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WHERE DO BRITISH UNIVERSITIES GET THEIR STUDENTS FROM?

John Stillwell and Philip Rees

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School of Geography
University of Leeds
Leeds LS2 9JT

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ABSTRACT

The paper examines the patterns of migration of undergraduate students entering United Kingdom universities over the period 1976-1983 using the spatial framework of regions (of domicile) and university clusters provided in the UCCA statistics. The ways in which the changing numbers of university candidates applying and candidates accepted are distributed across the regions of the country and among groups of universities are described. The picture is a stable one despite for the fluctuation in the volume of migration and the increased participation of women. The national origins of overseas students are also outlined for recent years.

Analysis of the distribution of student migration flows reveals a very high degree of interregional migration, particularly compared with the comparable age group in the general population. Distance between domicile region and university cluster does, however, have a determining influence on migration, although an investigation using doubly constrained spatial interaction models (SIMs) reveals a wide variation in its effect across domicile region populations. The models are also used to establish the ability of university clusters to attract students from distant regions. Two ingredients have to be added to the SIM analysis to achieve a higher degree of explanation of the student flows: a barrier to flows to Northern Ireland of 890 kilometres over and above the road and sea crossing distance, and a barrier to flows to and from Scotland of 355 kilometres.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

In October, 1984, over 78.5 thousand new students began undergraduate degree courses at universities throughout the UK. About 5.7 thousand of these arrived from overseas, but the large majority (93%) were home students for whom the choice of university education represented the opportunity to move away from the family home for at least a temporary period and in many cases, to leave home for the first time. The volume and pattern of this seasonal student migration which occurs annually, are determined by a variety of influences associated with spatial differences in the demand for and supply of university education. The level of total demand varies from region to region in relation to the number of qualified candidates leaving the schools and sixth form colleges. The demand for places at particular universities is a function of several factors including course availability and reputation, supply of places and campus attractiveness as well as factors reflecting individuals' perceptions and desires. The accessibility of the university or its distance from the region of domicile may also be a factor of importance although the provision of grants from central government to cover the costs incurred by student travel has enabled university choice to remain unconstrained by travel costs. Consequently, the typical British university student, in contrast to his or her American counterpart, is much less likely to want to spend a period of higher education at that university which is located closest to his or her place of usual residence.

The national supply of places for undergraduate study and the supply of opportunities at different universities is controlled by central government through the University Grants Committee (UGC). The picture of expansion during the late 1960s and 1970s, followed by contraction since 1980 is well-documented, and a policy of continued contraction of real funds, and therefore of places, regardless of demographic influences on demand (Department of Education and Science, 1984; Association of University Teachers, 1983; Rees, 1985), is likely to have an impact on student migration patterns, particularly if contraction results in the closure or merger of individual institutions.

The implications of alternative policies, fascinating though they may be, are not considered here since this paper undertakes, in preliminary fashion, an analysis of student migration since the mid 1970s. The level of this migration, the pattern of its origin by region of domicile and that of its destination by university cluster are examined in Section 3.

The probabilities of student migration between origin and destination zones within the UK are also investigated with particular reference to the extent to which students stay in their home regions to attend university, and the degree of temporal stability in the distribution pattern. In Section 4, the influence of distance on student migration is explored using doubly constrained spatial interaction models. Spatial and temporal variation in decay parameters are reported and barrier effects on student migration between certain regions are quantified. Section 5 of the paper reports on the overseas origins from which UK universities recruit undergraduates, and Section 6 contains some concluding remarks. However, it is necessary to consider the data sources and spatial units adopted before embarking on the analysis.

2. DATA

2.1 Student migration

Student migration is identified in this paper as the movement of new undergraduates from their places of domicile to their universities. The extent to which it is appropriate to consider this activity as migration is questionable since the movement is, on most occasions, to a temporary rather than permanent place of usual residence. Most students return to their parental homes during vacation periods, if not more frequently, and the Register of Electors, for example, is designed to include those persons who are normally resident at each address but who are temporarily away as students. At the end of the period of education, many graduate students enter the national labour market and secure positions which necessitate further migration of either temporary or permanent nature. On the other hand, some enter a local labour market close to the university from which they have graduated and subsequently become permanent residents of that area, while others may terminate their period of temporary absence by returning home to seek further opportunity.

While most studies of migration in the UK rely on the Census of Population as the major source of reliable data, the Census does not provide information of a type suitable to analyse the seasonal movement of students to universities. If the date that the Census is taken precedes the beginning of the summer term, then students will simply not be recorded. Moreover, university students would not be differentiated from students migrating to public sector institutions. Consequently, the main sources on student movement are the publications of the Universities Central Council on Admissions (UCCA).

2.2 UCCA statistics

Each year, UCCA publishes an Annual Report and an associated Statistical Supplement containing details of the universities admissions process of the previous year. Most of the data available relates either to 'candidates' or to 'accepted candidates'. Candidates (or applicants) are those who seek

admission to university through UCCA by completing an application form on which it is necessary to name up to five alternative courses, that is up to five applications. In 1982-83 approximately 8.2% out of 785,075 applications were 'unused choices'. Although candidates are classified by their region of domicile and it is therefore possible to examine the changing spatial pattern of demand for student places by region of origin, information is not published on the distribution of the applications which these candidates make.

The definition of candidates accepted requires slightly more explanation; a candidate may be given an offer which is either unconditional or conditional upon the achievement of some further qualification. If the first offer is unconditional, UCCA classify this candidate as accepted only when he firmly accepts the offer. If the first offer is conditional the candidate is counted as accepted only when having satisfied the university's conditions, he accepts the university's subsequent unconditional offer of a place. The data on candidates accepted includes those students accepted who applied through the Continuing Application Procedure (CAP) or through the Clearing process, both of which allow candidates whose initial applications were unsuccessful, to be reconsidered. The publication of data on candidates accepted by region of domicile and region of accepting university, disaggregated by sex, has been sporadic. For 1968-69, the figures were based on a 10.1% sample of home students, while for 1969-70, a 9.8% sample was taken. The flows for 1973-74, 1976-77, 1977-78, 1979-80 and 1982-83 were based on the whole population, and it is the matrices from 1976-77 onwards that have been used for analysis in this paper.

UCCA data on candidates accepted is not without its limitations, and there are two points to note in particular. Firstly, a number of candidates are admitted to certain universities by direct entry and therefore do not appear in the UCCA records. The Scottish universities of Glasgow and Strathclyde are in this category and the University of Aberdeen has only participated fully in the UCCA scheme since 1982. In 1982-83, UCCA recorded 130 candidates

accepted by Glasgow University and 89 by Strathclyde, while the UGC statistics on new full-time undergraduates (UGC, 1984) suggest intakes of 2,422 and 1,581 students respectively. These latter admissions figures are based on an alternative definition of home undergraduates to that used by UCCA, but if we consider that only 5% of candidates accepted by Glasgow and Strathclyde are admitted through UCCA, this means that total flows to Scottish universities as a group are underrepresented by approximately 36%.

The second limitation involves the method of classifying 'home' and 'overseas' candidates which was changed in 1980. The previous method took account of whether or not candidates would be expected to pay fees at the home or overseas rate. It was considered impractical to continue on this basis since UCCA had no knowledge of decisions relating to individual cases, and the distinction on the basis of fee-paying status was weakened because of the existence of candidates from the European Community who were charged fees at the home student rate. So from 1980, candidates have been classed as overseas if their place of permanent residence is overseas. This meant that in 1981, over 20% of overseas candidates, and also of those accepted, would have been classified as home candidates on the 'fees' basis formerly used. UCCA have recalculated figures for 1980 on a domicile basis to facilitate comparison. Prior to 1980, UCCA tabulated overseas candidates or candidates accepted by country where at least 100 apply or at least 20 are accepted. Since 1980-81, the data presented is for countries where at least 120 apply or at least 40 are accepted. Candidates normally resident in the UK but living abroad because of their parents' occupation are classified as home candidates.

UCCA does not publish information on the total number of new undergraduates who enter each university. Admission statistics are published by the UGC who still maintain fee-paying status as the basis of the distinction between home and overseas students. Moreover, the entrant count for overseas students includes a significant number of students from abroad who come to spend a

relatively short period of time at a British university, usually funded by their governments through particular schemes, and who by-pass the UCCA system entirely.

2.3 Origins and destinations

One further area of limitation with published UCCA data on student migration is that associated with the specification of origin and destination zones. The designation of regions of domicile has not been consistent over time and this limits longer time series analysis. The reorganisation of county boundaries in 1974 is likely to have had a small effect as parts of Lincolnshire were transferred from the East Midlands to Yorkshire and Humberside, and parts of Hampshire were transferred from the South East to the South West. In 1976-77, UCCA published data which for the first time, separated the Northern region from Yorkshire and Humberside and distinguished Greater London from the rest of the South East. The desire to undertake analysis of home students using the current set of 12 domicile regions (Figure 1) precludes the use of data prior to 1976-77 without estimation and adjustment. Two other groups of candidates are omitted from the analysis of home students: a very small number of candidates with unknown home address, and the group identified up to 1979-80 as 'non-UK' candidates, comprising those classified as home candidates but living outside the UK. The latter group formed 3.4% of all home candidates and 2% of those accepted in 1979-80, and disappeared from the tabulations after 1980 when the classification of home and overseas candidates was changed to one based on place of domicile. UCCA use two levels of disaggregation of area of origin of overseas candidates. In the first case, overseas candidates from Commonwealth countries, associated states, colonies and protectorates are distinguished from those overseas candidates from other countries; and in the second, overseas candidates are classified by continent and by country.

The zones of destination for student migrants are the accepting universities but UCCA have never published university-specific information and consequently 11 regional clusters of universities are defined (Figure 1) in which there exist two or more institutions. These regional clusters have not been changed over time.

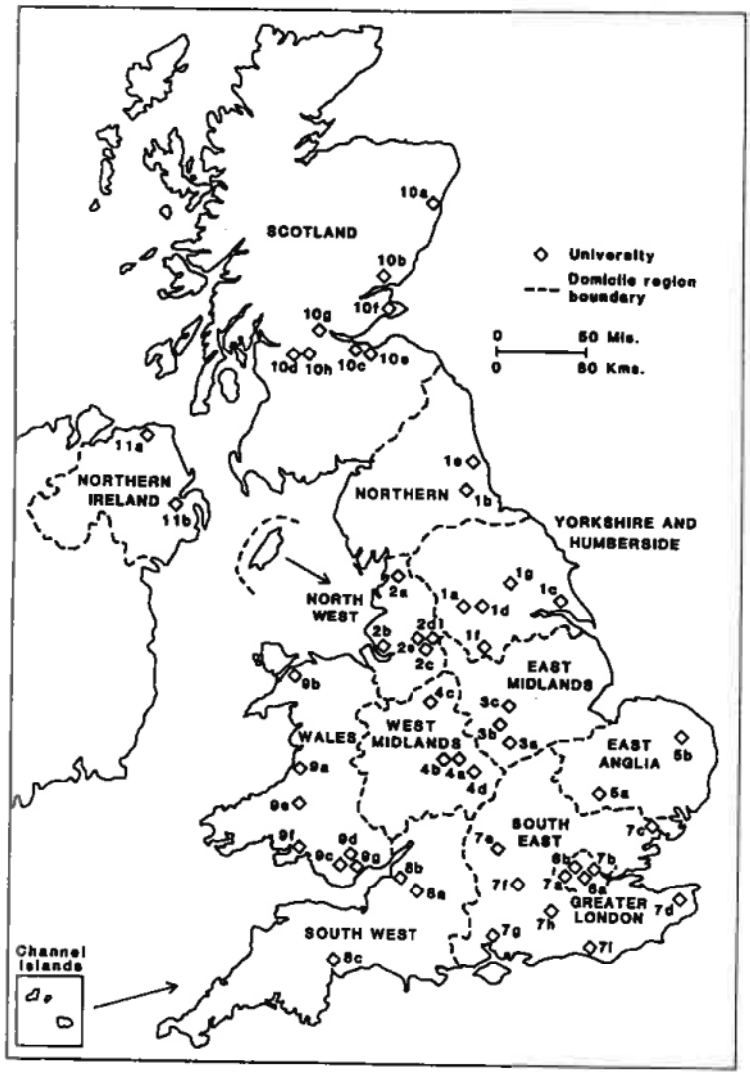

FIGURE 1 The location of United Kingdom domicile regions and universities

Key to Figure 1: The components of origin and destination regions

Regions of domicile

1.	Northern	(NO)	Cleveland, Cumbria, Durham, Northumberland, Tyne and Wear
2.	Yorkshire and Humberside	(YH)	Humberside, North Yorkshire, South Yorkshire, West Yorkshire
3.	North West	(NW)	Cheshire, Lancashire, Merseyside, Greater Manchester, Isle of Man
4.	East Midlands	(EM)	Derbyshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire
5.	West Midlands	(WM)	Hereford and Worcester, Shropshire, Staffordshire, Warwickshire, West Midlands
6.	East Anglia	(EA)	Cambridgeshire, Norfolk, Suffolk
7.	Greater London	(GL)	London Boroughs
8.	South East	(SE)	Bedfordshire, Berkshire, Buckinghamshire, East Sussex, Essex, Hampshire, Hertfordshire, Isle of Wight, Kent, Oxfordshire, Surrey, West Sussex
9.	South West	(SW)	Avon, Cornwall, Devon, Dorset, Gloucestershire, Somerset, Wiltshire, Isle of Scilly, Channel Islands
10.	Wales	(WA)	
11.	Scotland	(SC)	
12.	Northern Ireland	(NI)	

Regions of accepting university

1. North and Yorkshire (NY)
   - 1a Bradford
   - 1b Durham
   - 1c Hull
   - 1d Leeds
   - 1e Newcastle
   - 1f Sheffield
   - 1g York

2. North West (NW)
   - 2a Lancaster
   - 2b Liverpool
   - 2c Manchester
   - 2d Manchester IST
   - 2e Salford

3. East Midlands (EM)
   - 3a Leicester
   - 3b Loughborough
   - 3c Nottingham

4. West Midlands (WM)
   - 4a Aston
   - 4b Birmingham
   - 4c Keele
   - 4d Warwick

5. East Anglia (EA)
   - 5a Cambridge
   - 5b East Anglia

6. South East, London (SL)
   - 6a London Colleges
   - 6b London Medical and Dental Schools and Colleges

7. South East, Other (SO)
   - 7a Brunel
   - 7b City
   - 7c Essex
   - 7d Kent
   - 7e Oxford
   - 7f Reading
   - 7g Southampton
   - 7h Surrey
   - 7i Sussex

8. South West (SW)
   - 8a Bath
   - 8b Bristol
   - 8c Exeter

9. Wales (WA)
   - 9a Aberystwyth
   - 9b Bangor
   - 9c Cardiff
   - 9d UWIST
   - 9e St. Davids University, Lampeter
   - 9f Swansea
   - 9g Welsh National School of Medicine

10. Scotland (SC)
   - 10a Aberdeen
   - 10b Dundee
   - 10c Edinburgh
   - 10d Glasgow
   - 10e Heriot Watt
   - 10f St. Andrews
   - 10g Stirling
   - 10h Strathclyde

11. Northern Ireland (NI)
   - 11a University of Ulster, Coleraine
   - 11b Queen's University, Belfast

3. CHARACTERISTICS OF THE MIGRATION OF HOME UNDERGRADUATES

3.1 The components of undergraduate migration

The raw data on undergraduate migration consists of 15 matrices of flows of accepted candidates (with a UK domicile) from 12 domicile regions to 11 university clusters. There is one set of 5 matrices for each of males, females and persons. The 5 matrices refer to acceptance in application years (roughly 1st October in one year to 30th September in the next) 1976-77, 1977-78, 1978-79, 1979-80 and 1982-83. These will be referred to in the tables by the year of entry, for example, 1983 for 1982-83.

It has proved useful to decompose migration matrices into component levels and probabilities, in order to separate out different trends and patterns. Frey (1983, 1984), for example, has decomposed intra-metropolitan migration into a mobility component (the rate at which persons migrate) and destination propensities (the probability of choosing a central city or suburban destination). Willekens and Baydar (1983) recognise, in their work on the migration between settlement types in the Netherlands over a twenty year period, a level component (the total number of intermunicipal migrations), a generation component (the proportions of migrations generated at origins) and a distribution component (the probability that a migration will go to a particular destination given a particular origin). The validity of the particular decomposition of migration can be tested using log-linear or discrete multivariate analysis (Bishop, Fienberg and Holland, 1975).

Here five components are proposed: (i) a level component; (ii) a sex component; (iii) a generation component; (iv) an admissions component; and (v) a distribution component. The level component measures the overall level of migration in the system. The sex component measures how the overall number of students are split in terms of men and women. The generation component measures the relative importance of the different domicile regions as producers of admitted candidates. The admission component measures the relative importance of the

different university clusters in providing places for students. The distribution component measures either the way in which students from different origins (domicile regions) choose different destinations (university clusters) or the way different university clusters (destinations) admit students from domicile regions (origins). All of these components can vary over time, and can interact in various ways. A formal (mathematical) model is not proposed at this stage (see Section 4 for models of the distribution component); rather we explore the trends and patterns of student migration under these headings.

3.2 The level of undergraduate migration

The level of undergraduate migration is determined by the supply of new places at universities, and hence by national government policy implemented through the University Grants Committee. New entrants (with a UK domicile) to UK universities reached a peak for those entering in 1980 (Table 1) at just over 78 thousand. Government imposed cutbacks had reduced this figure to 71.5 thousand for those entering in 1983 (the figures on a 'home fee' basis are 1-2 thousand higher). Undergraduate admissions were in 1983 and in 1984 below the level recorded in 1977.

The age group, the 18 year olds, that supplies around 60% of accepted candidates, continued to grow over the 1977-83 period (though it fell in 1984 and 1985) resulting in a substantial drop in the age participation ratio (ratio of new entrants to numbers of 18 year olds)(Table 2). However, the peak age participation ratio was reached earlier than the peak in new entrant numbers in 1978.

One consequence of the fall in the number of places at universities has been a displacement of demand into public sector institutions (polytechnics, colleges). The number of new entrants into the public sector continued to grow until 1982 (DES, 1984, Table 7.4). Unfortunately, there are no statistics available for the migrations of students entering public sector institutions.

Year of admission	New entrants (UGC)	Index (1977=100)	% female	Admitted candidates (UCCA)	Index (1977=100)	% female
1977	73,089	100	37.5	70,314	100	38.3
1978	74,927	103	38.4	73,049	104	38.4
1979	76,699	105	40.0	75,318	107	39.8
1980	78,386	107	40.4	77.390	110	40.8
1981	76,226	104	40.7	74,514	106	41.3
1982	73,954	101	41.4	72,634	103	41.6
1983	71,569	98	41.4	69,631	99	42.0

Notes

1. New entrant = full-time undergraduate new entrant, UK domicile, from UGC statistics.
2. Admitted candidate = candidate accepted, UK domicile, from UCCA statistics.

Sources

1. New entrants: UGC (1983), Table 7, pp. 24-25.
   UGC (1984), Table 7, pp. 24-25.
2. Admitted candidates: UCCA (1978-84b)

TABLE 1 Numbers of new entrants and accepted candidates, UK universities, 1977-83

Mid-year	England and Wales	Scotland	Northern Ireland	United Kingdom	APR (%)
1977	731	86	27	844	8.66
1978	740	86	27	853	8.78
1979	773	88	28	889	8.63
1980	791	89	28	908	8.63
1981	820	91	28	939	8.12
1982	843	94	28	965	7.66
1983	852	93	29	974	7.35

Notes

1. All figures are in 1,000s rounded to the nearest 1,000.
2. APR = % age participation ration = 100 (new entrants/ 18 year olds).

The new entrants figures are given in Table 1.

Sources

1. England and Wales: OPCS (1980a, 1980b, 1981, 1983, 1984a, 1985a).
2. Scotland: Registrar General (1978-84).
3. Northern Ireland, 1981-83: OPCS (1984b, 1985b).
4. Northern Ireland, 1977-80: Estimated from 15-19 year old population given in Registrar General, Northern Ireland (198-81).

All populations are mid-year estimates of the home population.

TABLE 2 Estimates of the numbers of 18 year olds in the UK, and the age participation ratio, 1977-83

3.3 The participation of women

A consistent trend over the past seven years (and earlier) has been the rising participation of women in higher education and their increasing proportion among the student body (Table 1). The female share has risen from around 38% in 1977 to 42% in 1983, although the rise has slowed down in the 1980s (particularly compared with the early 1970s, see AUT, 1983, Table 4, p. 18).

The trend of increasing female participation has been uniform across the country (Table 3), with gains in the female percentage of admitted candidates over the period 1977-83 varying by only ±0.7% around the mean value of 5.4%. The main differences across domicile region appear to be the greater female participation in Northern Ireland, and to a lesser extent in Scotland and Wales. The Northern Ireland figure is only just below the percentage that women make up of the 17-19 year old age group (between 48% and 49%).

3.4 The regional pattern of undergraduate origins

Where do new undergraduates come from? The fourth column in Table 4 lists an estimate, as of 1981 (entry year), of the distribution across domicile regions of accepted candidates. The figures have been corrected by the addition to the Scottish figures of 36% more entrants to allow for those admitted directly to Glasgow and Strathclyde universities. The South East (outside Greater London) supplies almost a quarter of the nation's new university undergraduates, the North West and Greater London supply an eighth and a ninth respectively, followed by Scotland with 9%. The West Midlands, South West and Yorkshire and Humberside provide 7 to 8% each; the East Midlands, Wales, Northern Ireland and Northern regions provide 4 to 5½% each; and East Anglia supplies the smallest share at just under 3%.

Is this share-out merely a reflection of the way the population of 17-19 year olds, from which the bulk of university undergraduates is admitted, is distributed? If the accepted candidates' percentage (column (4) in Table 4) is divided by

Region of domicile	Year of admission					Change in % 1977-83
	1977	1978	1979	1980	1983	
Northern	36.8	37.3	40.3	40.0	41.5	+ 4.7
Yorkshire and Humberside	35.3	36.6	38.8	40.5	41.0	+ 5.7
North West	36.5	37.3	38.9	40.5	41.3	+ 4.8
East Midlands	36.2	36.4	37.7	39.8	40.8	+ 4.6
West Midlands	35.6	37.7	38.0	39.2	41.8	+ 6.2
East Anglia	36.5	37.5	39.8	39.5	42.0	+ 5.5
Greater London	37.7	38.3	39.8	41.0	42.9	+ 5.2
South East	36.6	37.0	38.9	39.8	41.7	+ 5.1
South West	35.8	38.0	39.2	40.3	41.8	+ 6.0
Wales	38.6	39.7	40.7	41.3	43.3	+ 4.7
Scotland	39.1	38.7	41.2	41.7	43.9	+ 4.8
Northern Ireland	41.7	41.0	43.9	44.4	47.8	+ 6.1
United Kingdom	37.0	37.7	39.5	40.5	42.4	+ 5.4

Notes

1. Based on accepted candidates with UK domicile.

Source: UCCA (1978-84b).

TABLE 3 The female share of undergraduate admissions

Region of domicile	18 year olds 1981 % (1)	Qualified leavers 1981 % (2)	Candidates 1981 % (3)	Accepted candidates 1981 % (4)	Ratio of accepted candidates to 18 year olds (5)	Qualified leavers (6)	Candidates (7)
Northern	5.5	4.9	4.3	4.3	78	88	100
Yorkshire and Humberside	8.7	8.1	6.8	7.1	82	88	104
North West	11.5	11.0	11.5	12.0	104	109	104
East Midlands	6.7	6.4	5.4	5.4	81	84	100
West Midlands	9.3	8.1	7.7	7.6	82	94	99
East Anglia	3.2	3.3	2.8	2.9	91	88	104
Greater London	11.1	11.9	12.7	11.0	99	92	87
South East	18.5	21.3	21.9	23.5	127	110	107
South West	7.7	8.2	7.3	7.6	99	93	104
Wales	4.8	4.6	4.9	5.0	104	109	102
Scotland	9.9	9.4	10.6	9.0	91	96	85
Northern Ireland	3.0	2.7	4.1	4.5	150	167	110
United Kingdom	100.0	100.0	100.0	100.0	100	100	100
TOTALS (persons/1,000s)	921	146	153.6	74.5			

Sources
1. 18 year olds, 1981: unpublished OPCS tabulations derived from OPCS (1984b).
2. Qualified leavers: computed using the model described in Rees (1985).
3. Candidates, 1981: UCCA (1982b) Statistical Supplement 1980-81.
4. Admitted candidates, 1981: interpolated from 1980 and 1983 figures.

TABLE 4 A comparison of 18 year olds, qualified leavers and accepted candidates by domicile region, 1981

the percentage for the 18 year old population (colume (1) in Table 4), a ratio is obtained (column (5) in Table 4) which shows the concentration of undergraduates. The ratios are multiplied by a constant of 100. Ratios above 100 indicate a greater than average concentration of university undergraduates. Above average concentrations are found in Northern Ireland, the South East, North West and Wales. The Northern Ireland figure must be interpreted with caution as the estimate of the Northern Ireland 18 year old population is rather rough, and because the accepted candidates figure is interpolated between the 1980 and 1983 statistics between which dates a public sector institution (Ulster Polytechnic) merged with a university (University of Ulster, Coleraine). The other Northern and Midlands regions produce substantially fewer students than 18 year olds proportionally while Greater London and the South West are close to the national average.

Part of the explanation of these regional differences lies in the social class composition of the regional populations. Most university undergraduates come from social classes I and II. The estimate of qualified school leavers (with 2 or more 'A' levels), upon which the column (2) distribution was based (Rees, 1985), was derived by estimating the social class distribution of 18 year olds and applying national rates of attainment of qualified leaver status given social class. The distribution of qualified leavers is closer to that of accepted candidates than is the population in 6 regions but further away in 6: overall the index of dissimilarity is 5.4 for qualified leavers versus accepted candidates compared with 7.2 for the population.

The propensity of qualified leavers to become candidates for admission varies across the regions and the index of dissimilarity between the distribution of candidates and accepted candidates is only 3.4 points (on the usual 0-100 scale). The ratio of accepted candidates to candidates hovers quite close to 100 in most regions, though we should note the low ratios in Greater London and Scotland.

Roughly speaking then, variation among the regions in social class composition accounts for about a quarter of the difference between the distribution of accepted university candidates; variation in the propensity of qualified leavers accounts for another quarter; leaving half of the difference to be accounted for by variation in the success of candidates in different regions (see Table 5b). It should be stressed that these are very rough guesses since the Table 4 distributions are all problematic in one way or another.

What changes have occurred in recent years in the pattern of regional origins of new undergraduates? Table 5 sets out the distributions of candidates and accepted candidates in 1977 and 1983. The principal gaining regions increasing their shares of candidates by more than 0.2% of the national total are Greater London, Northern Ireland and East Anglia, with the percentage growth in candidates being between 37 and 38% in each. The Northern and Midlands regions experience lower than average growth as the number of candidates and in accepted candidates lose shares. The South East loses some of its share of accepted candidates. The synchronism of the increases and decreases in the shares of accepted candidates of Greater London and the South East revealed in Figure 2 suggests that there may be some quirks in the raw statistics. The overall pattern is one of stability, however, the changes being fairly marginal.

3.5 The pattern of student destinations by university cluster and university

The distribution of places for undergraduates domiciled in the UK differs quite a bit from the distribution of accepted candidates by domicile region prior to entry (compare Table 6 with Table 5b). Some 14% of new undergraduates in the 1980 entry would have had to have migrated outside their domicile region to attend university even if as many students as possible were allocated to their university cluster. The main deficits of places are for undergraduates living in the South East outside London: it is larger than the 8.9% (1977) or 8.5% (1983)

a. Candidates

Region of domicile	Candidates % 1977	Candidates % 1983	% change in candidates 1977-83	Change in % share 1977-83
Northern	4.4	4.3	+ 20.7	- 0.1
Yorkshire and Humberside	7.1	6.9	+ 19.6	- 0.2
North West	11.9	11.5	+ 19.0	- 0.4
East Midlands	5.5	5.6	+ 24.4	+ 0.1
West Midlands	8.0	7.9	+ 20.8	- 0.1
East Anglia	2.6	2.9	+ 37.5	+ 0.3
Greater London	11.8	13.3	+ 38.0	+ 1.6
South East	23.1	21.9	+ 15.8	- 1.2
South West	7.3	7.6	+ 27.5	+ 0.2
Wales	5.1	5.0	+ 21.6	- 0.1
Scotland	9.0	8.0	+ 9.2	- 1.0
Northern Ireland	4.3	4.8	+ 37.5	+ 0.5
United Kingdom (1,000s)	128.3	157.0	+ 22.4	-

TABLE 5a Regional origins of candidates and accepted candidates, 1977 and 1983

b. Accepted candidates

Region of domicile	Accepted candidates % 1977	Accepted candidates % 1983	Change in % share 1977-83	Acceptance % 1977	Acceptance % 1983
Northern	4.5	4.3	- 0.2	57	44
Yorkshire and Humberside	7.5	7.2	- 0.3	58	46
North West	12.5	11.9	- 0.6	58	46
East Midlands	5.7	5.5	- 0.2	57	44
West Midlands	8.1	7.6	- 0.5	55	42
East Anglia	2.8	3.1	+ 0.3	56	46
Greater London	10.6	12.2	+ 1.6	49	41
South East	24.5	23.4	- 1.1	58	47
South West	7.6	7.8	+ 0.2	58	46
Wales	5.1	4.9	- 0.2	55	43
Scotland	7.1	7.2	+ 0.1	43	40
Northern Ireland	4.0	4.9	+ 0.9	51	45
United Kingdom (%)	100.0	100.0	-	55	44

Source UCCA (1978-84b)

TABLE 5b Regional origins of candidates and accepted candidates, 1977 and 1983

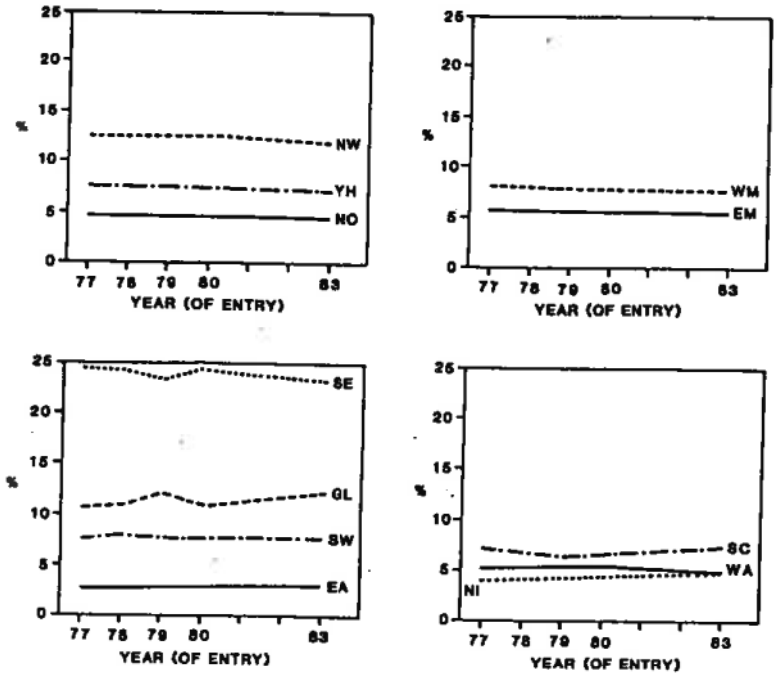

FIGURE 2 Percentages of accepted candidates, by region of domicile, 1977-83

University cluster	Accepted candidates % 1977	% 1983	Change in % share 1977-83	Total applications % 1982-83	ratio of applications accepted to candidates x 100
Northern and Yorkshire and Humberside	16.3	16.0	- 0.3	17.5	109
North West	11.5	11.4	- 0.1	10.7	94
East Midlands	6.3	5.9	- 0.4	9.0	153
West Midlands	8.2	7.5	- 0.7	8.5	113
East Anglia	5.5	5.9	+ 0.4	3.0	51
London	12.2	12.5	+ 0.3	11.8	94
South East	15.6	14.9	- 0.7	14.3	96
South West	5.7	6.0	+ 0.3	5.9	98
Wales	7.1	6.7	- 0.4	6.5	97
Scotland	8.7	9.5	+ 0.8	10.7	113
Northern Ireland	2.8	3.8	+ 1.0	2.4	64
United Kingdom	100.0	100.0	100.0	100.0	100

Source UCCA (1978-84b)

TABLE 6 The distribution of accepted candidates by university cluster, 1977 and 1983

differences between the Table 5b and Table 6 percentages because about 12% of the places in the South East, other cluster are located in Brunel and City Universities inside Greater London. Potential students from the South East must migrate outside their domicile region to university. Other deficit regions are the South West and Northern Ireland. Regions with surplus places are Yorkshire and Humberside, Scotland, Wales and East Anglia. Regions with an approximate balance of supply and demand are Greater London, North West, West Midlands, East Midlands and the North, although this does not mean that these regions retain a very large percentage of their potential students.

The changes between 1977 and 1983 in the numbers of accepted candidates (with UK domicile) by university cluster are not as marked as those for the regions of domicile, but they conceal firstly, a pattern of growth to 1980 and less thereafter, and secondly, wide variation in the loss pattern between universities within clusters. It is, of course, at the scale of individual institutions that the allocation decisions of the UGC are made. Table 7 collects together the relevant figures on new entrants who are full-time undergraduates of 'home' fee paying status. We offer no interpretation of 'winners' and 'losers' in the UGC shrinkage exercise of 1981-84 (enough has been written in the national press) except to note that larger institutions generally fared better than smaller, and that an equivalent exercise with respect to research activity will occupy universities in the 1985-86 academic year.

3.6 The distribution of flows of undergraduates from domicile region to university cluster

The fifth migration component which can be identified concerns the way in which students move from domicile region to university cluster.

Although most of the entries in the migration matrix involve migration, it is useful to ask how much of that migration is confined to the student's own region. In 1977 34.4% of accepted candidates migrated to universities in the university cluster

University and cluster	New entrants 1980	New entrants 1983	% change 1980-83
Durham	1404	1324	- 5.7
Newcastle	2082	1974	- 5.2
Northern	3486	3298	- 5.4
Bradford	1256	1042	- 17.0
Hull	1669	1222	- 26.8
Leeds	2830	2726	- 3.7
Sheffield	2163	1958	- 9.4
York	1045	909	- 13.0
Yorkshire and Humberside	8963	7857	- 12.3
Lancaster	1369	1258	- 8.1
Liverpool	2210	2131	- 3.6
Manchester	2845	2799	- 1.6
UMIST	1110	825	- 25.7
Salford	1287	851	- 33.8
North West	8821	7864	- 10.8
Leicester	1363	1186	- 13.0
Loughborough	1470	1119	- 23.9
Nottingham	1996	1821	- 8.8
East Midlands	4829	4126	- 14.6
Aston	1211	967	- 20.1
Birmingham	2401	2242	- 6.6
Keele	807	605	- 25.0
Warwick	1614	1497	- 7.2
West Midlands	6033	5311	- 12.0
Cambridge	3125	2986	- 4.4
East Anglia	1303	1103	- 15.3
East Anglia	4428	4089	- 7.7
London	9013	8356	- 7.3

University and cluster	New entrants 1980	New entrants 1983	% change 1980-83
Brunel	681	627	- 7.9
City	715	646	- 9.7
Essex	709	647	- 8.7
Kent	1247	1026	- 17.7
Oxford	2906	2775	- 4.5
Reading	1534	1239	- 19.2
Southampton	1647	1675	+ 1.7
Surrey	851	685	- 19.5
Sussex	1224	1199	- 2.0
South East	11514	10519	- 8.6
Bath	810	906	+ 11.9
Bristol	1911	1807	- 5.4
Exeter	1482	1369	- 7.6
South West	4203	4082	- 2.9
Aberystwyth	1000	764	- 23.6
Bangor	901	677	- 5.4
Cardiff	1482	1282	- 13.5
UWIST	735	638	- 13.2
St. Davids	236	227	- 3.8
Swansea	1114	956	- 14.2
WNSM	39	48	+ 23.0
Wales	5507	4592	- 16.6
Aberdeen	1431	1916	- 1.0
Dundee	843	620	- 26.5
Edinburgh	2433	2367	- 2.7
Heriot Watt	851	646	- 24.1
Glasgow	2431	2310	- 5.0
Strathclyde	1788	1628	- 8.9
Stirling	881	596	- 32.3
St. Andrews	862	822	- 4.6
Scotland	11520	10405	- 9.7
Queen's	1581	1698	+ 7.4
Ulster	481	733	+ 52.3
Northern Ireland	2062	2431	+ 17.9
TOTAL, UK	80379	72910	- 9.3

Source UGC (1981, 1984) Notes New entrants: full time undergraduates of 'home' fee paying status

TABLE 7 Undergraduate new entrants to university clusters and universities, 1980 and 1983 (year of entry)

matching their domicile region. By 1983 this figure had declined to 29.7%. This pattern of decline in the percentages of accepted candidates is characteristic of most regions (Figure 3) except East Anglia and Northern Ireland.

The level of intra-region migration is, however, very varied ranging from Scotland, where in 1983 around 85% of UCCA accepted candidates domiciled there started university in the same region, to the South West where only 11% do so. For the South West some 22% of accepted candidates moved to start university in the South East cluster. Scotland is followed in level of student retention by Northern Ireland (71% in 1983), then by Wales (39%) and the Northern regions (North 37%, Yorkshire and Humberside 32%, North West 28%). Grouped with the South West at the low end of the retention spectrum are East Midlands (12%), East Anglia (13%) and West Midlands (15%). The South East and Greater London (both 22% in 1983) occupy middle positions.

So, most new undergraduates move outside their domicile region to attend university. The matrix of migrations can be viewed from either an origins' standpoint (used in computing the retention levels cited above) or a destinations' point of view. Figure 4 adopts the latter point of view. In the graphs are plotted the rates of admission to university clusters from domicile regions for the entry years 1977-80 and 1983. The stippled graphs roughly along the diagonal pick out the intra-region admission proportions. Again most of these graphs show decline and reflect the same story that was described earlier from an origin region viewpoint. One exception is the graph for Northern Ireland. This shows that the proportion of students at Northern Ireland universities recruited from within Northern Ireland fell by about 6% between 1977 and 1983: by 1983 a small number of mainland students were prepared to attend Queen's Belfast or the University of Ulster, whereas in the 1970s they had not been.

The overwhelming impression of the graph is of general stability with some selected exceptions. All university clusters increased their recruitment from Greater London reflecting the significant rise in that region's share of

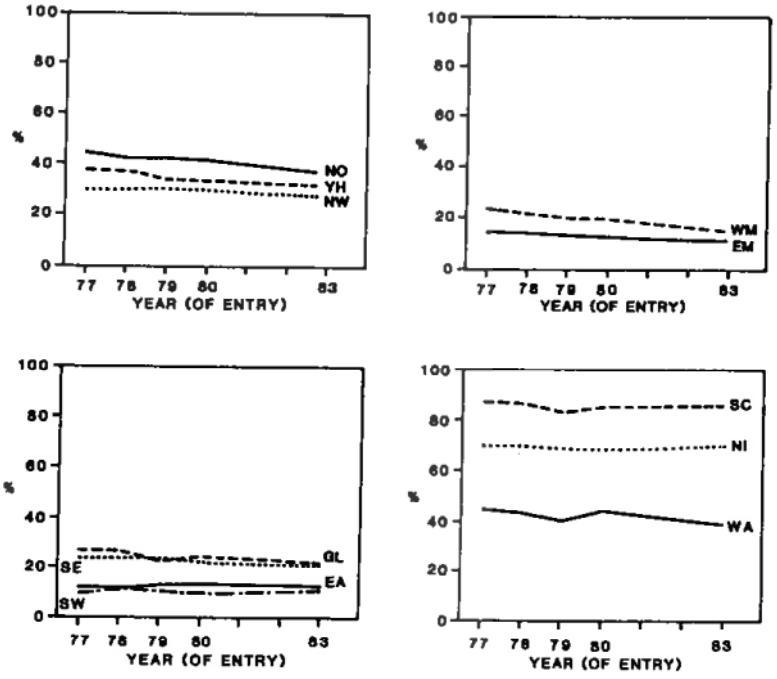

FIGURE 3 Percentages of accepted candidates entering universities in their own region

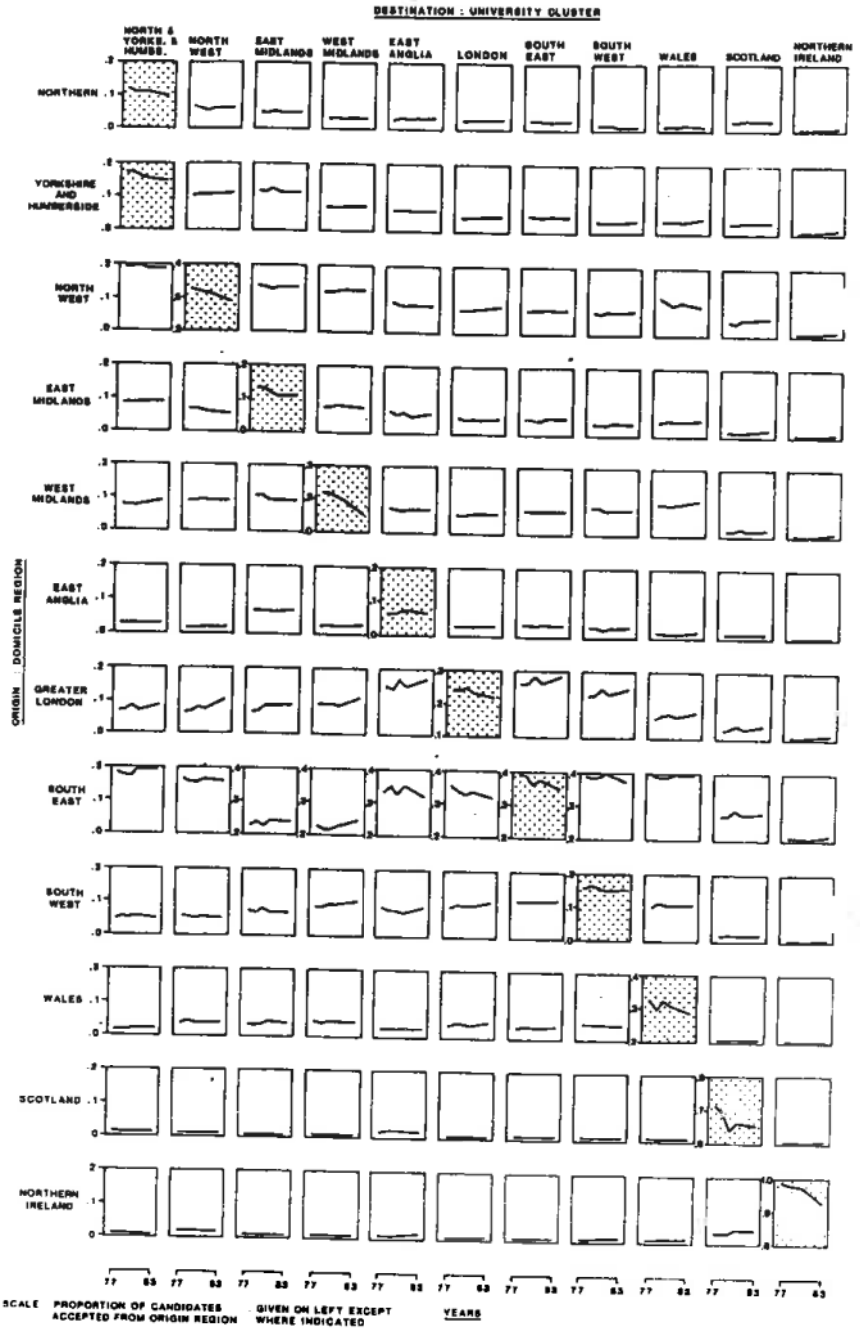

FIGURE 4 Admission proportions for university cluster by domicile region, 1977-83

accepted candidates noted earlier. Recruitment from the South East rose for the Northern and Yorkshire and Humberside, East Midlands, West Midlands and Scotland clusters, but fell for East Anglia, London and South West clusters, indicating a slight shift in preferences towards non-Southern regions perhaps.

Undergraduates migrating to start at university make up only a small percentage of their age group (7-8%). How does their migration activity compare with that of the age group (17-19 year olds) from which they come? It is clear from Table 8, in which the transition proportions for accepted candidates from UCCA data excluding flows to and from Northern Ireland are compared with the corresponding proportions for migrants from Census data, that university undergraduates move freely over greater distances and in rather different ways to members of the same age group. That the pattern of opportunities available to these two groups is dissimilar can be seen by comparing the rates at which accepted candidates and general migrants move to the North and Yorkshire and Humberside. This university cluster contains a substantial proportion (and surplus over regional requirements) of national university places, but a much smaller share of new job opportunities given the depression in the local economies of the region.

These flow patterns, which have been briefly described in this subsection, are now analysed in more depth in Section 4.

Region of domicile 1979-80 or former usual residence 1980		Region of accepting university, 1979-80 or usual residence, 1981								
		NY	NW	EM	WM	EA	SE	SW	WA	SC
NY	79-80(a)	.364	.161	.088	.070	.046	.167	.023	.035	.047
	80-81(b)	.850	.015	.021	.011	.007	.063	.020	.004	.010
NW	79-80	.246	.295	.069	.080	.037	.153	.029	.059	.033
	80-81	.027	.837	.015	.016	.005	.059	.020	.011	.009
EM	79-80	.239	.125	.122	.115	.054	.224	.042	.057	.024
	80-81	.029	.011	.798	.021	.019	.080	.026	.006	.009
WM	79-80	.163	.136	.078	.198	.051	.217	.048	.089	.019
	80-81	.016	.014	.029	.811	.010	.069	.031	.012	.007
EA	79-80	.172	.075	.095	.065	.144	.321	.060	.041	.026
	80-81	.016	.006	.026	.010	.777	.124	.028	.003	.010
SE	79-80	.122	.080	.060	.071	.079	.418	.087	.057	.027
	80-81	.014	.007	.014	.010	.017	.886	.037	.006	.009
SW	79-80	.117	.085	.058	.097	.052	.359	.107	.102	.023
	80-81	.019	.008	.013	.017	.007	.143	.768	.015	.011
WA	79-80	.066	.089	.053	.066	.028	.193	.047	.444	.014
	80-81	.014	.023	.015	.025	.008	.092	.039	.777	.007
SC	79-80	.035	.014	.007	.009	.020	.042	.009	.009	.854
	80-81	.015	.007	.008	.008	.004	.053	.015	.003	.889

Notes For key to region order see Figure 1.
(a) UCCA accepted candidates, 1979-80.
(b) Census migrants, 1980-81. The diagonal (intra-region) entries refer to migrants not stayers.

Source UCCA (1978-84b) for 1979-80 and OPCS, England and GRO, Scotland (1983) for 1980-81.

TABLE 8 Outmigration transition probabilities for UCCA accepted candidates, 1980 and 17-19 year olds in the year prior to the 1981 Census

4. MODELS OF THE MIGRATION OF HOME UNDERGRADUATES

4.1 Spatial interaction models (SIMs) and the influence of distance

Analysis of the pattern of student migration can be extended beyond that reported in the previous section by using spatial interaction models to investigate the frictional influence of distance. This type of migration modelling has been undertaken in a number of different historical and forecasting contexts (see for example Stillwell, 1978, 1983), and involves incorporating measures of the basic gravity variables, origin propulsiveness, destination attractiveness and spatial separation, in a multiplicative equation. There exists a family of spatial interaction models (Wilson, 1971), different members of which are distinguished by the amount of information which is available. The least constrained models assume that origin and destination attractiveness can be measured by some size variable and a scale parameter is introduced which ensures that the sum of the predicted flows equals the sum of the observed flows. When exact values for either outflow totals from origins and/or inflow totals to destinations are known, balancing factors are introduced to ensure that model predictions satisfy constraint equations for either outflows and/or inflows.

In each of these cases, spatial separation is measured by distance and the model equation incorporates a distance term which reflects an inverse relationship with the interaction phenomenon and which may be defined by one of a variety of different functions (Taylor, 1975). Two of the most commonly identified relationships are the negative power and the negative exponential distance functions, in which the rate of distance decay is measured by a parameter, β, which can be calibrated using an automatic search routine and which can be interpreted as a measure of the propensity to migrate over distance. Measurement of distance in the context of student migration presents its own conceptual as well as pragmatic difficulties. On a conceptual level, it might be argued

that with the provision of central government grants to cover student travel costs effectively reduces the frictional impact of distance on choice of university; the result of which might be that the volume of student migration remains constant over distance. This type of migration in behaviour is not evident from first observations of the flow distribution (Rees, 1985). Although in certain regions there is more inter- than intra-regional movement, inter-regional outmigration probabilities have a tendency to decline as the destination region becomes further from the origin region. Road distance has therefore been used as an appropriate measure of distance and the practical difficulties of estimating distances between regions of domicile and university clusters, have been resolved by adoption of the following procedure:

(1) Centroids are selected for the 12 regions of origin (domicile): NO-Newcastle; YH-Leeds; NW-Manchester; EM-Nottingham; WM-Birmingham; EA-Cambridge; GL-London; SE-Guildford; SW-Bristol; WA-Cardiff; SC-Edinburgh; NI-Belfast.

(2) Locations of the 52 universities are identified.

(3) Physical road distances are measured in kilometres between domicile region centroids and university locations (using Automobile Association through-route maps). The distances between Northern Ireland and elsewhere are approximated by the distance of sea crossing and the length of ferry routes between Belfast and Heysham, Stranraer or Glasgow are measured as appropriate for alternative origins/destinations.

(4) Distance values are set to zero when a domicile centroid is the same as a university location.

(5) Mean distance between each domicile centroid and the universities in each regional cluster is calculated, allowing for variation in university size by weighting each distance by the total number of full-time undergraduate entrants of home fee-paying status in 1982-83.

(6) A value is selected to measure the distance between the domicile region centroid of Greater London and the university locations within the London region. For convenience, the minimum value estimated in step (5) is adopted.

This procedure is used to estimate the distance values of the asymmetric matrix shown in Table 9 which are required in the modelling analysis now described.

4.2 A doubly constrained SIM for student migration

The historical migration of students between domicile regions and university clusters can be modelled using a doubly constrained SIM defined as:

$$\hat{M}_{ij} = A_i B_j O_i D_j f(d_{ij}) \tag{1}$$

where $\hat{M}_{ij}$ = the predicted flow of students from domicile region i to university cluster j,

O_i = the total outflow of students from domicile region i,

D_j = the total inflow of students to university cluster j, and

$f(d_{ij})$ = the distance impedance function between region i and cluster j.

The two other terms in the equation represent a balancing factor for origin zone i:

$$A_i = 1/\Sigma_j B_j D_j f(d_{ij}) \tag{2}$$

and a balancing factor for destination zone j:

$$B_j = 1/\Sigma_i A_i O_i f(d_{ij}) \tag{3}$$

which serve to ensure that the constraints on outmovement from zone i:

$$O_i = \Sigma_j \hat{M}_{ij} \tag{4}$$

and on inmovement to zone j:

$$D_j = \Sigma_i \hat{M}_{ij} \tag{5}$$

are satisfied. Since the balancing factors are functions of one another, they are estimated using an iterative procedure which terminates on convergence. The model is calibrated using a

Region of domicile	Domicile centroid	Region of university cluster										
		NY	NW	EM	WM	EA	SL	SO	SW	WA	SC	NI
NO	Newcastle	155	231	279	336	384	451	477	525	494	242	361
YH	Leeds	87	88	133	187	249	312	333	388	311	379	403
NW	Manchester	120	68	130	141	266	317	324	315	278	414	345
EM	Nottingham	152	147	33	88	151	206	231	280	257	485	456
WM	Birmingham	239	189	80	44	189	190	191	177	194	524	450
EA	Cambridge	271	277	125	166	100	97	150	285	333	597	585
GL	London	346	335	185	191	121	33	93	220	304	687	627
SE	Guildford	393	350	230	201	176	48	82	192	287	710	647
SW	Bristol	373	292	215	150	276	193	176	82	146	650	588
WA	Cardiff	407	321	260	184	329	246	231	113	154	678	612
SC	Edinburgh	306	340	457	472	502	652	660	641	606	97	309
NI	Belfast	380	308	438	423	579	600	615	596	508	282	92

Note See Figure 1 for definitions of the domicile region and university cluster codes.

TABLE 9 A matrix of estimated distances (in kilometres) between domicile regions and university clusters

software package (Stillwell, 1984) which allows the selection of either a negative power function:

$$f(d_{ij}) = d_{ij}^{-\beta} \tag{6}$$

or a negative exponential function:

$$f(d_{ij}) = \exp(-\beta d_{ij}) \tag{7}$$

and the optimum β value is determined when the predicted mean migration distance converges with the observed mean migration distance, i.e. where:

$$\left| \frac{M_{ij} d_{ij}}{M_{ij}} - \frac{\hat{M}_{ij} d_{ij}}{\hat{M}_{ij}} \right| < \text{convergence criterion} \tag{8}$$

and the convergence criterion is specified by the user. An initial value of β is required and this is adjusted on successive iterations using a Newton Raphson automatic search routine until convergence is achieved. Once the distance matrix has been prepared, the next step in the analysis is to test which of the two distance functions gives the more accurate set of predictions for a historical period. A set of goodness-of-fit statistics can be used to evaluate the predictive capability of the model. The results of calibration based on flows of all students for 1982-83 (Table 10) suggest that the model incorporating an exponential function performs significantly better than that which utilises a power function. The superiority of the exponential function is shown by all the fit statistics; the sum of squared deviations (SS) of predictions from observations associated with the exponential model results is 36% lower than the SS associated with the power model results; the Mean Absolute Deviation (MAD) is 30% compared with 40%; the Index of Dissimilarity (IOD) which calculates the sum of the observed and predicted proportions of total migration in each cell of the matrix, is 15% compared with 20% and both the correlation coefficient (R) and the coefficient of determination (R^2) are higher when the exponential function is used.

Fit statistic	Doubly constrained SIM	
	Power function	Exponential function
Sum of Squared Deviations (SS)	16,353,824	10,419,939
Mean Absolute Co-Deviation (MAD)	39.5	29.5
Index of Dissimilarity (IOD)	19.8	14.8
Coefficient of Correlation (R)	0.87	0.91
Coefficient of Determination (R^2)	0.76	0.83
Decay Parameter (β)	1.1868	0.00544
Mean Migration Distance (MMD)	193.2 km	193.2 km
Total Migration (T)	69,631	69,631

TABLE 10 A comparison of doubly constrained SIMs with alternative distance functions, 1983

Fit statistic	Doubly constrained SIM	
	Male	Female
MAD	28.7	31.0
IOD	14.3	15.5
R	0.92	0.91
R^2	0.84	0.83
β	0.00527	0.00565
MMD	194.0 km	192.1 km
T	40,356	29,275

TABLE 11 A comparison of doubly constrained SIMs for male and female students, 1983

The average distance over which the 69,631 students migrated to their universities on entry in 1983 was 193 km and the results shown in Table 11 indicate that males tended to move slightly further than females, and had a lower decay parameter value. The goodness-of-fit statistics show that the distribution of male students is modelled more accurately than the distribution of female students.

4.3 Spatial variation in distance decay parameters

More information can be gained on the system of student migration if origin-specific or destination-specific decay parameters are estimated. A comparison of origin-specific parameters demonstrates variation in how students from different regions perceive distance to be a deterrent to movement. The sex disaggregated, origin-specific version of the doubly constrained SIM has the form:

$$\hat{M}_{ij}^{x} = A_i^x B_j^x O_i^x D_j^x \exp(-\beta_i^x d_{ij}) \tag{9}$$

where x is the superscript denoting sex, and where

$$A_i^x = 1/\Sigma_j B_j^x D_j^x \exp(-\beta_i^x d_{ij}) \tag{10}$$

and

$$B_j^x = 1/\Sigma_i A_i^x O_i^x \exp(-\beta_i^x d_{ij}) \tag{11}$$

Estimated β_i values show significant variation around the UK 'average' in 1983 (Figure 5). Students from the Northern region perceive distance to have least influence on their movement whilst students from Northern Ireland experience the lowest propensity to move over distance. The South East, Greater London, East Anglia, South West and Yorkshire and Humberside, together with the North, are the origin regions in which students have lower than average β_i values and are thus less affected by distance, whereas those from the East Midlands, North West, West Midlands, Wales and Scotland, as well as from Northern Ireland, have higher than average β_i

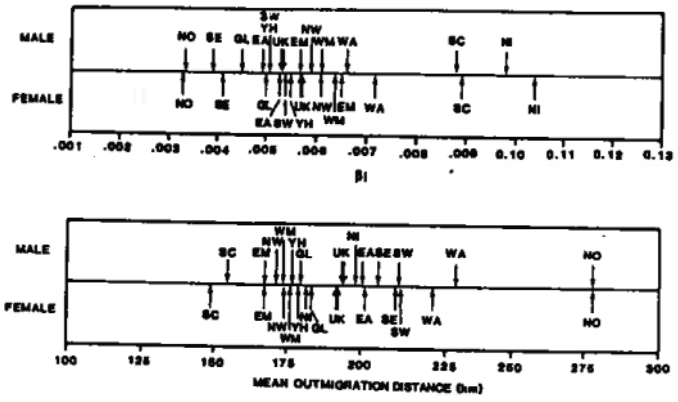

FIGURE 5 β_i values and mean outmigration distances, males and females, 1983

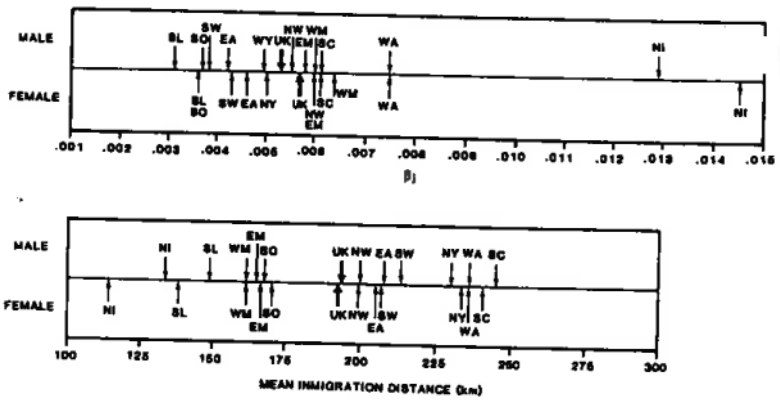

FIGURE 6 β_j values and mean inmigration distances, males and females, 1983

values and perceive distance to be a greater deterrent to movement. The frictional effect of distance is greater for females than males across all origin regions and the largest differential is that for the East Midlands.

It has been suggested that estimated distance decay parameters tend to be less negative for accessible origins than for inaccessible origins (Fotheringham, 1981). The influence of spatial structure or the 'map pattern' effect (Cliff et.al., 1974; Johnston, 1975), in the context of student migration is much less significant. The mean migration distance is not necessarily shorter for more accessible regions. The mean trip length for migrants from both Scotland and Northern Ireland is below the mean distance of outmigration from the South East for example. The longer distance student migrants come from the North, Wales, the South West and the South East, whilst the students travelling the shortest distances come from Scotland, the East Midlands and the North West. The relationship between β_i and mean migration distance for male students is negative (i.e. mean migration distance increases as β becomes less negative) but relatively weak (Spearman's rank correlation coefficient = - 0.49).

The calibration of destination-specific parameters provides an indication of the variation in the perception of distance by students who arrive at different regional clusters of universities. The destination-specific model is written as:

$$\hat{M}^{x}_{ij} = A^{x}_{i} B^{x}_{j} O^{x}_{i} D^{x}_{j} \exp(-\beta^{x}_{j} d_{ij}) \qquad (12)$$

and the results which are illustrated in Figure 6 show the extent to which Northern Ireland is separated from the rest of the system; β_j values for male and female students from Northern Ireland are more than double the UK average. Students to universities in London and the South East, the South West and East Anglia are least affected by the friction of distance, whereas students going to universities in Wales, Scotland and

the West Midlands are most influenced by distance. The β_j value is higher for females than males at all destinations except the remainder of the South East, although females move over longer distances than males to the North and Yorkshire and East Midlands, as well as to the rest of the South East. The mean migration distance, or the average distance over which university clusters recruit students, varies between 116 km for female students to Northern Ireland and 245 km for male students to Scottish universities, although the Scottish figures are inflated because the migration data does not contain the large number of flows to Glasgow and Strathclyde which are likely to occur over relatively short distances.

A Spearman's coefficient of 0.1 indicates the lack of a significant relationship between β_j and mean inmigration length values for male students, influenced by the fact that, except for Northern Ireland, the more accessible university clusters have shorter mean inmigration distances than those that have less accessible locations.

4.3 Temporal trends in distance decay parameters

Origin and destination specific models have been calibrated for male and female flows for 1977-83. The national trend over this period shows a continuing decline in the frictional effect of distance on student migration and an increase in the average distance of migration from 183.4 km in 1977 to 193.2 km in 1983. This downward trend is reflected in the majority of parameter schedules illustrated in Figures 7 and 8, although the aggregate parameter change does conceal some trend variation between regions. The β_i schedules for male students from Wales and for both sexes from East Anglia show a greater degree of instability between 1977 and 1983, whilst female students from the South West tend to perceive distance as being more of a deterrent to migration in 1983 than in 1977.

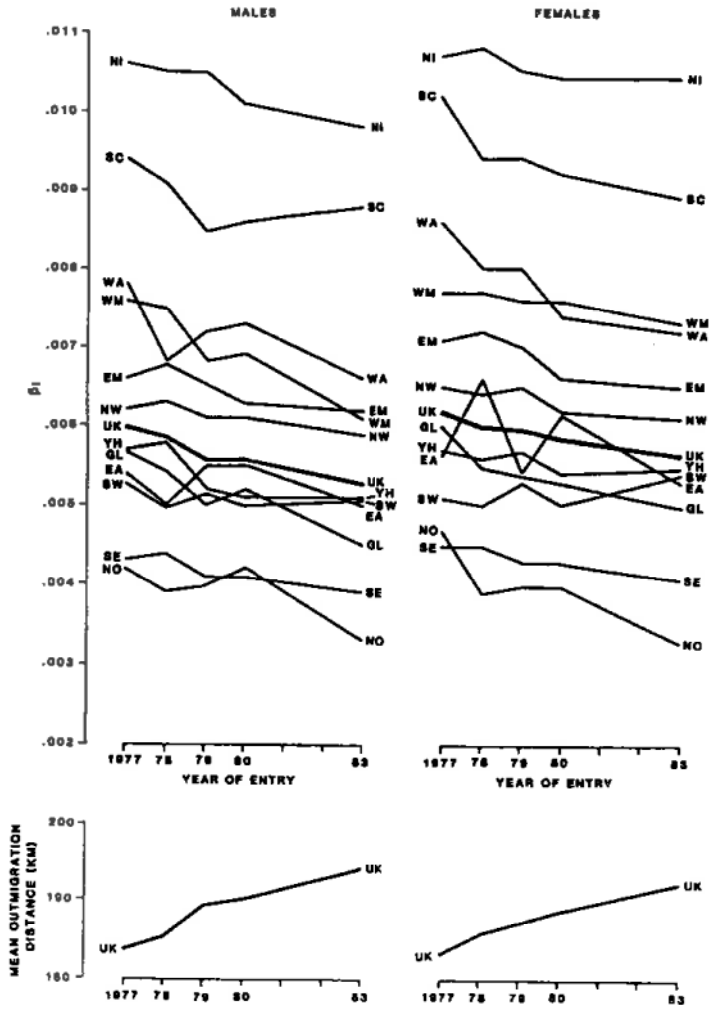

FIGURE 7 Time series trends in β_i values and overall mean outmigration distance, 1977-83

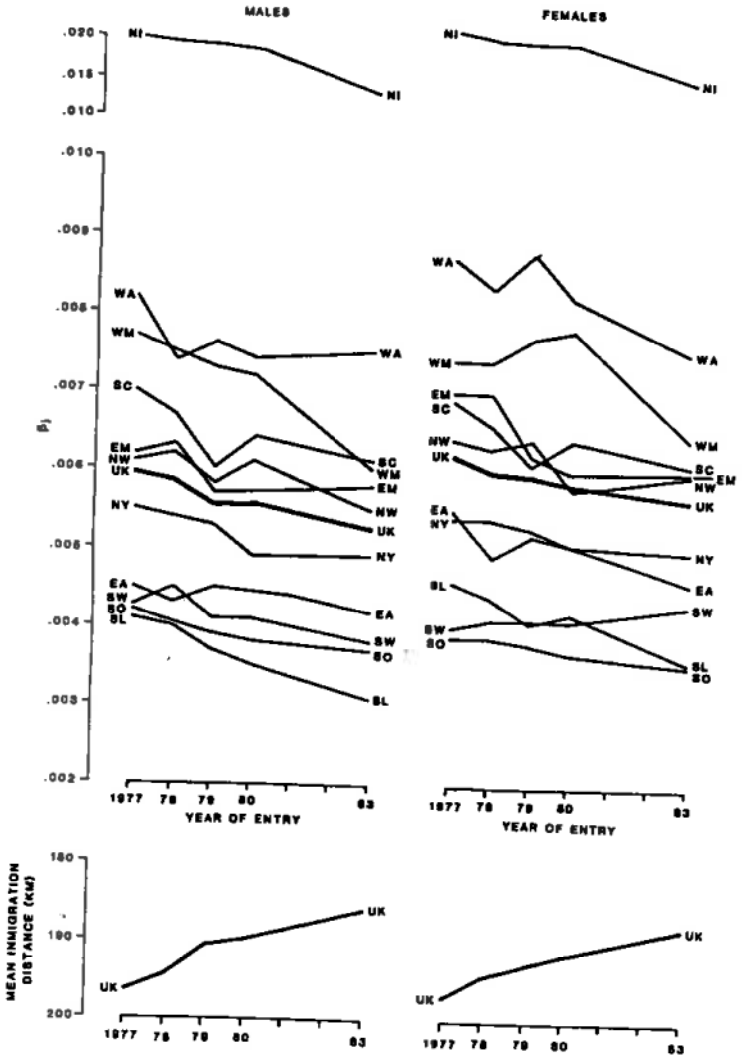

FIGURE 8 Time series trends in β_j values and overall mean inmigration distance, 1977-83

A small increase in the β parameter for female students moving to universities in the South West is also apparent and other groups of students experiencing trends counter to the decline since 1980 are males to universities in Wales and the East Midlands, and females to the North West.

4.5 Barrier effects on student migration

The doubly constrained SIM described in Section 4.2 generates a set of predicted person flows which are compared against observed data (Table 10). Residuals are the differences between corresponding elements of the observed and predicted matrices, and can be computed as percentages of the observed flows. The pattern of residuals which is generated when using a negative exponential model with the optimum decay parameter is dominated by the overprediction of flows to Northern Ireland. This particular region has its own unique set of religious, political and socio-economic circumstances which acts as a major disincentive to potential undergraduate students from the rest of the UK. The 'troubles' in Northern Ireland can be regarded as an additional barrier to student migration, over and above that which is represented by road and sea crossing distance. The barrier effect can be incorporated by addition of a constant (K_1) to the distances from the other 11 regions of domicile to Northern Ireland.

The constant is determined through successive SIM calibration with a distance matrix adjusted on each iteration, such that the optimum value is achieved where a selected goodness-of-fit statistic is maximised. Based on 1982-83 flows and using R^2 as the fit statistic, the 'troubles parameter', K_1, is computed as 890 km, and its inclusion results in the improvement of the correlation coefficient from 0.91317 to 0.94216 (Table 12).

A further source of error in the residuals matrix involves overprediction of many of the flows to and from Scotland. In this case there is an argument for the inclusion of a second constant, (K_2), to represent a 'Scotland barrier' attributable

Model	Goodness-of-fit statistic				
	SS	MAD	IOD	R	R^2
a	10,419,939	25.5	14.8	0.91317	0.83388
b	6,994,105	22.6	11.3	0.94216	0.88767
c	6,101,821	22.1	11.1	0.95050	0.90345
d	2,384,969	16.4	8.2	0.97716	0.95483
e	2,193,652	14.7	7.3	0.98224	0.96480

Notes
Model a: doubly constrained SIM with exponential function.
Model b: model a including $K_1 = 890$.
Model c: model a including $K_2 = 355$.
Model d: model a including $K_1 = 890$ and $K_2 = 355$.
Model e: model d with origin-specific decay parameters.

TABLE 12 Goodness-of-fit statistics associated with alternative SIM calibrations based on student flows, 1983

to differences in the system of education between Scotland and elsewhere in the UK. The same method of 'trial and error' calibration described above produces a K_2 value of 355 km and a correlation coefficient of 0.9505 (model c, Table 12).

When a doubly constrained model is calibrated with a distance matrix adjusted to include both K_1 and K_2, the correlation coefficient increases to 0.97716, and the coefficient is raised further to 0.98224 with origin-specific decay parameters (model e, Table 12).

So far, the description and analysis of student migration has been confined to home-based UK undergraduates. However, UK universities have recruited 7 to 9% of their undergraduates from overseas in recent years. Their patterns of entry and their geographical distribution are described in the next section of the paper.

5. THE INMIGRATION OF OVERSEAS UNDERGRADUATES

Foreign students have always been attracted by the reputation of higher education in the UK, and British universities in the past have recruited substantial numbers from the Far East, Middle East and Africa as well as from Western Europe. In recent years, the demand from overseas has been influenced by the introduction of higher fees, the effect of which has been partly offset by the efforts and initiatives undertaken by certain universities and institutions to recruit from abroad and thus to receive the benefits of higher fee income.

Although the majority of overseas students who arrive in the UK are postgradute students, 17.2 thousand overseas candidates applied to UCCA in 1983-84 and 5.7 thousand were accepted on to undergraduate courses. In the last couple of years, the decline due to the imposition of higher fees in 1980 has been reversed (Table 13). Time series trends since 1976 are obscured by the change in the basis of classification of home and overseas students introduced in 1981 and explained in Section 2 of the paper. Totals before 1981 represent students defined as overseas by their fee-paying status whereas numbers since 1981 refer to candidates classed as overseas by their place of permanent residence. The 1980 and 1981 figures have been recalculated on a domicile basis to facilitate comparison, and are approximately 20% higher than those defined on a fees basis. It is apparent from the data in the top half of the table that the peak year for overseas applicants was 1979 and that the impact of higher fees in 1980 had an immediate impact, with a decline of over 35% in overseas candidates in 1981. The number of accepted candidates, which had been in slow decline since 1977, dropped by 20% in 1981. The time series in the bottom half of the table shows an overall decline of 40% of applicants and 26% candidates accepted between 1980 and 1982, but with increases of 16% and 11% respectively between 1982 and 1984. One implication of trends in demand is observed in the

Basis of definition of 'overseas'	Year	Overseas candidates	Accepted overseas candidates	% overseas candidates accepted
Fees status	1976	20,503	6,076	29.6
	1977	21,569	6,277	29.1
	1978	22,918	6,191	27.0
	1979	24,134	5,767	23.9
	1980	21,105	5,756	27.3
	1981	13,813	4,610	33.4
Domicile status	1980	24,795	6,953	28.0
	1981	17,766	5,827	32.8
	1982	14,821	5,118	34.5
	1983	15,723	5,229	33.3
	1984	17,186	5,663	32.9
Change	1980-84	- 7,609	- 1,290	+ 4.9

Source UCCA (1978-84)

TABLE 13 Overseas candidates, accepted candidates and % candidates accepted, 1976-84

application success rate, which increased from a low point of 24% in 1979 to a peak of 34.5% in 1982. In comparison with home students, a higher proportion of those from overseas are male (over 70%) but there does not appear to be any significant differential in the percentage of male or female candidates who are accepted.

Where do the overseas students come from? Data for 1981 and 1983 (Table 14) reveal that 67% of candidates come from Commonwealth countries, associated states, colonies and protectorates. These candidates appear to have a better chance of being accepted than overseas students from other countries, and in 1983, 71% of accepted candidates were from countries with historical ties with Britain. The major world region generating potential students for university entrance is the Far East, which accounted for over 75% of candidates applying through UCCA in 1981 and 1983, and over 55% of candidates accepted in each of those years. Europe has recently pushed Africa out of second place, and provided 20% of accepted candidates in 1983, whilst the Middle East (including Cyprus) and America together generated about 12.5% of accepted students. The demand from Australasia is almost insignificant in comparison with that from the other continents mentioned. The proportion of candidates accepted shows marked variation between continents. In 1981 and 1983, the most successful applicants were those from the Far East whereas the least successful applicatns were from Africa. Pie graphs have been used in Figure 9 to illustrate the proportions of students accepted in 1983 from different countries within five continental blocs. Those countries in each bloc providing the largest number of accepted candidates are Nigeria, Norway, Hong Kong, USA and Cyprus. Countries providing more than 50 accepted candidates in 1983 have been ranked in Table 15. Nearly 44% of all overseas students came from either Hong Kong or Malaysia; and these two countries dominate the league table. Other countries providing over 100 students are Singapore, Nigeria, Cyprus, Greece and West Germany. Admission success rates

Area of origin	Overseas candidates 1980-81 (%)	Overseas candidates 1982-83 (%)	Accepted overseas candidates 1981 (%)	Accepted overseas candidates 1983 (%)	% candidates accepted 1981	% candidates accepted 1983
Commonwealth countries	67.2	67.3	73.4	70.7	35.8	34.9
Other countries	32.8	32.7	26.6	29.3	26.6	29.9
Africa	20.83	18.23	14.74	11.65	23.2	21.2
America	5.14	6.19	3.95	5.22	25.2	28.0
Australasia	0.04	0.05	0.05	0.05	36.4	29.3
Europe	12.99	19.29	12.60	20.06	31.8	34.6
Far East	45.24	46.71	56.63	55.27	41.1	39.4
Middle East (including Cyprus)	15.33	9.04	11.57	7.34	24.8	27.0
Total Number	17766	15923	5827	5229	32.8	33.3

Notes Commonwealth countries includes all Commonwealth countries, associated states, colonies and protectorates.

Source UCCA (1978-84b)

TABLE 14 Overseas candidates, accepted candidates and % candidates accepted by continent of origin, 1981 and 1983

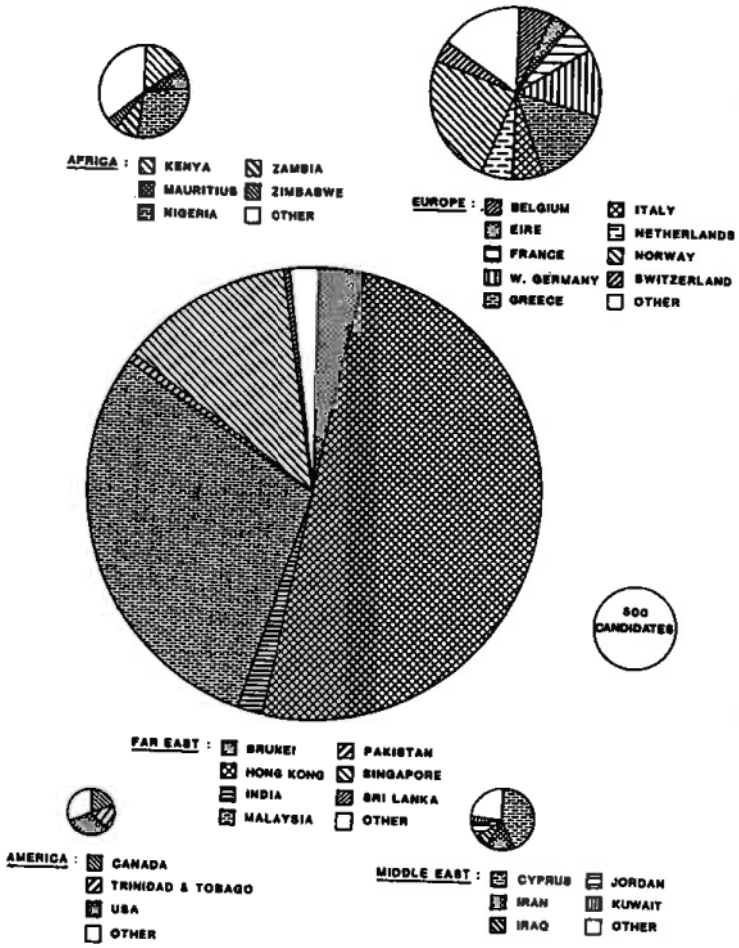

FIGURE 9 Pie charts of accepted overseas candidates by country of origin, 1983

Country of origin	Overseas candidates accepted 1983	% overseas candidates accepted 1981	% overseas candidates accepted 1983	Overseas domiciled new entrants 1983
Hong Kong	1,444	46.2	40.9	1,262
Malaysia	844	41.5	36.5	658
Singapore	377	37.5	54.2	302
Norway	255	51.9	45.4	238
Nigeria	195	13.7	14.2	235
Cyprus	165	34.8	46.6	156
Greece	160	26.7	25.0	159
W. Germany	136	22.2	29.2	492
Kenya	98	28.1	27.4	82
USA	96	24.9	27.0	1,639
Netherlands	63	46.3	43.8	67
Italy	62	36.0	40.0	64
Belgium	61	50.6	46.6	62
France	58	32.9	33.1	118
Iran	58	22.7	16.3	58
Brunei	55	26.2	40.7	63
Canada	52	25.1	29.1	84
India	51	25.9	27.6	42

Sources UCCA (1978-84b); UGC (1984).

TABLE 15 Countries providing more than 50 overseas accepted candidates, 1983 (ranked), % of candidates accepted, 1981 and 1983, and entrants, 1983

vary quite dramatically from country to country as shown in Table 15. Applicants from Hong Kong, Malaysia, Singapore, Norway, Cyprus, Netherlands, Italy and Belgium have consistently high success rates (>30%) in comparison with applicants from Nigeria, of whom less than 15% were successful in their applications in both 1981 and 1983. There are many reasons behind the spatial variation in success rates and in their fluctuation over time. Standards of secondary education vary widely between countries in the developed and the developing world, and differences in higher education provision, in school curriculum content, in English language instruction and methods of examination and in the provision of financial support will have significant effects.

The final column in Table 15 records the overseas domiciled new undergraduate entrants to UK universities in 1983 (UGC, 1984). The major discrepancy between the UCCA and UGC statistics is for students from the USA, although this may be explained by the existence of the 'Junior Year Abroad' scheme, through which young American students can spend a year at a British university without having to apply through UCCA. Similar schemes for short term study abroad are available in certain Western European countries, and are likely to explain why the number of entrants from West Germany and France exceeds the number of candidates accepted through UCCA from those countries.

UGC statistics on full-time undergraduate new entrants can be used to give an indication of the regional distribution of overseas students within the UK (Table 16) but they exclude those students resident abroad who are entitled by special circumstances to pay home fees (for example, European Community students). The highest proportions of entrants from overseas (>9%) involve universities in London, the South Eastand Scotland, which together take nearly 60% of all those paying 'other fees'. The North, North West, West Midlands, East Anglia and Wales form a second category of regions where overseas admissions contribute between 5 and 9% of total

University cluster	Overseas entrants	Overseas entrants as % of total entrants	University with highest proportion of overseas entrants		University with lowest proportion of overseas entrants	
North	193	5.3	Newcastle	6.5	Durham	3.6
Yorkshire and Humberside	300	3.5	Bradford	5.8	Hull	1.5
North West	580	6.9	Salford	17.6	Liverpool	2.4
East Midlands	146	3.2	Loughborough	4.6	Leicester	1.5
West Midlands	325	5.6	Keele	10.7	Birmingham	3.0
East Anglia	302	7.0	East Anglia	8.0	Cambridge	6.6
London	1,168	11.9				
South East	1,137	9.4	Kent	21.2	Brunel	2.1
South West	165	3.8	Bath	4.8	Bristol	3.5
Wales	348	6.4	UWIST	12.4	St. Davids	1.8
Scotland	1,078	9.2	Heriot Watt	16.5	Dundee	4.6
Northern Ireland	44	1.8	Ulster	3.4	Queens	1.1

Notes Overseas entrants are defined as full-time undergraduate new entrants of 'overseas' fee-paying status.

Source UGC (1984).

TABLE 1f Distribution of overseas entrants by university cluster, 1983

admissions, and in the remaining regions of Yorkshire and Humberside, East Midlands, South West and Northern Ireland, less than 5% of entrants are from overseas. There are, of course, substantial differences in overseas admission rates between universities within the same region; for example, 17.6% of new entrants to Salford University are from overseas, whereas 2.4% of Liverpool's new undergraduates come from abroad. This is partly attributable to the types of course on offer at alternative institutions but also reflects differing attitudes and policies on overseas recruitment at universities across the country.

6. CONCLUDING REMARKS

The 1980s have seen cessation of growth in undergraduate numbers in UK universities and a reduction in the chances of a school leaver of gaining admission to a university. Despite these developments the spatial patterns of and temporal trends in recruitment of new entrants characteristic of the later 1970s have persisted into the 1980s.

The percentage of new undergraduates which was female has continued to increase in the 1980s, although at a slower rates and this trend has been uniform across all domicile regions. The distribution of new undergraduates across the country generally reflected the distribution of the recruitment age group, but more qualified leavers were generated proportionately in the more middle class regions of the country (the South East, Greater London, South West, East Anglia). Qualified leavers became candidates for entry fairly uniformly across the country, although chances were greater in Northern Ireland, Scotland and Wales than in Northern and Midlands England. The chances of acceptance given candidacy showed much less regional variation than the chances of becoming qualified leavers or candidates. Regions gaining in their share of new entrants against a background of falling admittances were Greater London, the South West and East Anglia, and regions losing included the Northern, Midlands regions and Wales. The gains in Northern Ireland were difficult to interpret because of the expansion through merger of a public sector institution and a university.

The shifts in the recruitment across university cluster in the later 1970s and early 1980s reflected the decision of the UGC with respect to individual institutions, but the regional outcomes of such decisions were gains in shares for East Anglia, London and the South West, and losses in the other English regions, including in the South East cluster.

The pattern of flows from domicile region to university cluster showed a very high level of migration compared with the recruitment age group (17-19 year olds) or any allocation

based on surpluses or deficits of places. The propensity to migrate to distant university clusters increased steadily over the period. Recuitment from the domicile region that matched the university cluster declined proportionally; the average distance of migration increased and the frictional effect of distance fell steadily, for almost all origins and destinations. Men remained slightly more mobile than women over the period.

Recruitment of new undergraduates from overseas suffered 'a price shock' earlier than the intake of home undergraduates suffered 'quota shocks', but some recovery in numbers took place from 1982. The dominant origins of overseas new entrants were to be found in the Far East, although Common Market countries have supplied an increasing share of overseas students in the 1980s at the expense of Africa and the Middle East.

In what ways might this description of the spatial patterns and temporal trends be improved, and made more relevant to both university and national policy making? Clearly, it would be of interest to examine the migration fields of individual universities. Registrars would be interested if their recruitment fields revealed major lacunae or departed markedly from regional averages. The spatial interaction models developed in Section 4 of the paper could be adapted to examine the impact in student recruitment of policy changes such as a reduction in the student travel grant, or a new set of institutional financial allocations, or the shift from a supply-of-places-determined system of recruitment to a freer market situation. None of these policies would, in the authors' views, be welcome, but it would be useful to 'be prepared'.

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UCCA = Universities Central Council on Admissions.
UGC = University Grants Committee.

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