<hr/>									
Fertility rates for Indians in Bradford Scenario 3, total fertility rate = 1.8 (Current British level) Zone = Inner Bradford									
age	stage	period	period						
transition		1	2	3	4	5	6	7	
		1979-83	1981-86	1984-91	1991-96	1998-01	2001-06	2006-11	
10-14to15-19	-0.01978	0.0056	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	
15-19to20-24	-0.07479	0.6994	0.5125	0.6183	0.6183	0.6183	0.6183	0.6183	
20-24to25-29	-0.05860	1.1181	0.9716	0.6766	0.6676	0.6676	0.6676	0.6676	
25-29to30-34	-0.00155	0.6720	0.6482	0.4400	0.6527	0.6449	0.5372	0.6294	
30-34to35-39	-0.00346	0.2755	0.2476	0.2509	0.2550	0.2285	0.1996	0.1873	
35-39to40-44	-0.00280	0.0949	0.0839	0.0739	0.0639	0.0539	0.0539	0.0539	
40-44to45-49	0.00000	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	
total fertility rate	2.9555	2.5341	2.1622	2.1163	2.0813	2.0468	2.0274		
<hr/>									
Fertility rates for Indians in Bradford Scenario 3, total fertility rate = 1.8 (Current British level) Zone = Outer Bradford									
age	stage	period	period						
transition		1	2	3	4	5	6	7	
		1979-83	1981-86	1984-91	1991-96	1998-01	2001-06	2006-11	
10-14to15-19	-0.01978	0.0076	0.0550	0.0550	0.0550	0.0550	0.0550	0.0550	
15-19to20-24	-0.07479	0.5474	0.6183	0.6183	0.6183	0.6183	0.6183	0.6183	
20-24to25-29	-0.05860	0.8750	0.7285	0.6676	0.6676	0.6676	0.6676	0.6676	
25-29to30-34	-0.00155	0.5259	0.5221	0.5143	0.5064	0.4985	0.4911	0.4833	
30-34to35-39	-0.00346	0.2150	0.2071	0.1901	0.1873	0.1873	0.1873	0.1873	
35-39to40-44	-0.00280	0.0774	0.0624	0.0539	0.0539	0.0539	0.0539	0.0539	
40-44to45-49	0.00000	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	
total fertility rate	2.3243	2.0194	1.9233	1.9045	1.8908	1.8890	1.8813		

TABLE A.23 Migration flows between zones, Indians in Bradford
1976-81

Location 1981	Zone 1	Zone 2	Zone 3	Zone 4	Total	Migran between zones
Location 1976	University Ward	Bradford Moor Ward	Inner Bradford	Outer Bradford		
University Ward						
Bradford Moor	166	9	19	4	198	32
Ward	0	105	4	10	119	14
Inner Bradford	3	29	266	2	300	34
Outer Bradford	0	0	19	47	66	19
Totals	169	143	308	63	683	99
Rest of UK	0	0	8	0	8	8
Rest of the world	5	10	5	0	20	20
Totals	174	153	321	63	711	127

Source: 1984 household survey, Ram, (1985)

TABLE A.24 Migrants by age and sex, Indians in Bradford.
and migration-age ratio 1976-81

Age group in 1981	Migrants (in survey)		Population (in survey)		Observed migration rates		Adjusted migration rates	Migration age ratio = Adjusted migration rate/ Average migration rate (=.3903)
	Male	Female	Male	Female	Males	Females	Persons	
0 - 4	14	21	29	35	.4828	.6000	.5469	.5469
5 - 9	22	16	54	37	.4074	.4324	.4176	1.4012
10 - 14	20	17	64	46	.3125	.3696	.3364	1.0599
15 - 19	6	12	24	34	.2500	.3529	.3103	0.8619
20-24	15	12	38	35	.3947	.3429	.3699	0.7950
25 - 29	16	14	28	23	.5714	.6087	.5882	0.9477
30 - 34	10	10	24	26	.4167	.3846	.4000	1.5070
35 - 39	7	9	20	25	.3500	.3600	.3555	1.0249
40 - 44	5	6	19	20	.2632	.3000	.2821	0.9111
45 - 49	5	6	19	14	.2632	.4286	.3333	0.7228
50 - 54	4	2	10	5	.4000	.4000	.4000	0.8640
55 - 59	5	4	11	15	.4545	.2667	.3462	0.8673
60 - 64	2	0	9	1	.2222	.0000	.2000	0.8673
65 - 69	1	1	4	3	.2500	.3333	.2857	0.8673
70 - 74	0	1	2	1	.0000	.10000	.3333	0.8673
75 - 79	0	0	0	1	.0000	.0000	.0000	0.8673
80 +	1	1	2	1	.5000	.10000	.6667	0.8673
Totals	1533	132	357	322	.3725	.4099	.3903	

Note: Intra-ward migrants are included

Source: 1984 household sample survey, Ram (1985)

Table A.25 Migration rates between zones in Bradford

1. MIGRATION FROM UNIVERSITY WARD (ZONE 1)

Age group 1976	Age group 1981	Migration age ratio	Survival rate Zone 1	Migration rate		
				University ward	Bradford Moor	Inner Bradford
MALES						
all	all	1.0000	-	.0	.0455	.0960
birth	0-4	1.4012	.9816	.0	.0625	.1320
0-4	5-9	1.0699	.9957	.0	.0484	.1022
5-9	10-14	0.8619	.9983	.0	.0391	.0826
10-14	15-19	0.7950	.9964	.0	.0360	.0760
15-19	20-24	0.9477	.9946	.0	.0429	.0904
20-24	25-29	1.5070	.9944	.0	.0681	.1458
25-29	30-34	1.0249	.9938	.0	.0463	.0977
30-34	35-39	0.9111	.9925	.0	.0411	.0867
35-39	40-44	0.7228	.9872	.0	.0325	.0605
40-44	45-49	0.8540	.9772	.0	.0379	.0800
45-49	50-54	0.8673	.9591	.0	.0378	.0798
50-54	55-59	0.8673	.9253	.0	.0365	.0770
55-59	60-64	0.8673	.8815	.0	.0347	.0733
60-64	65-69	0.8673	.8090	.0	.0319	.0673
65-69	70-74	0.8673	.7236	.0	.0285	.0602
70-74	75-79	0.8673	.6090	.0	.0240	.0507
75+	80+	0.8673	.5684	.0	.0145	.0307
						.0064
FEMALES						
all	all	1.000	-	.0	.0455	.0960
birth	0-4	1.4012	.9830	.0	.0627	.1323
0-4	5-9	1.0699	.9968	.0	.0484	.1024
5-9	10-14	0.8619	.9987	.0	.0391	.0826
10-14	15-19	0.7950	.9991	.0	.0361	.0762
15-19	20-24	0.9477	.9969	.0	.0431	.0908
20-24	25-29	1.5070	.9976	.0	.0683	.1443
25-29	30-34	1.0249	.9970	.0	.0465	.0980
30-34	35-39	0.9111	.9952	.0	.0412	.0870
35-39	40-44	0.7228	.9917	.0	.0326	.0688
40-44	45-49	0.8540	.9857	.0	.0382	.0807
45-49	50-54	0.8673	.9749	.0	.0364	.0811
50-54	55-59	0.8673	.9592	.0	.0378	.0798
55-59	60-64	0.8673	.9395	.0	.0370	.0782
60-64	65-69	0.8673	.9039	.0	.0356	.0752
65-69	70-74	0.8673	.8400	.0	.0334	.0705
70-74	75-79	0.8673	.6566	.0	.0259	.0546
75+	80+	0.8673	.5651	.0	.0223	.0470
						.0099

Table A.25 (cont'd)

2. MIGRATION FROM BRADFORD MOON (ZONE 2)

Age 1975 YEARS	Group 1981	Migration age ratio	Survival rate Zone 2	University ward	Migration to: Bradford Zone		Inner Bradford	Outer Bradford
					all	all		
birth	0-4	1.4012	.9616		.0	.0	.0336	.0840
0-4	5-9	1.0699	.9957		.0	.0	.0462	.1155
5-9	10-14	0.8619	.9963		.0	.0	.0358	.0895
10-14	15-19	0.7950	.9964		.0	.0	.0290	.0723
15-19	20-24	0.9477	.9946		.0	.0	.0266	.0666
20-24	25-29	1.5070	.9944		.0	.0	.0318	.0792
25-29	30-34	1.0249	.9938		.0	.0	.0503	.1259
30-34	35-39	0.9111	.9923		.0	.0	.0342	.0856
35-39	40-44	0.7228	.9872		.0	.0	.0304	.0760
40-44	45-49	0.8540	.9772		.0	.0	.0240	.0599
45-49	50-54	0.8673	.9591		.0	.0	.0280	.0702
50-54	55-59	0.8673	.9253		.0	.0	.0280	.0699
55-59	60-64	0.8673	.8815		.0	.0	.0270	.0675
60-64	65-69	0.8673	.8050		.0	.0	.0257	.0643
65-69	70-74	0.8673	.7236		.0	.0	.0236	.0589
70-74	75-79	0.8673	.6090		.0	.0	.0211	.0528
75+	80+	0.8673	.3664		.0	.0	.0178	.0444
							.0108	.0269
FEMALES								
all	all	1.000	-		.0	.0	.0336	.0840
birth	0-4	1.4012	.9636		.0	.0	.0463	.1158
0-4	5-9	1.0699	.9968		.0	.0	.0359	.0896
5-9	10-14	0.8619	.9987		.0	.0	.0290	.0723
10-14	15-19	0.7950	.9991		.0	.0	.0267	.0667
15-19	20-24	0.9477	.9989		.0	.0	.0318	.0794
20-24	25-29	1.5070	.9976		.0	.0	.0505	.1265
25-29	30-34	1.0249	.9970		.0	.0	.0343	.0858
30-34	35-39	0.9111	.9952		.0	.0	.0305	.0762
35-39	40-44	0.7228	.9917		.0	.0	.0241	.0602
40-44	45-49	0.8540	.9857		.0	.0	.0283	.0708
45-49	50-54	0.8673	.9749		.0	.0	.0285	.0711
50-54	55-59	0.8673	.9592		.0	.0	.0280	.0699
55-59	60-64	0.8673	.9395		.0	.0	.0274	.0685
60-64	65-69	0.8673	.9039		.0	.0	.0264	.0659
65-69	70-74	0.8673	.8480		.0	.0	.0248	.0618
70-74	75-79	0.8673	.6566		.0	.0	.0192	.0479
75+	80+	0.8673	.5651		.0	.0	.0165	.0412

Table A25 (cont'd)

5. MIGRATION FROM INNER BRADFORD (ZONE 3)

Age group 1976-1981	Migration age ratio	Survival rate Zone 3	Migration to:			Outer Bradford
			University ward 1	Bradford Moor	Inner Bradford	
MALES						
all all	1.0000	-	.0100	.0967	.0	.0067
birth 0-4	1.4012	.9824	.0135	.1330	.0	.0091
0-4 5-9	1.0699	.9979	.0107	.1032	.0	.0071
5-9 10-14	0.8619	.9984	.0086	.0832	.0	.0057
10-14 15-19	0.7950	.9966	.0079	.0765	.0	.0053
15-19 20-24	0.9477	.9948	.0095	.0911	.0	.0063
20-24 25-29	1.5070	.9946	.0150	.1449	.0	.0099
25-29 30-34	1.0249	.9941	.0101	.0985	.0	.0068
30-34 35-39	0.9111	.9926	.0090	.0874	.0	.0061
35-39 40-44	0.7228	.9867	.0071	.0690	.0	.0047
40-44 45-49	0.8540	.9782	.0083	.0808	.0	.0056
45-49 50-54	0.8673	.9608	.0084	.0805	.0	.0056
50-54 55-59	0.8673	.9203	.0081	.0778	.0	.0054
55-59 60-64	0.8673	.8661	.0077	.0743	.0	.0051
60-64 65-69	0.8673	.8162	.0071	.0684	.0	.0047
65-69 70-74	0.8673	.7336	.0064	.0615	.0	.0043
70-74 75-79	0.8673	.6222	.0054	.0521	.0	.0036
75+ 80+	0.8673	.5867	.0034	.0324	.0	.0023
Females						
all all	1.0000	-	.0100	.0967	.0	.0067
birth 0-4	1.4012	.9844	.0138	.1333	.0	.0092
0-4 5-9	1.0699	.9970	.0107	.1031	.0	.0071
5-9 10-14	0.8619	.9988	.0086	.0832	.0	.0057
10-14 15-19	0.7950	.9964	.0079	.0767	.0	.0053
15-19 20-24	0.9477	.9980	.0095	.0914	.0	.0063
20-24 25-29	1.5070	.9978	.0151	.1454	.0	.0100
25-29 30-34	1.0249	.9972	.0102	.0988	.0	.0068
30-34 35-39	0.9111	.9954	.0091	.0877	.0	.0061
35-39 40-44	0.7228	.9922	.0071	.0694	.0	.0048
40-44 45-49	0.8540	.9865	.0084	.0815	.0	.0056
45-49 50-54	0.8673	.9764	.0085	.0818	.0	.0057
50-54 55-59	0.8673	.9616	.0084	.0806	.0	.0056
55-59 60-64	0.8673	.9431	.0082	.0790	.0	.0055
60-64 65-69	0.8673	.9095	.0079	.0762	.0	.0053
65-69 70-74	0.8673	.8565	.0075	.0718	.0	.0050
70-74 75-79	0.8673	.6743	.0059	.0565	.0	.0039
75+ 80+	0.8673	.5861	.0051	.0491	.0	.0034

Table A25 (cont'd)

4. MIGRATION FROM OUTER BRADFORD (ZONE 4)

Age group 1976 1981	Migration age ratio	Survival rate Zone 4	University ward	Migration to: Bradford Moor	Inner Bradford	Outer Bradford
MALES						
all all	1.0000	-	.0	.0	.2879	.0
birth	1.4012	.9847	.0	.0	.3972	.0
0-4 5-9	1.0699	.9964	.0	.0	.3069	.0
5-9 10-14	0.8619	.9986	.0	.0	.2471	.0
10-14 15-19	0.7950	.9970	.0	.0	.2262	.0
15-19 20-24	0.9477	.9955	.0	.0	.2716	.0
20-24 25-29	1.5070	.9953	.0	.0	.4318	.0
25-29 30-34	1.0249	.9949	.0	.0	.2935	.0
30-34 35-39	0.9111	.9936	.0	.0	.2606	.0
35-39 40-44	0.7228	.9903	.0	.0	.2059	.0
40-44 45-49	0.8540	.9810	.0	.0	.2411	.0
45-49 50-54	0.8673	.9658	.0	.0	.2412	.0
50-54 55-59	0.8673	.9373	.0	.0	.2341	.0
55-59 60-64	0.8673	.9003	.0	.0	.2248	.0
60-64 65-69	0.8673	.8582	.0	.0	.2093	.0
65-69 70-74	0.8673	.7643	.0	.0	.1908	.0
70-74 75-79	0.8673	.6632	.0	.0	.1656	.0
75+ 80+	0.8673	.4445	.0	.0	.1110	.0
FEMALES						
all all	1.0000	-	.0	.0	.2879	.0
birth	1.4012	.9865	.0	.0	.3979	.0
0-4 5-9	1.0699	.9973	.0	.0	.3072	.0
5-9 10-14	0.8619	.9989	.0	.0	.2478	.0
10-14 15-19	0.7950	.9985	.0	.0	.2266	.0
15-19 20-24	0.9477	.9982	.0	.0	.2723	.0
20-24 25-29	1.5070	.9979	.0	.0	.4329	.0
25-29 30-34	1.0249	.9974	.0	.0	.2942	.0
30-34 35-39	0.9111	.9960	.0	.0	.2613	.0
35-39 40-44	0.7228	.9928	.0	.0	.2056	.0
40-44 45-49	0.8540	.9875	.0	.0	.2427	.0
45-49 50-54	0.8673	.9781	.0	.0	.2442	.0
50-54 55-59	0.8673	.9644	.0	.0	.2400	.0
55-59 60-64	0.8673	.9472	.0	.0	.2365	.0
60-64 65-69	0.8673	.9159	.0	.0	.2287	.0
65-69 70-74	0.8673	.8665	.0	.0	.2164	.0
70-74 75-79	0.8673	.6945	.0	.0	.1734	.0
75+ 80+	0.8673	.6108	.0	.0	.1525	.0

Notes to Table A.25

1. Migration rates for all ages were computed from Table A.23.
2. Survival rates were computed from zonal mortality rates worked out in section 4.2. The mortality rates used differed slightly from those in Table A.12 in that the multipliers for zones were respectively (males) 1.20, 1.20, 1.15 and 1.00 and (females) 1.15, 1.15, 1.08, 1.00. The slight differences for Bradford Moor and Inner Bradford make very little difference to the survival rates, so these were not recomputed.
3. The formula for the survival rates was

$$\text{survival rate} = (1 - \frac{1}{2} \text{mortality rate}) / (1 + \frac{1}{2} \text{mortality rate})$$

TABLE A.26 Inputs to the estimation of external migration,
Bradford M.D., 1976-81

A. MIGRATION FROM AND TO THE REST OF THE WORLD

Year	Immigrants from India to Bradford	Immigration to UK from India, Bangladesh & Sri Lanka	Emigration from UK to India, Bangladesh & Sri Lanka	Emigration from Bradford
	(a)	(b)	(c)	(d)
Last quarter of 1976	66	3,750	1,000	
1977	218	11,000	4,000	809
1978	173	19,000	4,000	x
1979	160	19,000	4,000	(19,500/ 80,250)
3 quarters of 1981	78	13,500	1,500	
Total	809	80,250	19,500	197

B. MIGRATION FROM AND TO THE REST OF THE UK

Years	1984 Survey (d)	In-migrants from Rest of UK	Total sample	In-migration rate	1981 Census	In- popul- ation	Estimates migrants
1976-81	8	711	.0113		12,428	140	140

TABLE A. 26 (Continued)

C. AGE-SEX DISAGGREGATION OF EXTERNAL MIGRATION: PROPORTIONS

Age group at end of interval	Immigration from India (a)		1984 Survey (d) All migrants	
	Male	Female	Male	Female
0- 4	.0159	.0053	.0660	.0660
5 -9	.0159	.0159	.0717	.0717
10-14	.0212	.0132	.0698	.0698
15-19	.0661	.2011	.0340	.0340
20-24	.1984	.2011	.0509	.0509
25-29	.0661	.0529	.0566	.0566
30-34	.0106	.0106	.0377	.0377
35-39	.0079	.0079	.0302	.0302
40-44	.0026	.0159	.0208	.0208
45-49	.0000	.0132	.0208	.0208
50-54	.0026	.0079	.0113	.0113
55-59	.0000	.0000	.0170	.0170
60-64	.0000	.0079	.0038	.0038
65-69	.0000	.0079	.0038	.0038
70-74))	.0019	.0019
75-79)	.0185) .0132	.0000	.0000
80+))	.0038	.0038
Total	1.0000		1.0000	

Sources:

- (a) Policy Unit, Bradford (1983).
 (b) International Passenger Survey in OPCS 1985b.
 (c) International Passenger Survey in OPCS 1985b.
 (d) Survey 1984, Ram (1985).

TABLE A.27 External migration estimates, Bradford M.D., 1976-81

Age group 1981	In-migration				Out-migration			
	From the Rest of the world		From the Rest of the UK		To the Rest of the world		To the Rest of the UK	
	M	F	M	F	M	F	M	F
0- 4	13	4	9	9	4	1	9	9
5- 9	13	13	10	10	4	2	10	10
10-14	17	11	9	9	5	2	9	9
15-19	53	163	5	5	18	29	5	5
20-24	161	163	7	7	54	29	7	7
25-29	53	43	8	8	18	8	8	8
30-34	9	9	5	5	3	1	5	5
35-39	6	6	4	4	2	1	4	4
40-44	2	13	3	3	1	2	3	3
45-49	0	11	3	3	0	2	3	3
50-54	2	6	2	2	1	1	2	2
55-59	0	0	2	2	0	0	2	2
60-64	0	6	1	1	0	1	1	1
65-69	0	6	1	1	0	1	1	1
70-74))	0	0)		0	0
75-79)	15)	11	0	0)	5
80+))	1	1)		1	1
Totals	344	465	70	70	115	82	70	70

TABLE A.28 External migration estimates by zone, 1976-81

Age group 1976 1981	University Ward (Zone 1)				Bradford Moor (Zone 2)			
	In-migration		Out-migration		In-migration		Out-migration	
	M	F	M	F	M	F	M	F
Birth	0 - 4	2	0	2	2	1	1	1
0 - 4	5 - 9	3	2	4	4	6	4	2
5 - 9	10 - 14	3	3	4	4	8	6	2
10-14	15 - 19	9	21	6	8	18	44	3
15-19	20 - 24	27	41	14	11	53	82	6
20-24	25 - 29	27	26	14	8	53	52	7
25-29	30 - 34	8	6	5	3	16	13	3
30-34	35 - 39	2	2	2	1	3	3	1
35-39	40 - 44	1	3	2	1	2	5	2
40-44	45 - 49	0	3	1	2	1	6	0
45-49	50 - 54	0	2	1	2	1	4	0
50-54	55 - 59	0	1	1	1	1	1	0
55-59	60 - 64	0	1	1	1	0	1	0
60-64	65 - 69	0	2	1	1	0	3	0
65-69	70 - 74	2	2	1	0	4	5	0
70-74	75 - 79	2	1	1	0	3	3	0
75 +	80 +	0	0	0	0	0	0	0
Totals		86	116	60	49	172	233	26
Age groups		Inner Bradford (Zone 3)				Outer Bradford (Zone 4)		
1976 1981	In-Migration		Out-migration		In-migration		Out-migration	
	M	F	M	F	M	F	M	F
Birth	0 - 4	7	6	3	2	0	0	1
0 - 4	5 - 9	13	12	5	3	0	0	3
5 - 9	10 - 14	13	12	5	4	0	0	3
10-14	15 - 19	16	30	6	7	0	0	4
15-19	20 - 24	33	46	14	12	0	0	8
20-24	25 - 29	34	32	14	8	0	0	8
25-29	30 - 34	14	14	7	5	0	0	3
30-34	35 - 39	6	6	2	2	0	0	1
35-39	40 - 44	5	6	2	1	0	0	1
40-44	45 - 49	3	6	1	2	0	0	1
45-49	50 - 54	2	4	1	2	0	0	1
50-54	55 - 59	2	3	1	1	0	0	0
55-59	60 - 64	2	3	1	1	0	0	0
60-64	65 - 69	1	2	0	0	0	0	1
65-69	70 - 74	2	2	1	0	0	0	1
70-74	75 - 79	2	1	1	1	0	0	1
75 +	80 +	1	1	0	0	0	0	0
Totals		156	186	69	52	0	0	35

TABLE A.29 Population accounts for Indians in Bradford,
1979-83. projections 3 and 4

Initial state	Survival, end 1983					Death, 1979-83					Totals	
	UN	BM	IB	OB	RW	UN	BM	IB	OB	RW		
Exist	UN	1267	63	135	28	57	43	0	0	0	1596	
start	BM	0	801	36	88	25	0	23	0	0	976	
1979	IB	21	208	1861	13	61	0	0	56	0	2229	
	OB	0	0	241	674	33	0	0	0	18	969	
	RW	84	169	149	0	0	1	2	2	0	406	
Birth	UN	168	14	29	6	2	4	0	0	0	223	
1979-	BM	0	135	8	.19	1	0	3	0	0	166	
1983	IB	4	40	246	3	3	0	0	5	0	301	
	OB	0	0	38	55	1	0	0	0	1	94	
	RW	2	3	7	0	0	0	0	0	0	12	
Totals		1547	1437	2743	886	183	48	32	69	20	1	6972

Notes

1. Zone definitions:
 UN = University ward
 BM = Bradford Moor ward
 IB = Inner Bradford wards
 OB = Outer Bradford wards
2. Rows and columns may not add exactly to the totals displayed due to rounding errors in the display in whole number form of the contents of the accounts. Such rounding errors are rather severe in the deaths half of the table as displayed, although the underlying accounts are consistent.

TABLE A.30 Zonal populations and shares, 1981-2011, four projections

TABLE A.3C (continued)

TABLE A.31 Projected numbers of Indians, Bradford zones, 1979-2011,
by sex and age; projection 1, natural increase only,
vital rates constant over space and time

Projection for University ward (Zone 1)

Sex	YEAR							
Age group	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	189	193	197	222	247	257	266	277
5 - 9	200	185	192	196	221	246	256	265
10 - 14	184	215	185	192	196	221	246	256
15 - 19	149	152	214	184	191	195	220	245
20 - 24	150	146	151	213	183	190	194	219
25 - 29	127	153	145	150	212	182	189	193
30 - 34	90	100	152	144	149	211	181	188
35 - 39	85	80	99	151	143	148	210	180
40 - 44	85	89	79	98	149	141	146	208
45 - 49	77	79	87	77	96	146	138	143
50 - 54	60	72	76	84	74	93	141	133
55 - 59	40	45	67	71	79	69	87	132
60 - 64	25	31	41	60	64	71	62	78
65 - 69	16	16	26	35	51	54	60	52
70 - 74	12	12	12	20	27	39	41	46
75 +	12	13	14	14	19	26	38	44
Totals	1501	1581	1737	1911	2101	2289	2475	2659
FEMALES								
0 - 4	182	190	185	209	232	242	250	260
5 - 9	184	173	189	184	208	231	241	249
10 - 14	170	194	173	189	184	208	231	241
15 - 19	143	145	194	173	189	184	208	231
20 - 24	135	140	145	194	173	189	184	208
25 - 29	122	129	140	145	194	173	189	184
30 - 34	98	115	129	140	145	193	173	189
35 - 39	80	80	115	128	139	144	192	172
40 - 44	72	79	79	114	127	138	143	191
45 - 49	59	64	78	78	113	125	136	141
50 - 54	42	52	63	76	76	111	122	133
55 - 59	27	31	50	61	73	73	107	118
60 - 64	16	22	29	47	58	69	69	101
65 - 69	9	9	20	27	43	53	63	63
70 - 74	10	8	8	17	23	37	46	55
75 +	17	14	15	15	21	29	44	59
Totals	1366	1445	1612	1797	1998	2199	2398	2595
PERSONS	1366	3026	3349	3708	4099	4488	4873	5254
Index (1981)	95	100	111	123	135	148	161	174

* 100)

TABLE A.31 (Contd.)
Projection for Bradford Moor (Zone 2)
YEAR

Sex	Age group	1979	1981	1986	1991	1996	2001	2006	2011
MALES									
	0 - 4	141	144	150	170	189	197	203	212
	5 - 9	150	138	143	149	169	188	196	202
	10 - 14	138	161	138	143	149	169	188	196
	15 - 19	112	114	161	138	143	149	168	187
	20 - 24	112	109	113	160	137	142	148	167
	25 - 29	94	114	108	112	159	136	141	147
	30 - 34	67	74	113	107	111	158	135	140
	35 - 39	64	60	74	112	106	110	157	134
	40 - 44	64	67	59	73	111	105	109	155
	45 - 49	57	59	66	58	72	109	103	107
	50 - 54	45	54	57	64	56	70	105	99
	55 - 59	30	34	51	53	60	52	66	98
	60 - 64	19	23	31	46	48	54	47	59
	65 - 69	12	12	19	26	39	40	46	40
	70 - 74	11	9	9	15	20	30	31	35
	75 +	8	9	10	10	14	19	28	33
	Totals	1124	1181	1302	1436	1583	1728	1871	2011
FEMALES									
	0 - 4	136	146	141	159	177	185	191	200
	5 - 9	141	132	146	141	159	177	184	190
	10 - 14	130	149	132	146	141	159	177	184
	15 - 19	109	111	149	132	146	141	159	177
	20 - 24	103	107	111	149	132	146	141	155
	25 - 29	94	99	107	111	149	132	146	141
	30 - 34	70	88	99	107	111	149	132	146
	35 - 39	61	61	88	99	107	111	148	131
	40 - 44	55	60	61	87	98	106	110	147
	45 - 49	45	49	59	60	86	97	105	109
	50 - 54	33	40	48	58	59	84	95	103
	55 - 59	21	24	39	46	56	57	81	92
	60 - 64	13	17	23	37	44	53	54	77
	65 - 69	7	7	16	21	34	40	49	49
	70 - 74	10	6	6	14	18	29	35	41
	75 +	14	11	11	11	17	23	34	41
	Totals	1042	1107	1236	1378	1534	1689	1841	1993
	Total	2166	2288	2538	2814	3117	3417	3712	4003
	Index (1981 = 100)	95	100	111	123	136	149	162	175

TABLE A.31 (Contd.)
Projection for Inner Bradford (Zone 3)

Sex		YEAR							
	Age group	1979	1981	1986	1991	1996	2001	2006	20
MALES									
	0 - 4	296	301	300	339	375	391	403	4
	5 - 9	313	289	300	299	338	374	390	40
	10 - 14	287	336	289	300	299	338	373	38
	15 - 19	234	238	335	288	299	298	337	31
	20 - 24	234	228	237	333	287	298	297	31
	25 - 29	198	239	227	236	331	286	297	29
	30 - 34	140	155	238	226	235	329	285	29
	35 - 39	133	125	154	236	225	233	327	28
	40 - 44	133	139	124	152	233	223	231	31
	45 - 49	120	124	136	122	149	229	219	22
	50 - 54	94	112	120	131	118	144	221	21
	55 - 59	63	71	105	112	123	111	135	20
	60 - 64	40	48	64	95	101	111	100	12
	65 - 69	26	25	40	54	80	85	94	8
	70 - 74	23	19	19	31	41	61	65	7
	75+	15	20	22	23	31	41	58	6
	Totals	2352	2469	2710	2977	3265	3552	3832	410
FEMALES									
	0 - 4	297	290	282	318	352	368	379	39
	5 - 9	280	264	289	281	317	351	367	37
	10 - 14	259	296	264	289	281	317	351	36
	15 - 19	218	221	296	264	289	281	317	35
	20 - 24	206	214	221	295	264	288	280	31
	25 - 29	186	197	214	221	294	263	287	27
	30 - 34	149	175	196	213	220	293	262	28
	35 - 39	121	122	174	195	212	219	292	26
	40 - 44	109	120	121	173	194	210	217	29
	45 - 49	89	97	119	119	171	192	207	21
	50 - 54	65	80	95	116	116	167	188	20
	55 - 59	42	48	77	92	112	112	161	18
	60 - 64	25	33	45	73	87	106	106	15
	65 - 69	14	14	30	41	67	80	97	9
	70 - 74	21	13	12	26	36	58	69	8
	75+	26	21	22	21	31	44	67	81
	Totals	2107	2205	2457	2737	3043	3349	3647	3941
Persons		4459	4674	5167	5714	6308	6901	7479	8050
Index (1981 = 100)		95	100	111	122	135	148	160	172

TABLE A-31 (Contd.)
Projection for Outer Bradford (Zone 4)

Sex	YEAR							
Age group	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	113	115	121	137	151	159	164	172
5 - 9	120	111	115	121	137	150	158	163
10 - 14	110	129	111	115	121	137	150	158
15 - 19	89	91	129	111	115	121	137	150
20 - 25	89	57	91	128	111	114	120	136
25 - 29	75	91	87	91	127	110	113	119
30 - 34	53	59	91	87	91	126	109	112
35 - 39	51	48	59	90	86	90	125	108
40 - 44	50	53	47	58	89	85	89	124
45 - 49	46	47	52	46	57	87	83	87
50 - 54	36	43	45	50	44	55	84	80
55 - 59	24	27	40	42	47	41	52	79
60 - 64	15	6	24	36	38	42	37	47
65 - 69	9	9	5	20	30	32	35	31
70 - 74	9	7	7	4	15	23	24	27
75 +	7	8	9	9	7	13	21	25
Totals	896	951	1033	1145	1266	1385	1501	1618
FEMALES								
0 - 4	112	117	114	129	142	149	154	161
5 - 9	106	106	117	114	129	142	149	154
10 - 14	104	119	106	117	114	129	142	149
15 - 19	88	89	119	106	117	114	129	142
20 - 25	83	86	89	119	106	117	114	129
25 - 29	75	79	86	89	119	106	117	114
30 - 34	60	71	79	86	89	119	106	117
35 - 39	49	49	71	79	86	89	119	106
40 - 44	44	49	49	70	78	85	88	118
45 - 49	36	39	48	48	69	77	84	87
50 - 54	26	32	38	47	47	67	75	82
55 - 59	16	19	31	37	45	45	65	72
60 - 64	9	13	18	29	35	43	43	62
65 - 69	5	5	12	16	27	32	39	39
70 - 74	8	5	4	10	14	23	28	19
75 +	10	8	8	8	12	17	26	16
Totals	831	886	989	1104	1229	1354	1478	1601
Persons	1727	1817	2022	2249	2495	2739	2979	3219
Index (1981 = 100)	95	100	111	124	137	151	164	177

TABLE A.32 Projected numbers of Indians, Bradford zones, 1979-2011,
by sex and age: projection 2, natural increase only,
vital rates variable over space and constant over time

Projection for University ward (zone 1)

Sex Age group	YEAR							
	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	189	193	231	261	290	305	327	361
5 - 9	200	185	192	230	260	289	304	321
10 - 14	184	215	185	192	230	260	289	301
15 - 19	149	152	214	184	191	229	259	281
20 - 24	150	146	151	213	183	190	228	258
25 - 29	127	153	145	150	212	182	189	225
30 - 34	90	100	152	144	149	211	181	188
35 - 39	85	80	99	151	143	148	209	180
40 - 44	85	89	79	98	149	141	146	206
45 - 49	77	79	87	77	96	146	138	143
50 - 54	61	72	70	83	74	92	140	132
55 - 59	40	45	67	70	77	68	85	130
60 - 64	26	31	40	59	62	68	60	75
65 - 69	10	16	25	32	48	50	55	49
70 - 74	13	12	12	18	23	35	36	40
75 +	13	13	12	11	15	20	28	32
Totals	1505	1581	1767	1973	2202	2434	2674	2939
FEMALES								
0 - 4	182	190	217	246	273	287	307	341
5 - 9	184	173	189	216	245	272	286	306
10 - 14	170	194	173	189	216	245	272	286
15 - 19	143	145	194	173	189	216	245	272
20 - 24	135	140	145	194	173	189	216	244
25 - 29	122	129	140	145	194	173	189	215
30 - 34	98	115	129	140	145	193	172	168
35 - 39	80	80	14	128	139	144	192	171
40 - 44	72	79	79	113	127	138	143	190
45 - 49	59	64	78	78	111	125	136	141
50 - 54	42	52	62	76	76	108	122	133
55 - 59	27	31	50	59	73	73	104	117
60 - 64	16	22	29	47	55	69	69	98
65 - 69	9	9	20	26	42	50	62	62
70 - 74	11	8	8	17	22	36	42	53
75 +	18	14	13	12	18	24	38	49
Totals	1368	1445	1640	1859	2098	2342	2595	2866
Persons	2873	3026	3407	3832	4300	4776	5269	5805
Index (1981 = 100)	95	100	113	127	142	158	174	192

(Contd.)

TABLE A.32 (Contd.)
Projection for Bradford Moor (Zone 2)

Sex Age group	Year							
	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	141	144	172	195	216	227	243	266
5 - 9	150	138	143	171	194	215	226	241
10 - 14	138	161	138	143	171	194	215	226
15 - 19	112	114	160	138	143	170	193	214
20 - 24	112	109	113	159	137	142	169	197
25 - 29	94	114	108	112	158	136	141	168
30 - 34	67	74	113	107	111	157	135	140
35 - 39	64	60	73	112	106	110	156	134
40 - 44	64	67	59	72	111	105	109	154
45 - 49	58	59	66	58	70	109	103	107
50 - 54	46	54	57	63	56	67	105	99
55 - 59	30	34	50	53	58	52	62	97
60 - 64	19	23	30	44	47	51	46	55
65 - 69	12	12	19	25	36	39	42	38
70 - 74	11	9	9	14	18	26	29	31
75 +	9	9	9	9	12	16	22	27
Totals	1127	1181	1319	1475	1644	1816	1996	2190
FEMALES								
0 - 4	136	146	162	183	204	214	228	250
5 - 9	141	132	146	162	182	203	213	227
10 - 14	130	149	132	146	162	182	203	213
15 - 19	109	111	149	132	146	162	182	203
20 - 24	103	107	111	149	132	146	162	182
25 - 29	94	99	107	111	149	132	146	162
30 - 34	70	88	99	107	111	149	132	146
35 - 39	61	61	88	99	107	111	148	131
40 - 44	55	60	61	87	98	106	110	147
45 - 49	45	49	59	60	86	97	105	108
50 - 54	33	40	48	58	59	84	95	102
55 - 59	21	24	38	46	56	57	81	91
60 - 64	13	17	23	36	43	53	54	76
65 - 69	7	7	15	21	33	39	48	49
70 - 74	10	6	6	13	18	28	33	41
75 +	14	11	10	10	15	21	31	40
Totals	1042	1107	1254	1420	1601	1784	1971	2168
Persons	2169	2288	2573	2895	3245	3600	3967	4358
Index (1981 = 100)	95	100	112	127	142	157	173	190

/Contd...

TABLE A.32 (Contd.)
Projection for Inner Bradford (Cont. 3)

Sex Age group	YEAR							
	1979	1981	1986	1991	1996	2001	2006	20
MALES								
0 - 4	296	301	311	352	389	407	423	4
5 - 9	313	289	300	310	351	387	405	4
10 - 14	267	236	229	200	310	350	386	40
15 - 19	234	238	235	186	299	309	349	38
20 - 24	234	228	237	333	287	296	37	34
25 - 29	198	239	227	236	531	286	296	30
30 - 34	140	155	238	226	235	329	284	29
35 - 39	133	125	154	136	224	233	327	28
40 - 44	133	139	124	152	233	221	230	32
45 - 49	120	174	136	121	149	228	216	22
50 - 54	95	112	119	131	116	143	219	20
55 - 59	63	71	104	111	122	108	133	20
60 - 64	40	48	63	93	99	109	96	11
65 - 69	26	25	40	52	77	82	90	8
70 - 74	24	19	19	30	39	57	61	6
75 +	19	20	20	20	27	36	51	60
Totals	2355	2469	2716	2991	3288	3583	3873	4170
FEMALES								
0 - 4	297	220	221	331	365	383	398	421
5 - 9	280	264	219	291	330	364	382	397
10 - 14	259	296	264	230	291	330	364	381
15 - 19	218	221	296	264	289	291	329	363
20 - 24	206	211	221	295	263	288	290	328
25 - 29	186	197	214	221	294	262	287	289
30 - 34	149	175	196	213	220	293	261	281
35 - 39	121	122	174	195	212	219	292	260
40 - 44	109	120	121	173	193	210	217	290
45 - 49	90	97	118	119	171	190	207	214
50 - 54	65	80	95	115	116	167	186	200
55 - 59	42	48	77	91	111	112	161	179
60 - 64	25	33	45	73	86	105	106	152
65 - 69	15	14	30	41	66	78	96	96
70 - 74	21	13	12	26	35	57	67	82
75 +	26	21	21	26	30	42	63	82
Totals	2109	2205	2465	2757	3072	3391	3706	4023
Persons	4464	4674	5181	5743	6360	6974	7579	8193
Index (1981 = 100)	96	100	111	123	136	149	162	175

/Contd.....

TABLE A.52 (Contd.)

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Projection for Outer Bradford (Zone 4)

Sex	YEAR							
	Age Group	1979	1981	1986	1991	1996	2001	2006
MALES								
0 - 4	113	115	99	111	123	129	127	122
5 - 9	120	111	115	99	111	123	129	127
10 - 14	110	129	111	115	99	111	123	129
15 - 19	89	91	129	111	115	99	111	123
20 - 24	89	87	91	128	111	114	99	111
25 - 29	75	91	87	91	127	110	113	99
30 - 34	53	59	91	87	91	126	109	112
35 - 39	51	48	59	90	86	90	125	108
40 - 44	50	53	47	58	89	85	89	124
45 - 49	46	47	52	46	57	87	83	87
50 - 54	36	43	45	50	44	55	84	80
55 - 59	24	27	40	42	47	41	52	79
60 - 64	15	6	24	36	38	42	37	47
65 - 69	9	9	5	20	30	32	35	31
70 - 74	9	7	7	4	15	23	24	27
75 +	7	8	9	9	7	13	21	25
Totals	896	931	1011	1097	1190	1280	1361	1431
FEMALES								
0 - 4	112	117	93	104	116	121	119	115
5 - 9	106	106	117	93	104	116	121	119
10 - 14	104	119	106	117	93	104	116	121
15 - 19	88	89	119	106	117	93	104	116
20 - 24	83	86	89	119	106	117	93	104
25 - 29	75	79	86	89	119	106	117	93
30 - 34	60	71	79	86	89	119	106	117
35 - 39	49	49	71	79	86	89	119	106
40 - 44	44	49	49	70	78	85	88	118
45 - 49	36	39	48	48	69	77	84	87
50 - 54	26	32	38	47	47	67	75	82
55 - 59	16	19	31	37	45	45	65	72
60 - 64	9	13	18	29	35	43	43	62
65 - 69	5	5	12	16	27	32	39	39
70 - 74	8	5	4	10	14	23	28	34
75 +	10	8	8	8	12	17	26	35
Totals	831	886	968	1058	1157	1254	1343	1420
Persons	1727	1817	1979	2155	2347	2534	2704	2851
Index (1981 = 100)	91	100	104	113	123	133	142	150

/Contd...

TABLE A.33 Projected numbers of Indians, Bradford zones, 1979-2011, by sex and age: projection 3, migration included, vital rates variable over space and constant over time

Projection for University Ward (Zone 1)

Sex	YEAR							
	Age group	1979	1981	1986	1991	1996	2001	2006
MALES								
0 - 4	205	193	178	195	201	194	186	18
5 - 9	213	185	161	150	164	170	165	15
10 - 14	193	215	161	141	132	145	150	14
15 - 19	153	152	191	146	129	122	134	13
20 - 24	160	146	143	173	139	127	122	13
25 - 29	135	153	127	125	147	124	116	11
30 - 34	96	100	131	111	110	128	110	10
35 - 39	90	80	87	114	97	97	113	9
40 - 44	91	89	70	76	100	85	85	100
45 - 49	82	79	75	59	65	85	73	7
50 - 54	65	72	65	62	49	54	71	6
55 - 59	43	45	57	52	4	39	43	57
60 - 64	28	31	33	43	39	37	30	33
65 - 69	16	16	21	22	29	26	25	20
70 - 74	13	12	11	14	15	19	17	16
75 +	13	13	11	11	12	13	14	15
Totals	1596	1581	1522	1494	1477	1465	1454	1449
FEMALES								
0 - 4	197	190	166	181	187	181	173	172
5 - 9	196	173	158	139	152	157	153	147
10 - 14	173	194	150	138	123	134	139	136
15 - 19	138	145	183	147	137	125	135	139
20 - 24	140	140	154	185	157	150	141	149
25 - 29	130	129	127	137	160	141	136	130
30 - 34	104	115	112	111	120	139	124	110
35 - 39	83	80	100	98	98	106	122	110
40 - 44	78	79	73	91	89	90	97	111
45 - 49	62	64	65	61	75	74	75	51
50 - 54	45	52	54	55	52	64	63	65
55 - 59	29	31	43	45	46	44	54	53
60 - 64	17	22	25	35	37	38	36	44
65 - 69	9	9	18	20	28	29	30	29
70 - 74	10	8	9	15	17	23	24	13
75 +	12	14	13	12	16	19	23	22
Totals	1423	1445	1450	1470	1494	1514	1525	1538
Persons	3019	3026	2972	2964	2971	2979	2979	2987
Index (1981 = 100)	100	100	98	98	98	98	98	99

TABLE A.33 (Contd...)

Projection for Bradford Moor (Zone 2)

Sex	YEAR							
	Age group	1979	1981	1986	1991	1996	2001	2006
MALES								
0 - 4	128	144	244	364	458	515	571	650
5 - 9	137	138	170	261	374	465	515	567
10 - 14	122	161	161	192	276	384	469	518
15 - 19	81	114	193	190	219	296	398	479
20 - 24	77	109	176	255	247	273	340	433
25 - 29	81	114	178	235	314	300	322	377
30 - 34	62	74	143	199	250	328	311	330
35 - 39	60	60	85	156	205	252	330	311
40 - 44	59	67	67	92	163	207	250	327
45 - 49	54	59	75	73	99	170	209	249
50 - 54	42	54	65	80	77	103	173	207
55 - 59	29	34	57	68	82	78	102	168
60 - 64	18	23	34	56	65	78	73	95
65 - 69	9	12	21	31	50	57	68	63
70 - 74	9	9	14	21	29	43	48	56
75 +	8	9	13	18	24	32	44	52
Totals	976	1181	1696	2291	2932	3579	4223	4882
FEMALES								
0 - 4	125	146	228	340	429	482	535	609
5 - 9	130	132	169	245	351	435	485	533
10 - 14	103	149	152	190	260	361	442	489
15 - 19	64	111	204	205	241	304	399	476
20 - 24	69	107	202	292	290	324	379	467
25 - 29	82	99	175	258	345	339	370	415
30 - 34	64	88	123	195	271	356	347	377
35 - 39	56	61	100	135	202	273	357	346
40 - 44	47	60	69	109	142	204	270	351
45 - 49	40	49	76	86	130	165	228	295
50 - 54	30	40	57	83	92	136	170	228
55 - 59	19	24	44	61	85	93	136	168
60 - 64	10	17	26	46	63	85	92	133
65 - 69	4	7	20	29	48	63	83	89
70 - 74	8	6	12	23	31	48	61	78
75 +	9	11	15	20	31	42	60	80
Totals	860	1107	1672	2317	3011	3710	4414	5134
Persons	1836	2288	3568	4608	5943	7289	8637	10016
Index (1981 = 100)	80	100	147	201	260	319	377	438

/Contd...

TABLE A.33 (Contd.)

Projection for Inner Bradford (Zone 3)

Sex Age group	YEAR							2
	1979	1981	1986	1991	1996	2001	2006	
MALES								
0 - 4	280	301	360	450	531	570	606	-
5 - 9	299	289	331	381	469	542	519	-
10 - 14	274	336	316	348	391	479	552	-
15 - 19	216	238	364	334	360	400	487	-
20 - 24	211	226	272	388	352	372	408	-
25 - 29	187	239	272	302	408	368	382	-
30 - 34	134	155	261	280	307	408	368	-
35 - 39	128	125	168	270	283	309	408	-
40 - 44	128	139	133	173	271	282	308	-
45 - 49	116	124	147	137	174	269	278	-
50 - 54	91	112	129	148	136	171	261	-
55 - 59	61	71	112	125	141	128	159	-
60 - 64	38	48	68	104	113	126	114	-
65 - 69	25	25	41	59	89	96	106	-
70 - 74	23	19	21	31	44	65	69	-
75 +	18	20	23	25	31	41	57	-
Totals	2229	2469	3024	3561	4100	4626	5142	5
FEMALES								
0 - 4	261	290	345	429	500	537	570	-
5 - 9	266	264	324	361	443	514	549	-
10 - 14	239	296	291	342	371	453	523	-
15 - 19	192	221	337	323	367	392	473	-
20 - 24	181	214	272	378	358	395	416	-
25 - 29	174	197	264	309	409	383	414	-
30 - 34	141	175	222	277	321	418	391	-
35 - 39	115	122	191	232	282	326	422	-
40 - 44	107	120	133	200	238	285	330	-
45 - 49	85	97	123	132	191	223	265	-
50 - 54	62	80	103	129	135	192	221	-
55 - 59	39	48	84	105	130	134	188	-
60 - 64	23	33	50	63	102	125	129	-
65 - 69	13	14	34	49	79	96	117	-
70 - 74	21	13	14	30	42	65	79	-
75 +	17	21	23	23	33	46	68	-
Totals	1936	2205	2810	3402	4001	4584	5155	5
Persons	4165	4674	5834	6963	8101	9210	10297	114
Index (1981 = 100)	89	100	125	149	173	197	220	-

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/Contd....

TABLE A.33 (Contd..)
Projection for Outer Bradford (Zone 4)

Sex Age group	Year							
	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	123	115	87	102	119	127	138	151
5 - 9	128	111	95	86	108	128	138	151
10 - 14	117	129	95	86	86	111	132	144
15 - 19	99	91	112	85	81	86	113	134
20 - 24	102	87	71	92	74	73	83	109
25 - 29	82	91	62	63	85	74	76	90
30 - 34	57	59	75	61	66	89	80	83
35 - 39	54	48	51	68	62	70	93	85
40 - 44	54	53	42	46	64	62	71	94
45 - 49	49	47	45	37	42	61	62	77
50 - 54	38	43	38	38	32	37	56	53
55 - 59	25	27	36	33	34	29	35	54
60 - 64	15	6	21	29	28	30	26	37
65 - 69	10	9	6	16	23	23	25	22
70 - 74	9	7	5	4	9	14	14	15
75 +	7	6	7	0	6	10	14	16
Totals	969	951	848	852	919	1024	1156	1315
FEMALES								
0 - 4	121	117	82	96	112	120	129	146
5 - 9	120	106	98	82	102	121	132	142
10 - 14	112	119	92	89	82	105	126	138
15 - 19	97	89	101	81	81	80	104	125
20 - 24	93	86	70	87	73	76	81	104
25 - 29	81	79	64	69	91	83	89	98
30 - 34	64	71	66	63	74	97	91	98
35 - 39	52	49	61	60	64	78	102	96
40 - 44	44	49	43	55	57	64	79	103
45 - 49	38	39	49	45	59	63	72	86
50 - 54	27	32	34	43	41	55	61	72
55 - 59	18	19	27	30	39	38	52	59
60 - 64	10	13	15	22	25	33	32	45
65 - 69	6	5	9	11	17	20	26	26
70 - 74	8	5	4	8	10	16	19	24
75 +	7	6	7	7	10	13	19	25
Totals	898	886	822	848	937	1062	1214	1387
Persons	1867	1817	1670	1700	1856	2086	2370	2702
Index (1981 = 100)	98	100	88	89	96	110	129	142

TABLE A.34 Projected number of Indians, Bradford zones, 1979-2011,
by sex and age: projection 4, migration included,
vital rates variable over space and variable over time

Sex	Projection for University Ward (Zone 1)							
	YEAR							
Age group	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	205	193	155	137	132	130	120	112
5 - 9	213	185	161	131	117	113	112	109
10 - 14	193	215	161	141	116	104	101	100
15 - 19	153	152	191	146	130	109	99	95
20 - 24	160	146	143	174	140	128	112	100
25 - 29	135	153	127	125	148	125	117	100
30 - 34	96	100	131	111	110	129	111	100
35 - 39	90	80	87	114	97	97	114	99
40 - 44	91	89	70	76	100	86	86	100
45 - 49	82	79	75	59	65	86	74	77
50 - 54	65	72	65	62	49	54	72	66
55 - 59	43	45	57	51	49	39	43	55
60 - 64	28	31	33	42	38	36	29	35
65 - 69	16	16	21	22	29	26	25	22
70 - 74	13	12	11	14	15	20	18	11
75 +	13	13	11	11	13	16	19	11
Totals	1596	1581	1499	1416	1348	1298	1252	1211
FEMALES								
0 - 4	197	190	144	126	122	119	110	100
5 - 9	196	173	158	121	107	104	102	99
10 - 14	173	194	150	138	107	96	93	92
15 - 19	138	145	183	147	137	112	105	100
20 - 24	140	140	154	185	157	150	130	122
25 - 29	130	129	127	137	160	141	136	122
30 - 34	104	115	112	111	120	140	124	120
35 - 39	83	80	100	98	98	106	124	116
40 - 44	78	79	73	91	90	90	97	114
45 - 49	62	64	65	61	76	75	76	82
50 - 54	45	52	54	55	52	65	65	66
55 - 59	29	31	43	45	46	44	55	55
60 - 64	17	22	25	35	37	38	36	40
65 - 69	9	9	18	20	28	29	30	29
70 - 74	10	8	9	15	17	23	24	25
75 +	12	14	13	13	17	21	27	32
Totals	1423	1445	1428	1396	1371	1353	1332	1314
Persons	3019	3026	2927	2814	2719	2651	2584	2527
Index (1981)	100	100	97	93	90	88	85	84

TABLE A.34 (Contd....)
Projection for Bradford Moor (Zone 2)

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Sex Age group	YEAR							
	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	128	144	212	259	311	355	373	391
5 - 9	137	138	170	228	269	318	359	375
10 - 14	122	161	161	192	242	279	326	365
15 - 19	81	114	193	190	219	262	295	340
20 - 24	77	109	176	255	248	274	308	336
25 - 29	81	114	178	235	314	301	323	347
30 - 34	62	74	143	199	250	328	312	332
35 - 39	60	60	85	156	206	253	331	313
40 - 44	59	67	67	92	163	209	253	330
45 - 49	54	59	75	73	99	171	212	253
50 - 54	42	54	65	80	77	103	173	208
55 - 59	29	34	57	67	81	77	101	166
60 - 64	18	23	34	55	64	76	71	92
65 - 69	9	12	21	31	50	57	67	63
70 - 74	9	9	14	21	30	45	51	59
75 +	6	9	13	19	27	37	55	70
Totals	976	1181	1664	2152	2650	3145	3610	4040
FEMALES								
0 - 4	125	146	197	241	289	330	347	363
5 - 9	130	132	169	212	251	297	335	350
10 - 14	103	149	152	190	226	261	305	342
15 - 19	64	111	204	205	241	271	302	343
20 - 24	69	107	202	292	290	324	347	374
25 - 29	82	99	175	258	345	339	371	384
30 - 34	64	88	123	195	271	357	348	379
35 - 39	56	61	100	135	203	274	359	348
40 - 44	47	60	69	109	143	206	272	354
45 - 49	40	49	76	86	131	167	231	299
50 - 54	30	40	57	83	93	138	172	232
55 - 59	19	24	44	61	85	95	139	171
60 - 64	10	17	26	47	63	86	95	137
65 - 69	4	7	20	29	49	64	85	92
70 - 74	8	6	12	23	31	49	61	79
75 +	9	11	15	21	31	46	68	93
Totals	860	1107	1641	2187	2743	3304	3837	4340
Persons	1836	2288	3305	4339	5393	6449	7447	8380
Index (1981 =100)	80	100	144	190	230	282	325	366

/Contd.....

TABLE A.34 (Contd.)
Projection for Inner Bradford (Zone 3)

Sex	YEAR							
Age group	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	280	301	317	332	378	411	415	41
5 - 9	299	289	331	332	345	389	421	46
10 - 14	274	336	316	348	343	356	398	44
15 - 19	216	238	364	334	360	353	366	41
20 - 24	211	228	272	389	352	372	365	33
25 - 29	187	239	273	302	410	369	384	33
30 - 34	134	155	261	281	308	411	370	33
35 - 39	128	125	168	270	284	311	412	33
40 - 44	128	139	133	174	272	284	311	44
45 - 49	116	124	147	137	176	270	281	33
50 - 54	91	112	128	148	136	172	261	22
55 - 59	61	71	112	123	140	127	159	22
60 - 64	38	48	68	103	111	124	112	11
65 - 69	25	25	41	60	89	96	106	
70 - 74	23	19	21	31	46	68	73	
75 +	18	20	24	27	34	49	72	
Totals	2229	2469	2976	3391	3784	4162	4506	48
FEMALES								
0 - 4	261	290	298	311	354	384	388	35
5 - 9	266	264	324	314	326	367	396	40
10 - 14	239	296	291	342	325	336	376	40
15 - 19	192	221	337	323	368	347	359	35
20 - 24	131	214	272	378	358	396	374	38
25 - 29	174	197	264	309	409	384	410	35
30 - 34	141	175	222	277	321	418	393	40
35 - 39	115	122	191	232	282	327	423	39
40 - 44	107	120	133	201	239	286	333	42
45 - 49	85	97	123	132	193	225	267	31
50 - 54	62	80	103	129	136	195	224	26
55 - 59	39	48	84	105	130	136	193	22
60 - 64	23	33	50	84	103	126	132	16
65 - 69	13	14	34	49	80	97	119	12
70 - 74	21	13	14	30	41	66	79	9
75 +	17	21	23	24	36	51	76	10
Totals	1936	2205	2763	3240	3701	4141	4548	491
Persons	4165	4674	5739	6631	7485	8303	9054	9741
Index (1981 = 100)	89	100	123	142	160	178	194	201

/Contd.

TABLE A.34 (Contd)
Projection for Outer Bradford (Zone 4)

Sex Age group	YEAR							
	1979	1981	1986	1991	1996	2001	2006	2011
MALES								
0 - 4	123	115	75	78	87	95	98	101
5 - 9	128	111	95	74	80	91	101	106
10 - 14	117	129	95	86	74	82	93	106
15 - 19	99	91	112	85	81	75	83	91
20 - 24	102	87	71	92	74	74	73	81
25 - 29	82	91	62	63	85	74	77	81
30 - 34	57	59	75	61	67	89	80	81
35 - 39	54	48	51	68	63	71	94	81
40 - 44	54	53	42	46	64	63	73	91
45 - 49	49	47	45	37	42	61	63	71
50 - 54	38	43	38	38	32	37	56	66
55 - 59	25	27	36	33	34	29	34	35
60 - 64	15	6	21	29	28	29	25	33
65 - 69	10	9	6	16	23	23	24	22
70 - 74	9	7	5	4	10	14	15	13
75 +	7	8	8	7	7	12	18	12
Totals	969	931	837	817	851	919	1007	1100
FEMALES								
0 - 4	121	117	71	73	82	89	91	91
5 - 9	120	106	98	71	76	86	95	91
10 - 14	112	119	92	89	71	78	89	91
15 - 19	97	89	101	81	81	70	77	81
20 - 24	93	86	70	87	73	76	71	71
25 - 29	81	79	64	69	91	83	89	81
30 - 34	64	71	66	63	74	97	91	91
35 - 39	52	49	61	60	64	78	102	91
40 - 44	44	49	43	55	57	64	80	101
45 - 49	38	39	49	45	60	64	72	81
50 - 54	27	32	34	43	41	56	62	71
55 - 59	18	19	27	30	39	38	53	61
60 - 64	10	13	15	22	25	33	33	41
65 - 69	6	5	9	11	17	20	26	21
70 - 74	8	5	4	8	10	16	19	13
75 +	7	8	7	7	11	14	22	7
Totals	898	886	811	814	872	962	1072	1119
Persons	1867	1817	1648	1631	1723	1881	2079	2229
Index (1981 = 100)	103	100	91	90	95	104	114	112

TABLE A.35 The proportion female in the Indian population,
Bradford zones, 1981, 1996, 2011

Projection, zone.	1981	1996	2011
Projection 1			
University ward	.476	.487	.484
Bradford Moor	.481	.492	.498
Inner Bradford	.473	.482	.490
Outer Bradford	<u>.481</u>	<u>.493</u>	<u>.497</u>
All Indians	.477	.487	.493
Projection 2			
University ward	.476	.488	.494
Bradford Moor	.481	.493	.497
Inner Bradford	.473	.483	.491
Outer Bradford	<u>.481</u>	<u>.493</u>	<u>.498</u>
All Indians	.477	.488	.494
Projection 3			
University ward	.476	.503	.515
Bradford Moor	.481	.507	.513
Inner Bradford	.473	.494	.503
Outer Bradford	<u>.481</u>	<u>.505</u>	<u>.513</u>
All Indians	.477	.500	.509
Projection 4			
University ward	.476	.504	.520
Bradford Moor	.481	.509	.518
Inner Bradford	.473	.494	.505
Outer Bradford	<u>.481</u>	<u>.506</u>	<u>.518</u>
All Indians	.477	.502	.513

Note

1. The proportion of females in the Bradford M.D. population born in England & Wales in 1981 is 0.520

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 TABLE A.36 Age structure of the Indian population:
Numbers and percentages, Bradford zones,
1981 and 2011, projections 1 to 4

Zone, broad age group	1981				2011							
	Projection 1		Projection 2		Projection 3		Projection 4					
UNIVERSITY WARD	N	%	N	%	N	%	N	%	N	%	N	%
0 - 19	1447	48	2024	39	2489	43	1222	41	801	32		
20 - 59	1454	48	2732	52	2863	49	1556	52	1506	60		
60 +	125	4	498	9	458	8	209	7	220	9		
Total	3026	100	5254	100	5805	100	2987	100	2527	100		
75 +	27	1	103	2	81	1	42	1	49	2		
BRADFORD MOOR												
0 - 19	1095	48	1548	39	1841	42	4321	43	2869	34		
20 - 59	1099	48	2075	52	2160	50	5049	50	4826	58		
60 +	94	4	380	9	357	8	646	6	685	8		
Total	2288	100	4003	100	4358	100	1016	100	8380	100		
75 +	20	1	78	2	67	2	132	1	163	2		
INNER BRADFORD												
0 - 19	2235	48	3074	38	3220	39	5217	46	3272	34		
20 - 59	2246	48	4207	52	4236	52	5337	47	5563	57		
60 +	193	4	769	10	737	9	859	8	911	9		
Total	4674	100	8050	100	8193	100	11413	100	9746	100		
75 +	41	1	158	2	142	2	152	1	191	2		
OUTER BRADFORD												
0 - 19	877	48	1249	39	972	34	1135	42	783	34		
20 - 59	879	48	1704	53	1579	55	1362	50	1299	57		
60 +	61	4	266	8	300	11	205	8	217	9		
Total	1817	100	3219	100	2851	100	2702	100	2299	100		
75 +	16	1	41	1	60	2	41	2	52	2		
ALL INDIANS												
0 - 19	5654	48	7895	38	8517	40	11895	44	7725	34		
20 - 59	5678	48	10718	52	10838	51	13304	49	13194	57		
60 +	473	4	1913	9	1852	9	1919	7	2033	9		
Total	11805	100	20526	100	21207	100	27118	100	22952	100		
75 +	104	1	380	2	350	2	367	1	455	2		

Source: computed from Tables A.31, A.32, A.33 and A.34.

Notes: N = number % = percentage of all age total.