

Applying novel data and methodologies to population science 1

Age-disaggregated subnational patterns of internet and mobile phone adoption

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Digital technologies are transforming population and development processes, yet access remains uneven across geography, gender, and age -- particularly in low- and middle-income countries (LMICs). While younger individuals are typically more connected, most existing evidence on these age patterns comes from high-income countries, leaving uncertain whether similar dynamics hold in LMICs. Whether digital gender gaps persist among younger cohorts in LMICs is also unclear. Reliable subnational, age-disaggregated data on who is connected remain scarce, limiting understanding of demographic digital divides and progress toward the Sustainable Development Goals. This paper introduces a two-stage approach to estimate subnational age- and gender-specific patterns of internet and mobile adoption across LMICs. We first smooth sparse survey data from the Demographic and Health Surveys (DHS) and Multiple Indicators Cluster Surveys (MICS) across ages to generate age curves of digital adoption for subnational areas. We then apply a machine learning model integrating social media, geospatial, and development covariates to predict adoption where survey data are unavailable. The results will provide new global, age-structured subnational estimates, advancing digital demography by revealing demographic dimensions of digital inequality.

Safeguarding urban communities: Assessing the impact of the spatial structure of urban mobility on the spreading of infectious diseases

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With urbanisation continuing to rise, cities are increasingly prone to becoming epidemic hotspots given their concentration of large, highly mobile populations, as evidenced during the COVID-19 pandemic. Developing resilient urban environments is therefore crucial to effectively respond to future pandemics. Emerging evidence suggests that monocentric cities, prominently concentrating socioeconomic activity in a central area, record lower transmission rates. Conversely, polycentric cities with activity distributed across multiple centres, typically have slower outbreaks. However, evidence on the relationship between these urban structures and infectious disease transmission remains limited. This study addresses this gap by investigating (1) how infectious disease spreading varies across these urban structures, and (2) how confounding factors moderate the relationship between urban structure and disease spreading? Drawing on mobile phone location data, we examine 82 Functional Urban Areas (FUAs) in England and Scotland during February-April 2021. We compute two mobility indicators, directionality and centrality, to classify each FUA as monocentric/polycentric, and estimate the Effective Reproduction Number (R) to capture COVID-19 spreading. Relevant demographic and socioeconomic indicators from the UK Census are incorporated as confounders in our multilevel regression models. Unlike most studies assessing urban mobility, we capture flows within-FUAs and regional flows across-FUAs, which we anticipate to increase vulnerability of FUAs to disease spreading. Pending analysis completion, we expect contagion to be harder to contain in polycentric cities as these have multiple centres to address should an outbreak occur. In partnership with the UK Health Security Agency, our findings are aimed to be directly translated into public health practice.

Bayesian reconstruction of a latent multidimensional migration tensor from partially observed margins

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Estimating bilateral international migration flows disaggregated by age, sex, and country of birth (CoB) remains a fundamental challenge in population research. No single data source captures the full origin–destination–CoB–age–sex–time structure of migration flows; existing datasets are partial, inconsistently reported across countries, and subject to distinct coverage gaps and measurement error. We propose a Bayesian hierarchical model that jointly reconciles four complementary marginal data sources: emigration counts by origin and CoB, immigration counts by destination and CoB, and bilateral flows reported by both sending and receiving countries, treating each as a noisy partial observation of a latent six-dimensional flow tensor. Each marginal is modelled as an analytic sum over the unobserved dimensions of this tensor, with source-specific negative binomial likelihoods accommodating overdispersion and additive bias terms capturing systematic reporting asymmetries between sending and receiving countries. The hierarchical

structure partially pools information across dimensions, stabilising estimates where cells are sparsely observed. Posterior inference yields a complete bilateral flow table for European countries over 2013–2022, from which we derive a typology of migrant populations defined by the relationship between CoB, origin and destination, including return, onward, and secondary migrants, unobservable from any single source. The approach provides a principled and scalable framework for flow estimation under structural data fragmentation, with implications for demographic accounting, population projections, and the harmonisation of European migration statistics.

Are fewer cross-language online connections associated with higher support for radical right political parties? Evidence from the United Kingdom's 2024 General Election
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Intergroup contact between non-migrant and migrant communities is often cited as a key explanatory variable in determining attitudes toward migration. Studies testing this in the quantitative literature almost exclusively evaluate the influence of real-world contact, either through survey questions or by approximating contact through geographic residential proximity to migrants. Increasingly, however, social contact occurs not primarily in the physical world, but online, a phenomenon that the quantitative literature has explored little. Using novel data on Facebook friendships, this study investigates the association between an area's level of cross-language online connections and electoral support for radical right political parties, used to approximate negative feelings toward migration, at the UK 2024 general election. Results provide support for the contact hypothesis in the digital context: support for the radical right was greater in areas with fewer connections between English-language users and those who use Facebook in a different language. Moreover, in areas with fewer cross-language Facebook friendships than expected, given the social, employment, and educational environments in which users interact, the radical right's vote share was also higher. By applying traditional sociological theory to the digital domain, this study introduces new theoretical and methodological perspectives on the influence of intergroup contact on public attitudes towards migration and associated political behaviours.

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Enhancing population estimates and projections in post conflict, limited data settings: Lessons from the DRC, Somaliland and Iraq

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Reliable population estimates and projections remain essential for effective planning, yet many national statistical systems continue to operate in environments where data are sparse, outdated, or disrupted by conflict. Building on the framework presented at BSPS 2025, this paper outlines recent and emerging work undertaken by the Office for National Statistics (ONS) to strengthen capacity in three post conflict, limited data settings: Democratic Republic of Congo (DRC), Somaliland, and Iraq.

In the DRC, the absence of a census since 1984 and limited civil registration coverage place considerable pressure on household surveys as the primary demographic evidence base. ONS is supporting Institut National de la Statistique to strengthen analytical capability through training in R, advanced DHS analysis, and improved approaches to deriving demographic measures from surveys. This work illustrates how targeted capacity building can enable analysts to move beyond externally produced outputs towards sustainable, “home-grown” analysis.

In Somaliland, long term displacement and fragmented administrative systems further complicate population estimation. ONS has worked with the Central Statistics Department to introduce projection methods adapted for extremely limited inputs, combining survey derived fertility and mortality estimates with indirect estimation techniques to improve the plausibility of age-sex structures and communicate uncertainty transparently.

Finally, the paper outlines proposed methodological and capacity building support for Iraq, where recent census data create new opportunities for thematic analysis and projections, but where analytical capacity and stakeholder demands present distinct challenges. Together, these experiences highlight practical, scalable strategies for producing credible population estimates and projections in post conflict contexts, and underline the importance of partnership driven approaches.

Projecting population size and structure in conflict settings for humanitarian response and disaster preparedness: insights from Haiti, Mozambique, and Sudan

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Up-to-date subnational population estimates—disaggregated by age, sex, and to the lowest geographical level possible—are a key component of evidence-based humanitarian action. In many humanitarian crises, however, large-scale population mobility, combined with disruptions to national statistical systems, make updating subnational population estimates challenging. Addressing these estimation challenges requires incorporating non-traditional population data sources, including mobility data generated for operational humanitarian response efforts, and addressing a range of data interoperability issues. In this paper, we present recent work by the United Nations Population Fund (UNFPA) to update subnational population projections for Mozambique, Haiti, and Sudan by adapting applied demographic methods to a mix of traditional and non-traditional population data sources. These projections are used by UN Humanitarian Country Teams as a common population baseline for UN system-wide decision-making and operational response. We also highlight how cohort-component Bayesian probabilistic projection techniques can be leveraged, alongside modeling of subnational mobility flows, to better measure and communicate uncertainty to humanitarian decision-makers in limited-data settings. Our work offers insights on key issues related to population data and estimation in humanitarian settings, including accounting for the impact of large-scale crisis-related mobility in subnational population projections.

Understanding the Impact and Aftermath of COVID-19 on Reshaping Migration Flows

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The COVID-19 pandemic caused extensive disruption to international migration, halting cross-border mobility and reshaping global migration flows. While the immediate contraction of flows in 2020-2021 is well documented, less is known about how and where migration recovered, and which structural factors shaped

diverging recovery trajectories. The paper investigates the reconfiguration of international migration flows, during, and after the pandemic (January 2019 – December 2022) using Meta's International Migration Flows dataset – a large-scale digital trace source capturing monthly movements between 181 countries. We develop a Migration Recovery Index (MRI) that measures four dimensions of recovery after the pandemic-induced collapse: speed, duration, persistence, and volatility. Using a multilevel model with varying intercepts for origin and destination countries, we identify key drivers of recovery across migration corridors. Results show that migration recovery was highly uneven: corridors linking geographically proximate and institutionally connected countries (e.g. those with shared language or EU membership) exhibited faster and more stable recovery, while long-distance and more restrictive destinations lagged behind. Stronger governance in origin countries and larger destination populations was also associated with higher recovery scores. By integrating digital trace data, systems-based analysis, and resilience perspectives, this research provides new insights into how global mobility systems adapt crises. Ongoing work will extend the analysis through dynamic clustering of recovery trajectories, contributing to broader debates on migration resilience and adaptation under new global realities shaped by pandemics, conflicts, and inequality.

Dynamic count models with flexible innovation processes for irregular maritime migration

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Motivated by the challenge of analyzing the dynamics of weekly sea border crossings in the Mediterranean (2015-2025) and the English Channel (2018-2025), we develop a Bayesian dynamic framework for modeling heteroskedastic count time series. Building on theoretical considerations and empirical stylized facts, our approach utilizes a Poisson random walk model that allows for heavy-tailed innovations or stochastic volatility dynamics, while incorporating an explicit mechanism to separate structural from sampling zeros. Posterior inference is carried out via a straightforward Markov chain Monte Carlo algorithm. Applying this methodology to Mediterranean and English Channel data, we compare alternative model specifications through a comprehensive out-of-sample forecasting exercise. Using log predictive scores and empirical coverage at predictive quantiles to evaluate each model, we find strong evidence for stochastic volatility in migration innovations. These models deliver the strongest out-of-sample forecasts with empirical coverage close to nominal levels up to the 99th percentile. Our framework can be used to develop risk indicators with direct policy implications for improving governance and preparedness for migration surges. More broadly, the methodology extends to other zero-inflated non-stationary count time series applications, including epidemiological surveillance and public safety incident monitoring.