# Estimating how levels of international migration have been affected by the coronavirus pandemic

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# **Presentation outline**

- Background
- The challenge
- A framework for longitudinally linked admin data
- Exploratory analysis
- Use of multivariate State Space Models
- Results
- Discussion and next steps

#### Acknowledgements

- ONS Methodology: Nicky Rogers, Sonya Ridden, Amy Large, Mingqing Wu
- Home Office: HO Analysis and Insights experts and analysts (Ross Drayton, Bex Newell)
- University of Southampton: Peter Smith, Jakub Bijak, Jason Hilton
- Methodological Assurance Review Panel (Sir Bernard Silverman Chair)
- **Delphi Expert Panel:** Helen Pennington Home Office, Esther Roughsedge National Records Scotland, Phil Rees University of Leeds, Jon Forster University of Warwick, Madeleine Sumption University of Oxford/Migration Observatory, Doug Rendle Bank of England, Alan Manning London School of Economics, Jonathan Portes Kings College London, + 3 who chose to contribute anonymously

# Background

- Intention to move away from IPS as leading indicator of migration
- Ongoing research identified range of admin data sources
- Accelerated by COVID-19
- Tactical (modelling) approach developed to estimate international migration in Q2 2020
- Strategic approach (ABME) developed using Department for Work and Pensions (DWP) Registration and Population Interaction Database (RAPID) and Home Office Border data separately. Reported up to March 2020
- Now considering statistical design and methods to bring two approaches together

# The challenge

- IPS stood up 16 March 2020 (has resumed for T&T since Jan 2021)
- Timeliness issues on lags due to (a) appearance on admin data, (b) definitional constraints
- Can't rely on past trends alone
- Travel and migration behaviours have changed
- Our usual definitions of 'usual resident' and 'international migrant' are for a steady state
- Required innovative use of data and modelling methods to produce provisional estimates, subject to later confirmation
- Disentangling impact of COVID and Brexit

# If Covid-19 hadn't happened.....Immigration



# If Covid-19 hadn't happened.....Emigration



## What is it that we are trying to measure?



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## What is it that we are trying to measure?

Emigration from UK by former reason for migration, 2020

Non-EU EU British

![](_page_8_Figure_3.jpeg)

New emigrants are those who have never lived outside the UK long enough to establish usual residence elsewhere and are therefore leaving the UK for the first time as long-term international emigrants.

Former immigrants originally born in the UK migrating before 1 April 2013 were not asked their previous main reason for immigration. All former immigrants in the year ending March 2014 and later were asked their previous main reason for immigration.

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# Applying single source error framework

![](_page_9_Figure_1.jpeg)

Error due to:

- Coverage
- Timing differences
- Linkage

# **Applying multiple source error framework**

![](_page_10_Figure_1.jpeg)

Error due to:

- Timing differences
- Linkage
- Coverage
- Identification
- Processing
- Attrition
- Periodicity/Seasonality

# Data sources used in exploratory analysis and models

- International Passenger Survey data 2010 February 2020
- Home Office Visas Issued and Exit Checks data
- Civil Aviation Authority, Eurotunnel, Eurostar and Ferry data
- Home Office Advanced Passenger Information
- National Insurance Allocations to adult overseas nationals
- GP Patient Register Flag 4 registrations and de-registrations
- Higher Education Statistics Agency data
- English and Welsh School Census data
- Real Time Information PAYE

 Less timely or coverage issues

#### **Exit Checks: Single Source Error**

Quality Indicator	Visa, immigration and travel event data
Single source	HO report on statistics relating to Exit Checks
quality	
Deduplication	Available
Counts of records	Counts for 2015 onwards, for linkages and
	residuals
Match rates	High-level match rates
Linkage error	Estimated for false positives
Conflicts	Listed with resolution rules and counted
Characteristics of	Analysis undertaken regularly
residuals	
Coverage	Known coverage issues

#### Air passenger arrivals

![](_page_13_Figure_1.jpeg)

Source: Statistics relating to passenger arrivals since the COVID-19 outbreak, February 2021, Home Office 2021

#### Air passenger departures

![](_page_14_Figure_1.jpeg)

Source: Source: ONS analysis of Home Office Advanced Passenger Information (API)

#### Passenger in-flows by mode as a proportion of all passenger in-flows

![](_page_15_Figure_1.jpeg)

Source: Civil Aviation Authority, Eurotunnel and Department for Transport Sea Passenger Statistics

#### Passenger out-flows by mode as a proportion of all passenger out-flows

![](_page_16_Figure_1.jpeg)

Source: Civil Aviation Authority, Eurotunnel and Department for Transport Sea Passenger Statistics

#### **Exit Checks: Multiple Source Error**

Quality Indicator	Linked visa, immigration and travel events	
Frame error	Omissions: Common Travel Area, EEA at time of reporting	
Timing	Better quality data available 2015 onwards. Timely data collection Known edge effects and censoring	
Coverage- match rates	High linkage rates – reduce false positives	
Coverage- false positive and negative matching	Estimated for false positives	
Characteristics of residuals	Regularly conducted	
Definitional differences	Definitional constraints for Int'l migration	

# Work visas granted to non-EU visa nationals and associated arrivals, UK, Quarter 1 2018 to Quarter 4 2020

![](_page_18_Figure_1.jpeg)

Source: ONS analysis of Home Office border crossing data, April 2015 – October 2020

# Work visas granted to non-EU visa nationals and associated last departure, UK, Quarter 1 2018 to Quarter 4 2020

![](_page_19_Figure_1.jpeg)

Source: ONS analysis of Home Office border crossing data, April 2015 – October 2020

# Modelling approach

- Multivariate state space models to estimate international migration for March 2020 onwards
- Incorporates IPS, Home Office border crossing data, and passenger flow data for air, train and ferry
- Additional assumptions for EU and GB nationals
- Expert judgement on model assumptions and early estimates based on different scenarios (Delphi approach)
- Final models based on majority view\* from Delphi

• \* Under normal Delphi conditions would expect consensus

# **Description of the model**

- Log of IPS series modelled as basic structural model with sampling error
  - Smooth trend model with trigonometric seasonal
- Log of administrative based series modelled as basic structural model
  - Smooth trend model with trigonometric seasonal
- Both series include an additional error term for the level of the trend when COVID-19 impacts (magnitude is estimated based on admin data as IPS is missing)
- Trend components of IPS series assumed correlated to trend components of admin based series

#### variance of IPS survey estimate

number of NON EU visa migrants

The trend components are modelled as a random walk with drift.

 $\mu_{t+1}^{x} = \mu_{t}^{x} + \nu_{t}^{x} + r_{t}\eta_{t}^{\mu}$  $v_{t+1}^{\chi} = v_t^{\chi} + \eta_t^{\nu_{\chi}},$ 

error

![](_page_22_Figure_6.jpeg)

 $r_{\rm t}$  is an indicator equal to 0 outside the Covid period and 1 within. This error term acts as a proportional adjustment based on behavioural change.

Seasonal components modelled as trigonometric seasonals with error terms (assumed independent)

trend seasonal

x = an IPS or administrative based time series

a = an administrative based time series

**NB** certain pairs of IPS and admin based series the slope error terms  $(\eta_t^{\nu_x})$  are assumed to be contemporaneously correlated

$$\eta_t^{\mu_a} \sim \mathrm{N}(0, \sigma_{\eta^{\mu_a}}^2)$$
  
 $\eta_t^{\nu_x} \sim \mathrm{N}(0, \sigma_{\eta^x}^2)$ 

# Implementing changed migration behaviour in models

- Non-EU
- Adjust estimated immigration with observed arrivals behaviour
- Adjust estimated emigration with observed departures behaviour
- EU

• /	Adjust estimated	immigration	with observed	d non-EU	arrivals behaviour
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- Adjust estimated emigration with observed non-EU departures behaviour
- GB
- Adjust estimated immigration with observed non-EU departures behaviour Expect returning GB migrants' behaviour
- Adjust estimated emigration with observed non-EU arrivals behaviour

Plus travel options adjustment

Expect GB emigrants' behaviour is same

is same as non-EU emigrants

as non-EU immigrants

# **Total immigration**

![](_page_24_Figure_1.jpeg)

Source: Office for National Statistics

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# **Total emigration**

![](_page_25_Figure_1.jpeg)

Source: Office for National Statistics

#### Office for National Statistics

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### **Total net migration**

![](_page_26_Figure_1.jpeg)

Source: Office for National Statistics

### **Cumulative total net migration, UK**

![](_page_27_Figure_1.jpeg)

Source: Office for National Statistics

# **Discussion**

- Covid-19 pandemic has highlighted an urgent need for timely estimates of the population
- Concept of long-term migration has been a fluid and challenging to measure statistically
- Our models reflect changes in migration behaviour and availability of data, and rely on assumptions validated by experts
- Going forward we plan to model Q3+Q4 2020 and beyond with more granularity
- Modelling underlines importance of prediction in the absence of the IPS and less timely ABME
- This demands *provisional* estimates that are subject to *retrospective revision*
- Continue to explore data sources and incorporate into models

# **April 2021 Publication**

Home > Kelease calendar > Published > Using statistical modelling to estimate UK international migration
Release:
Using statistical modelling to estimate UK international migration
Contact: Release date: Next release:   Nicky Rogers 16 April 2021 09:30 To be announced
In the absence of the International Passenger Survey (IPS). ONS Methodology is developing methods for estimating international migration for Quarter 2 (April to June) of 2020 and beyond. We are making innovative use of available data sources and methods to estimate how levels of international migration have been affected by the COVID-19 pandemic.
Data
Using statistical modelling to estimate UK international migration Modelled estimates for UK immigration, emigration and net migration, January 2018 to June 2020.
You might also be interested in:
Using statistical modelling to estimate UK international

https://www.ons.gov.uk/methodology/methodologicalpublications/generalmethodology/onsworkingpaperseries/usingstatisticalmodellingtoestimate ukinternationalmigration