

Challenges of updating projection models to incorporate 2021 Census

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Ben Corr, Wil Tonkiss
Greater London Authority



Content

- Intro - GLA population projections
- Challenges of updating projections
- Our approach



GLA population projections

- Annually updated public projections
- Bespoke projection services for London boroughs
- Scenario-based outputs to support strategic planning

<https://data.london.gov.uk/demography/population-and-household-projections/>

Core models (2020-based)

Trend-based – (LADs in E&W)

- Multi-regional Cohort Component Model (CCM)

Housing-led – (London LADs)

- Extended CCM – reconciles housing demand with capacity

Small-area – (London Wards & MSOAs)

- Hybrid Housing Unit / bi-regional CCM



Key inputs to update

- Consistent backseries of population and components
- Dwelling/household totals
- Household formation rates
- Small area migration flows



Challenges

1. Our schedule

- Updated scenario projections for TfL – **Oct '22**
- Published 2021-based projections – **Dec '22**
- Bespoke projection service – **Feb '23**
- Published 2022-based projections – **Sept '23**

2. Census release schedule

- Consistent backseries of population and components

May '23 (local authorities); ? for small areas

- Dwelling/household totals

Households – Oct/Nov '22; Dwellings – early '23?

- Household formation rates

2023?

- Small area migration flows

??

2. Census release schedule

- Key data will be released piecemeal over period spanning multiple sets of projections
- Inputs must remain coherent at each stage
 - Account for model interactions and sensitivities
- Naively 'improving' inputs can make system performance worse

3. The pandemic

- Discontinuities in trends and data collection
- Migration patterns captured by Census will be atypical
- Outflow of young adults through 2020
- Reversal in 2021 (after Census)

Change in number of London payrolled employees by age

Indexed: March 2020 = 100



Source: ONS, Earnings & Employment PAYE Real Time Information. Chart: GLA demography.
Note: Final data point is an early estimate liable to revision.

<https://data.london.gov.uk/dataset/population-change-in-london-during-the-pandemic>

4. Changing geographies

- New Wards adopted in all London Boroughs since 2011
- Boroughs want outputs on 2022 Wards
- Census migration inputs for MSOA11 and 2013 Wards only
- Fitting population data to new Wards not straightforward...



Our approach



What we need to do

- Produce our own backseries
- Remove dependence on new Census O-D data
- Enable operation on new geographies
- Be able to account for changes since 2021



How we're doing it

Develop flexible 'framework' approaches to key problems

- Model small area migration flows
- Revise annual backseries to fit Census-year estimates
- Create input data for alternative geographies

Build tools and methods to implement (*Regrosser* package)

- Focus on reproducibility



Model small area flows



Model small area migration flows

Framework:

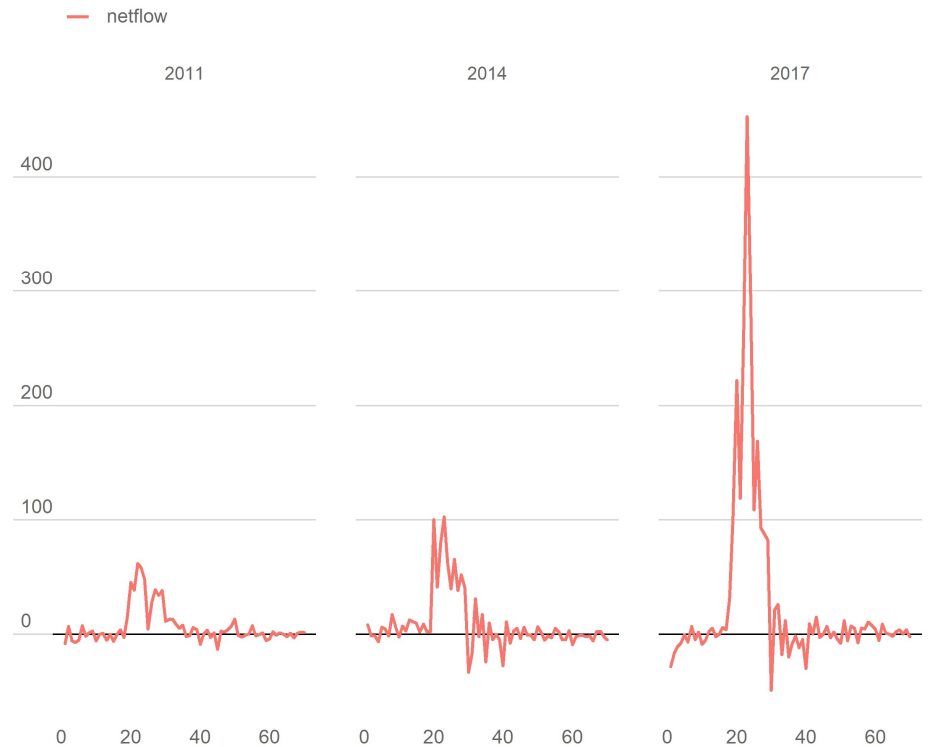
- Estimate net migration from annual population change
- Calculate 'typical' gross flows
- Allocate gross flows that are most consistent with typical values

Model small area migration flows

Estimate net migration from annual population change

- Residual change after accounting for births and deaths

Estimated annual net flows by age



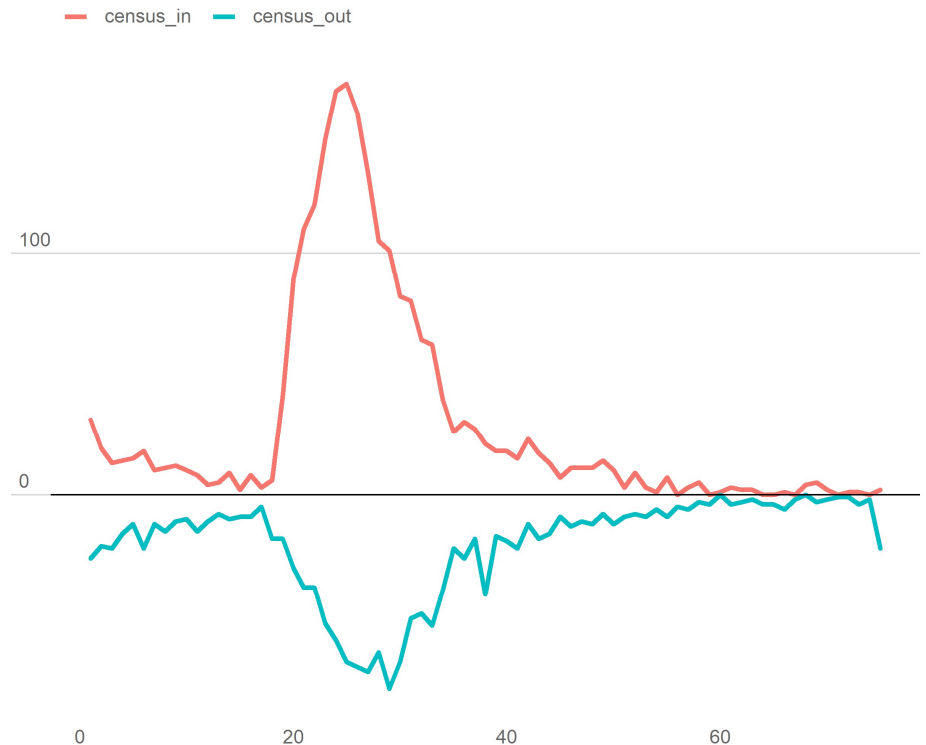
Model small area migration flows

Calculate 'typical' gross flows

- Inflows: 2011 Census O-D

Census does not capture international outflows

Migration flows captured by 2011 Census

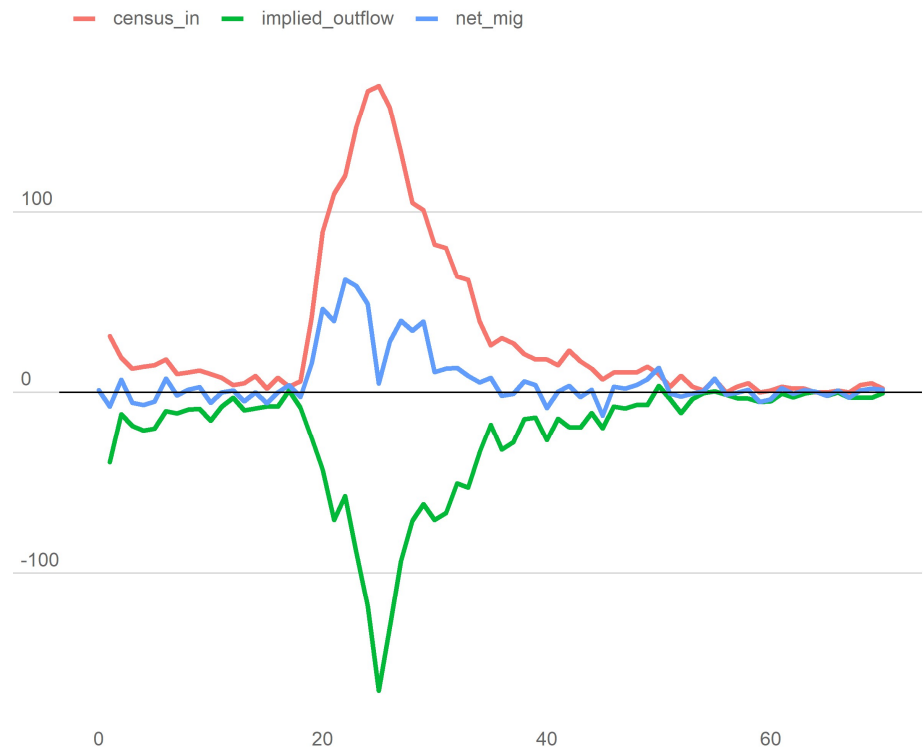


Model small area migration flows

Calculate 'typical' gross flows

- Inflows: 2011 Census O-D
- Outflows: difference inflows with 2010-11 net flow

Estimated flows for 2011



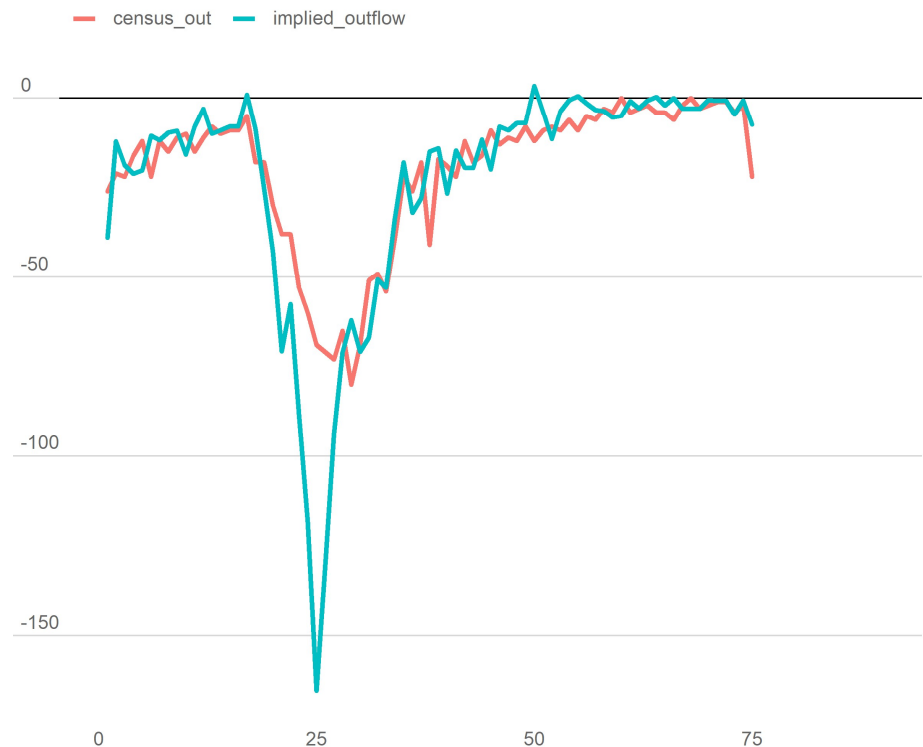
Model small area migration flows

Calculate 'typical' gross flows

- Inflows: 2011 Census O-D
- Outflows: difference inflows with 2010-11 net flow

Sense check implied outflow against Census

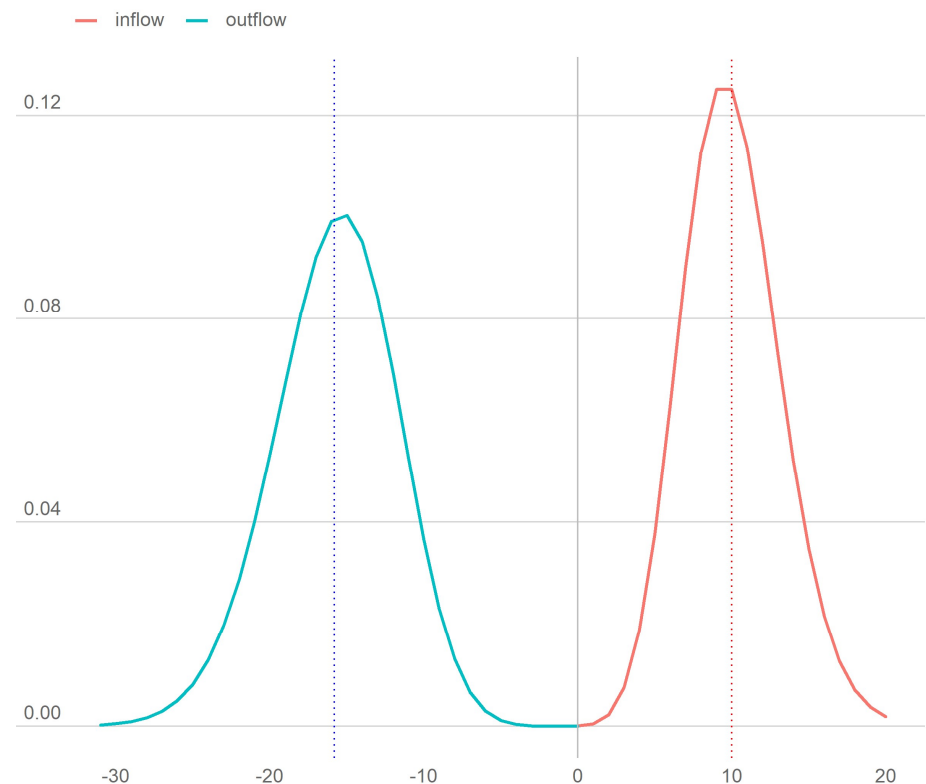
Comparison of outflows



Model small area migration flows

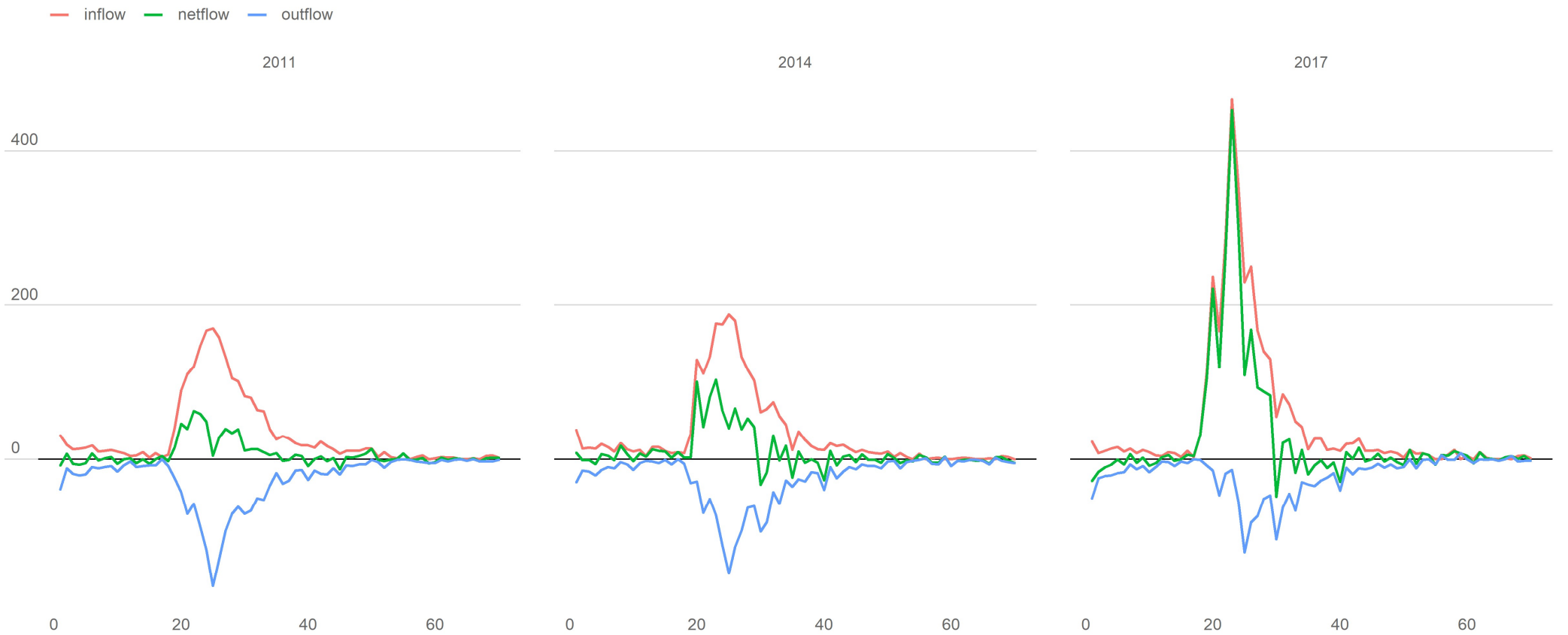
Allocate gross flows that are most consistent with 'typical' values

- Assign probability distributions to flows based on typical values
- Select pair that yield target net value with lowest cost



Model small area migration flows

Modelled annual gross flows by age





Revise annual backseries



Revise annual backseries

Framework

- For each cohort, calculate residual differences from existing components
- Match 2021 target by making 'lowest cost' set of adjustments
- Fit consistent gross flows
- Recreate annual population series from new components

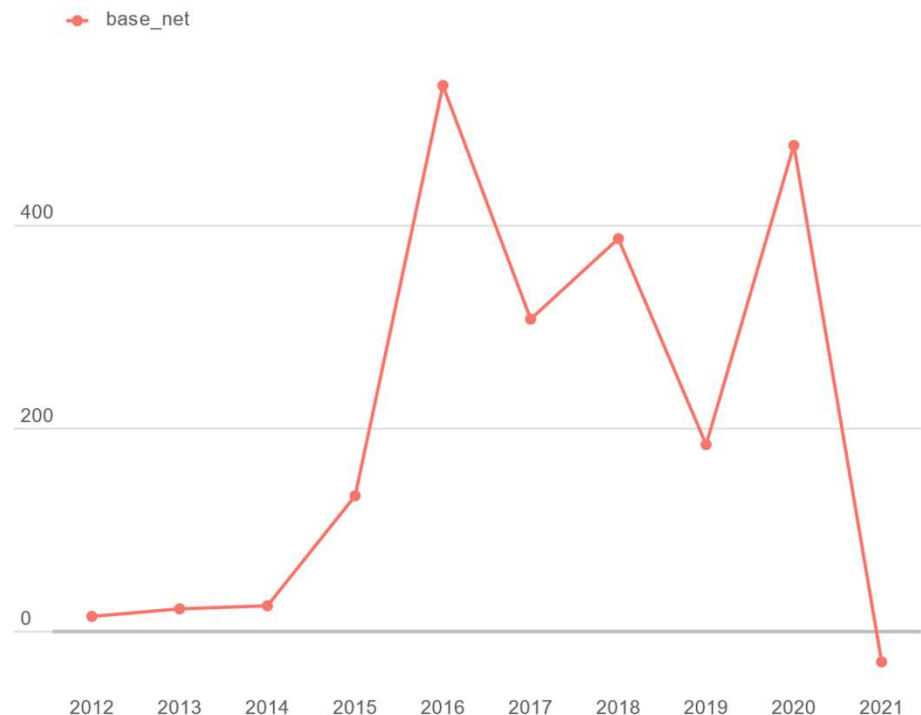
Revise annual backseries

Calculate residual differences from existing components for each cohort

Example:

- Components give **+700** more than 2011-2021 change
- Adjust annual net international to match

Adjusting net flows by year
1997 birth cohort

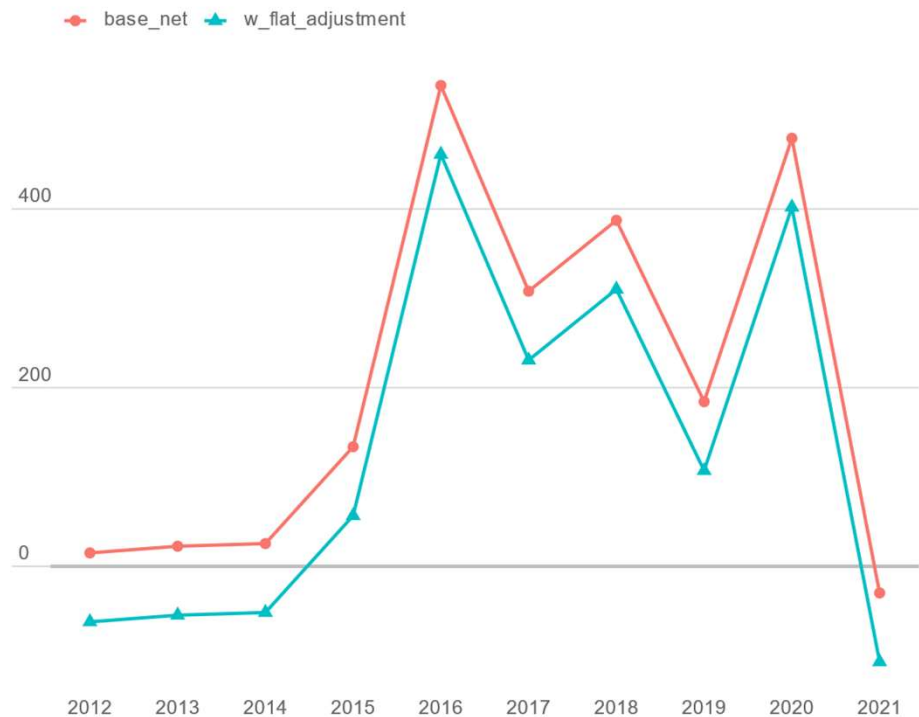


Revise annual backseries

Adjust annual net migration to match 2021 target

Could adjust each year by 1/10th difference...

Adjusting net flows by year
1997 birth cohort



Revise annual backseries

Adjust annual net migration to match 2021 target

Could adjust each year by 1/10th difference...

Scale of turnover varies by year/age

International migration by age - net and total gross
1997 birth cohort



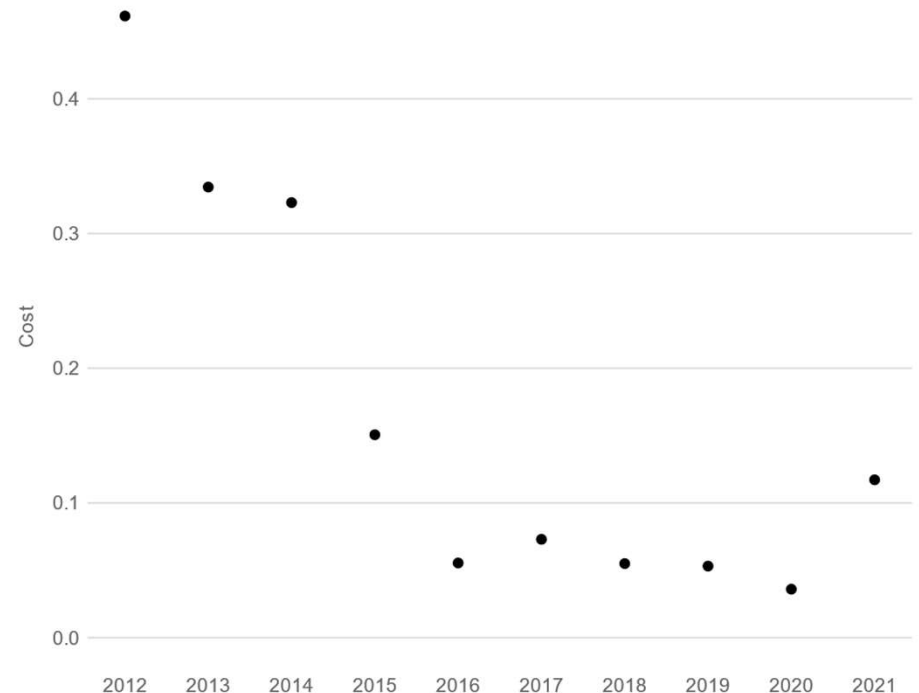
Revise annual backseries

Adjust annual net migration to match 2021 target

- Assign probability distributions to net flows
- Calculate relative costs of adjusting each year

Proportional drop in probability of moving away from base net

Indicative cost of unit change in net flow by year
1997 birth cohort

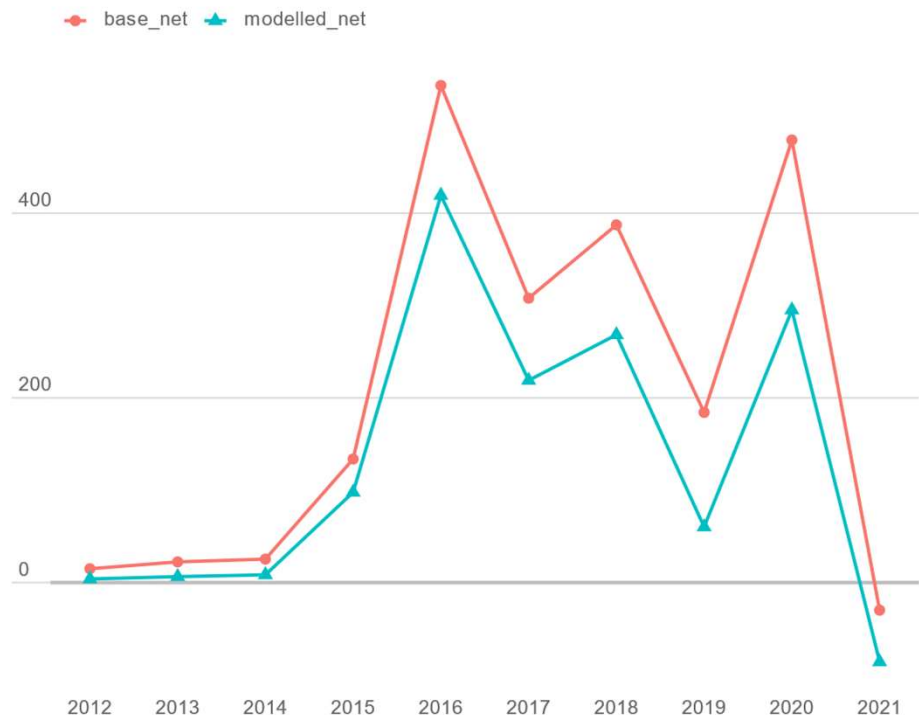


Revise annual backseries

Adjust annual net migration to match 2021 target

- Assign probability distributions to net flows
- Calculate relative costs of adjusting each year
- Allocate adjustments across years so that overall cost penalty minimised

Adjusting net flows by year
1997 birth cohort

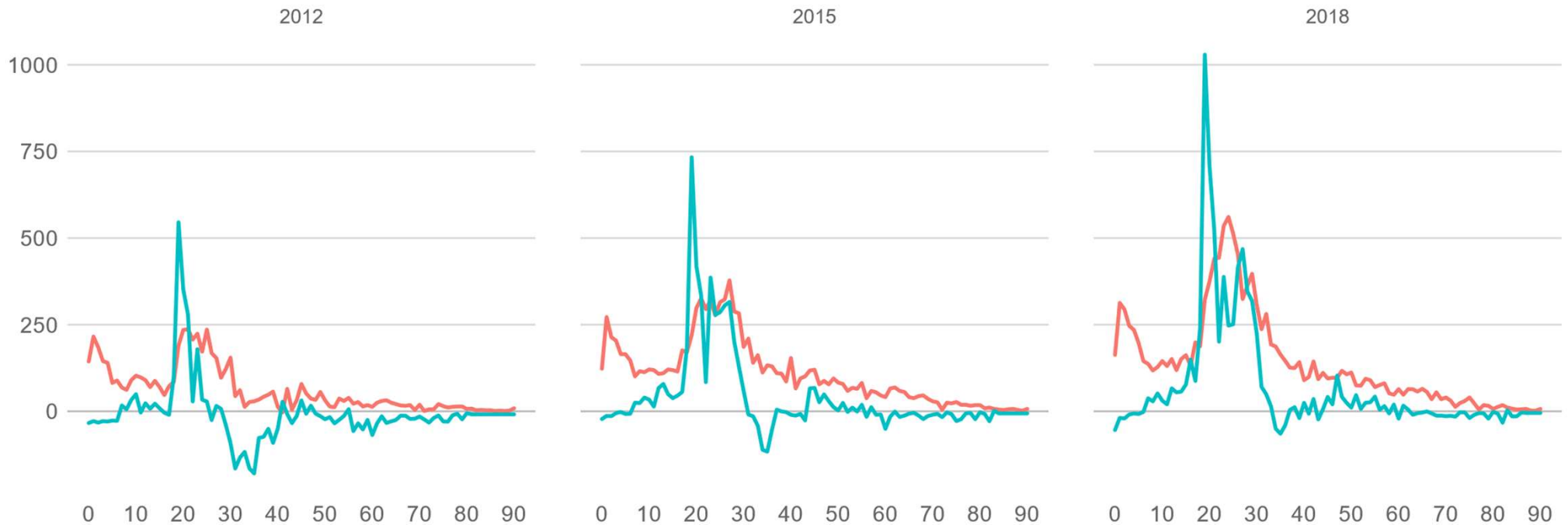


Revise annual backseries

Adjusted annual net

Westminster - net international

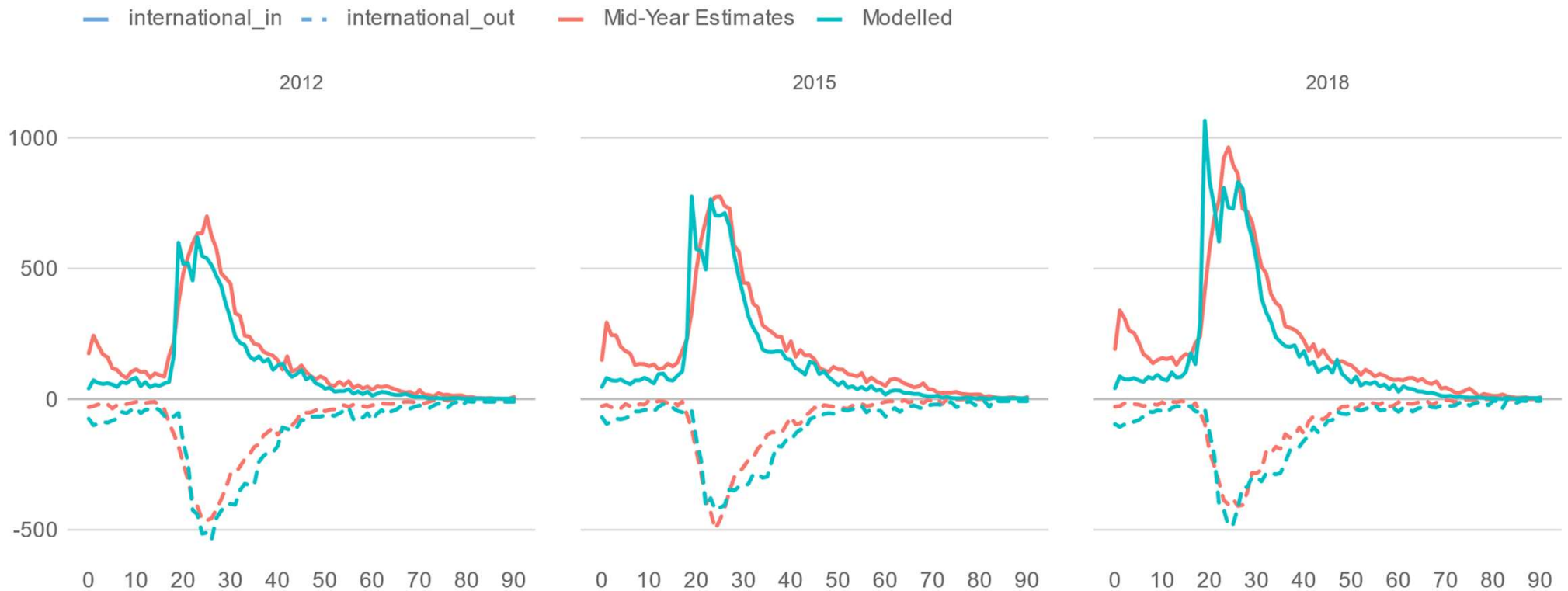
— Mid-Year Estimates — Modelled



Revise annual backseries

Fit consistent gross flows

Westminster - international flows

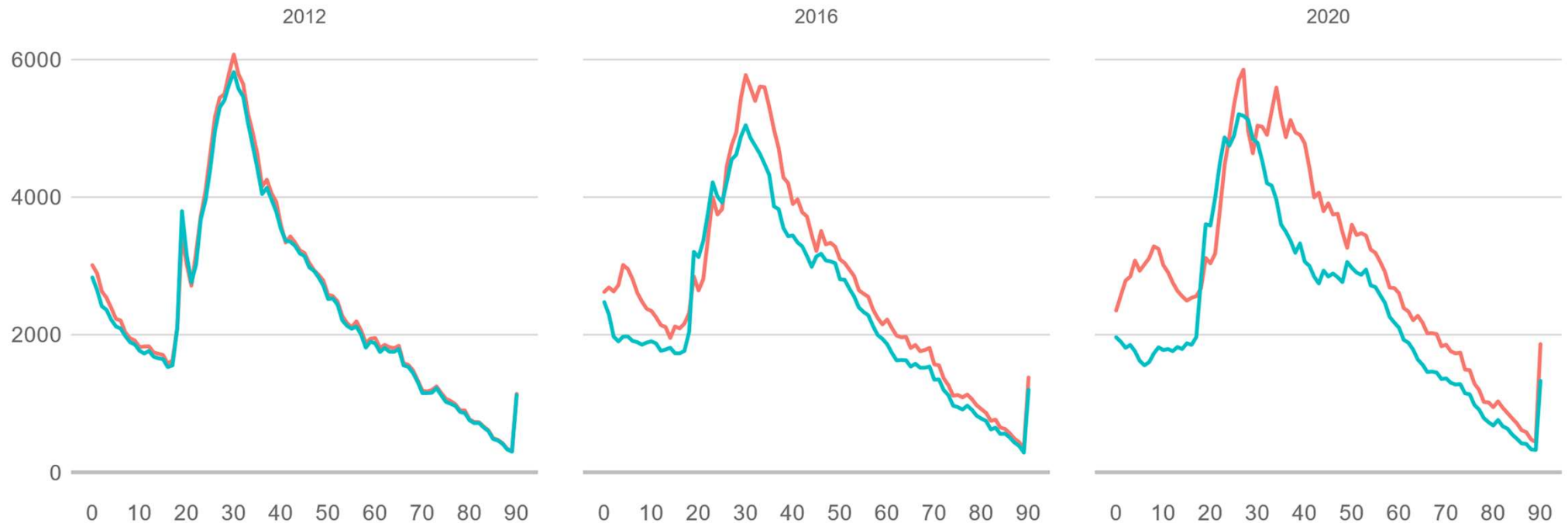


Revise annual backseries

Recreate annual population series from new components

Westminster - age structure

— Mid-Year Estimates — Modelled



Revise annual backseries

- Currently testing with dummy 2021 population
- Revisions initially limited to international flows
- Refine methods to address anomalies
- Extend approach to small area estimates

Goal to have revised series on day of 2021 MYE release

Potential wildcard: new ONS Dynamic Model



Create inputs for alternative geographies

Create inputs for alternative geographies

Framework:

- Best-fit annual estimates of population, births, deaths from existing Output Area data
- Calculate annual net for new geography
- Best-fit typical gross flows from existing data (MSOA-level)
 - Rescale to account for changing proportion internal moves
- Allocate gross flows to annual net

Create inputs for alternative geographies

Flexible Area model

- Replaces old *Small-Area Model*
- Operates on your choice of boundaries
- Projections better reflect recent migration trends
- Less dependent on housing/new census data
- Coverage now national
- Already used for 2022 borough service



Contact

ben.corr@london.gov.uk

william.Tonkiss@london.gov.uk

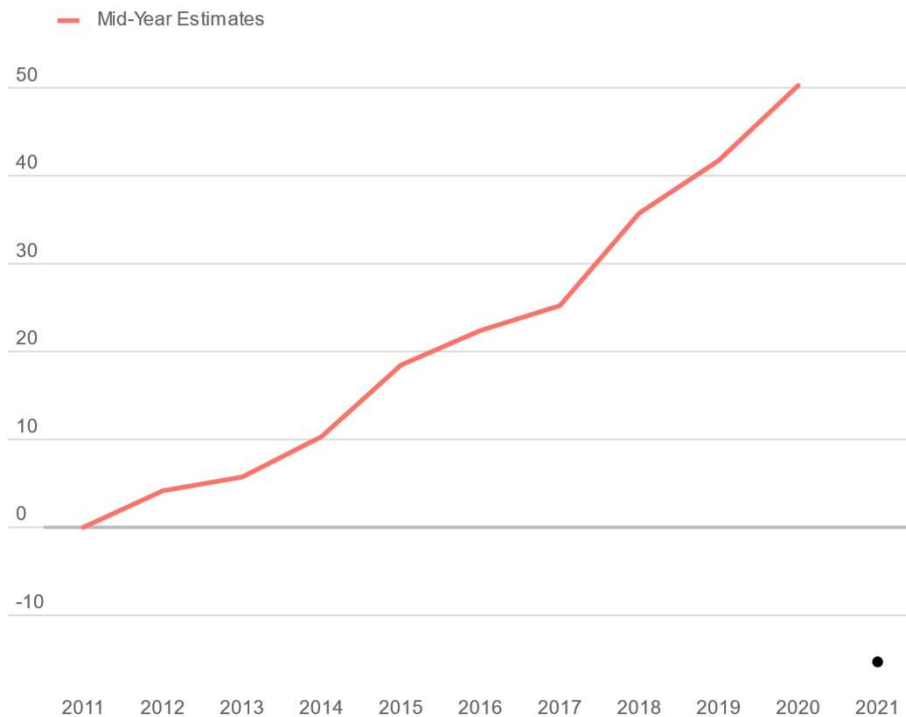
demography@london.gov.uk

CITY INTELLIGENCE

Population backseries

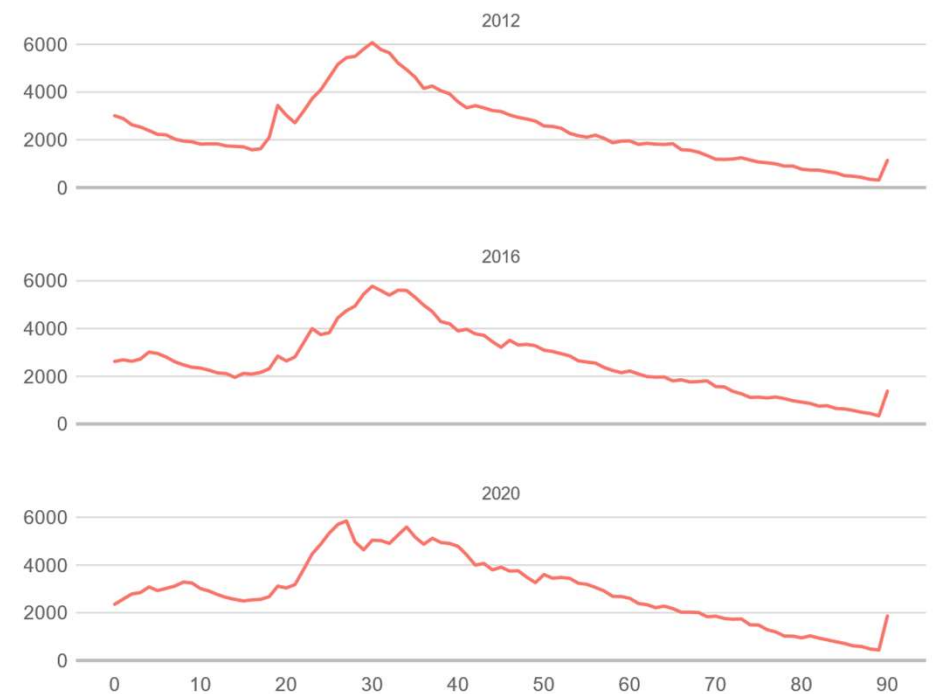
Westminster - change since 2011

(thousands)



Westminster - age structure

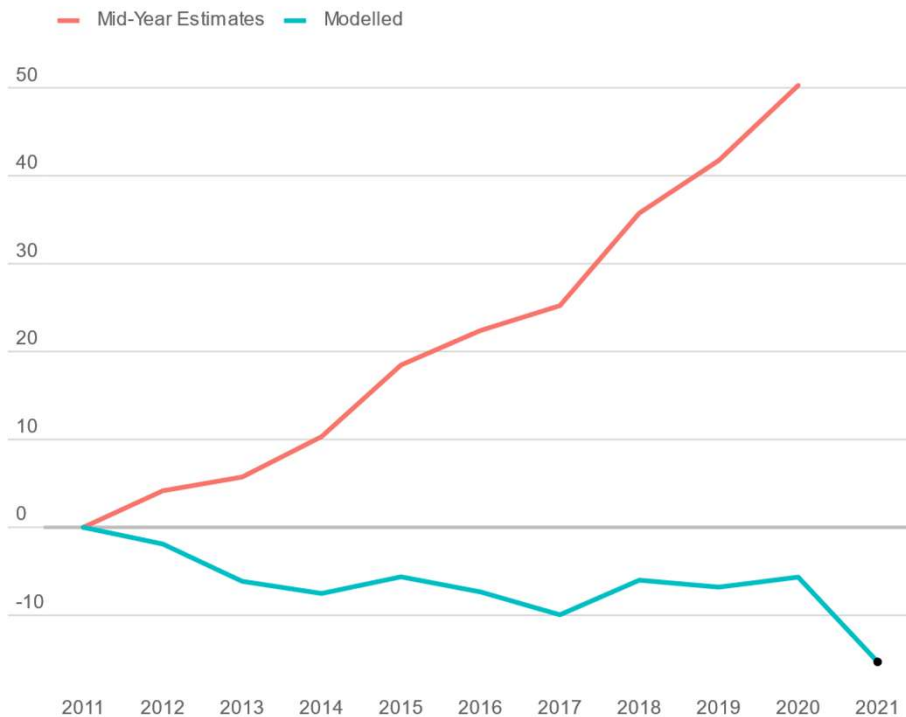
— Mid-Year Estimates



Population backseries

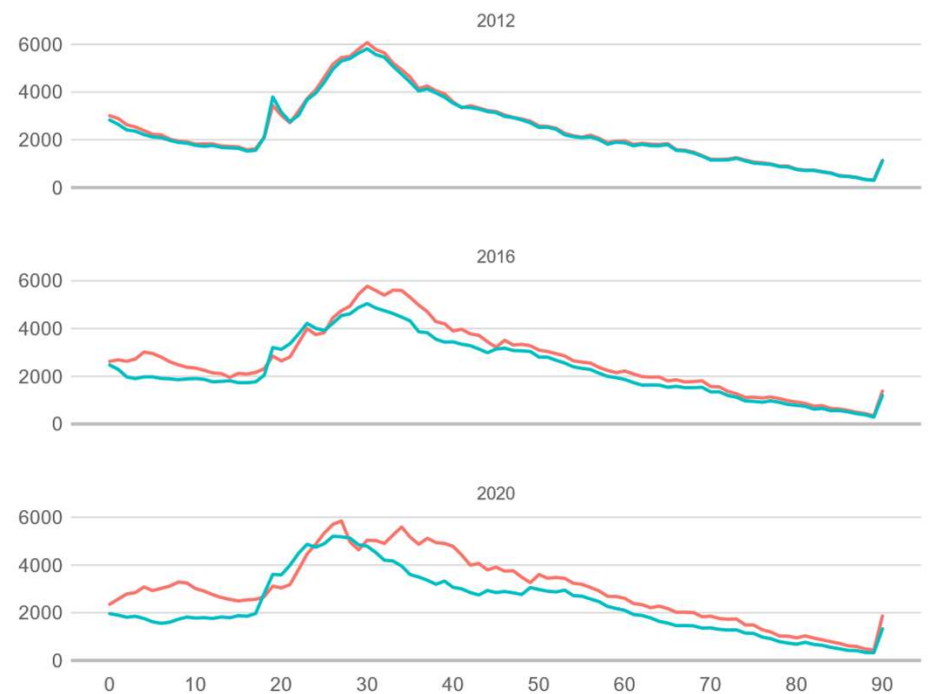
Westminster - change since 2011

(thousands)



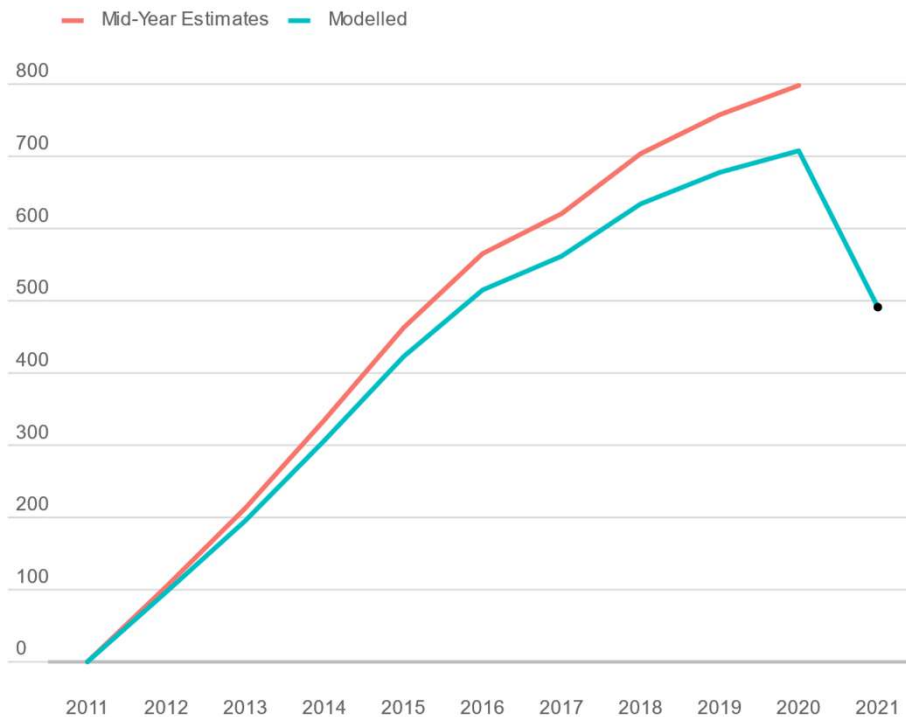
Westminster - age structure

— Mid-Year Estimates — Modelled

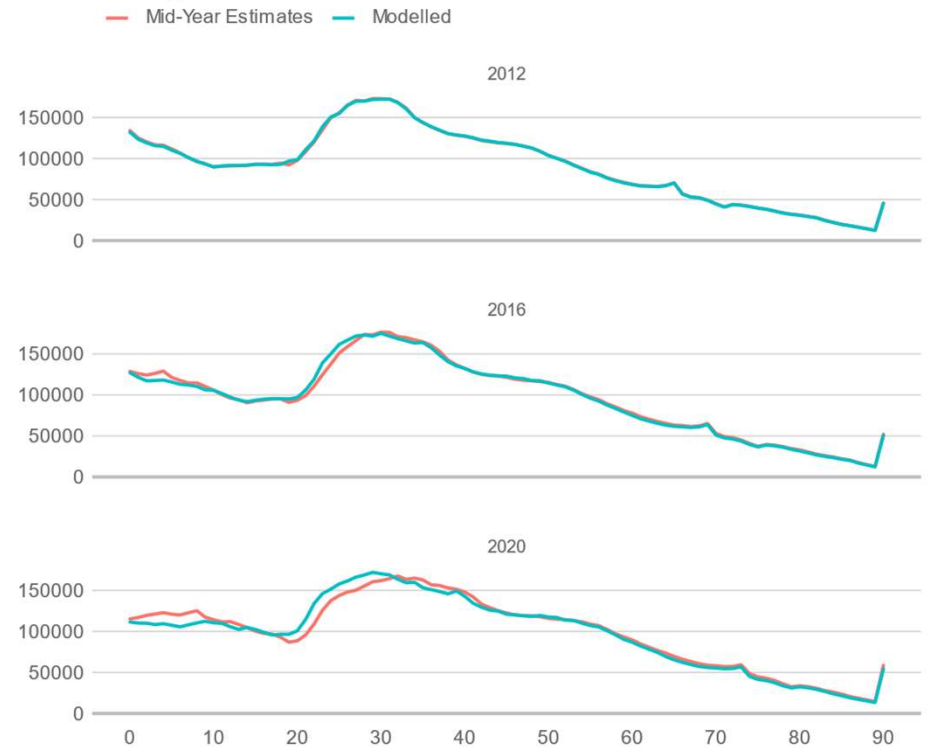


Population backseries

London - change since 2011
(thousands)

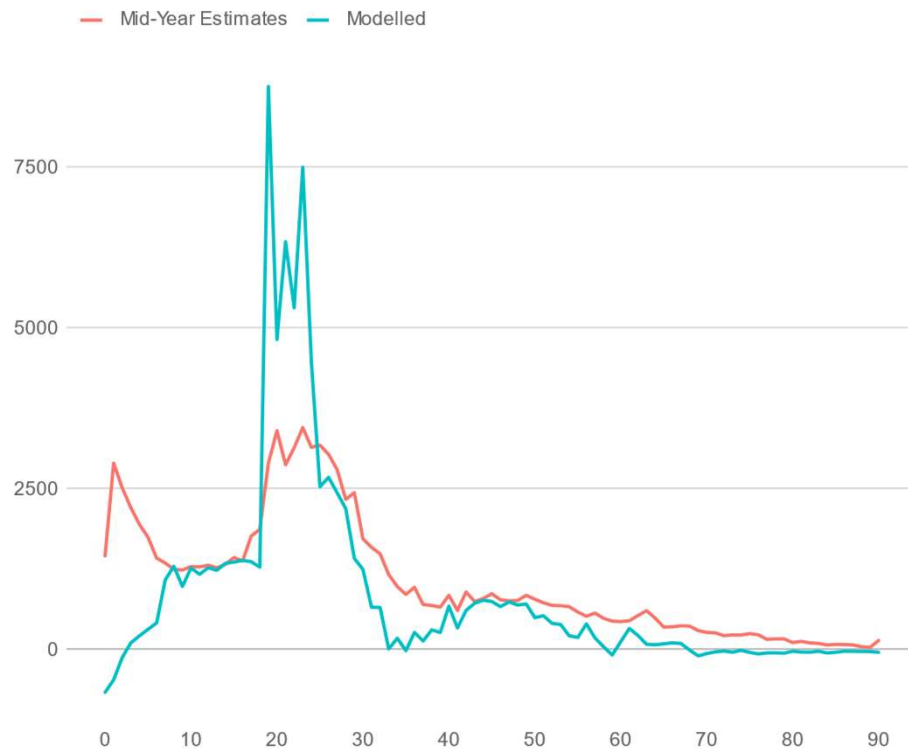


London - age structure



Population backseries

London - mean net international



London - mean gross flows

