Ethnic populations: the components for projection

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Plus: Phil Rees, Pia Wohland
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Royal Statistical Society, 12 Errol Street, London

ESRC Research Awards:
“What happens when international migrants settle? Ethnic group population trends and projections for UK local areas” RES-165-25-0032
“Internal migration of Britain's ethnic populations” RES-163-25-0028
Why population by ethnic group?

Data needed in ethnic-relevant applications

- Plan services, housing type, language support, health
- Targets for the composition of employment and service take-up; discrimination measures can be better targeted
- Contribute to debates about immigration, identity and diversity in UK

Quality of estimates / projections improved

- Need to account for demographic behaviour of sub-group
- Institutions, students, armed forces, etc
- Ethnic group
What are estimates & projections?

Based on available evidence of population counts or indicators of change

Estimates

Past

Census 1991

Intercensal estimates

Future

Census 2001

Postcensal estimates

Now

‘Latest available data’

Forecasts

Projections

Some predictions are made about what will happen to demographic trends
What are projections?

- Different composition & rates leads to different composition …
Ethnic populations: the components for projection

Presentation outline

1. Aims, projection framework (PN)
2. Mortality / survival (PN)
3. International migration (PB)
4. Internal migration (JS)
5. Fertility & next steps (PN)
Ethnic populations: the components for projection

Aim

- To project the ethnic populations of local areas (local authorities) in the UK over the next 50 years

Technical overview

- State space of model
- Accounting framework
- Model structure
State Space

UK: Zones (432)
(O origins, D destinations)

- England 352 LAs  (City of London with Westminster; Isles of Scilly with Penwith)
- Wales 22 UAs
- Scotland 32 CAs
- Northern Ireland 26 DCs

Ages (102 period - cohorts) (A)

- Bto0, 0to1, 1to2, …, 99to100, 100+to101+ (102)

Sexes (2) (S)

- Males, Females

Ethnic Groups (16) (E)

- Groups from the 2001 Census (as relevant to UK countries)

Time intervals (T)

- 2006-7, …, 2050-51 (projections)
### Accounting framework for zones within countries

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<tr>
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<th>England</th>
<th>Wales</th>
<th>Scotland</th>
<th>Northern Ireland</th>
<th>Rest of UK</th>
<th>Total Europe and Canada</th>
<th>Start populations</th>
<th>Survivors</th>
<th>Surviving stayers</th>
<th>Surviving migrants within countries</th>
<th>Surviving migrants between countries</th>
<th>Surviving emigrants</th>
<th>Final populations</th>
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*Note: The table above is a simplified representation of the accounting framework for zones within countries. The actual table includes detailed data for various regions and demographic groups.*
Components for projection

Initial database
- Populations
- Fertility
- Mortality
- Internal migration
- International migration

Scenarios
- Mortality assumptions
- Emigration assumptions
- Internal migration assumptions
- Immigration assumptions
- Fertility assumptions

Projection outputs
- Projected deaths, survivors
- Projected surviving emigrants
- Projected surviving internal migrants
- Projected surviving immigrants
- Projected final populations and births

Projection outputs
- Survival
- Emigration
- Migration conditional on survival within UK
- Immigration
- Births
Ethnic populations: the components for projection

Evidence base
Develop initial database: 1980s to 2006 (-ish)
Most demographic components not available by
  • Consistent ethnic groups (if at all) at local authority geography
Estimation of rates & trends by ethnic group
  • Mortality
  • International migration
  • Internal migration
  • Fertility
Ethnic mortality

Paul Norman (Phil Rees & Pia Wohland)

US, New Zealand projections
  • Different life expectancies by race

UK projections
  • Ethnic groups calculated in estimation or projection models but no ethnic mortality differences utilised

There are strong individual and area relationships between self-reported health & mortality
  • Can ethnic-specific limiting long-term illness be used to estimate mortality?
Estimating ethnic mortality
Standardised illness ratios (SIRs) from the 2001 Census

Bangladeshi Males

Indian Males
Estimating ethnic mortality
Model SMRs using SIRs by ethnic group

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Estimating ethnic mortality

Modelled SMRs

Bangladeshi Males

Indian Males
Projection model uses survivorship

Ethnic group life tables: using ethnic group SMR & all group mortality rate age distribution

<table>
<thead>
<tr>
<th>White British</th>
<th>White Irish</th>
<th>White Other</th>
<th>Mixed, White and Black Caribbean</th>
<th>Mixed, White and Black African</th>
<th>Mixed, White and Asian</th>
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<tr>
<td><img src="image1.png" alt="Map" /></td>
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<table>
<thead>
<tr>
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<th>Asian or Asian British: Pakistani</th>
<th>Asian or Asian British: Bangladeshi</th>
<th>Asian or Asian British: Other Asian</th>
<th>Black or Black British: Caribbean</th>
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</table>

Maps of life expectancy at birth, for 16 ethnic groups, England, males, 2001

- Red: \(\geq 77.2\) to \(<84.56\)
- Gray: \(\geq 74.52\) to \(<77.22\)
- Blue: \(\geq 68.72\) to \(<74.52\)
Pete Boden

New Migrant databank

Concept, development and analysis
Number who came to live here in one year – not including illegal immigrants and the countless thousands we don’t even know about.

Number of British citizens who, in the same year, chose to leave this country to seek a new life for themselves and their families.

FULL STORY: PAGES 10-11
MPs attack migrant count methods

Existing methods of estimating migration and population figures are not "fit for purpose" say MPs.

The International Passenger Survey, designed to provide data for tourism, now plays a central role in migration estimates, the committee of MPs said.

They said it was "not fit for this purpose" and methods of measuring movement in the UK "unsatisfactory".

The committee said new surveys were needed. The Lib Dems said ministers had "totally lost track" of the population.

In its Counting the Population report, the Commons Treasury Committee accepted that the UK was in a period of 'significant population change' which made it harder to estimate numbers of migrants.
# Alternative sources

Review of alternative sources of international migration data, completed for the GLA in 2006

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<th>Source</th>
<th>Availability (since 2001)</th>
<th>Stocks</th>
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<th>Migrant Population</th>
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<th>GLA</th>
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Purpose

- ‘Single view’ of alternative statistics
- Clarity of conceptual and measurement differences
- Framework for analysis of trends and patterns in migration
- Analysis of short-term and long-term migration
- Derivation of ethnic-group migration estimates
- Complement the ongoing programme of work at ONS
Data sources

- Local Authority District & Unitary Authority (LADUA) statistics, 2001-2008
- Census (2001)
- Total International Migration (TIM)/International Passenger Survey (IPS)
- GP registrations (NHS-Flag4)
- National Insurance number registrations (NINo)
- Workers Registration Scheme (WRS)
- Higher Education Statistics Agency (HESA)
- Labour Force Survey (LFS)
- Work Permits (WP)/Points Based System (PBS)
- National Pupil Database (NPD)
Demonstration

New Migrant databank
WRS registrations

Source: Accession Monitoring Report, Home Office 2008
National Statistics
Estimates of international migration

International Passenger Survey
*Primary source*

Home Office
*Asylum seekers and dependants*

Irish CSO
*Migration between UK and Irish Republic*

Adjustments
*Visitor switchers & Migrant switchers*
National Statistics
Sub-national immigration estimates

International Passenger Survey
England & Wales

IPS/Labour Force Survey
GOR / Wales level
10 zones

IPS (smoothed) & LFS (London)
Intermediate Geography (NMGi)
63 zones

Census 2001
Local Authority District / Unitary Authority
376 zones
National Statistics
Sub-national emigration estimates

- **International Passenger Survey**
  England & Wales

- **International Passenger Survey**
  GOR / Wales level
  10 zones

- **IPS (smoothed)**
  Intermediate Geography (NMGi)
  63 zones

- **Propensity to migrate model**
  Local Authority District / Unitary Authority
  376 zones
England: Change over time

All data are Crown copyright. Sources: 100% data extract from the National Insurance Recording System (NIRS): 2006 Mid-year estimates (ONS, 2007a); GP registration statistics provided by ONS
GP Regs vs TIM estimates, 2002-2006

TIM lower than GP Regs  TIM higher than GP Regs

South West  TIM higher than GP Regs
South East  TIM higher than GP Regs
London  TIM lower than GP Regs
East of England  TIM lower than GP Regs
West Midlands  TIM lower than GP Regs
East Midlands  TIM lower than GP Regs
Yorkshire & Humber  TIM lower than GP Regs
North West  TIM lower than GP Regs
North East  TIM lower than GP Regs
England  TIM lower than GP Regs

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GOR profiles

West Midlands

Yorkshire & Humber

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Local authority profile

Leeds

Share of Region - 2006

All data are Crown copyright. Sources: 100% data extract from the National Insurance Recording System (NIRS): 2006 Mid-year estimates (ONS, 2007a); GP registration statistics provided by ONS
County profile

Herefordshire

Share of Region - 2006

TIM - SNPP 2016 3.9%
TIM - MYE 2.0%
Census 2.4%
WRS 16.9%
GP Regs 2.6%
NINO Acc 7.2%
NINO non-Acc 1.3%

All data are Crown copyright. Sources: 100% data extract from the National Insurance Recording System (NIRS): 2006 Mid-year estimates (ONS, 2007a); GP registration statistics provided by ONS
London Borough profile

Newham

Share of Region - 2006

All data are Crown copyright. Sources: 100% data extract from the National Insurance Recording System (NIRS): 2006 Mid-year estimates (ONS, 2007a); GP registration statistics provided by ONS.
Current research

Continued analysis of patterns and trends for UK local authorities as new data is released.

Cluster analysis to identify area ‘types’ where trends and dataset differences are similar.

A model for estimating local immigration which incorporates:
- TIM national estimates
- GP registration statistics at intermediate/local level
- NINO evidence on country of origin
Internal migration

John Stillwell

UPTAP project on “Internal migration of Britain’s ethnic populations” (RES-163-25-0028)

12 month project from June 2007 to June 2008

Serena Hussain was the Researcher

Based on 2001 Census data
Four research questions

Q1 What is the ethnic composition of aggregate internal migration in Britain at the *national level*?

Q2 How do migration propensities and patterns vary spatially at *district level*?

Q3 What spatial patterns of ethnic net migration are evident in London at the *ward level* and does the geographical variation tell us anything about processes of ethnic concentration or dispersal?

Q4 Is there any evidence in London at of ethnic groups moving away or towards *wards* of ethnic concentration and from those of higher deprivation?
Main data sets

*Special Migration Statistics* provide tables on migrants:
- Age by sex (Table MG201)
- Ethnic group by sex (Table MG203)

No cross-tabulation of ethnic group by age

Thus *tables commissioned* from ONS including:
- CO711: District-district matrix
- CO723: in two parts
  - Part 1: ward to region flows
  - Part 2: region to ward flows

Both for 7 age groups (0-15, 16-19, 20-24, 25-29, 30-44, 45-59, 60+) for 7 ethnic groups
<table>
<thead>
<tr>
<th>Label used</th>
<th>Ethnic group defined in Special Migration Statistics (Level 1)</th>
<th>Ethnic group defined in Key Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>White</td>
<td>White British; White Irish; Other White</td>
</tr>
<tr>
<td>Indian</td>
<td>Indian</td>
<td>Indian</td>
</tr>
<tr>
<td>POSA</td>
<td>Pakistani and Other South Asian</td>
<td>Pakistani; Bangladeshi; Other Asian</td>
</tr>
<tr>
<td>Chinese</td>
<td>Chinese</td>
<td>Chinese</td>
</tr>
<tr>
<td>Black</td>
<td>Caribbean, African, Black British and Black Other</td>
<td>Caribbean; African; Other Black</td>
</tr>
<tr>
<td>Mixed</td>
<td>Mixed</td>
<td>White and Black Caribbean; White and Black African; White and Asian; Other mixed</td>
</tr>
<tr>
<td>Other</td>
<td>Other</td>
<td>Other</td>
</tr>
</tbody>
</table>
## Q1: Ethnic internal migration at the national level?

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Migration between districts</th>
<th>Migration within districts</th>
<th>Total migration</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>2,215,010</td>
<td>3,295,652</td>
<td>5,510,662</td>
</tr>
<tr>
<td>Indian</td>
<td>50,997</td>
<td>52,460</td>
<td>103,457</td>
</tr>
<tr>
<td>POSA</td>
<td>44,567</td>
<td>87,051</td>
<td>131,618</td>
</tr>
<tr>
<td>Chinese</td>
<td>19,476</td>
<td>16,317</td>
<td>35,793</td>
</tr>
<tr>
<td>Black</td>
<td>61,748</td>
<td>78,063</td>
<td>139,811</td>
</tr>
<tr>
<td>Mixed</td>
<td>40,930</td>
<td>56,519</td>
<td>97,449</td>
</tr>
<tr>
<td>Other</td>
<td>17,498</td>
<td>18,380</td>
<td>35,878</td>
</tr>
<tr>
<td>Total</td>
<td>2,450,226</td>
<td>3,604,442</td>
<td>6,054,668</td>
</tr>
</tbody>
</table>

*Excludes persons with no usual address 12 months previously (456,736 in total) Source: Special Migration Statistics*
Migration rates by ethnic group, 2000-01

Source: Special Migration Statistics Table MG103 and Standard Table
Age-specific migration rates and shares by ethnic group, 2000-01

Source: Commissioned Table CO711
Q2: Net migration by district for total, white and non-white groups, 2000-01

Source: SMS Table MG103
District level analyses

Problem of how to analyse large data sets of 408*408*7*7 = over 8 million cells in matrix

Used two classification frameworks to analyse data:

(i) London boroughs (33), met districts (36), unitary authorities (68), council areas (32) and other local authorities (239)

(ii) Vickers et al. classification of districts into families (4), groups and classes (23)

Results of these analyses reported in two Working Papers - see

www.geog.leeds.ac.uk/wpapers/index.html
### Net migration between local authority classes by ethnic group

<table>
<thead>
<tr>
<th>Ethnic Group</th>
<th>London boroughs</th>
<th>Metro districts</th>
<th>Unitary authorities</th>
<th>Local authorities</th>
<th>Council areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>-44,405</td>
<td>-20,320</td>
<td>17,266</td>
<td>46,972</td>
<td>487</td>
</tr>
<tr>
<td>Indian</td>
<td>-995</td>
<td>-761</td>
<td>340</td>
<td>1545</td>
<td>-129</td>
</tr>
<tr>
<td>POSA</td>
<td>-1,586</td>
<td>387</td>
<td>899</td>
<td>326</td>
<td>-26</td>
</tr>
<tr>
<td>Chinese</td>
<td>225</td>
<td>190</td>
<td>76</td>
<td>-361</td>
<td>-130</td>
</tr>
<tr>
<td>Black</td>
<td>-4,430</td>
<td>508</td>
<td>2,228</td>
<td>1,769</td>
<td>-75</td>
</tr>
<tr>
<td>Mixed</td>
<td>-1,899</td>
<td>-37</td>
<td>677</td>
<td>1,375</td>
<td>-116</td>
</tr>
<tr>
<td>Other</td>
<td>57</td>
<td>65</td>
<td>128</td>
<td>-287</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>-53,033</td>
<td>-19,968</td>
<td>21,614</td>
<td>51,339</td>
<td>48</td>
</tr>
</tbody>
</table>
Population share and net migration rate, Whites
Q3: Spatial patterns of ethnic net migration are evident in London at the ward level?

London’s ethnic population, 2001

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>5,103,203</td>
<td>71.2</td>
<td>91.9</td>
<td>9.7</td>
<td>0.53</td>
<td>0.36</td>
</tr>
<tr>
<td>Indian</td>
<td>436,993</td>
<td>6.1</td>
<td>1.8</td>
<td>41.5</td>
<td>0.57</td>
<td>0.40</td>
</tr>
<tr>
<td>POSA</td>
<td>429,700</td>
<td>6.0</td>
<td>2.2</td>
<td>33.6</td>
<td>0.56</td>
<td>0.45</td>
</tr>
<tr>
<td>Chinese</td>
<td>80,201</td>
<td>1.1</td>
<td>0.4</td>
<td>33.0</td>
<td>0.32</td>
<td>0.31</td>
</tr>
<tr>
<td>Black</td>
<td>782,849</td>
<td>10.9</td>
<td>2.0</td>
<td>68.2</td>
<td>0.65</td>
<td>0.32</td>
</tr>
<tr>
<td>Mixed</td>
<td>226,111</td>
<td>3.2</td>
<td>1.2</td>
<td>33.6</td>
<td>0.34</td>
<td>0.21</td>
</tr>
<tr>
<td>Other</td>
<td>113,034</td>
<td>1.6</td>
<td>0.4</td>
<td>49.3</td>
<td>0.44</td>
<td>0.32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,172,091</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>12.6</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Index of segregation = 0.5 ∑|P_{ie}/P_{e}^* - P_{ir}/P_{r}^*| computed at district level
London’s ethnic population by borough, 2001
## London’s ethnic migration, 2000-01

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Flows* within London</th>
<th>Inflows to London from R of GB</th>
<th>Outflows from London to R of GB</th>
<th>Net flows for London with R of GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>444,000</td>
<td>124,337</td>
<td>169,116</td>
<td>-44,779</td>
</tr>
<tr>
<td>Indian</td>
<td>30,573</td>
<td>6,074</td>
<td>7,033</td>
<td>-959</td>
</tr>
<tr>
<td>POSA</td>
<td>40,585</td>
<td>4,093</td>
<td>5,642</td>
<td>-1,549</td>
</tr>
<tr>
<td>Chinese</td>
<td>8,483</td>
<td>2,227</td>
<td>2,071</td>
<td>156</td>
</tr>
<tr>
<td>Black</td>
<td>79,809</td>
<td>5,091</td>
<td>9,413</td>
<td>-4,322</td>
</tr>
<tr>
<td>Mixed</td>
<td>24,549</td>
<td>3,517</td>
<td>5,357</td>
<td>-1,840</td>
</tr>
<tr>
<td>Other</td>
<td>13,720</td>
<td>1,884</td>
<td>1,885</td>
<td>297</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>641,718</strong></td>
<td><strong>147,223</strong></td>
<td><strong>200,487</strong></td>
<td><strong>-53,264</strong></td>
</tr>
</tbody>
</table>

* Average of the inflows and outflows from Table C0723
Net migration by ward, whites

Flows within Greater London  Flows between GL and the rest of E&W
Patterns of non-white net migration within London

Indian

POSA

Chinese

Black

Mixed

Other
Patterns of non-white net migration outside London

- Indian
- POSA
- Chinese
- Black
- Mixed
- Other
White location quotients, London wards, 2001

Location quotient = \( \frac{P_{ie}/P_i}{P_e/P_{**}} \)  

>1 is over-representation
Net migration rate by ethnic group and location quotient quintile

Quintile 1
High location quotient/
Over-representation

Quintile 5
Low location quotient/
Under-representation
Townsend index for London wards

Quintile 1: least deprived
Quintile 5: most deprived
Net migration rate by ethnic group and deprivation quintile
Conclusions

There are significant variations in migration propensities by ethnic group and age.

Spatial patterns at district level dominated by white counterurbanisation and large net losses from London as a whole (and those districts with lower white share of population).

Decomposing net migration balances into flows ‘within’ and ‘outside’ London exposes key processes of suburban decentralisation, outward dispersal and inward concentration.

Non-white migration dispersing rather than concentrating non-white populations and all ethnic groups are moving from more deprived to less deprived areas.
Internal migration component of the ethnic projection model

No data on ethnic migration since the Census but time series of patient register/NHSCR data at LA district scale tell us something about the level and direction of migration.

Need to develop a model using these two data sets to estimate ethnic migration by age for the time series from 2001 onwards – and make assumptions about migrant behaviour in the future – to produce projections.
An informed projection model needs …

Information on past trends for LAs

• All persons
• Estimates by ethnic group

A range of plausible assumptions by ethnic group

• Age-Specific Fertility Rate (ASFR)
• Total Fertility Rate (TFR)
Fertility rates in a projection model

ASFRs in a projection: applied to surviving women

a.) TFR = 1.69
b.) TFR = 1.44

a.) 9,788 babies = 5,013 boys & 4,774 girls
b.) 7,927 babies = 4,060 boys & 3,867 girls
Fertility trends vary across space & time

All persons in Bradford & Leeds: 1982-2006

Bradford

Leeds

ASFRs

TFRs

<20 20-24 25-29 30-34 35-39 40+

ASFRs

TFRs

<20 20-24 25-29 30-34 35-39 40+
Mothers and the age debate: when is it best to have babies?

Mothers in the north are up to 10 years younger when they start a family than their southern counterparts. Lucy Rock and her friend Carmen Reid typify the difference. Here they examine how their choices have affected their lives, and their children.

A new mother in her late 30s lives in the north. She has just given birth to her first child, a boy. When they moved to this part of north London, they were excited about the things they could do with their new baby. The eldest of their two sons was born in the south. A few years ago, when they were expecting their third child, Lucy said: ‘It was the first time I really felt like I was a mother.’

The next day in the south, Lucy was expecting her second child. She said: ‘It was the first time I really felt like I was a mother.’

The two mothers met up in the south, where they are raising their children. They both agree that the difference is significant. Lucy said: ‘I feel like I have a better chance of success in my career and enjoying my family.’

In the north, Lucy was approaching her mid-30s, but in the south, she was only in her mid-20s. Lucy explained: ‘It was difficult to fit in with the rest of the mothers, but I was able to fit in with the rest of the families.’

The north is a very different place, where Lucy has to take care of her children alone, whereas in the south, she has help from her husband and friends. Lucy said: ‘It is much easier to care for the children in the north, where there are fewer distractions.’

The south is a very different place, where Lucy has to take care of her children alone, whereas in the north, she has help from her husband and friends. Lucy said: ‘It is much easier to care for the children in the south, where there are fewer distractions.’

The great baby divide

Women in the south of England are having children up to ten years later than women in the north, figures revealed yesterday.

A new mother in the most prosperous southern half of the country, with the south long even to be in the north, as the childbearing years, with the peak childbearing years in the north between 30 and 35.

The emergence of differences in the age of having a family is the latest evidence of a widening gap between the two halves of the country, with the south lagging behind the north in terms of childbearing.

In the north, the average age of first-time mothers is 30, whereas in the south, it is 40. However, the gap is closing, with the average age of first-time mothers in the north increasing to 35.

The north is a very different place, where women have to take care of their children alone, whereas in the south, they have help from their husbands and friends. Women in the south said: ‘It is much easier to care for the children, where there are fewer distractions.’

The south is a very different place, where women have to take care of their children alone, whereas in the north, they have help from their husbands and friends. Women in the north said: ‘It is much easier to care for the children, where there are fewer distractions.’

Men born in the 1960s and 1970s were more likely to be married, whereas in the south, more than 50% were not. In 1993, the percentage was 33.1.

Birthrates in the south, where they have not been for six years, have now risen for six years in a row. Births in the south, where they were falling in the years before 2010, have now risen for six years in a row. Births in the south, where they were falling in the years before 2010, have now risen for six years in a row.
Estimate TFRs by ethnic group using Child : Woman Ratios

For each LA:

\[ TFR({\text{Eth}}) = TFR({\text{AP}}) \times \left( \frac{CWR({\text{Eth}})}{CWR({\text{AP}})} \right) \]

- Under-estimates White & over-estimates other TFRs

\[ TFR({\text{Eth}}) = TFR({\text{E&W}}) \times \left( \frac{SF({\text{Eth}}) \times CWR({\text{Eth}})}{CWR({\text{E&W}})} \right) \]
Estimate national ASFRs by ethnic group

Use survey data: Labour Force Survey

Probability of infant by age and broad ethnic group

White

Pakistani & Bangladeshi
Estimate ASFRs by ethnic group & LA

**Triangulate**
- LA population-based ASFRs for all persons
- LA population-based TFRs by more detailed ethnic group
- National survey-based ASFRs by broad ethnic group
- Smoothing by Hadwiger curve

![Graphs of Estimated ASFRs for Bradford and Leeds](image-url)
Fertility scenarios?

Factors on which to focus, by ethnic group

- Trends in TFRs & ASFRs, ‘ageing’ of curves
- ‘Convergence’ to the White group?

k-means classification of trends by LA: apply scenarios to ‘cluster’
Next steps

Finish estimation of trends up to 2006
  • Inter-district flows by ethnic group

Develop set of plausible rates & scenarios
  • Classifications may be component specific

Computer programming
  • Large arrays, complexity by ethnic group & inter-district migration
  • Ethnic switching
Acknowledgements & contacts

ESRC Research Awards:
“What happens when international migrants settle? Ethnic group population trends and projections for UK local areas” RES-165-25-0032
- Phil Rees: P.H.Rees@leeds.ac.uk
- Paul Norman: P.D.Norman@leeds.ac.uk
- Peter Boden: P.Boden@leeds.ac.uk
- Pia Wohland: P.N.Wohland@leeds.ac.uk

“Internal migration of Britain's ethnic populations” RES-163-25-0028
- John Stillwell: J.C.H.Stillwell@leeds.ac.uk

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