

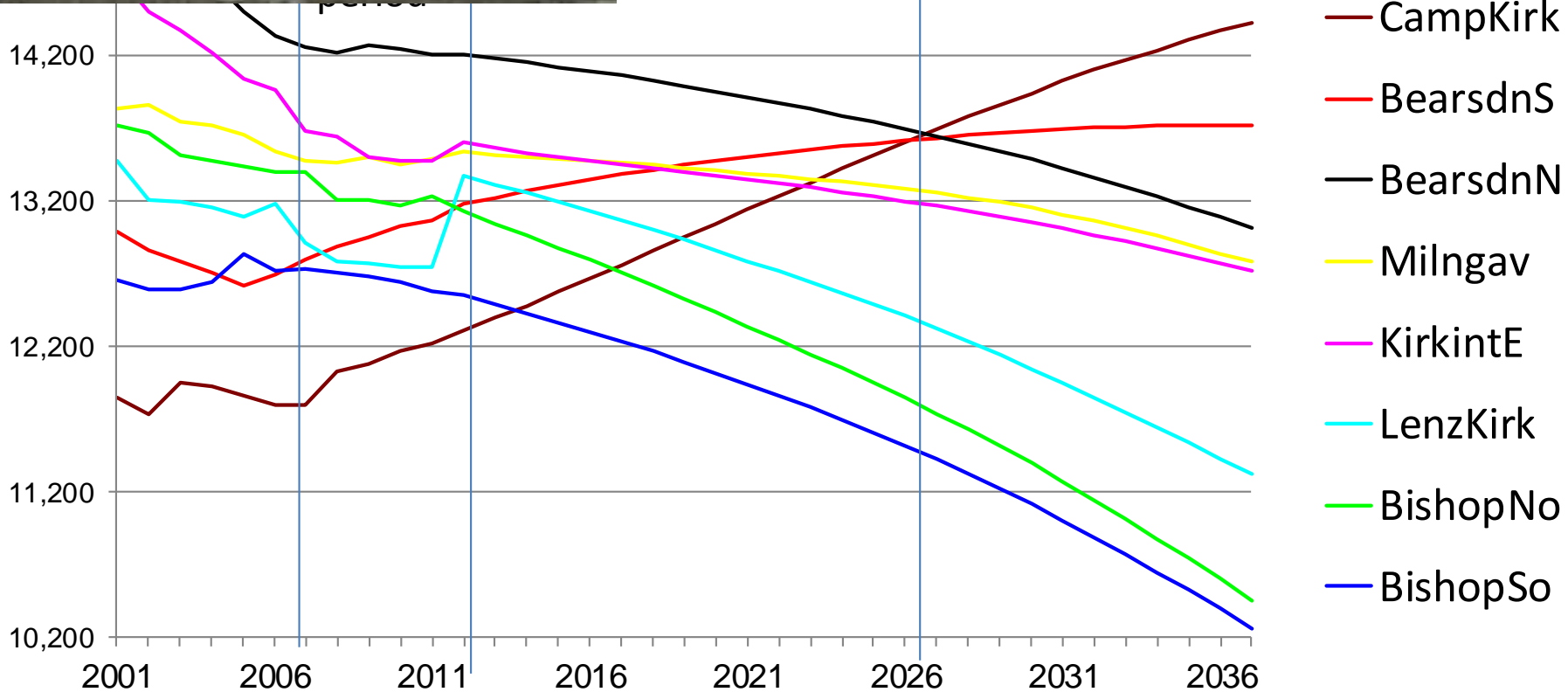
# Demographic analysis and local planning – with the methodology of new NRS sub-Council Area projections as a case study

Ludi Simpson, University of Manchester  
Centre for Population Change seminar  
Edinburgh 23<sup>rd</sup>/24<sup>th</sup> March 2016



shire Mu  
s, estimat

tion ->



# Two different types of demographic projection, each with uncertainty

- Government projections
  - Continues local level of fertility, mortality and migration of recent years
- The impact of a plan for jobs or housing on population
  - Considers the impact on population of a plan that is not business as usual
- ❖ Planning requires several projections
  - Government projection is only one representation of recent experience
  - Impact of a plan is also uncertain
- ❖ Terminology:
  - Business as usual ('trend projection', 'policy off', 'policy neutral')
  - Dwelling-led, Jobs-led, led by economic scenario of house-prices and income, ... ('policy on', 'policy-led')

# Small area projections: Data, methods and software

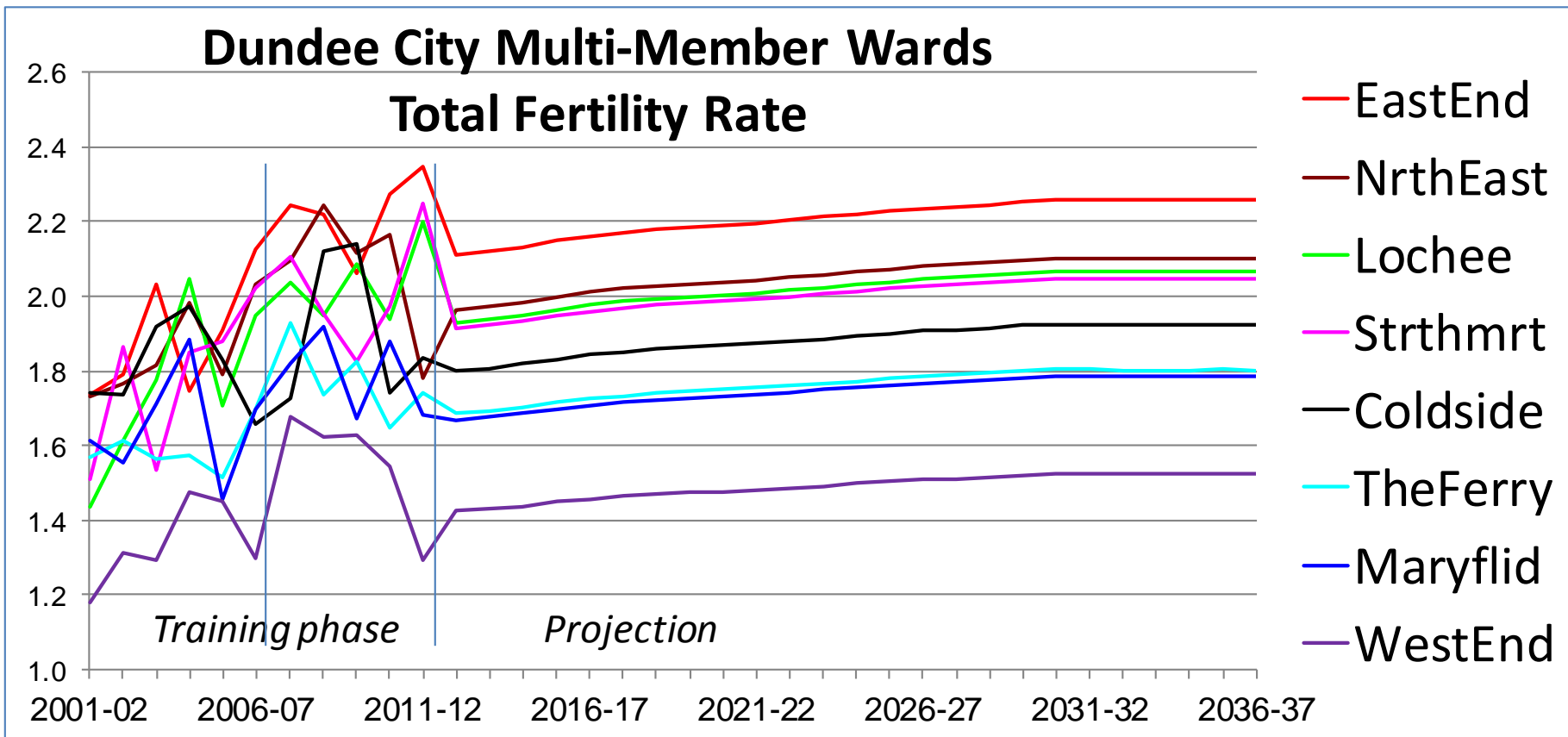
- Statistical agency estimates for past years
- Cohort component projection feasible for all areas
- Software POPGROUP & Derived Forecasts
- Age-sex composition gives specific service demand and integrated models
  - HNDA in Scotland for households only, CAs only

# Practical experience with projections

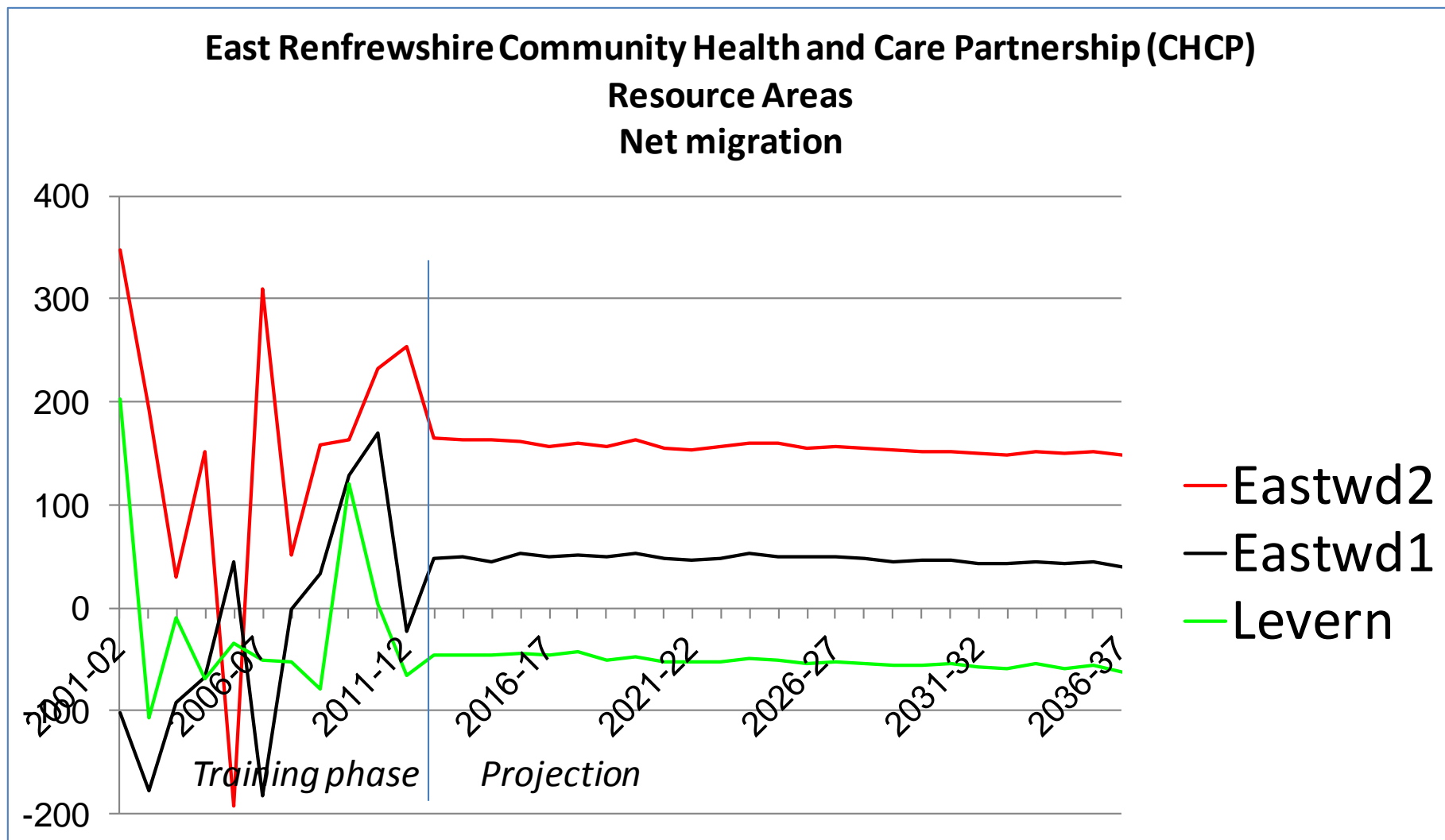
- Council Areas ('Districts')
  - Regular biennial production by Statistical agencies
  - Limited variants to show impact of uncertain migration
  - About 8 of 32 Scottish councils work on their own demographic projections
- POPGROUP User Group in Scotland 2010, 2012, 2015
- Smaller areas smaller than Districts
  - Interest from Councils preparing plans for specific services
  - 2010: Fife NRS experiment: proof of concept, good practice with available statistics, indirect measurement of migration
  - In Scotland to 2010: 1970s, and now Argyll and Bute; N Lanarkshire; S Lanarkshire; Stirling
  - In E&W: Cheshire, Hants, Manchester, GLA, Dorset, Wiltshire, more
  - 2016: NRS Sub-Council Areas throughout Scotland, 2012-based

# NRS method, building on Fife experiments in 2010

(a) Scotland's age structure of fertility, small area level of fertility fixed by the past annual counts of births



(b) Local net impact of migration: compare adjacent years' population estimates, after births and deaths



# (c) Migration age-sex structure

Analysis for single years of age every annual period...

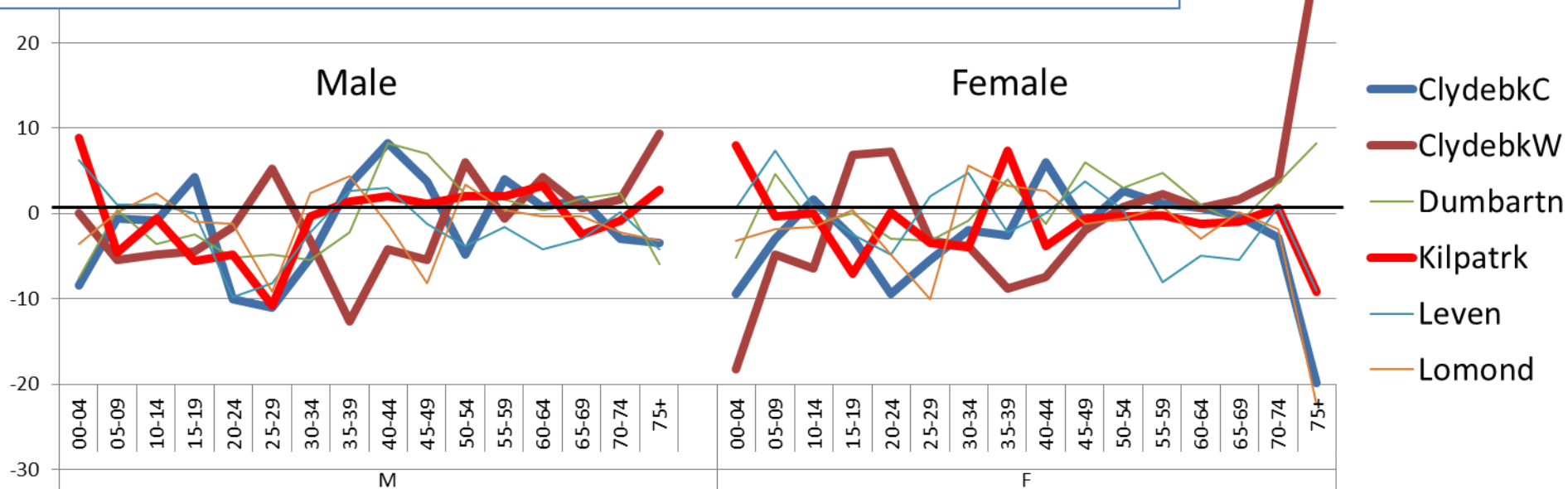
## West Dunbartonshire Multi-Member Wards

### Clydebank Central

Data are directly from NRS Small Area Population Estimates

Sex	Age	Base Year	Estimated and Forecast Years .....										
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
female	25	88	78	67	82	83	99	100	88	93	96	78	81
female	26	84	82	83	64	95	94	102	97	77	89	94	77
female	27	94	93	86	88	66	89	94	102	93	69	92	95
female	28	77	93	87	87	86	62	90	99	106	85	74	91
female	29	85	87	106	80	83	88	70	93	98	103	92	76
female	30	99	83	86	99	81	81	86	68	86	95	104	90

... is aggregated to five-year age groups and averaged over 2007-12

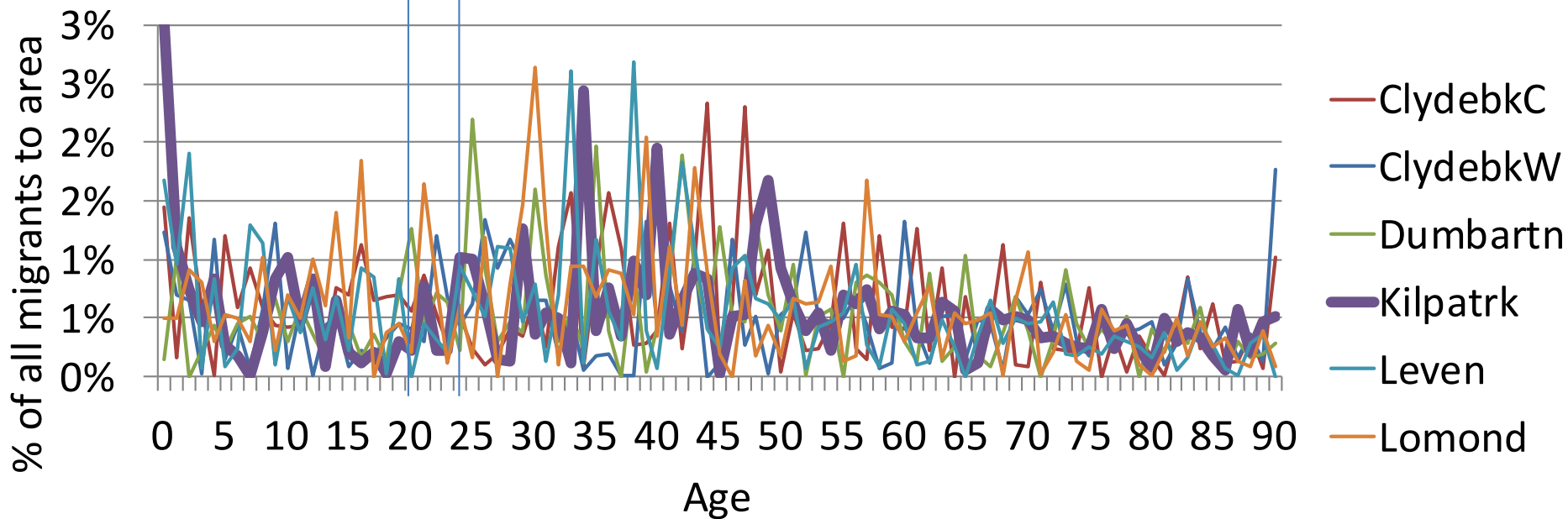




### (c) Migration: single ages *within 5-year age groups*

- **Out-migration**, rates at single year of age multiply the local population of that age
- **In-migration**, distribution at single year of age, adding to 100%

Male % of all in-migrants annual average 2007-2012



*Once the five-year age-sex bands have been fixed, smoothing the volatility of single years of age within them did not make much difference*

# Successes

## (a) Plausible local variation in fertility, mortality, migration

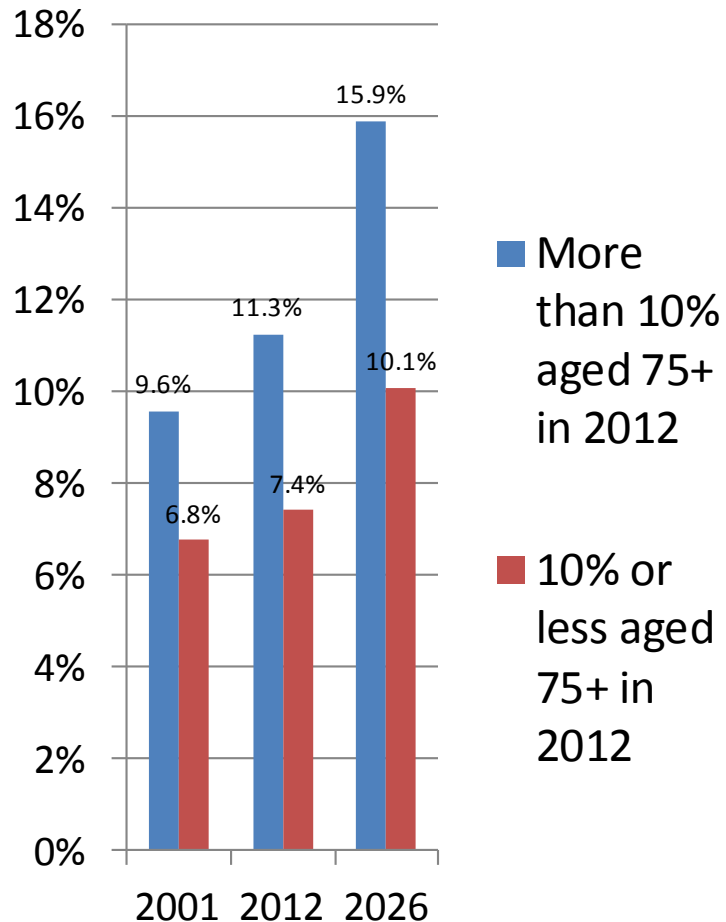
South Lanarkshire population change summary 2001-2012

	Population 2001	Natural change 2001-2012	Net migration 2001-2012	All change 2001-2012
<b>SLANARKS</b>	<b>302,340</b>	<b>+668</b>	<b>+11,352</b>	<b>+12,020</b>
Blantyre	17,551	+119	-182	-63
Bothwell	6,484	+76	-9	+67
Cambuslg	22,922	+1,237	+4,651	+5,888
Carluke	18,502	+10	+445	+455
ClydesdE	16,051	-73	+770	+697
Ekilbrid	74,721	+802	+960	+1,762
Hamilton	49,300	+812	+2,717	+3,529
Lanark	16,346	-161	+1,635	+1,474
Larkhall	17,113	-81	-201	-282
Lesmahgw	7,674	-440	+951	+511
Ruthrgln	33,040	-1,286	-823	-2,109
Stnhouse	6,206	-136	+529	+393
Strathvn	10,950	-4	-305	-309
Udingstn	5,480	-207	+214	+7

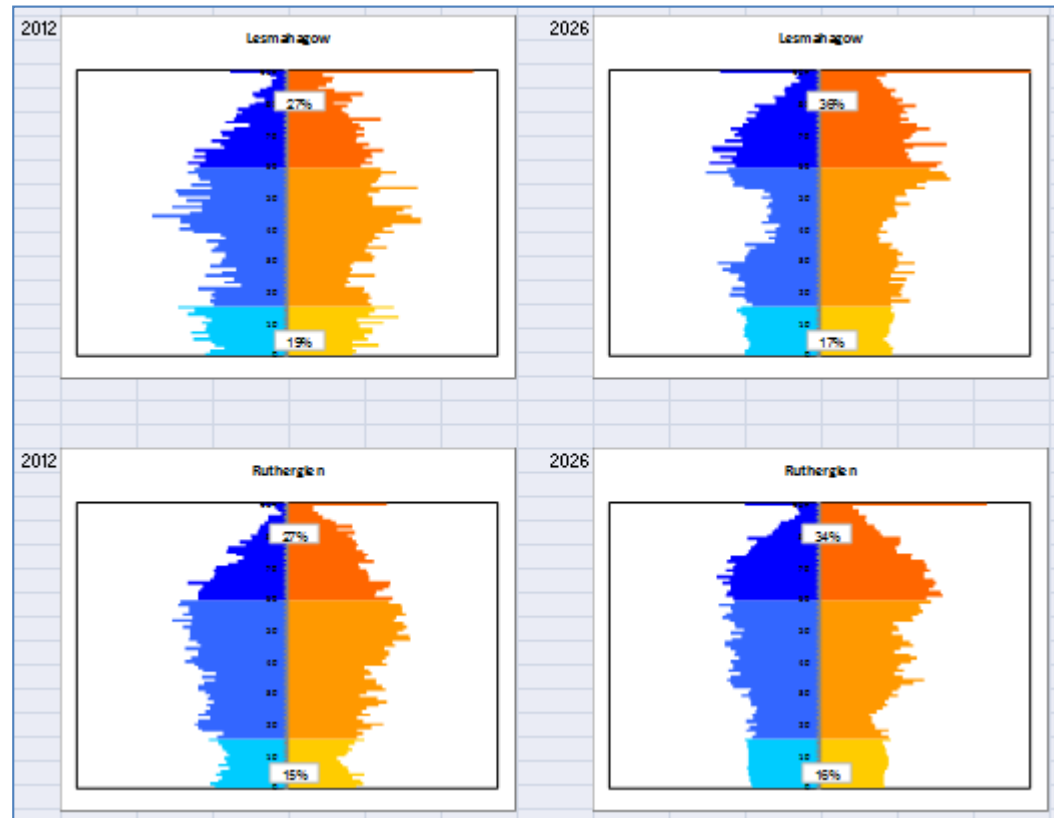
# Successes

## (b) Projected age structures

All 301 small areas in Scotland:  
an unequal impact of ageing

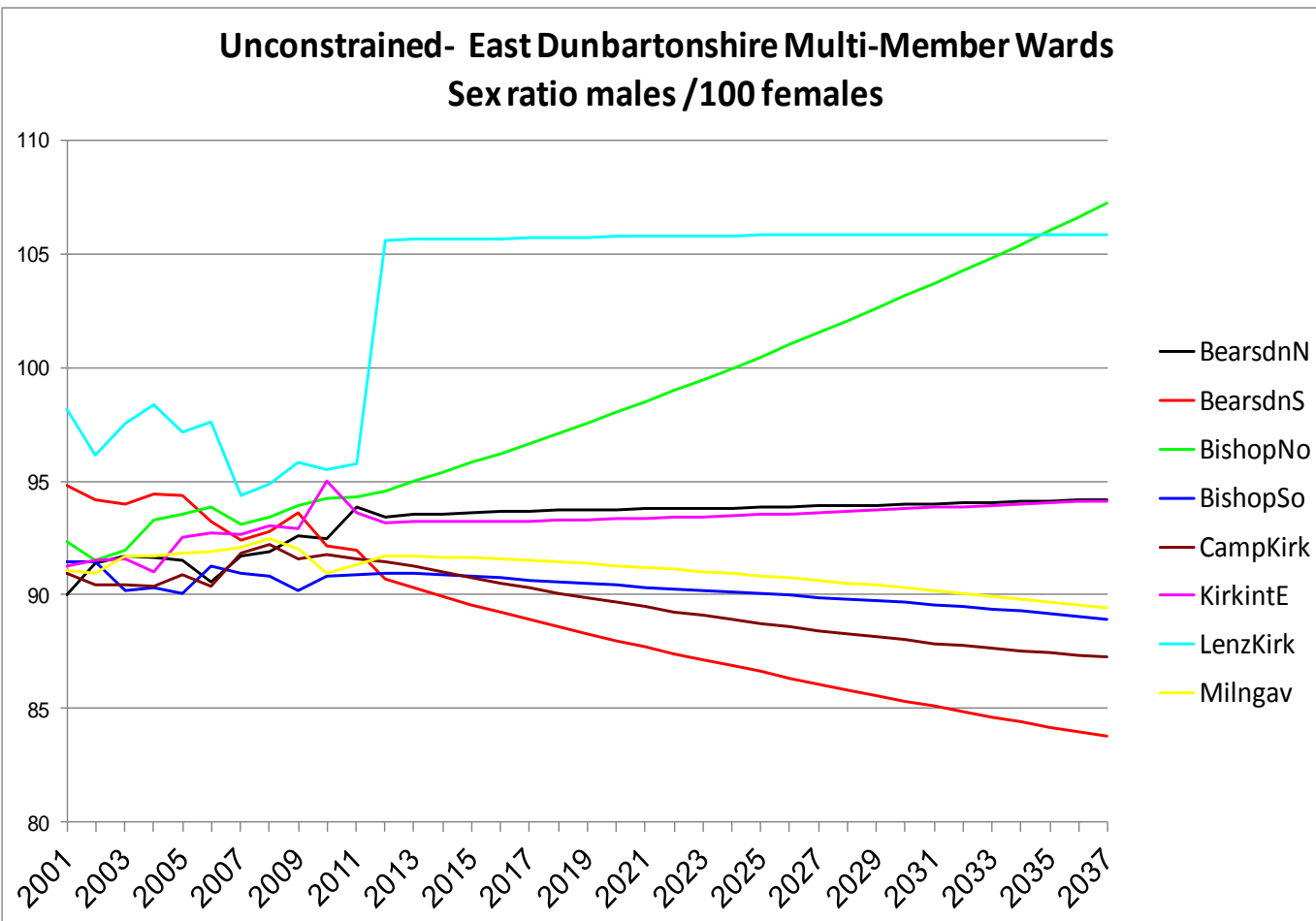


Lesmahagow and Rutherglen in South  
Lanarkshire



# Successes

(c) Separate special populations can clearly help when their past annual age-sex composition is known and when numbers are changing. It is even better when the data are shareable



Male prison in East Dunbartonshire – in Lenzie and Kirkintilloch South ward.

Closed 2006-07, reopened and expanded 2011-12.

# Short-term practitioners' strategy to use and develop small area projections

- Why do more than NRS has achieved?
  - Scenarios to judge robustness of 'business as usual' projection
  - Scenarios to measure the impact housing or jobs target
  - Repeat with other sets of areas that reflect service delivery
  - Update with 2013, 2014 estimates and 2014-based projections
  - Improve the assumptions using local knowledge
  - Outputs tailored to local needs
    - Including rounding of results to whole numbers (Jan Freeke method)
- You can use POPGROUP and NRS input files
  - But armed forces and students not available
    - Use NRS files with armed forces & students part of the general population
    - Or use estimates of student and armed forces age structure

# Improve the assumptions using local knowledge

## (a) Annual TFR, Total Fertility Rate

### Glasgow City multi-member wards

Total Fertility Rate	GLASGOW	Anderstn	Baillstn	Calton	Canal	Craigton	DrumAnn	EastCntr	GarsScot	GlsqwNE	Govan	GrtrPolk	Hillhead	Langside	Linn	MaryKlvn	NewAuldb	PartickW	Polkshld	Shetlstn	SouthCtI	Sprgburn
2001-02	1.5	1.2	1.3	1.7	1.2	1.3	1.5	1.4	1.6	1.5	1.7	1.6	1.3	0.9	1.5	1.8	1.9	1.2	1.8	1.4	1.7	1.8
2002-03	1.5	1.5	1.3	1.6	1.5	1.4	1.5	1.4	1.6	1.7	1.7	1.6	1.3	0.8	1.5	1.6	1.9	1.2	1.8	1.4	1.7	1.9
2003-04	1.6	1.4	1.4	1.6	1.4	1.5	1.5	1.4	2.0	1.6	1.7	1.8	1.4	1.1	1.6	1.7	1.9	1.2	1.8	1.4	1.7	2.0
2004-05	1.6	1.3	1.5	1.8	1.5	1.7	1.6	1.6	1.8	1.6	1.8	1.9	1.5	1.0	1.6	1.7	1.9	1.2	1.8	1.4	1.7	2.2
2005-06	1.6	1.4	1.4	1.7	1.6	1.5	1.7	1.6	1.7	1.7	1.8	1.9	1.3	1.1	1.6	1.7	1.9	1.2	1.8	1.4	1.7	2.2
2006-07	1.7	1.3	1.6	1.7	1.6	1.9	1.8	1.5	1.8	2.0	1.8	2.0	1.4	1.1	1.7	1.6	1.9	1.4	1.8	1.5	1.7	2.2
2007-08	1.8	1.3	1.6	1.6	1.7	1.8	1.8	1.7	2.0	2.0	2.0	2.1	1.5	1.1	1.7	1.7	2.0	1.4	1.9	1.8	2.0	2.0
2008-09	1.8	1.3	1.7	2.0	1.9	1.8	1.8	1.6	2.0	1.9	1.8	1.8	1.4	1.3	1.7	1.8	1.9	1.4	2.0	1.5	2.0	2.3
2009-10	1.8	1.4	1.7	1.8	1.8	1.8	1.8	1.8	2.0	2.1	2.0	2.0	1.3	1.2	1.9	1.9	1.8	1.4	1.8	1.7	1.9	2.4
2010-11	1.8	1.2	1.9	1.8	1.7	1.9	1.7	1.8	1.9	1.9	1.8	2.1	1.3	1.3	1.7	2.0	1.9	1.3	1.9	1.7	2.0	2.2
2011-12	1.8	1.0	1.7	1.7	1.8	1.8	1.7	1.7	1.9	2.1	1.9	2.1	1.4	1.3	1.8	1.7	2.2	1.3	1.9	1.6	1.9	2.2

TFR each year 2001-2011

5yr average	1.77	1.24	1.72	1.82	1.79	1.84	1.75	1.74	1.94	1.99	1.88	2.02	1.35	1.28	1.7	1.7	2.0	1.4	1.9	1.8	2.0	2.27
11 year average	1.67	1.29	1.55	1.73	1.62	1.69	1.67	1.59	1.84	1.82	1.81	1.93	1.37	1.12	1.6	1.6	1.9	1.4	1.8	1.5	1.7	2.13

5- and 11-year averages

Which small areas have different fertility from the Council Area? (Blue: the small area is higher, red, the small area is lower)	5yr SCA minus CA	11yr SCA minus CA												
5yr SCA minus CA	0.00	-0.53	-0.05	0.05	0.02	0.07	-0.02	-0.03	0.17	0.22	0.11	0.25	-0.42	0.50
11yr SCA minus CA	0.00	-0.38	-0.12	0.06	-0.05	0.02	0.00	-0.08	0.17	0.15	0.14	0.25	-0.31	0.45

Difference from Council Area

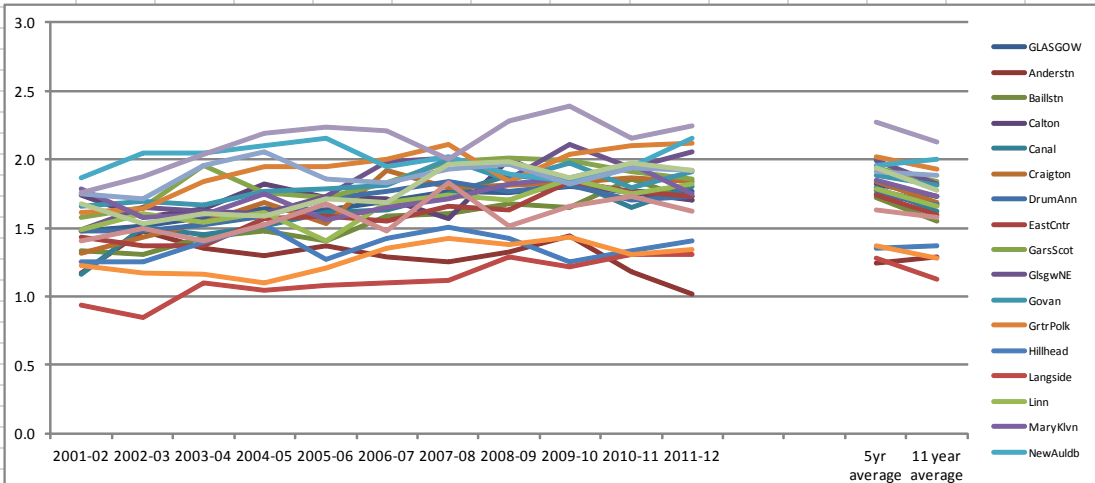
In which areas is the recent fertility different from the longer term fertility? (Blue: the 5yr average is higher than the 11 yr average; red: the 5 yr average is lower)	5yr minus 11yr													
5yr minus 11yr	0.10	-0.05	0.17	0.09	0.18	0.15	0.08	0.15	0.10	0.17	0.07	0.10	-0.01	0.4

Where 5-yr and 11 yr unequal

In which areas is fertility most volatile from year to year? (Red: most volatile)	Volatility (CV) 5 yr	Volatility (CV) 11 yr															
Volatility (CV) 5 yr	1%	13%	6%	9%	5%	2%	3%	5%	3%	5%	5%	6%	7%	6%	4%	6%	7%
Volatility (CV) 11 yr	7%	10%	11%	7%	13%	12%	8%	10%	8%	12%	6%	9%	7%	13%	8%	7%	7%

Most annual instability

Number of areas **19**

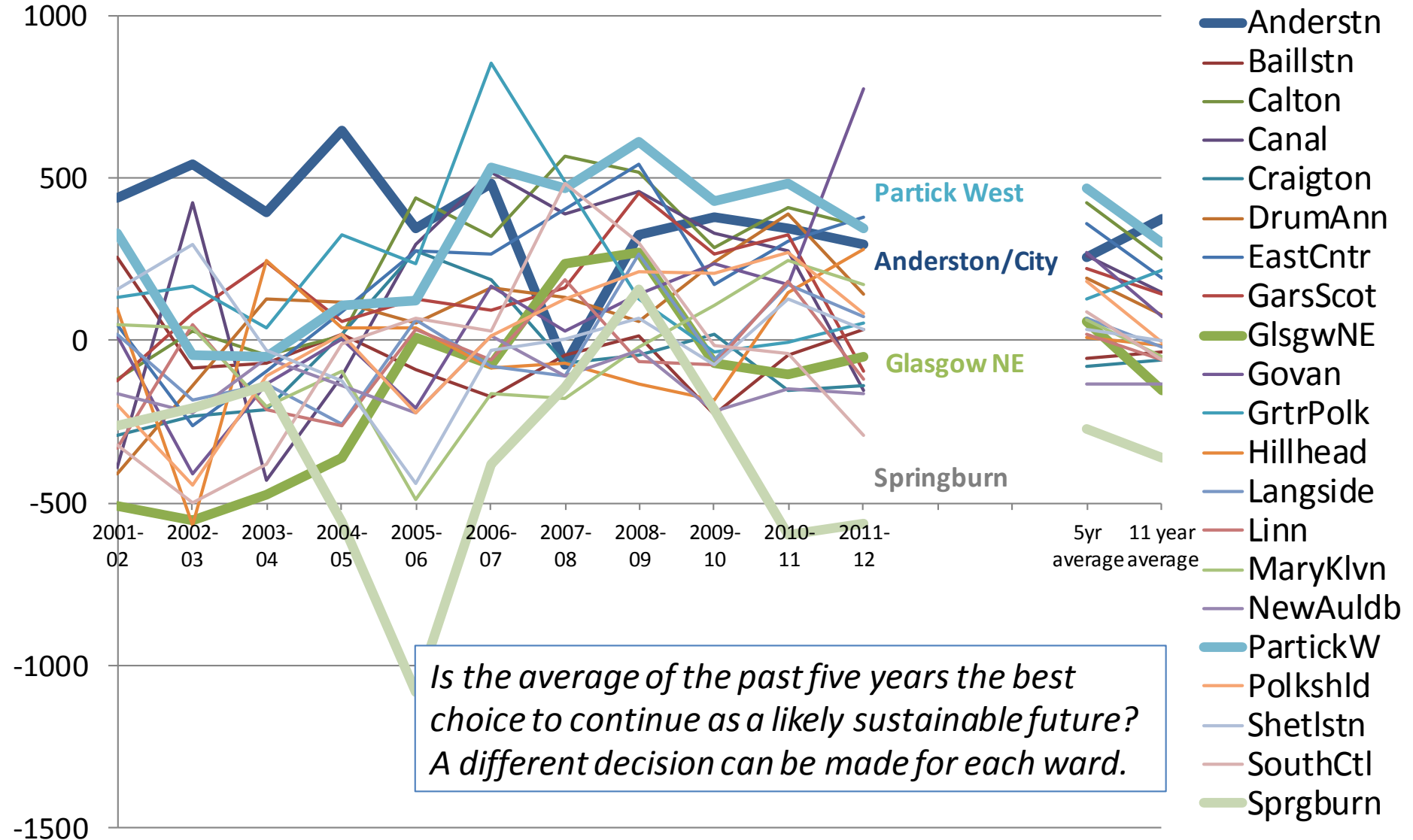


TFR each year and 5yr and 11 yr averages charted

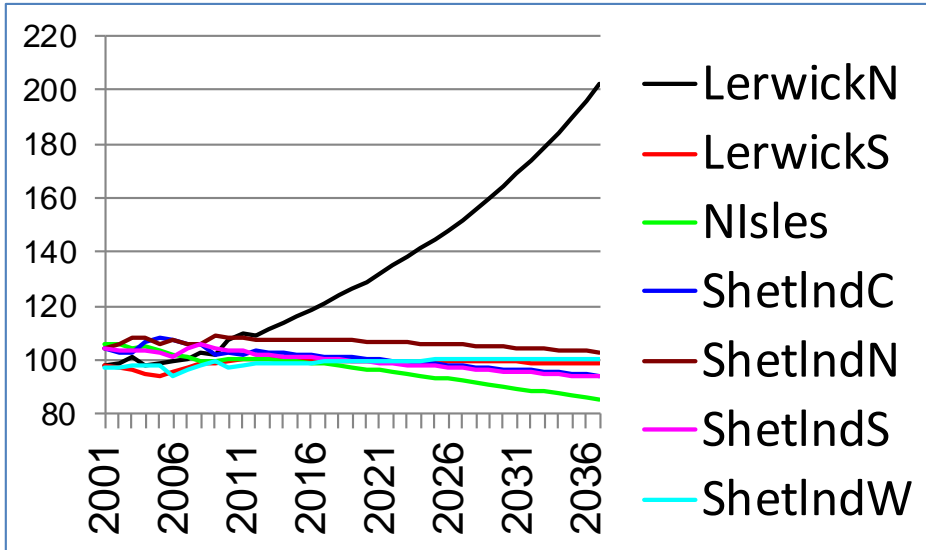
# Improve the assumptions using local knowledge

## (b) Annual net migration, total

Glasgow City multi-member wards



# An issue: males/ 100 females, example of Shetland Wards



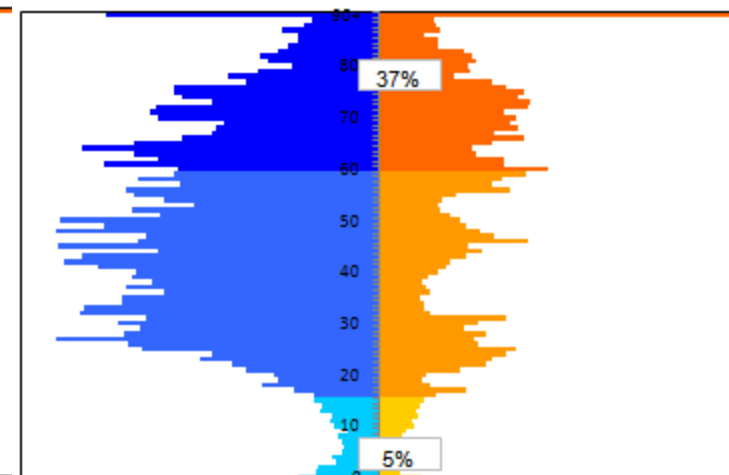
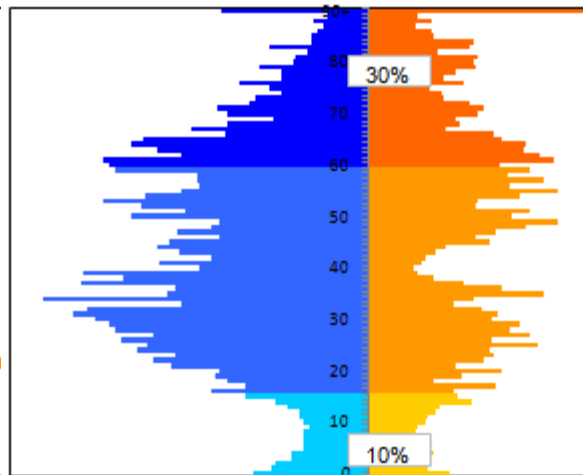
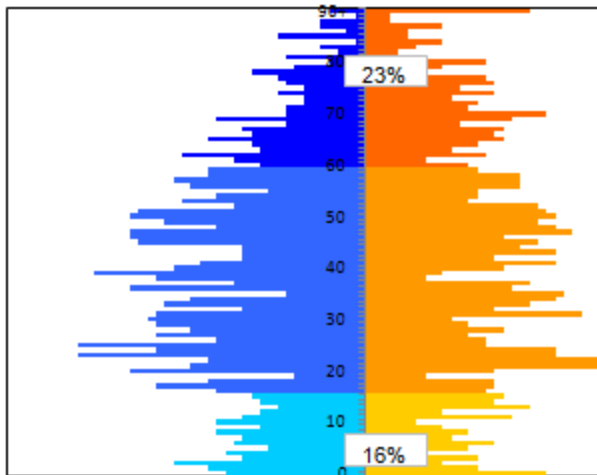
Lerwick N, pop 2,700 in 2012, 2,500 in 2026

Lerwick N, SAPE males-females		
	2007	2012
10-14	1	
15-19	-17	13
20-24	26	1
25-29	-7	50
30-34	12	15
35-39		31

2012

2026

2037





# Medium-term research agenda: technical

- Smoothing a migration age-sex structure
  - Volatility from one age to another, without losing real peaks like students
  - Dampening unusual patterns, eg male/female ratios
  - Specification of in and out gross flows and rates
  - In general: *What is reliable about uniquely estimated characteristics?*
- The impact of constraints
  - To the Council Area projection / to housing plans
  - Assumes plausible gross flows
- Stochastic modelling to reflect uncertainty in 'business as usual'?
- Study of accuracy of estimates and of projections

## Medium-term research agenda: better practice

- Shareable armed forces data, improved students data
- Survey of use of population statistics in planning services
- Low-cost support for practitioners
  - HNDA-like fixed scenarios?
  - Wikipedia for local analysis of population?
  - Production on demand?
  - Workshops & training?