

# General Register Office for Scotland Population Projection Seminar

9 November 2005

Chris Shaw

Government Actuary's Department



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[www.gad.gov.uk](http://www.gad.gov.uk)

# Who produces national projections?

- National statistical institutions
- International organisations:
  - United Nations
  - Eurostat
- Others



# What kinds of projections?

- National (for UK includes constituent countries)
- Sub-national
- Labour force
- Marital status
- Household



# National projections: key points

- ‘full’ projections done every two years
- can also do ‘interim’ projections in intervening year
- latest projections are 2004-based, published October 2005
- 70 year projection period
- split by age and sex
- use base of latest population estimates
- used as a control for more specialist projections
- standard (cohort component) methodology
- comprehensive data available on website
- a National Statistic



# The cohort component method

- a starting ('base') population by age and gender
- assumptions for future:
  - fertility
  - mortality
  - migration

$$P_{t+1} = P_t + B - D + I - E$$

# Responsibility for projections – currently!

- GAD has been responsible for official projections since 1954
- Since 1999, projections have been a devolved responsibility
- GAD is commissioned separately by the three RGs of the United Kingdom (England & Wales, Scotland and N Ireland) to produce national population projections



# Change of responsibility for national projections

- From Jan 31 2006 responsibility transfers from GAD to ONS
- ONS will produce NPP in consultation with GROS, NISRA and NAW
- Follows a review of the UK actuarial profession, including the role of GAD
- NPP will be part of the National Statistics Centre for Demography (NSCD) to be created in ONS also on 31 Jan 2006. NSCD will:
  - have UK-wide work programme
  - be overseen by new UK population committee including three RGs and Chief Statistician of Welsh Assembly Govt



# Decision making process

Final decisions are taken by NPP committee which comprises:

GAD

Office for National Statistics

General Register Office for Scotland

N Ireland Statistics and Research Agency

Welsh Assembly Government

Home Office



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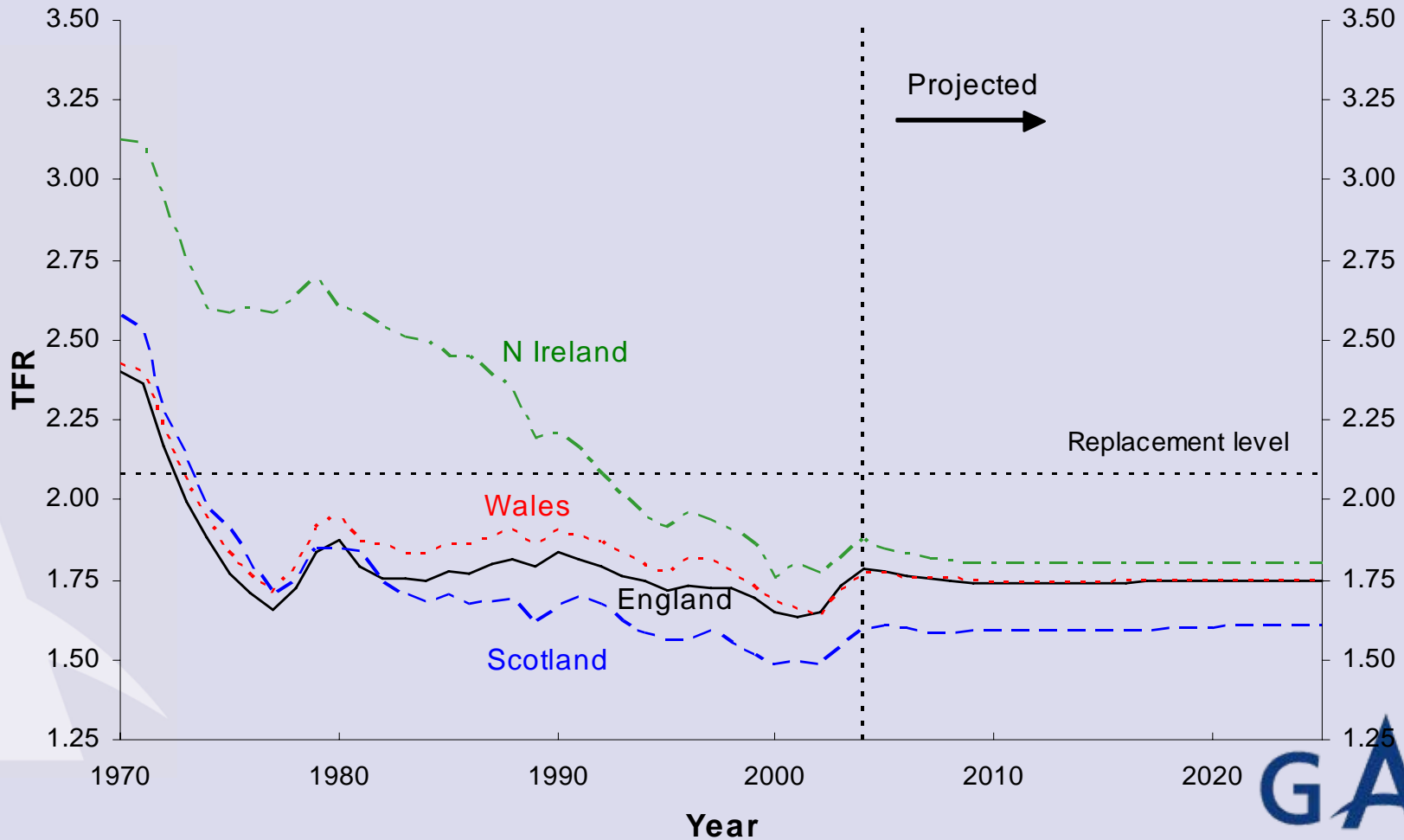


# Consultation

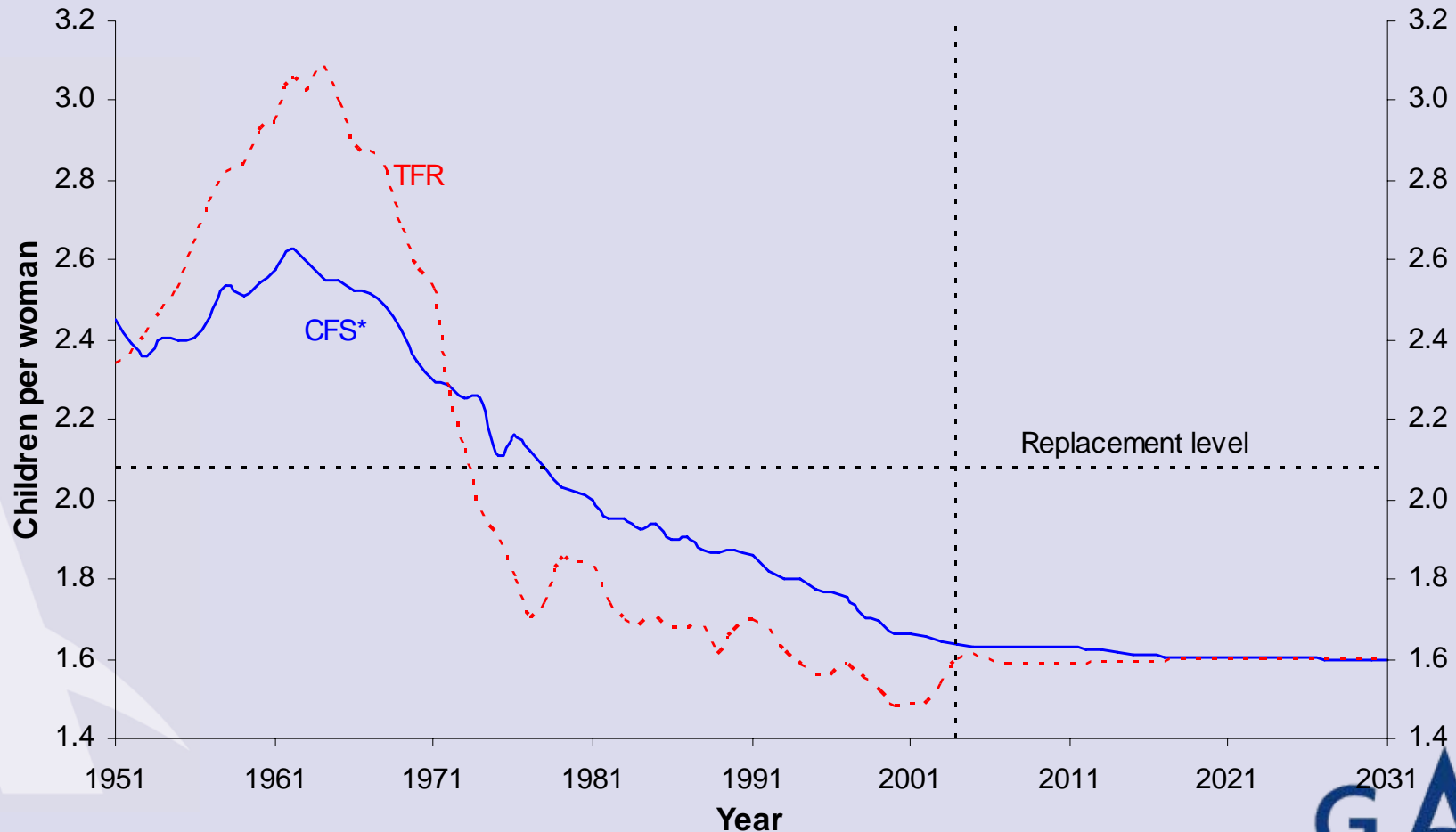
- GAD prepares proposals on 'headline' assumptions for each country
- individual countries consult key users, with GAD support as required
- consultation covers key UK government departments, e.g. HM Treasury, Dept of Health, ODPM, Dept for Work and Pensions and the Pensions Commission
- Expert academic group instigated in 2005



# Actual and assumed total fertility rates, 1970 to 2025



# Total Fertility Rate and average Completed Family Size, Scotland, 1951-2031



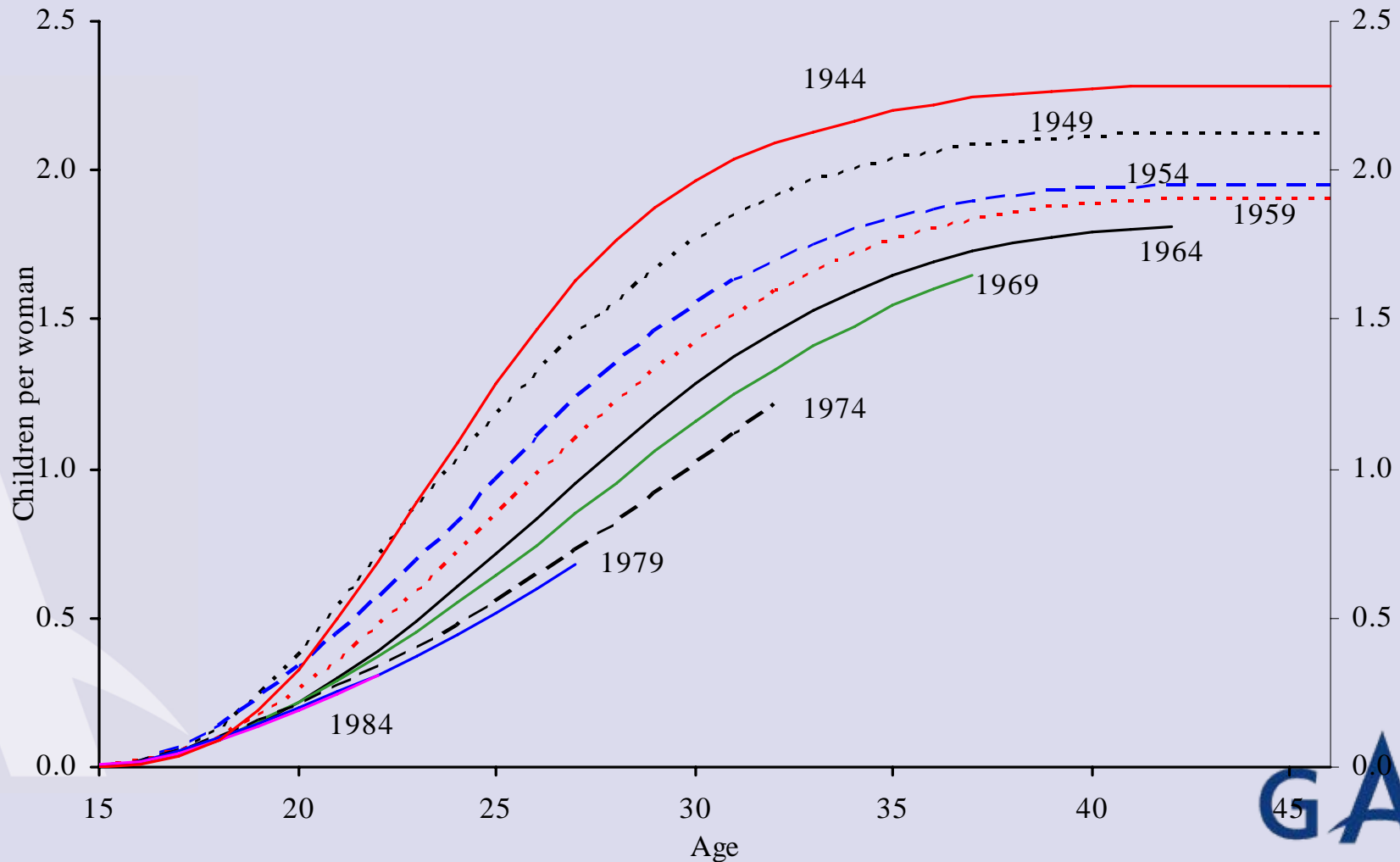
\* Completed family size for cohorts born 28 years earlier

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# Average achieved family size by age and year of birth of woman, Scotland, 1944-1984 cohorts

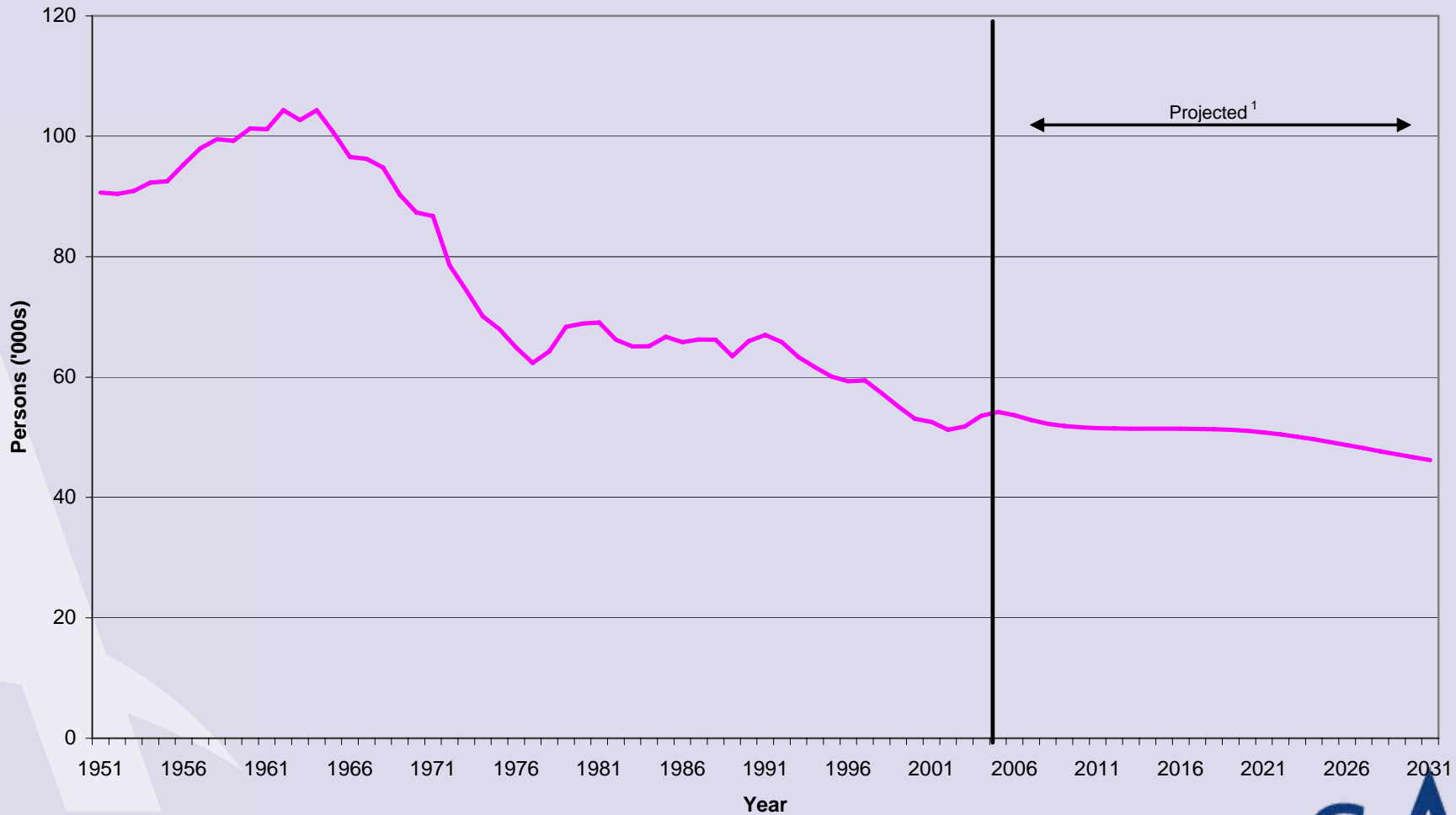


# Scottish fertility assumptions

- Average completed family size will continue to fall from around 1.90 children per woman born in the late 1950s to 1.60 for those born in the 1990s and later.
- This results in the projected number of births slowly decreasing over the next 25 years
- Long-term assumption of 1.60 is unchanged from previous projections, but assumptions for first few years are higher



# Births, actual and projected, Scotland 1951-2031



<sup>1</sup> 2004-based projections

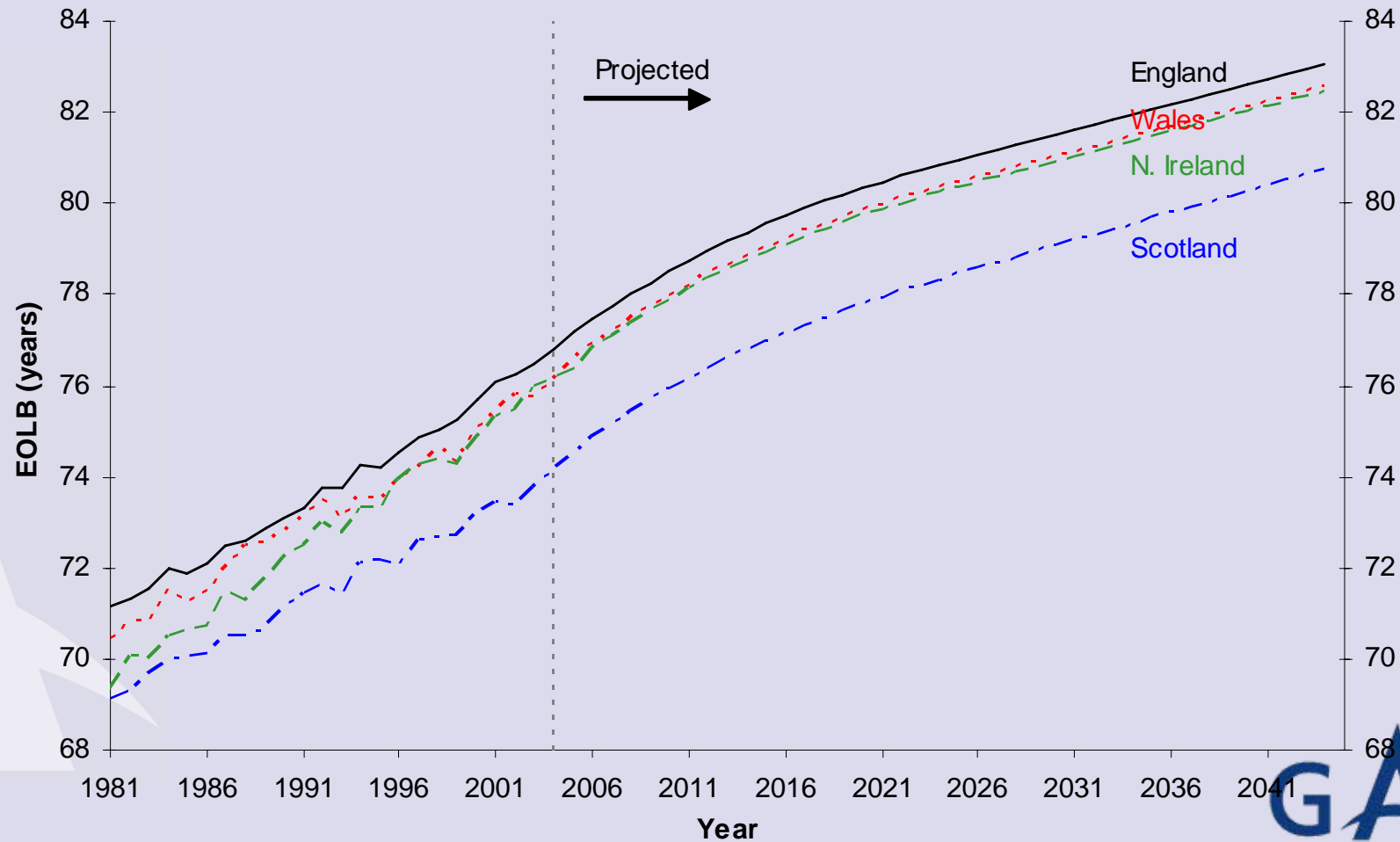


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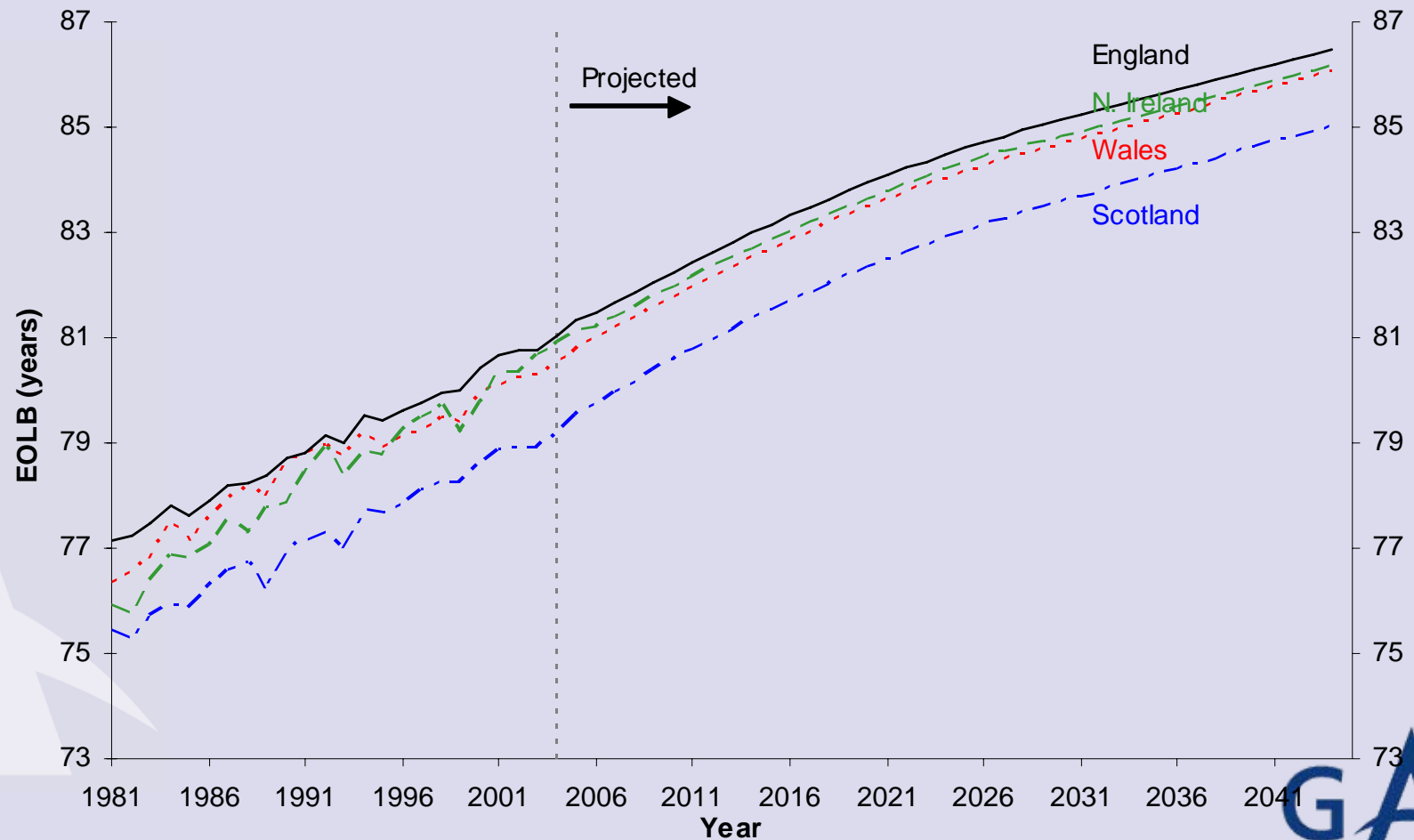
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# Period expectation of life at birth, Males, 1981 - 2044



# Period expectation of life at birth, Females, 1981 - 2044





# Comparison of projected smoothed percentage reduction in death rates by age, UK, 2003 - 2004

Males



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# Comparison of projected smoothed percentage reduction in death rates by age, UK, 2003 - 2004

Females



# Mortality Projections

- Set target rates of mortality improvement for some future year (target yr)
- Target year is 25<sup>th</sup> year of projection (ie 2029 for 2004-based projections)
- Target improvements in 2029 assumed to be 1% pa for all ages for both males and females
- Applies to UK and constituent countries



# Change in long-term assumptions

- Now assuming mortality rates will continue to improve at 1% per annum from 2029
- Previous projections assumed long-term rate of improvement would halve every subsequent 25 years



# Rationale for assumptions

## Target rate of improvement

- average rate of improvement over 20<sup>th</sup> century approximately 1.0% per annum

## Change to long-term assumptions

- continued evidence that past assumptions have underestimated long-term mortality improvements
- view of UK experts



# Overall annual rates of mortality improvement, UK

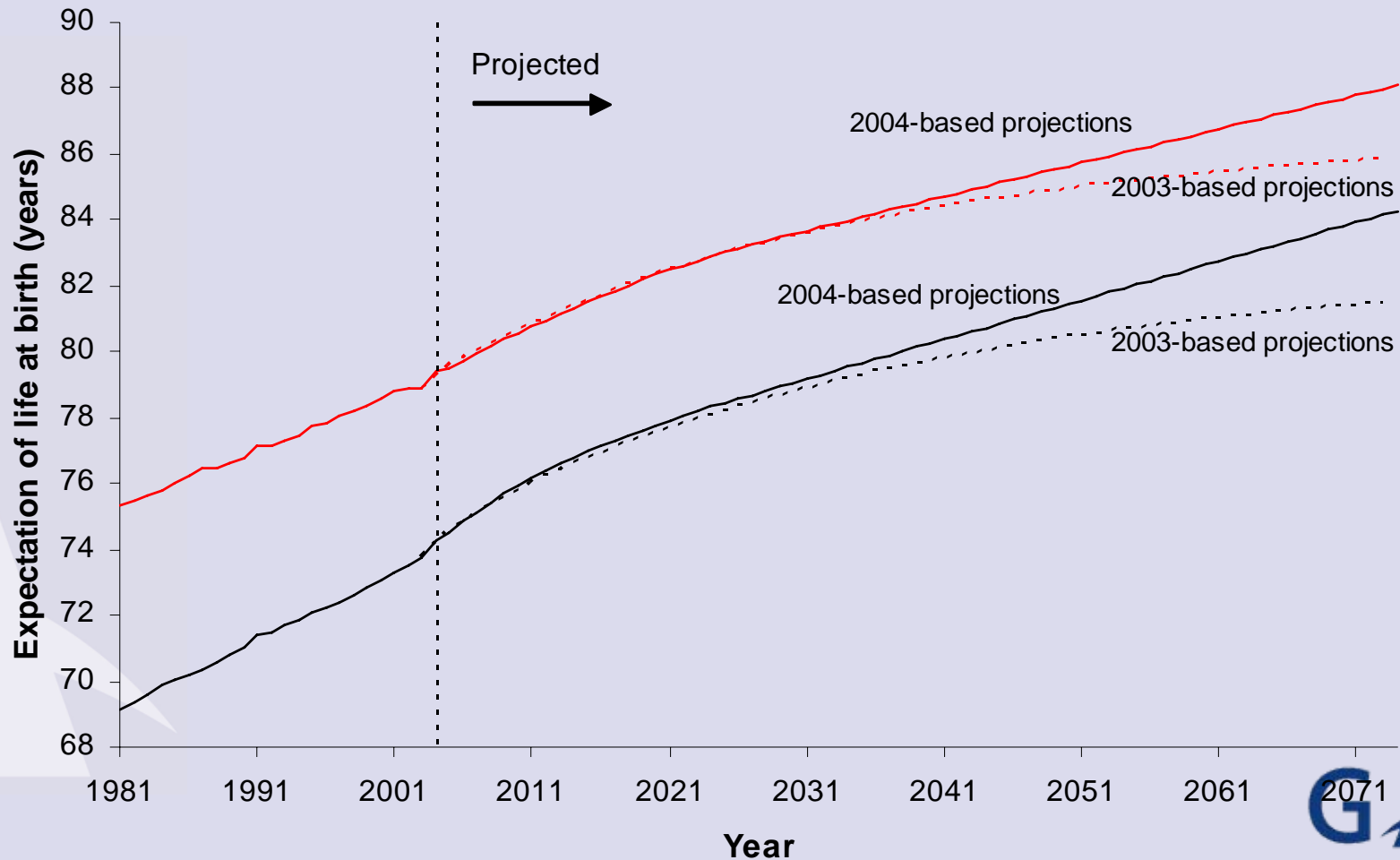
	Males		Females	
2004-05	3.00%		1.75%	
	Last x years	proposed next x years	last x years	proposed next x years
21 years	1.98%	1.94%	1.32%	1.81%
41 years	1.42%	1.48%	1.24%	1.43%
71 years	1.15%	1.28%	1.21%	1.25%

# Scottish mortality assumptions

- Mortality rates will continue to decrease but Scotland will continue to have higher rates than the rest of the UK
- Life expectancy at birth is projected to increase
  - Males: 73.8 in 2002-04 to 79.1 in 2030-31
  - Females: 79.1 in 2002-04 to 83.6 in 2030-31

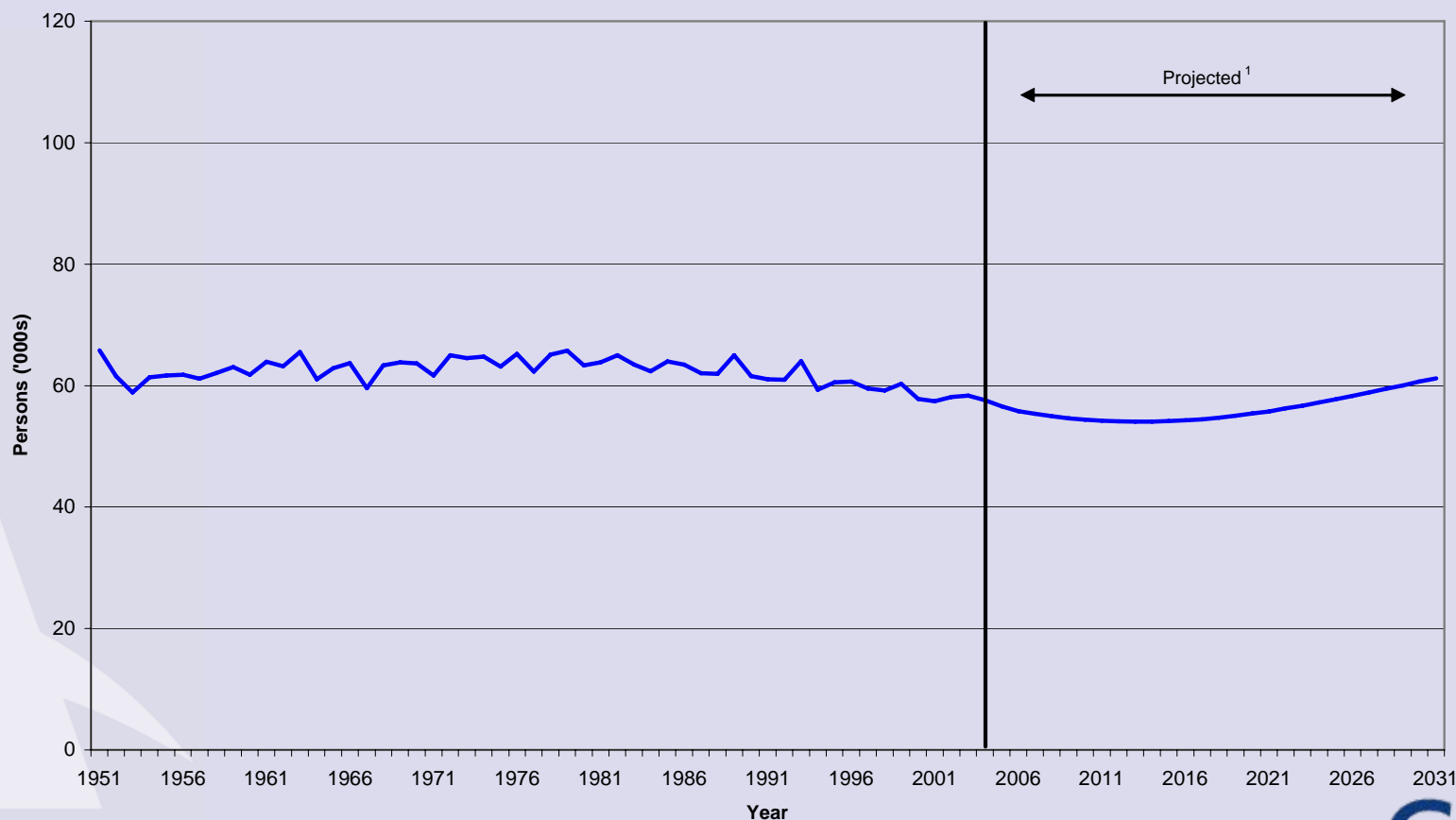


# Expectation of life at birth, Scotland, 1981-2074





# Deaths, Scotland, actual and projected, 1951-2031



<sup>1</sup> 2004-based projections



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# Migration assumptions

- Model of IPS flows
- Allowances for migrants not covered by the IPS
  - e.g. asylum seekers, Ireland
- Distribution of international migration between UK countries based on past trends
  - ONS Quality Review of International Migration looking at improving estimation of geographical distributions
- Cross-border migration assumptions based on past NHSCR data

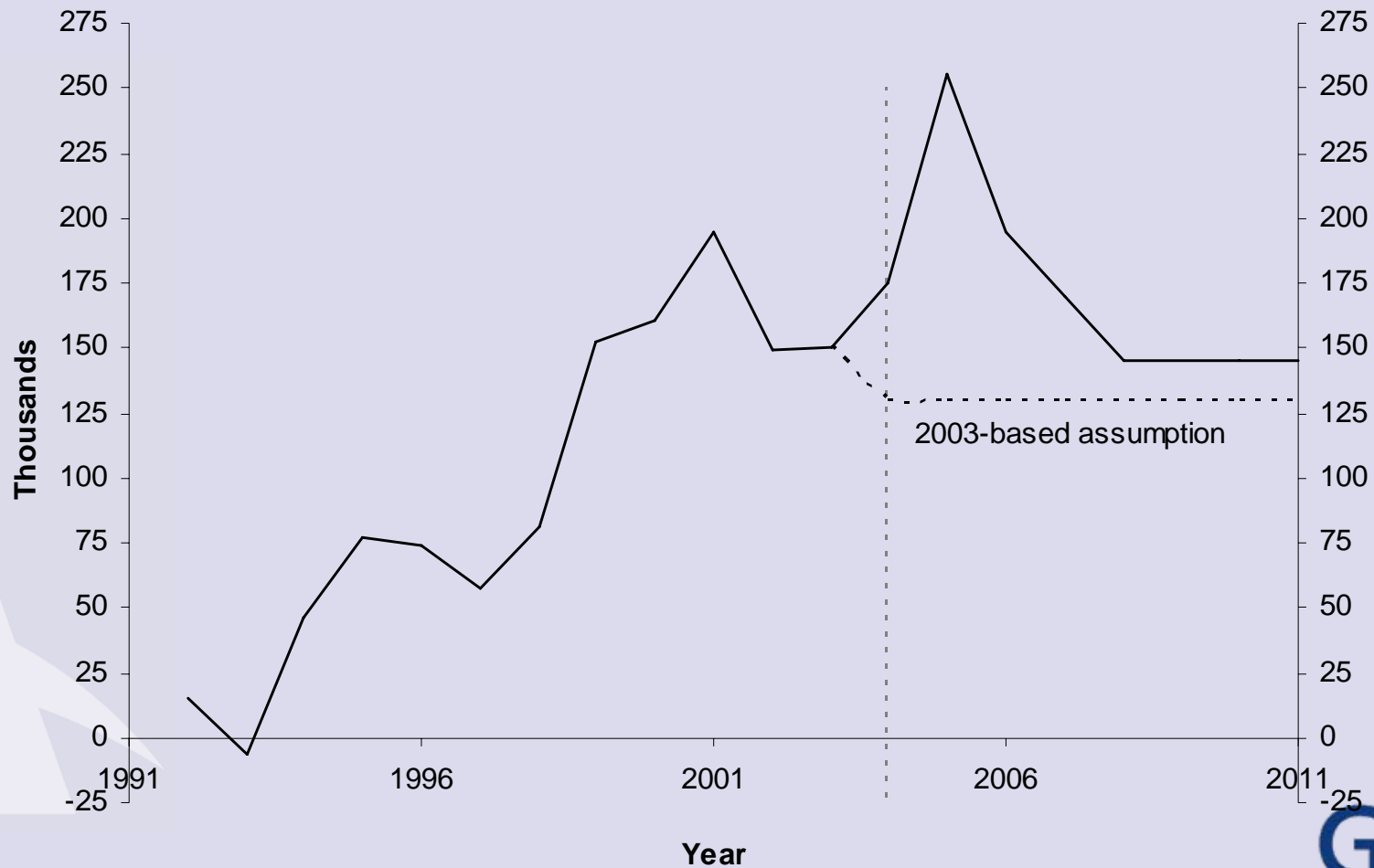


# Migration assumptions

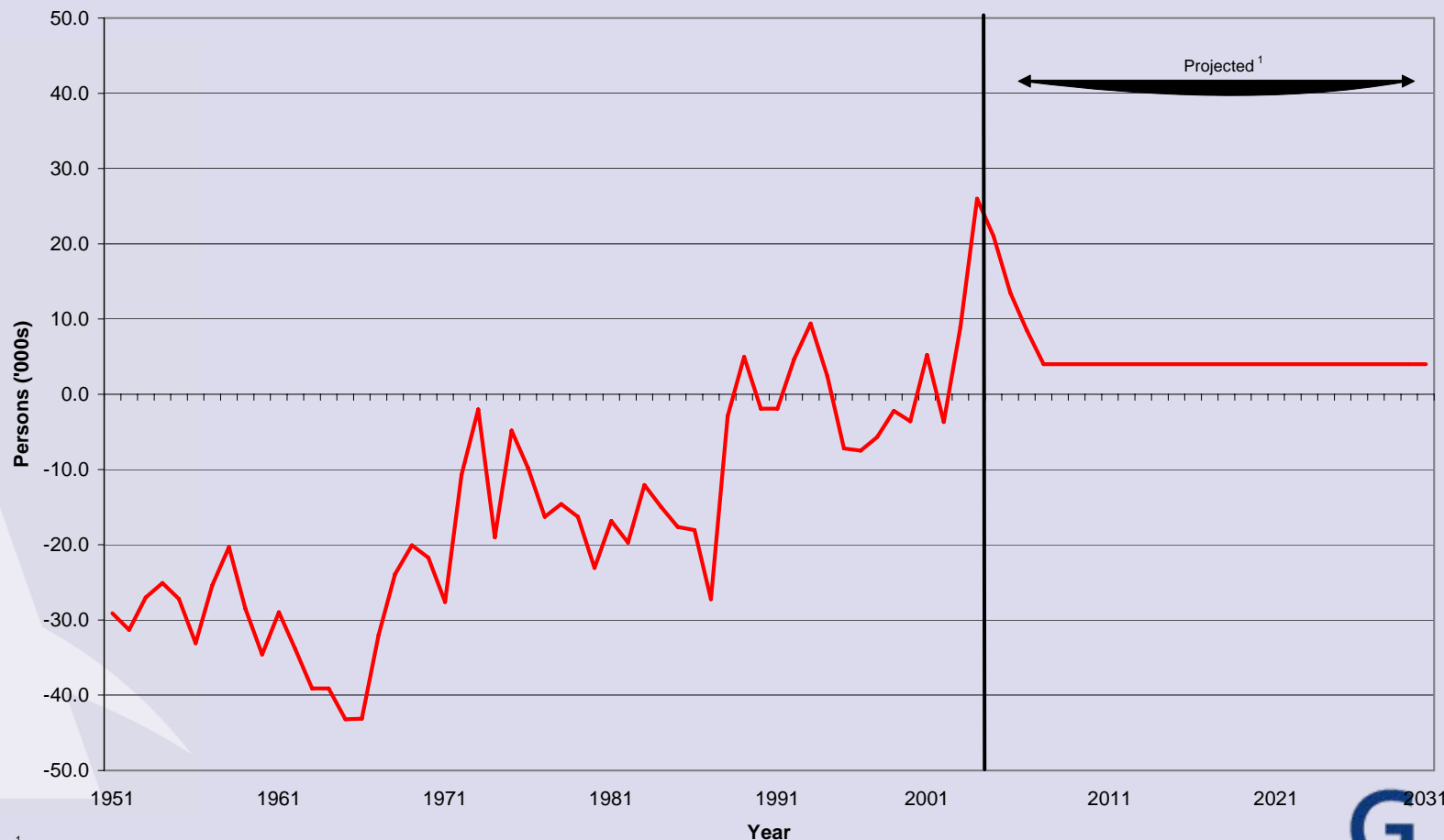
- Increase in long-term assumptions from 130,000 to 145,000 for UK and from -1,500 to 4,000 for Scotland
- Higher figures for first three years including A8 allowance
- Record migration in 2004



# UK total net migration 1991-2 to 2010-11



# Net migration, Scotland, estimated and projected, 1951-2031



<sup>1</sup> 2004-based projections



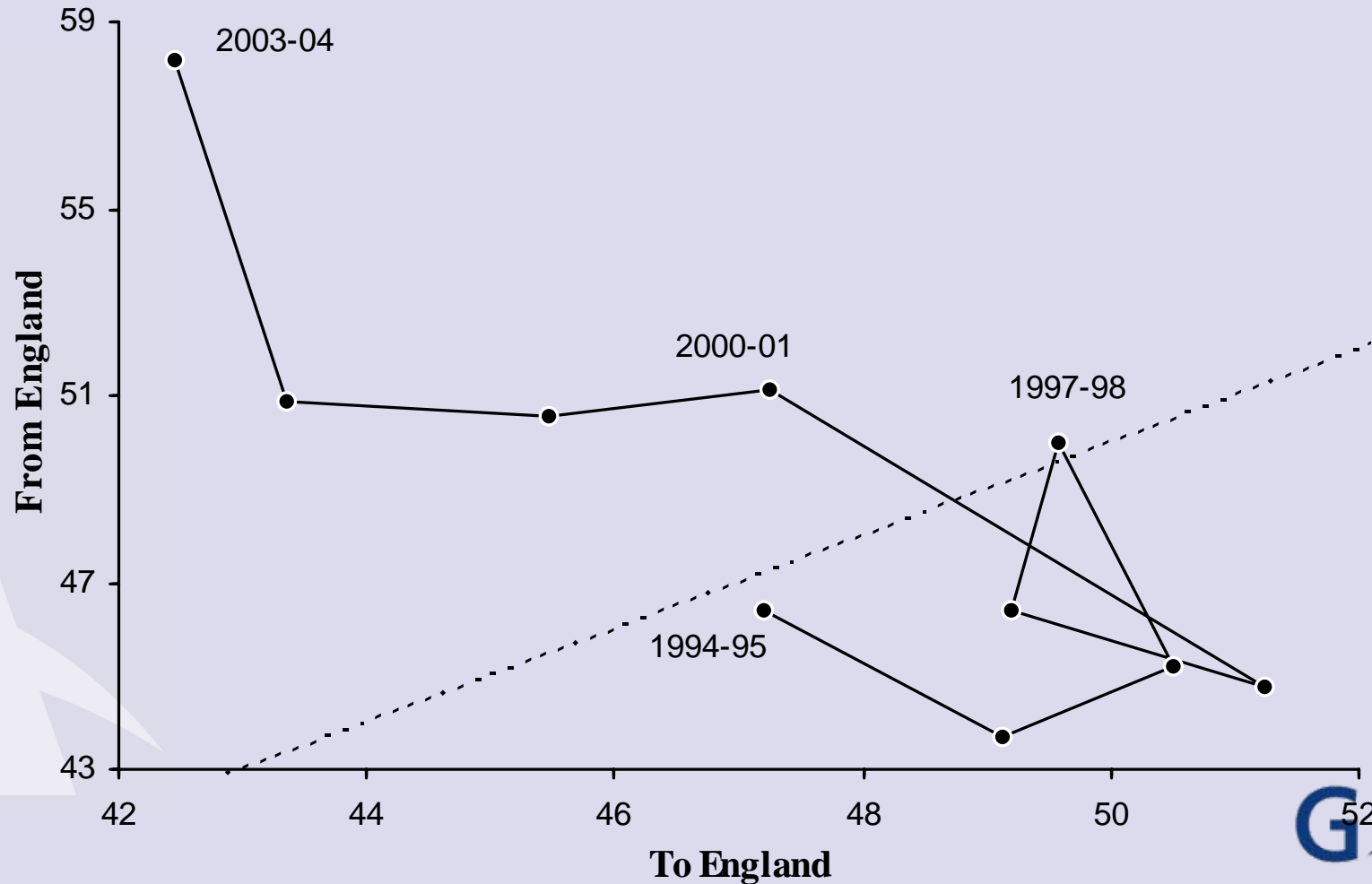
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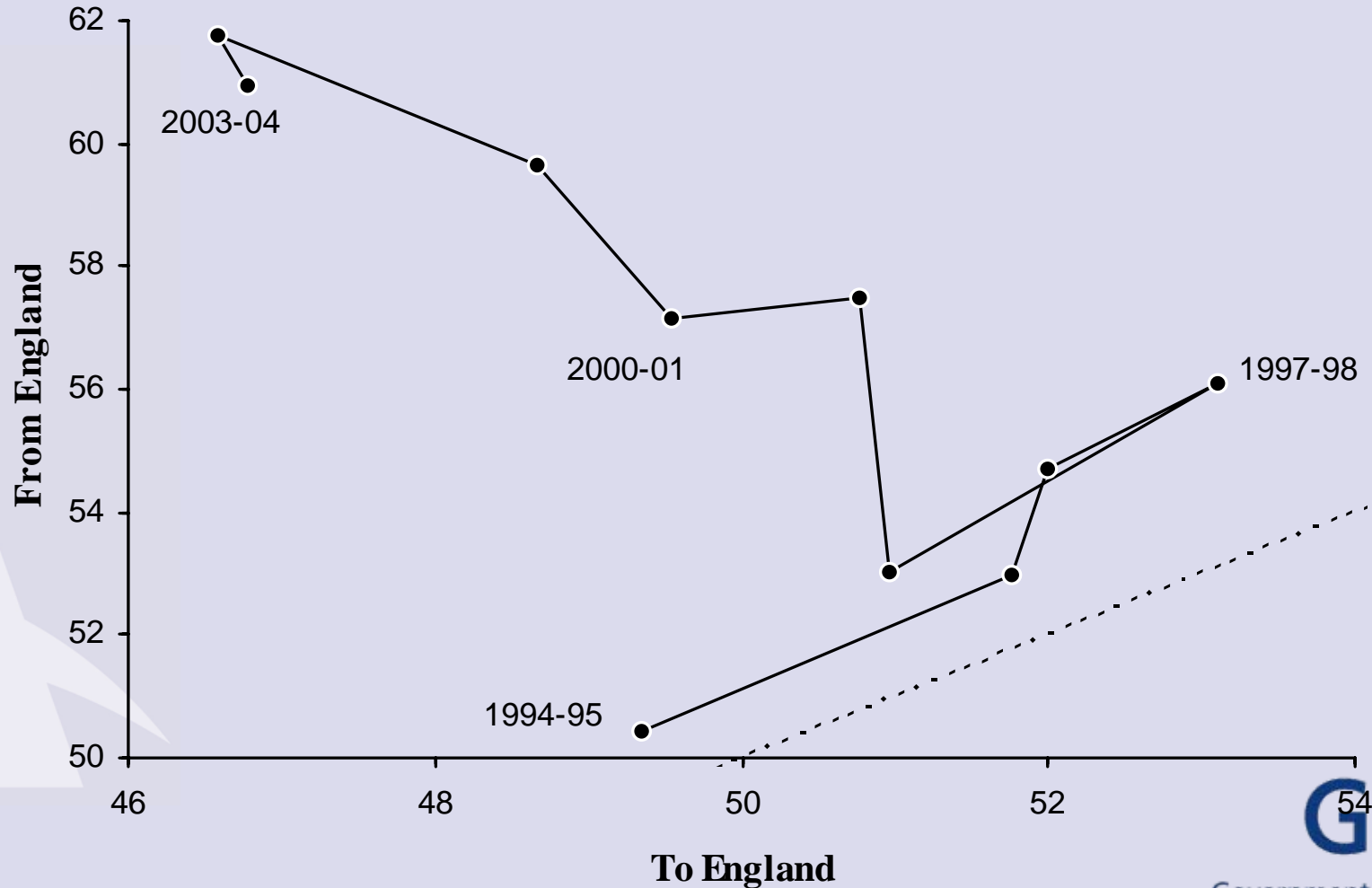
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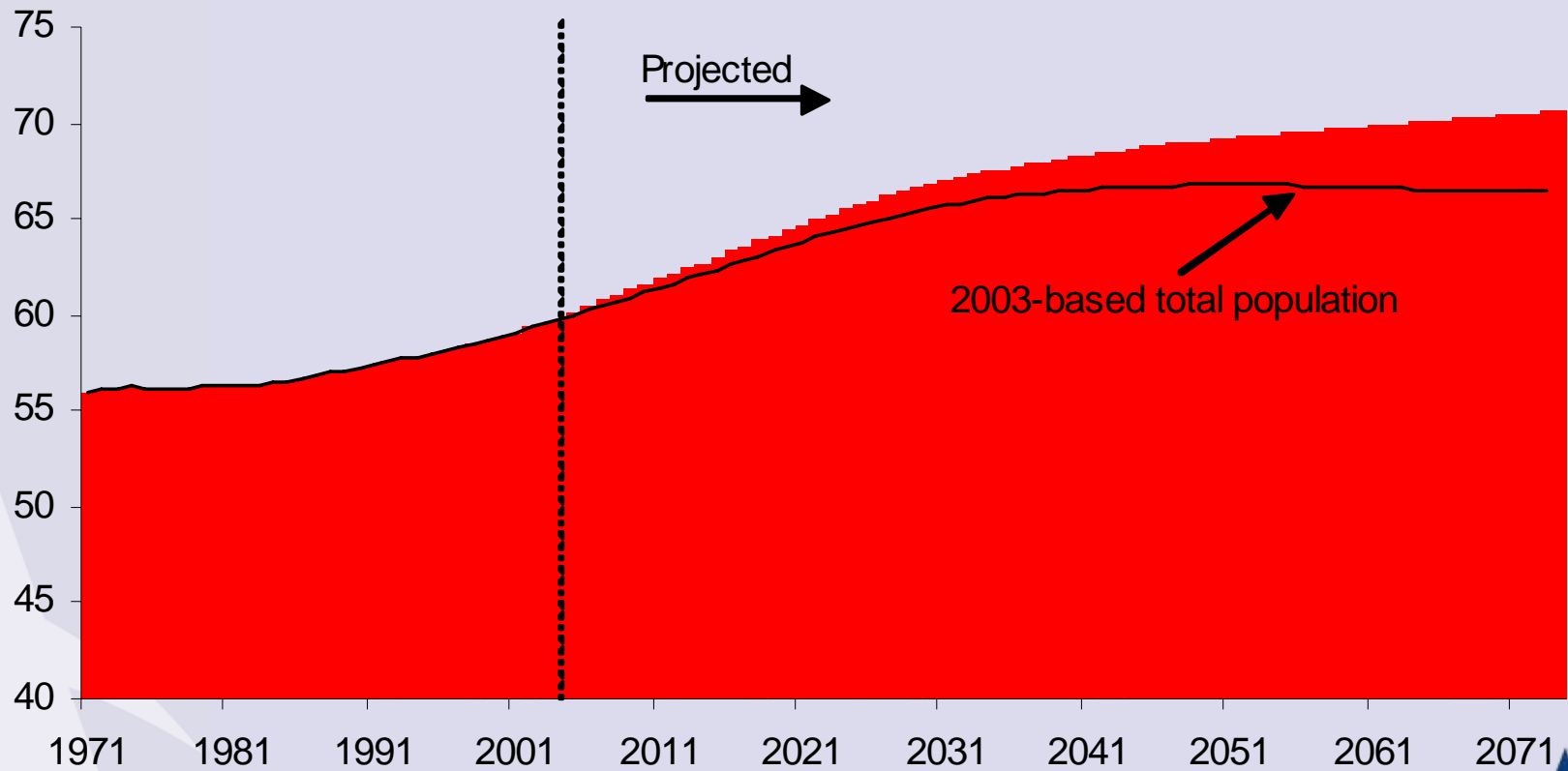
# Migration between Scotland and England, 1994-5 to 2003-4



# Migration between Wales and England, 1994-5 to 2003-4



# Actual and projected population of the United Kingdom, 1971 - 2074



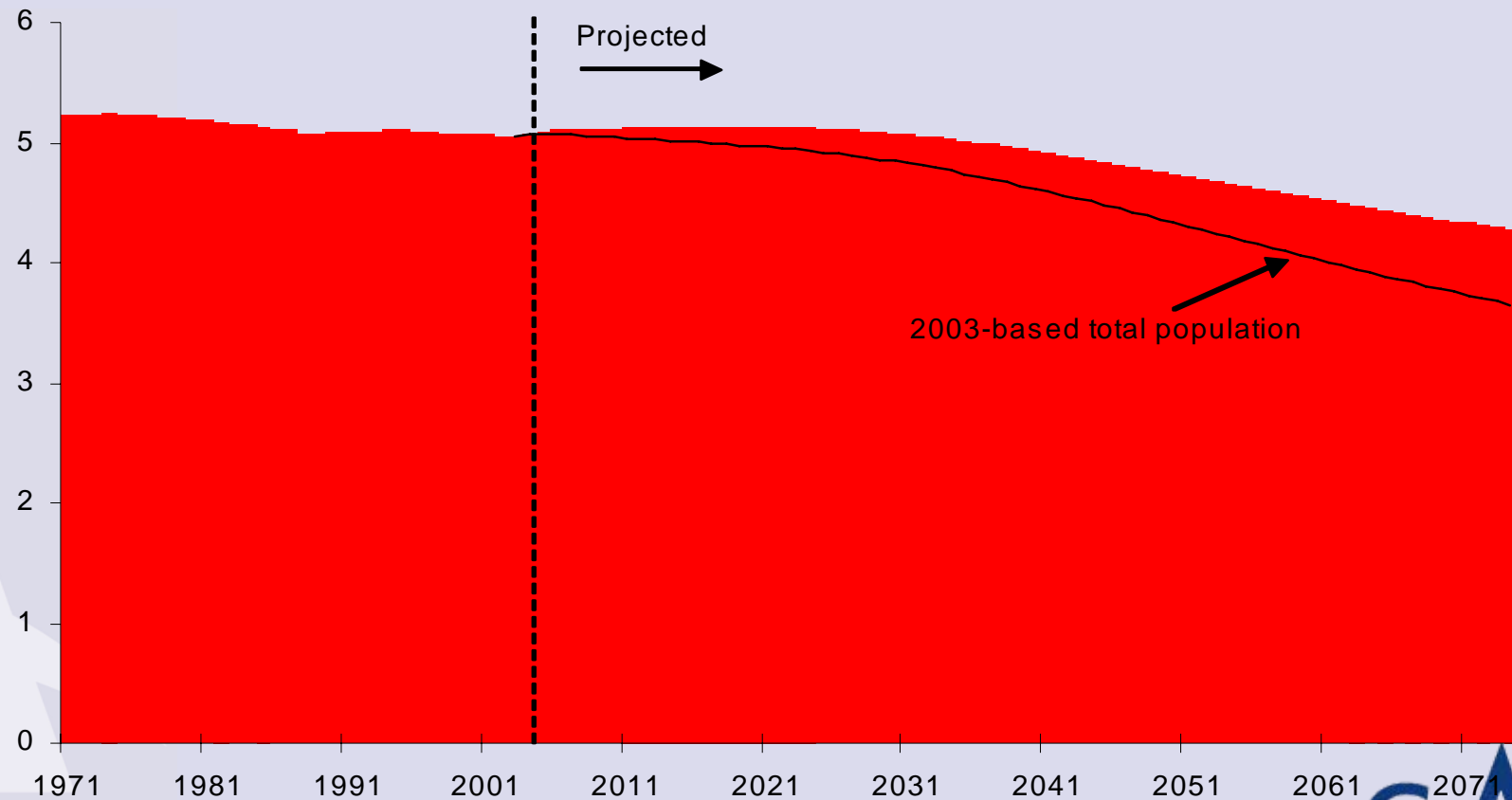
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# Actual and projected population of Scotland, 1971 - 2074



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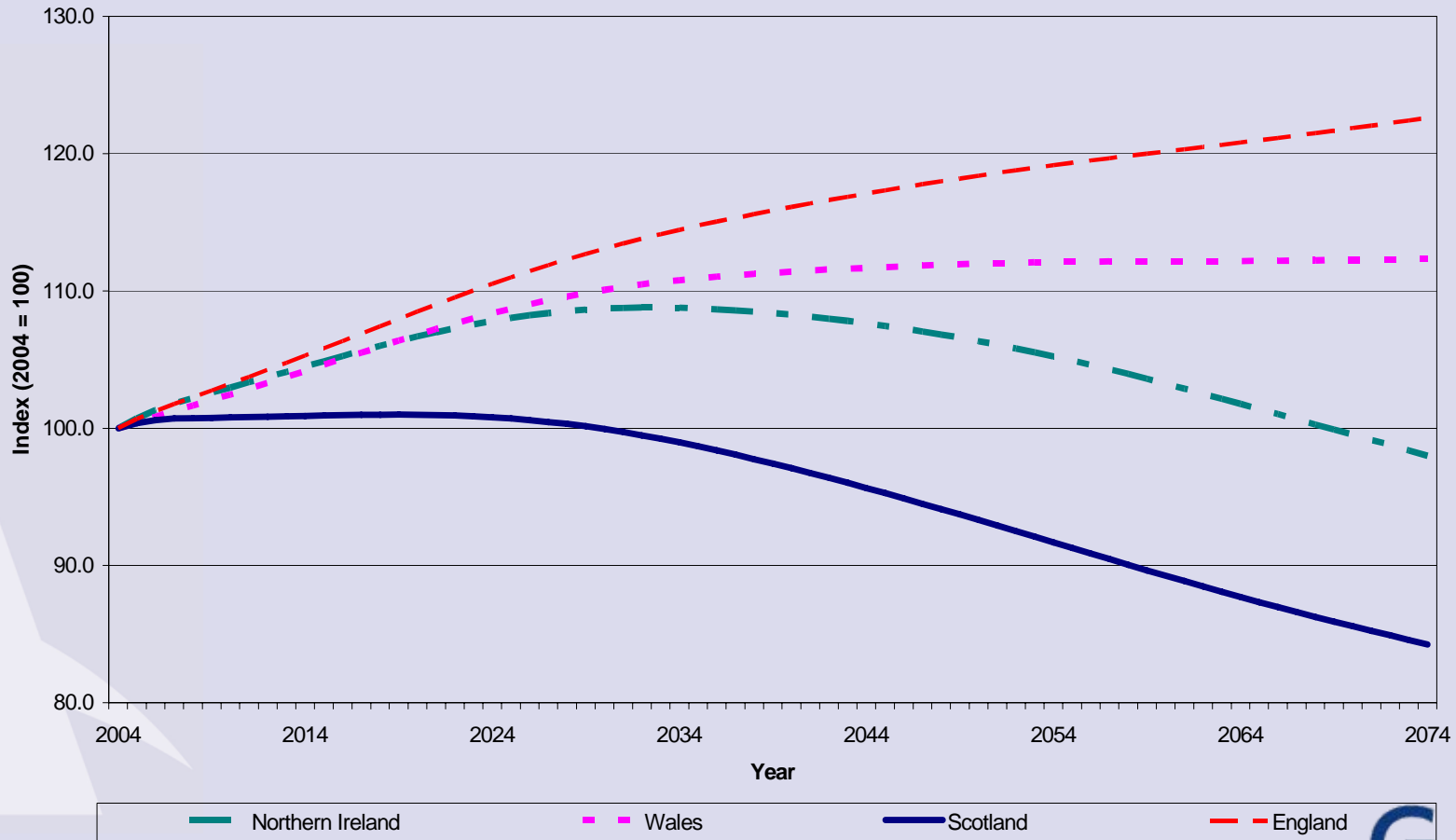
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# Results - Scotland

The population is projected to rise, peaking at 5.13 million in 2019 before falling back down to 5.07 million by 2031 and dropping below 5 million in 2036



# UK countries index of population, 2004 - 2074

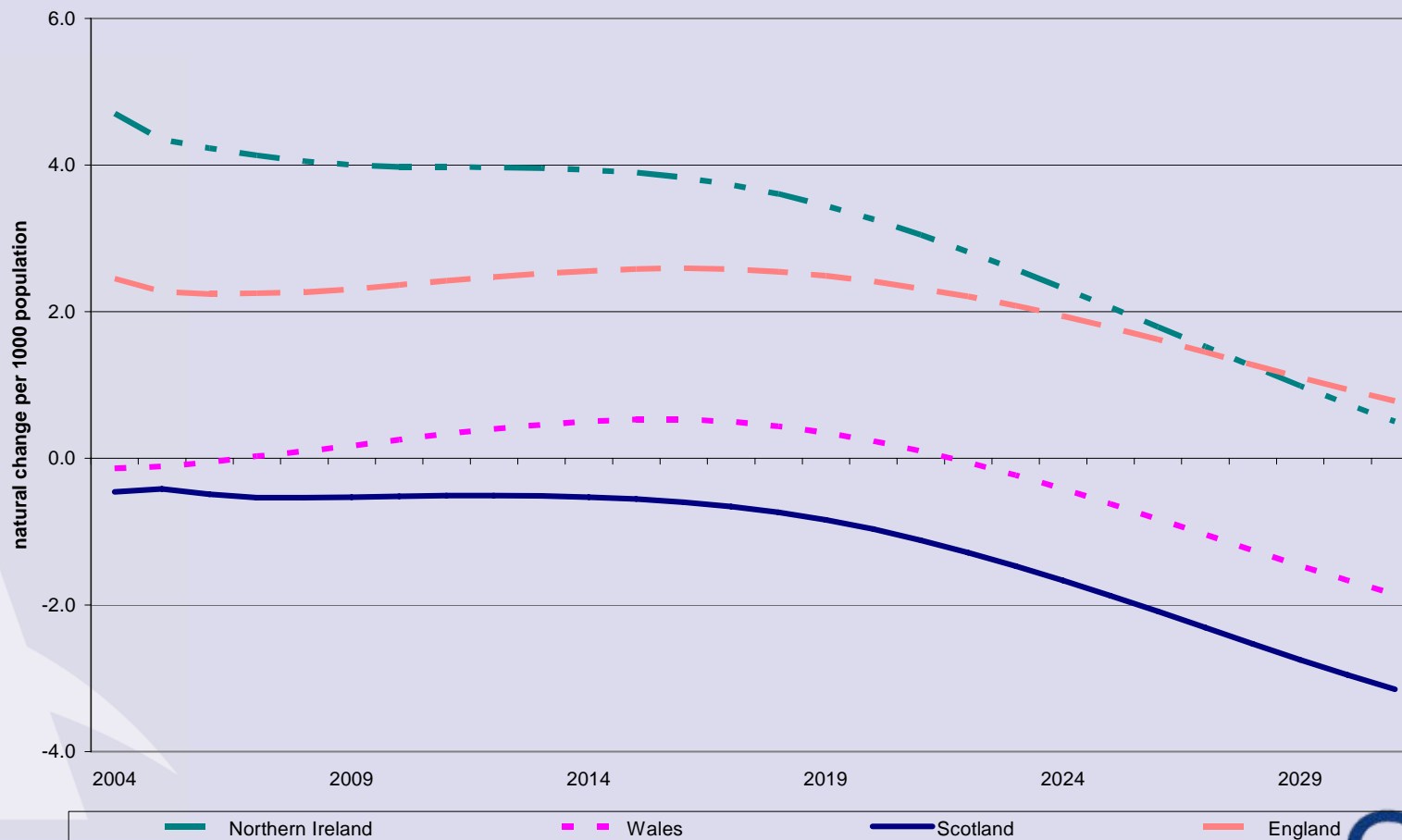


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# Natural change per 1,000 population, UK countries, 2004-2031

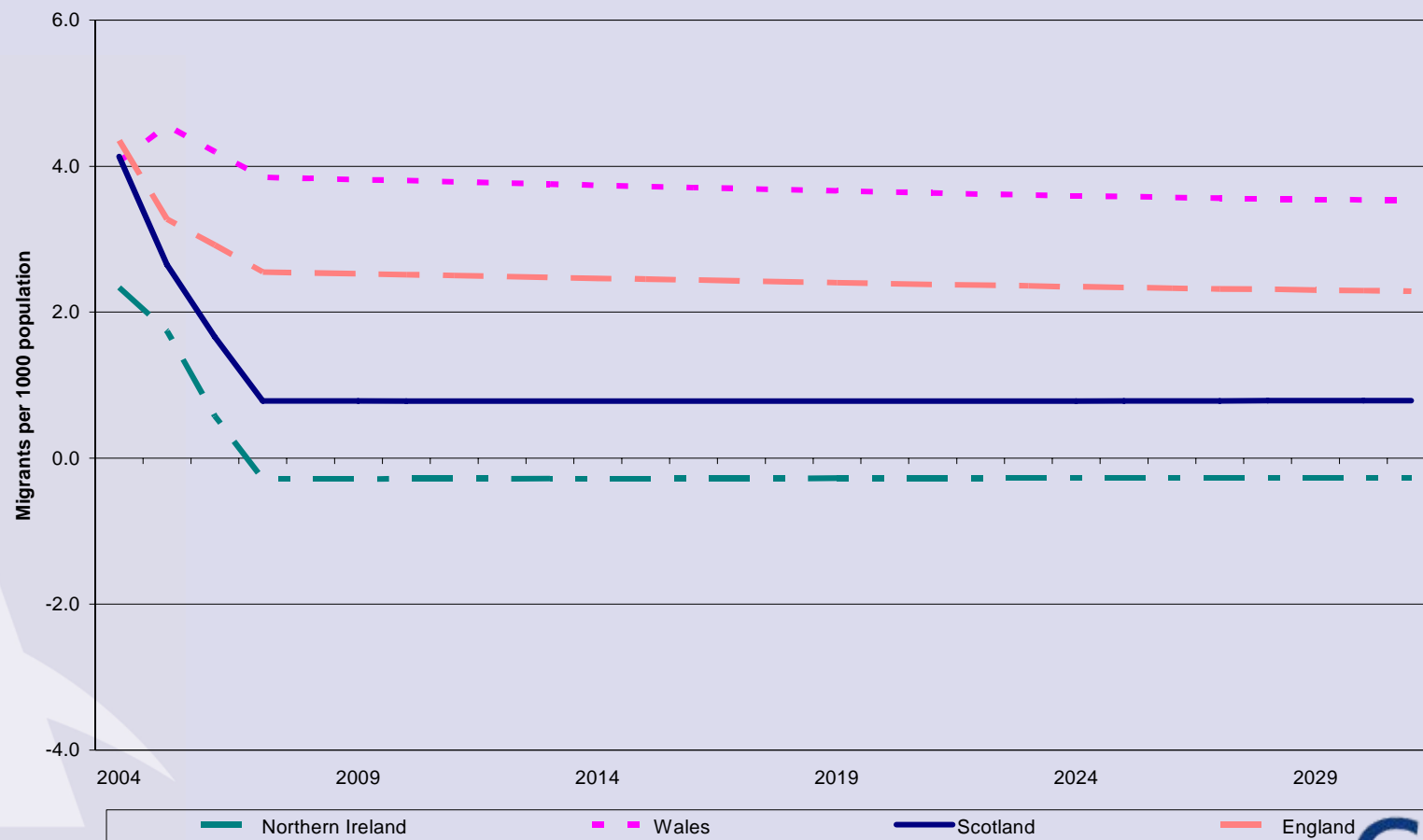


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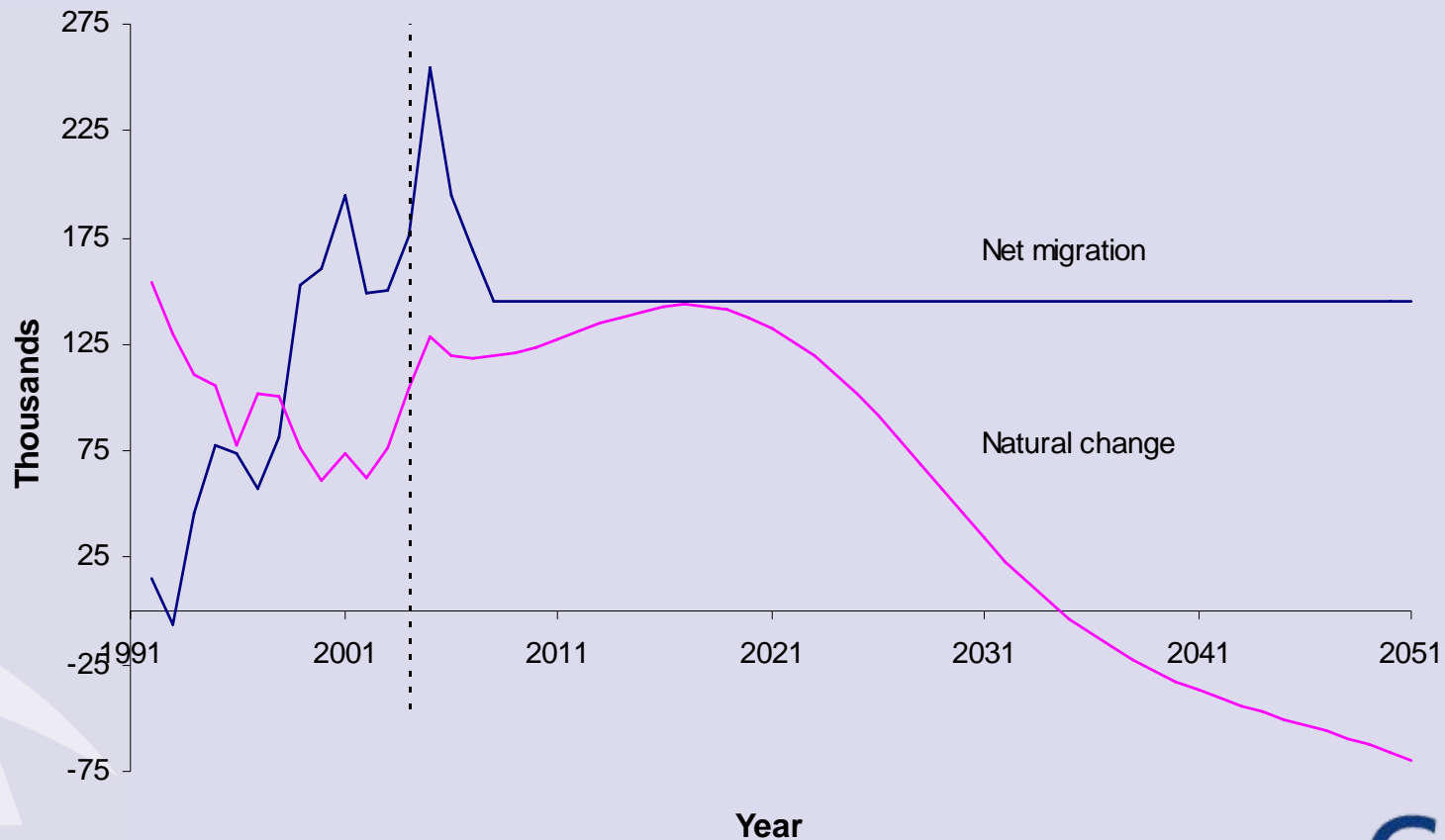
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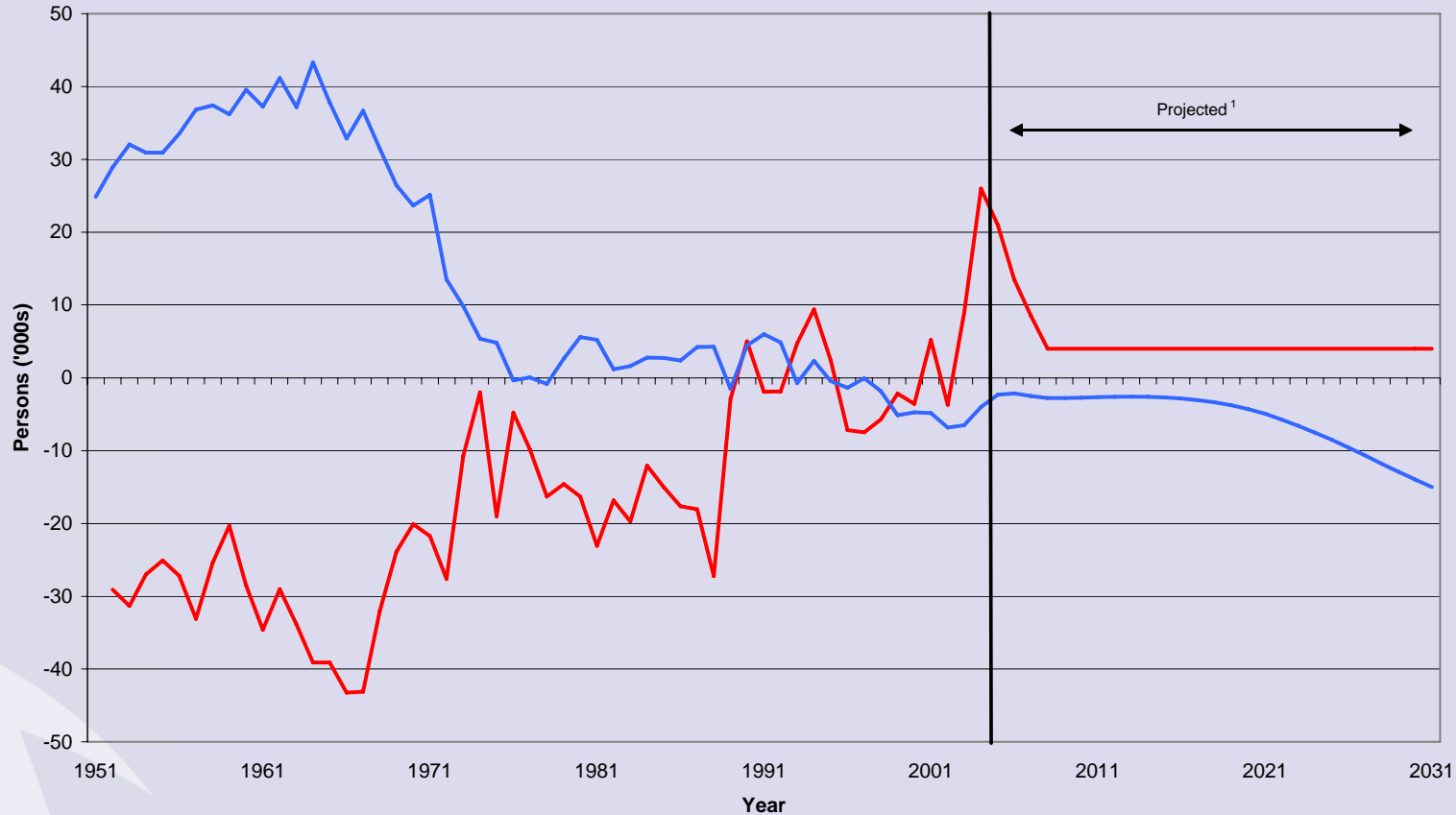
# Net migration per 1000 population, UK countries, 2004-2031



# Actual and projected net migration and natural change, United Kingdom, 1991-2 to 2050-51



# Actual and projected net migration and natural change, Scotland, 1951-2031



<sup>1</sup> 2004-based projections

— Net migration — natural change

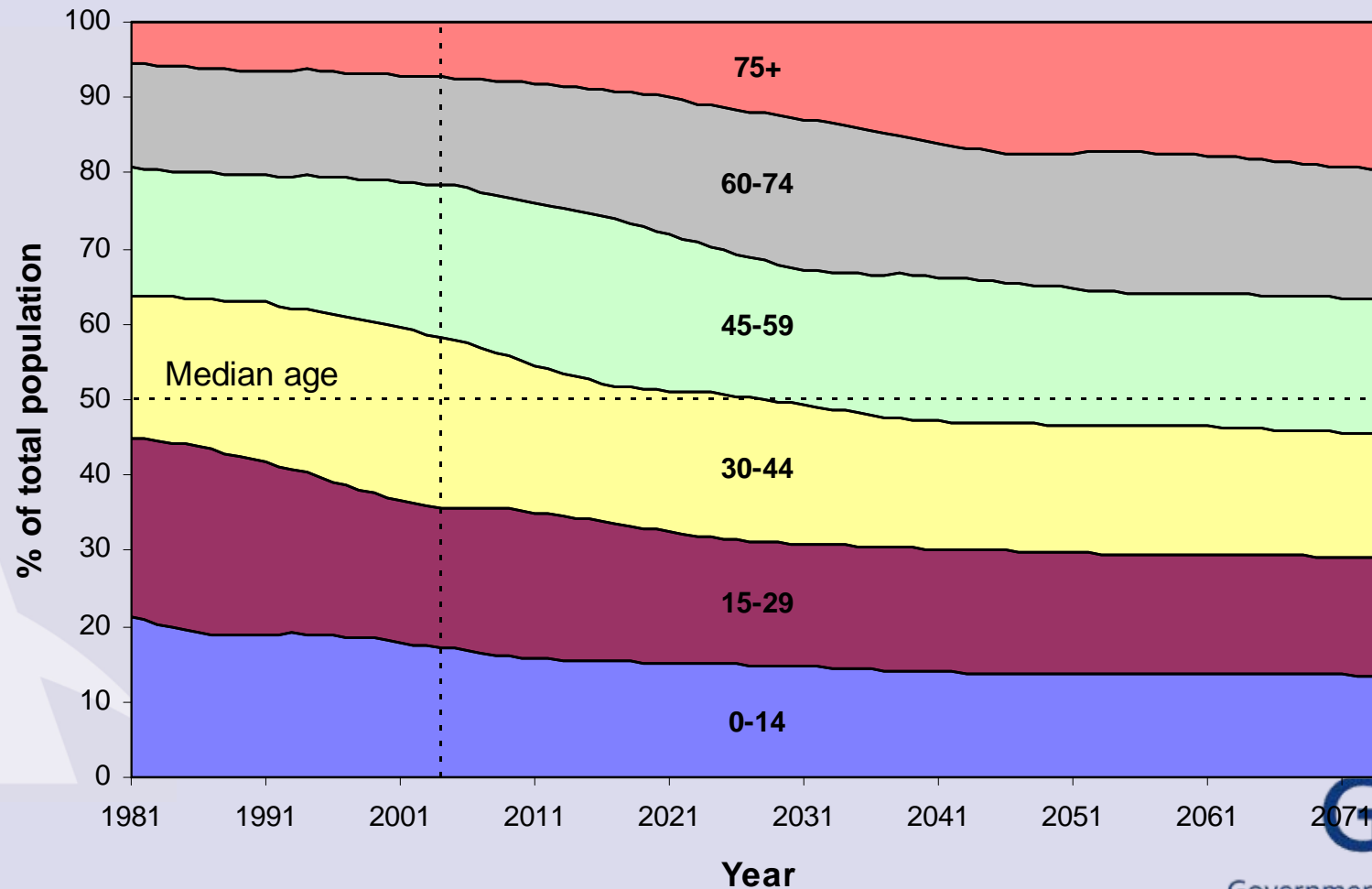


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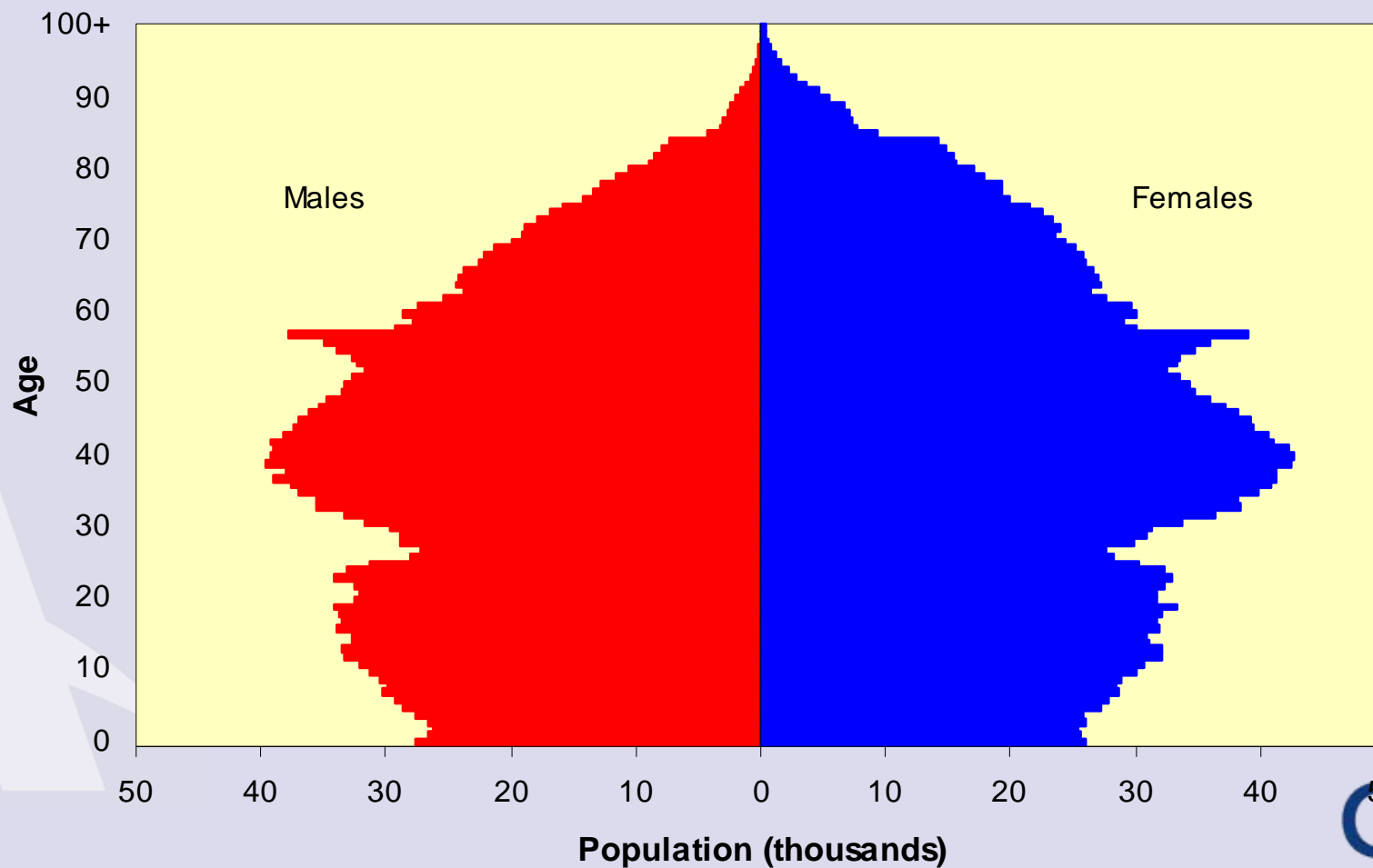
# Projected age distribution, Scotland, 2004-2074





# 2004-based national population projections Scotland

2004



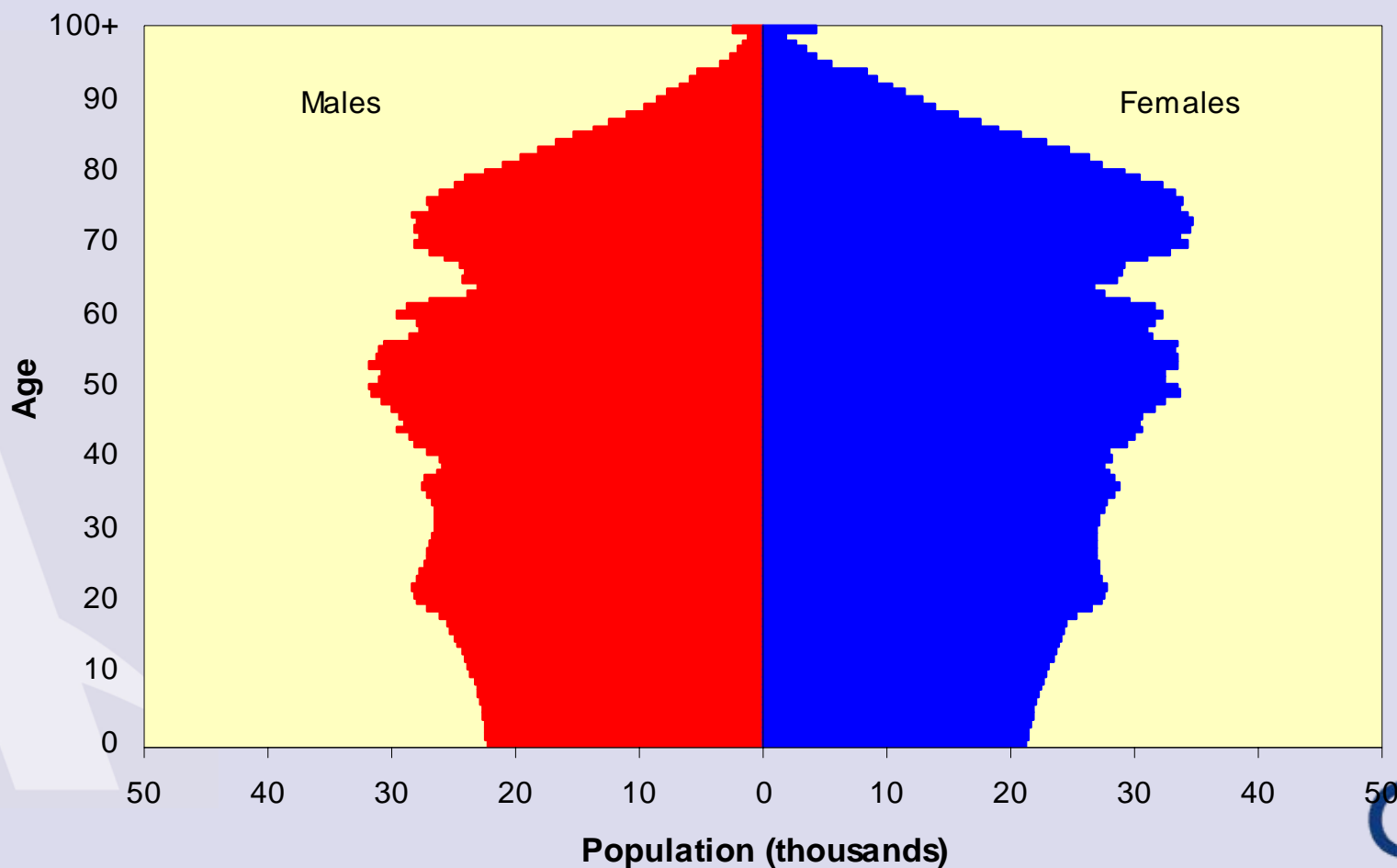
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# 2004-based national population projections Scotland

2041

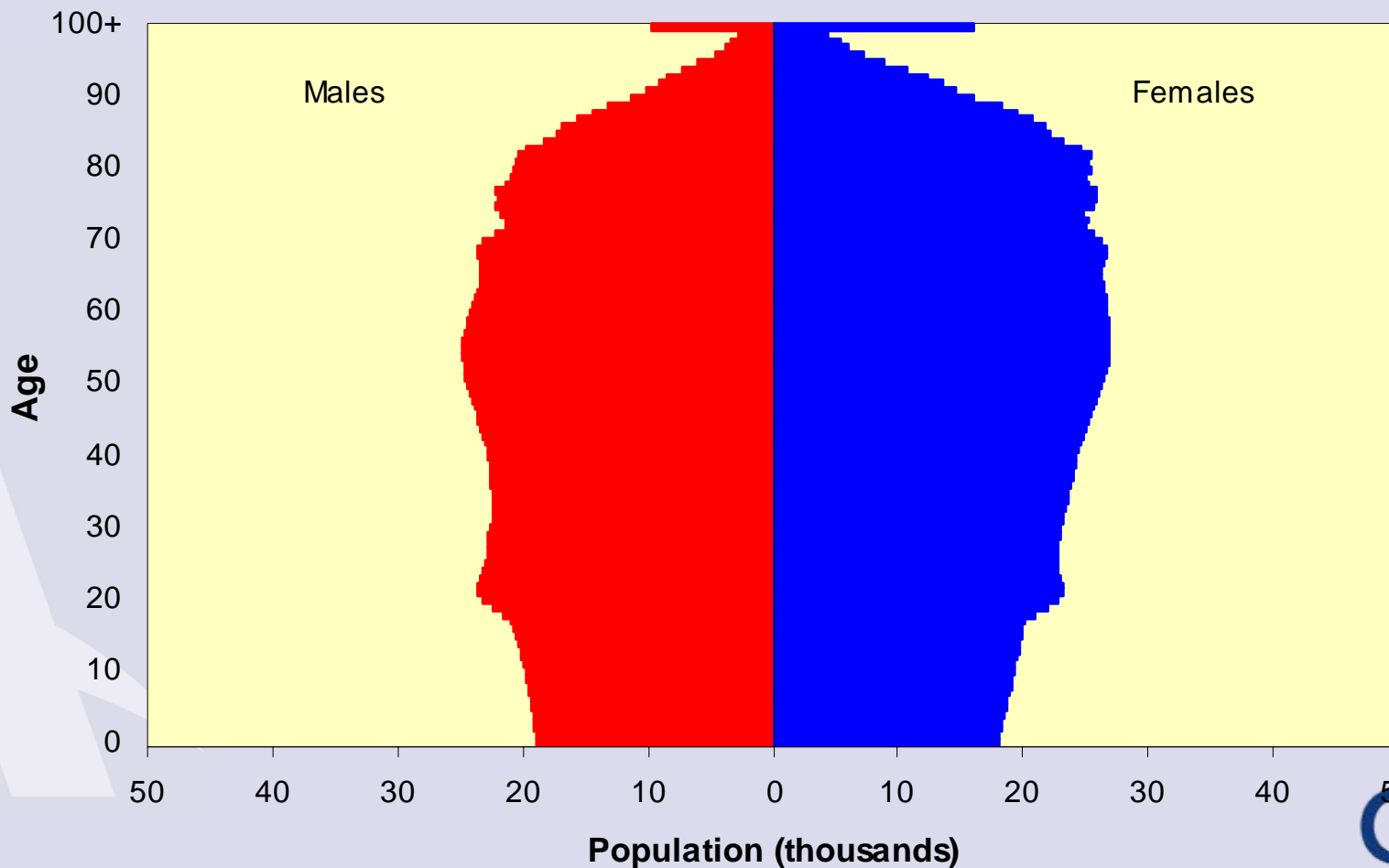


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# 2004-based national population projections Scotland

2074

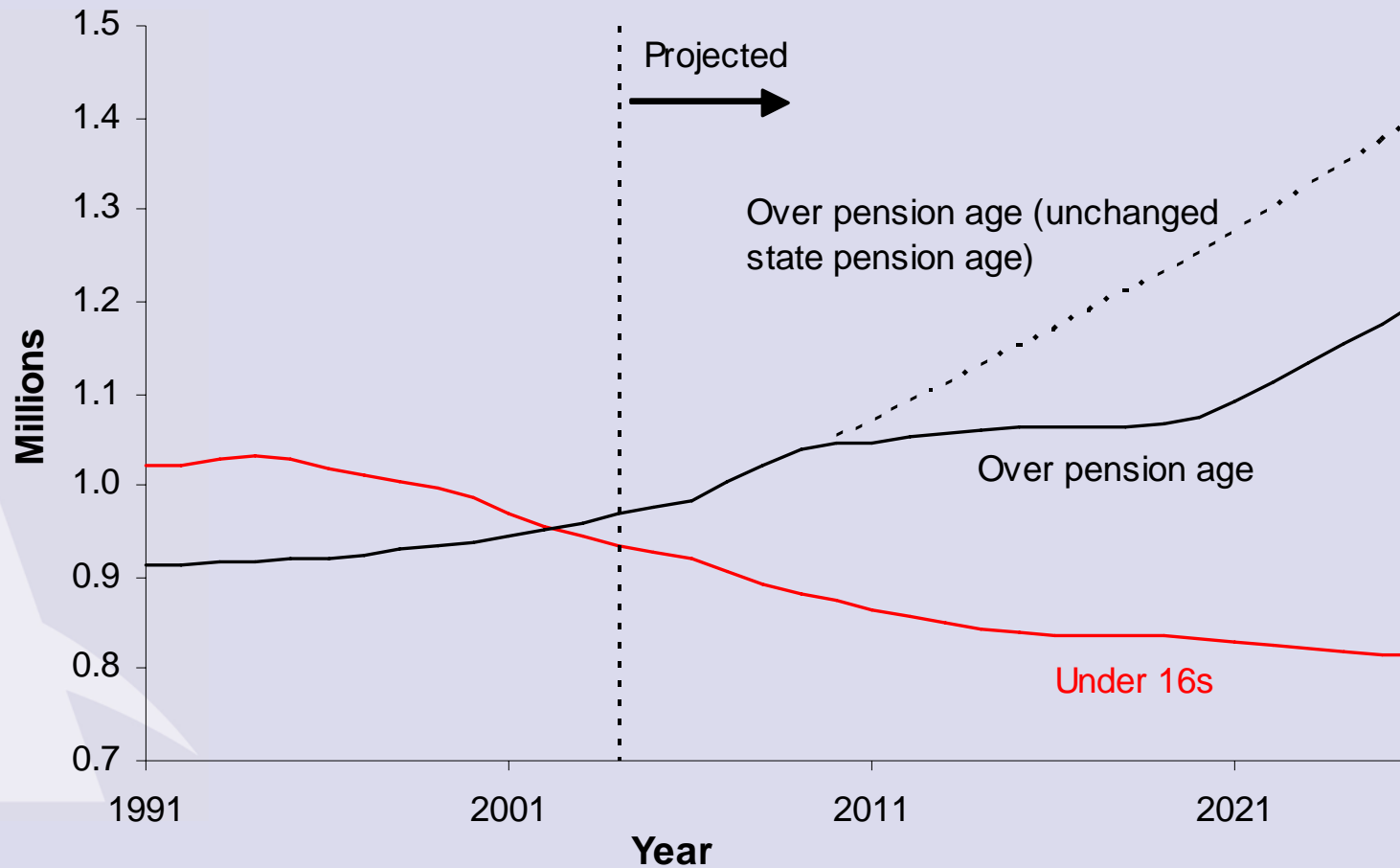


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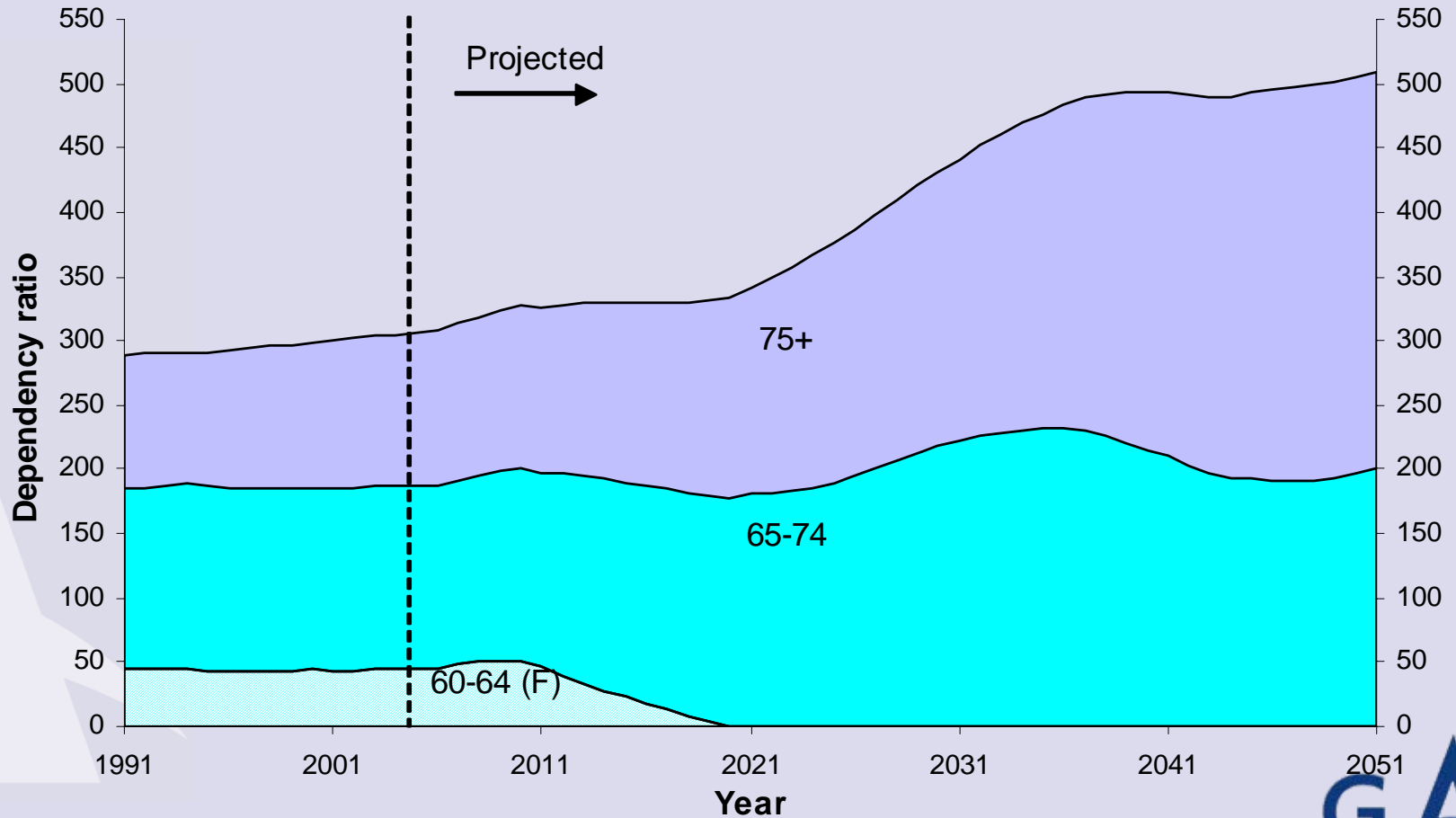
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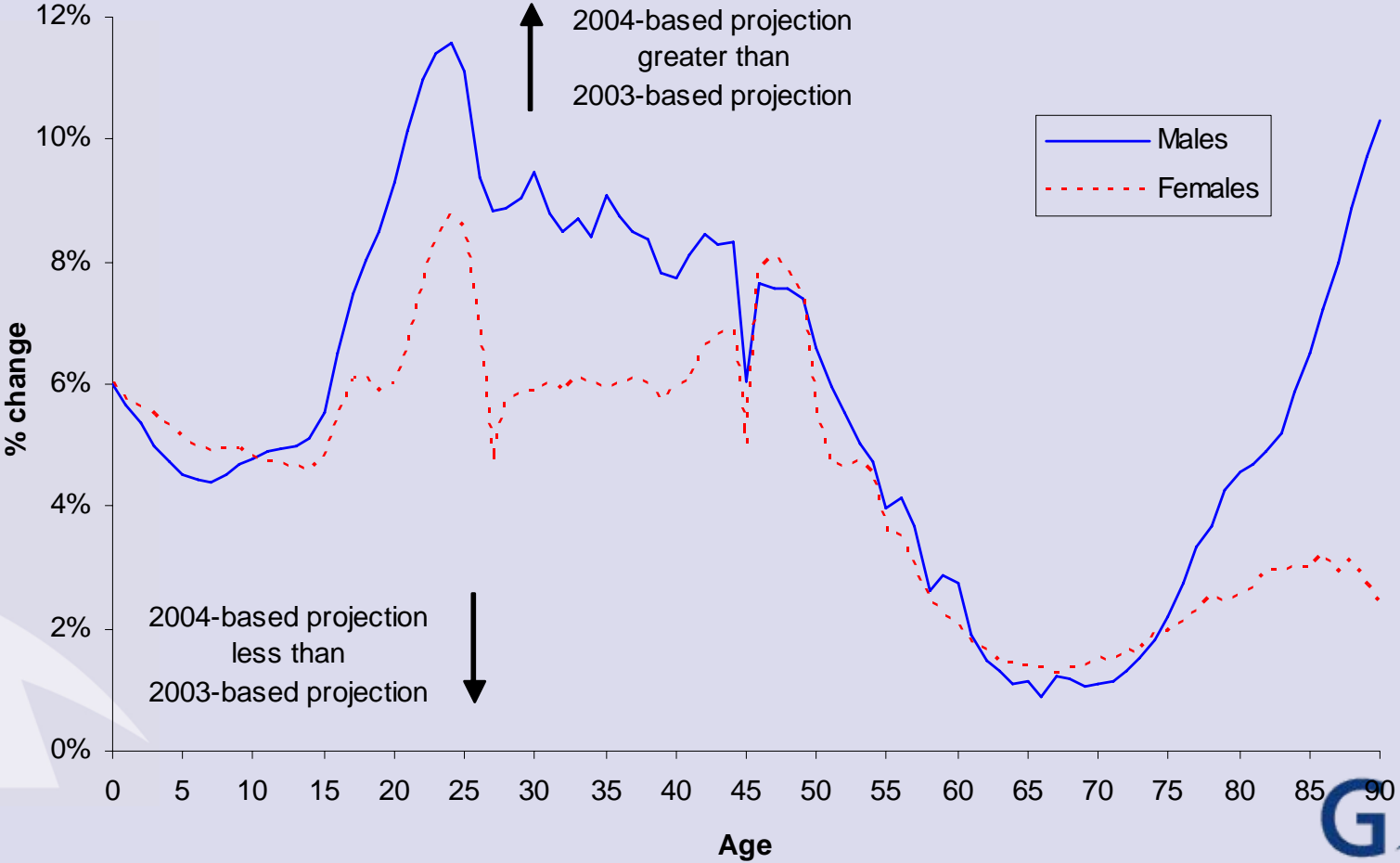
# Actual and projected dependants, Scotland, 1991-2051



# Components of elderly dependency ratio, Scotland, 1991 to 2051



# Change in projected population at 2031 by age and sex, Scotland



# Variant Projections

- Main variants – high and low of each of the three assumptions of mortality, migration and fertility – and natural change (no migration) variant completed
- Additional combination variants such as largest population, oldest population and special case variants such as replacement fertility to follow on 24 November



# Variant assumptions used in 2004-based population projections are:

Long-term average children per woman:

UK	High 1.94	Principal 1.74	Low 1.54
Scotland	High 1.80	Principal 1.60	Low 1.40

Long-term annual net migration:

UK	High 205,000	Principal 145,000	Low 85,000
Scotland	High 12,500	Principal 4,000	Low -4,500

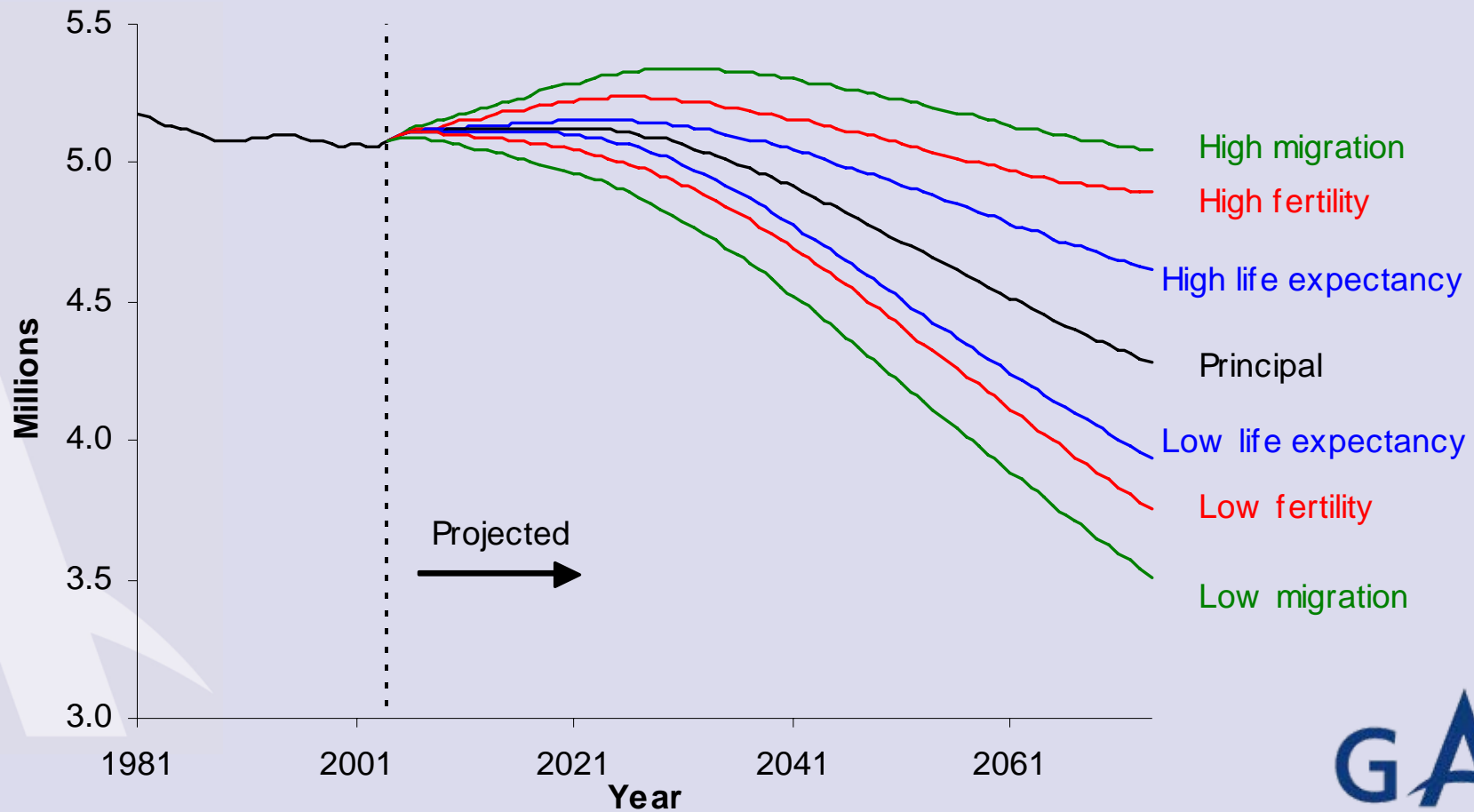
Annual mortality rate improvements at 2029:

High 2%	Principal 1%	Low 0%
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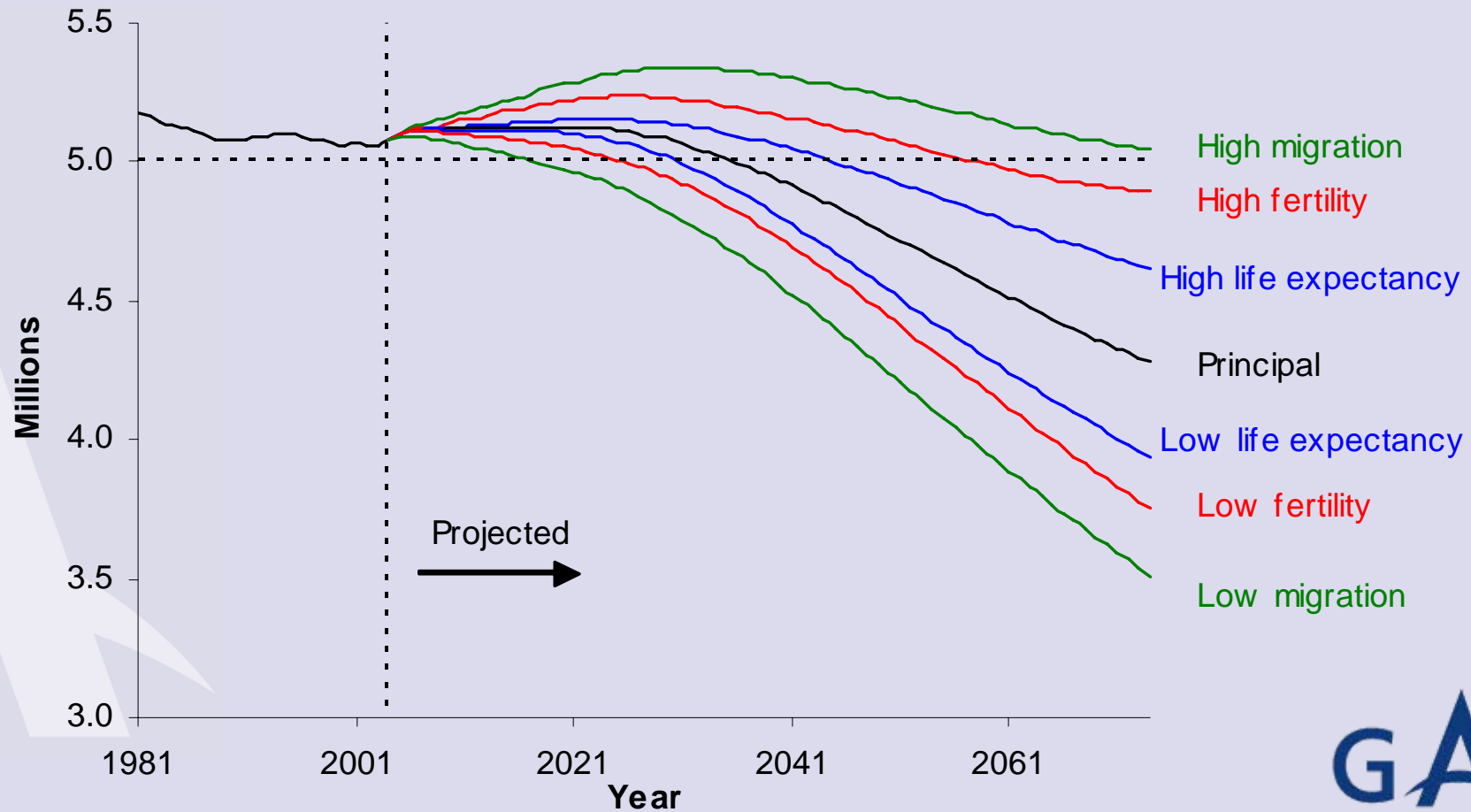




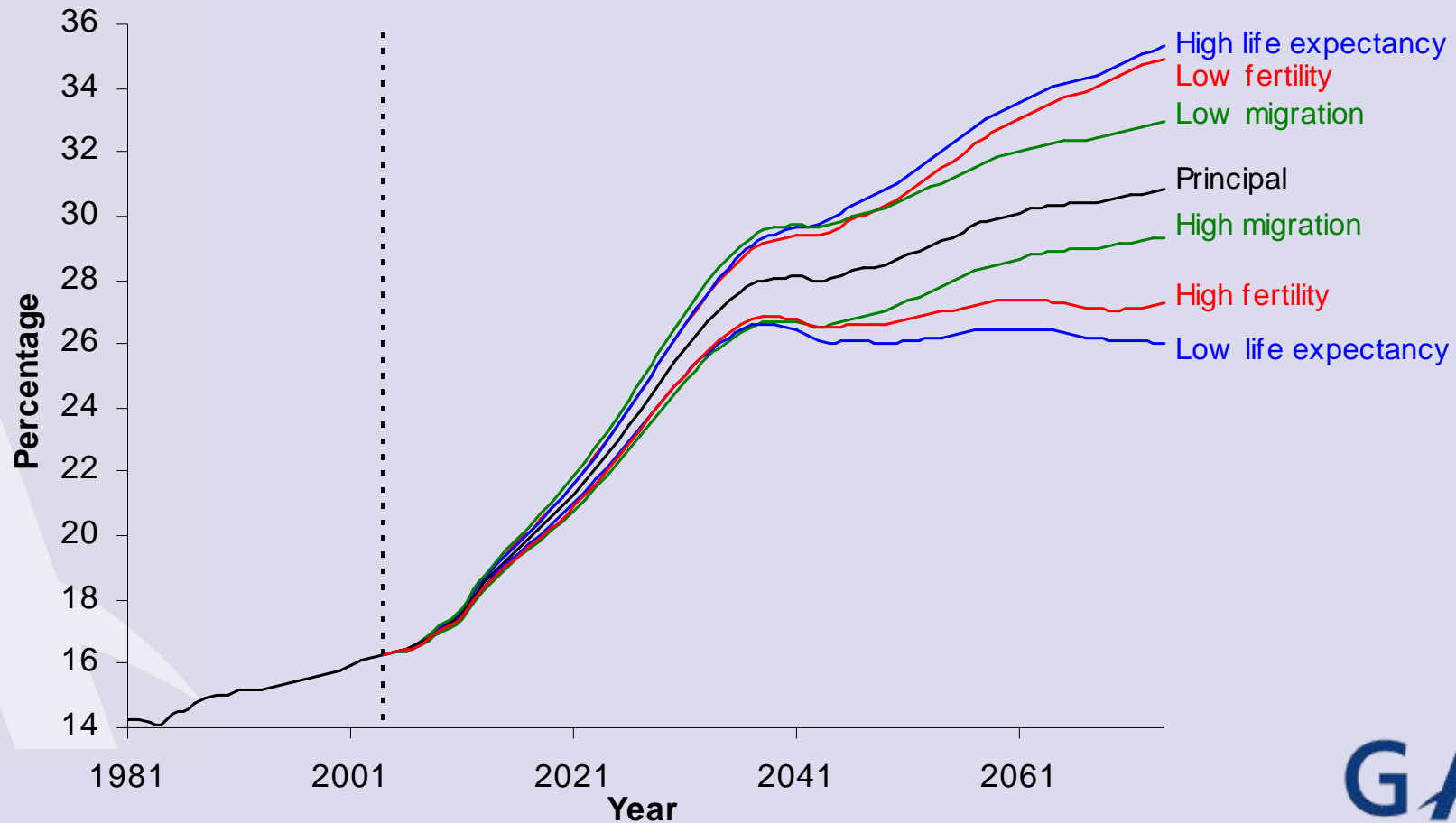
# Population of Scotland according to principal and variant 2004-based projections, 1981-2074



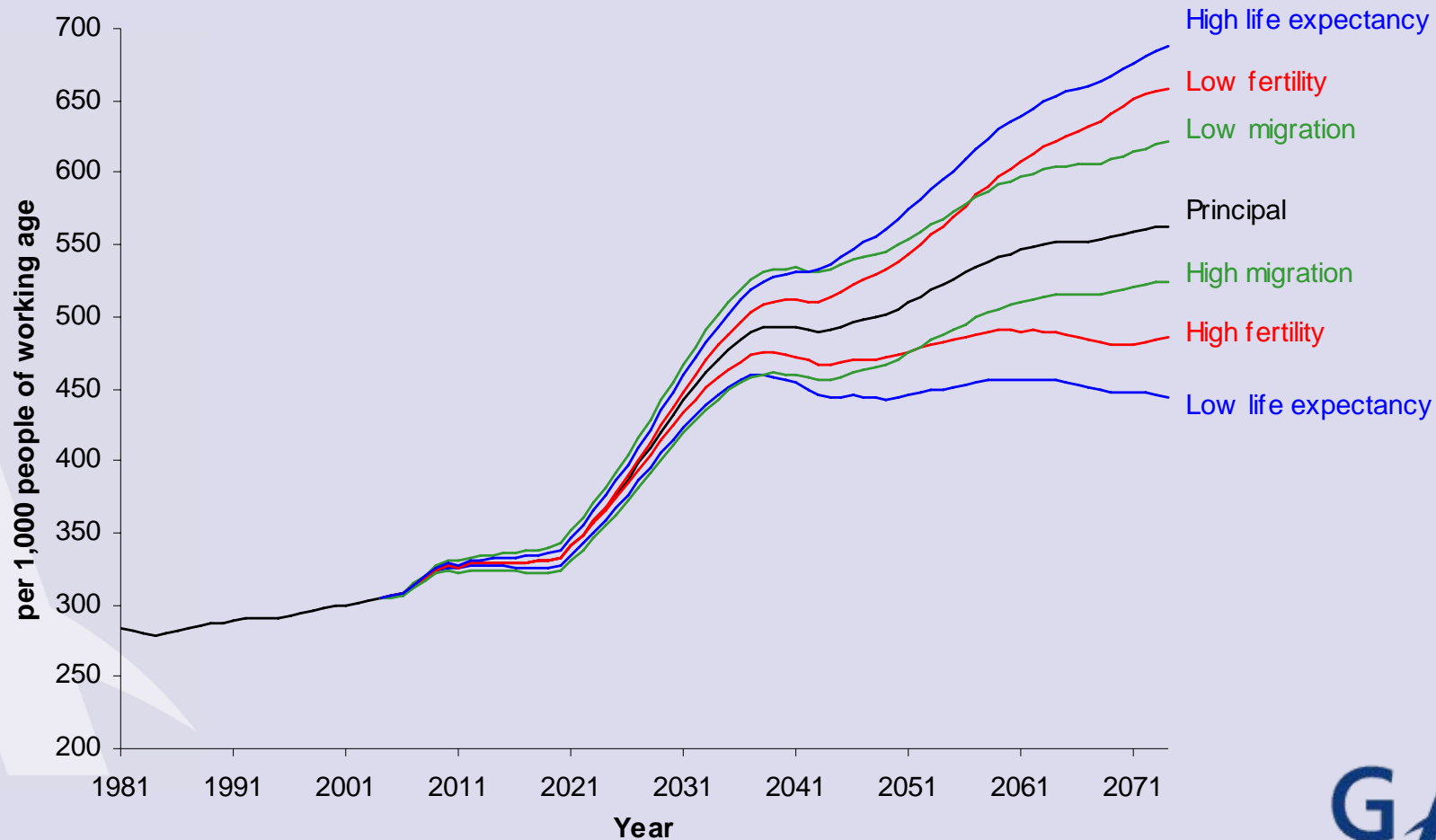
# Population of Scotland according to principal and variant 2004-based projections, 1981-2074



# Proportion of the population aged 65 and over, Scotland, 1981-2074, under various projection assumptions



# Elderly dependency ratio, Scotland, 1981-2074, under various projection assumptions



# Eurostat/UNECE work session on demographic projections

Vienna, September 2005

## Key issues

- Are EU demographic trends diverging or converging?
- Need for greater theoretical/evidence based underpinning of assumptions
  - Cause of death/cohort patterns for mortality
  - Motives for international migration
- Better communication of uncertainty



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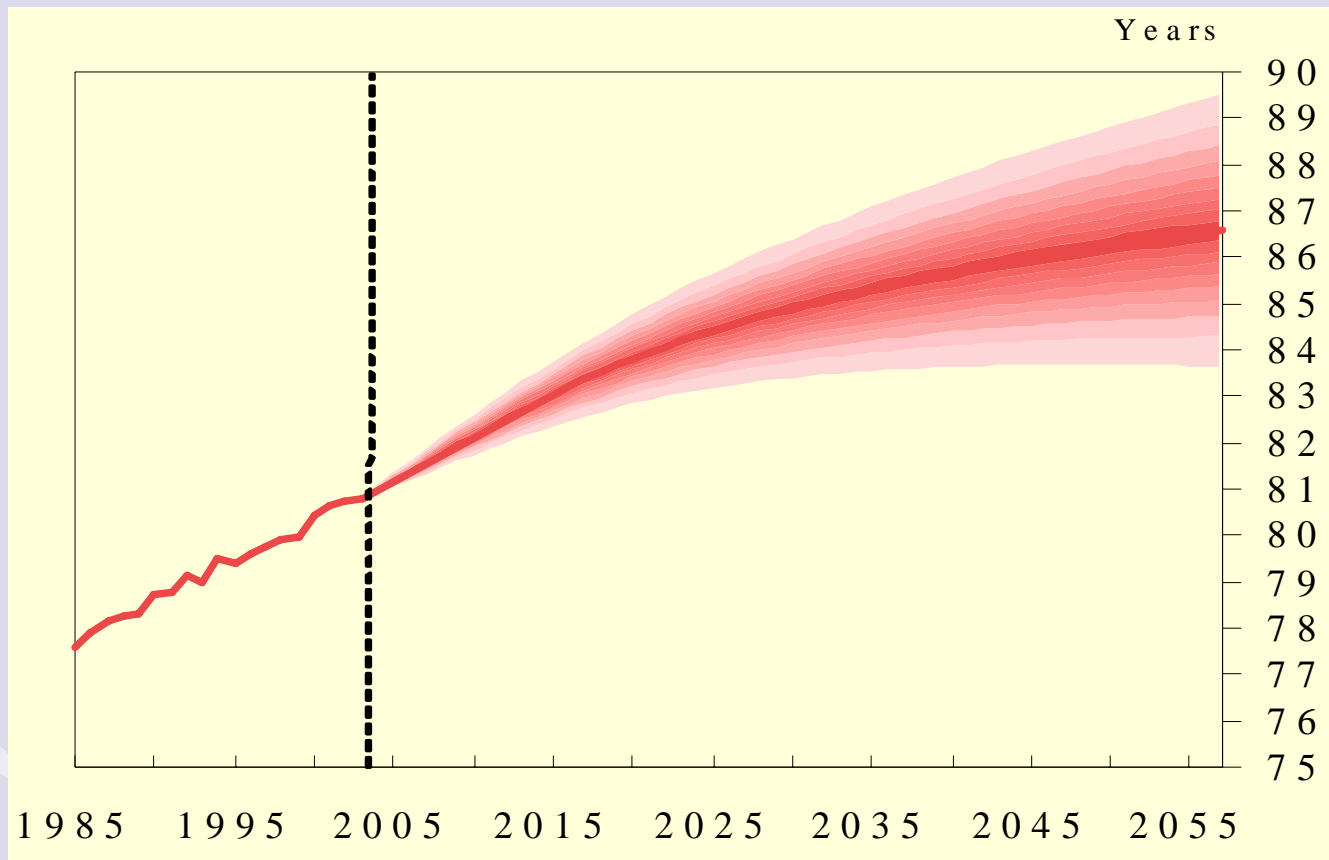
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# Uncertainty: Possible future developments in the UK

- Stochastic forecasting
- Make national projection model available to users
- Historic database of projections
- Update analysis of accuracy of past projections
- Uncertainty at subnational level



# Stochastic forecasting: life expectancy fan chart



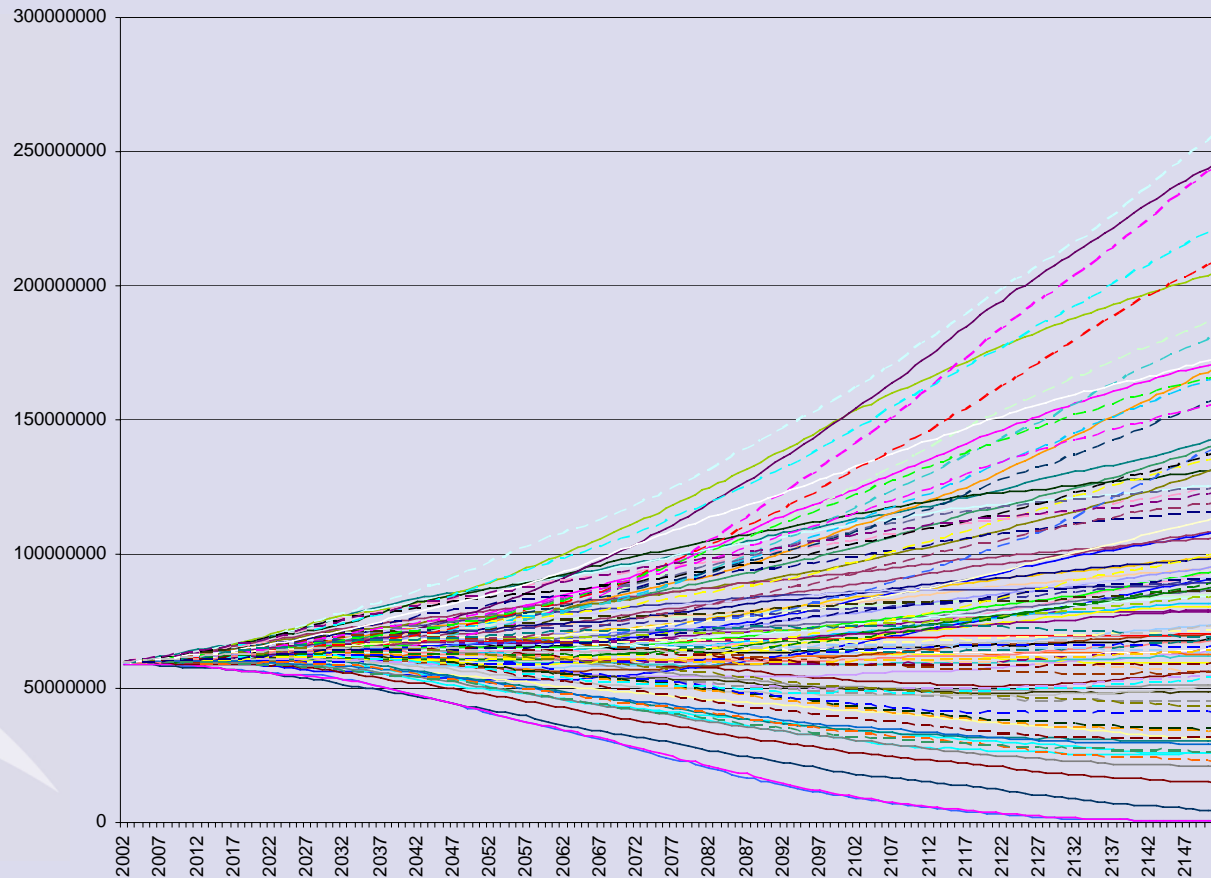
Source: Pensions Commission

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# Stochastic forecasting: demographic modelling



Source: NIESR



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