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White Paper on Migration Uncertainty: Towards Foresight and Preparedness

Harnessing Scientific Knowledge for Better Policy:
Evidence and Recommendations from the Horizon
2020 Project “Quantifying Migration Scenarios for
Better Policy” (QuantMig)

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**Jakub Bijak, Daniela Vono de Vilhena, Michaela Potančoková
and the QuantMig Team**

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Executive Summary

This White Paper presents the main results and policy recommendations from the Horizon 2020 project “Quantifying Migration Scenarios for Better Policy” (QuantMig). It discusses the uncertainty and complexity of migration processes (**Section 1**), assesses selected theoretical approaches for explaining migration (**Section 2**), reviews migration drivers in the origin, destination and transit countries (**Section 3**), evaluates data and migration measurements for scenario-building on future migration (**Section 4**) and presents ways to inform and construct migration scenarios (**Section 5**), followed by the project’s main conclusions and recommendations (**Section 6**).

Key Contributions

- Migration is uncertain and complex and therefore weakly predictable. The QuantMig project explored methodological options for various forward-looking approaches to constructing future migration scenarios. We have **advanced the methodology for early warning models (for short-term operational responses), forecasts (for mid-term planning) and scenarios (for long-term, strategic decision-making)**. QuantMig results offer a methodological blueprint for studying migration futures.
- We have created an innovative **typology of the sources of uncertainty in migration**, making a distinction between the potentially knowable (epistemic) and unknowable (aleatory) uncertainty. The former, encompassing data and measurements, knowledge of migration drivers, their environments, regularities and “stylised facts”, can be reduced through further research advances. The latter, including individual human actions or the inherent uncertainty of the future, cannot be reduced and needs to be managed instead.
- The work conducted in QuantMig focuses on options for preparedness considering the current limits of knowledge. To that end, the project has produced comprehensive, multi-perspective and robust **quantitative migration estimates and scenarios** to support various areas of European migration policy, based on cutting-edge developments in conceptualising, explaining, estimating and forecasting migration under uncertainty.
- QuantMig contributes to the **mainstreaming of uncertainty in migration narratives**. The project has made substantial methodological contributions by proposing different analytical perspectives and new tools. These scientific contributions are accompanied by a tangible project legacy, including a range of online tools and educational materials available on the project website (www.quantmig.eu). This includes databases of migration estimates, scenarios and policies, meta-databases of data on migration and its drivers, as well as open data deposits available on Zenodo (www.zenodo.org).
- Scenarios produced in the QuantMig project confirm that **international migration plays a key role in population change in Europe**. Migration exchange with the rest of the world is expected to gain prominence in the future, given declining intra-European migration due to population ageing, smaller young cohorts, and reduced intensity of emigration from newer member states. However, even high-migration events followed by persistent flows will only slightly alter the projected sizes and age structures of the working-age population and labour force in Europe until 2060.

Introduction

Human migration is fraught with unexpected features and surprise developments. Its uncertainty and complexity – two key aspects of contemporary mobility – mean that migration policies, if they are to be effective, need to explicitly acknowledge and address the related challenges head-on. As migration remains a top policy priority area across Europe, with many policies being proposed and implemented for different types of flows, this challenge is becoming increasingly more important.

There is a growing recognition, including at the highest political levels in Europe, of the challenges posed by highly unpredictable and potentially high-impact migration processes and events.¹ This involves acknowledging the need for better preparedness and generates demand for forward-looking tools, such as nowcasts and scenarios, to explore different short and long-term migration futures. Given how complex migration processes are, such tools are likely to be sophisticated both in conceptual and technical terms, while both their creators and users need to be realistic about what such tools can and cannot deliver. At the same time, scenario results need to be easy to comprehend and communicate to facilitate uptake by different user groups.

As part of these efforts, the QuantMig project has aimed to produce comprehensive, *multi-perspective and robust quantitative migration estimates and scenarios to support various areas of European migration policy, based on cutting-edge developments in conceptualising, explaining, estimating and forecasting migration under uncertainty*. In this context, looking at knowledge advances across all these different dimensions, this White Paper summarises the key project findings from the perspective of policy users: what we have found, what it means, and what we recommend for policy and practice on that basis.

Based on the QuantMig results, we therefore go through the successive steps of a multi-stage process of creating migration scenarios, attempting to tell a story of its promises and pitfalls. One of the cornerstones of the project has been the treatment of migration scenario-building as a process with inputs from different areas and stakeholders, so besides delivering a set of quantitative scenarios, we offer a blueprint for carrying out a comprehensive scenario-based analysis of complex, uncertain, multi-dimensional social processes and phenomena, utilising the results for policy advice and support.

We begin by discussing the pervasive uncertainty and complexity of migration processes (**Section 1**), closely followed by an evaluation of selected theoretical approaches for explaining migration (**Section 2**). We then move on to an overview of selected fragments of the complex driver environments focused on the origin, destination and transit countries (**Section 3**). We then evaluate the data and migration measurements underpinning scenario-building and discuss the ways of dealing with future migration uncertainty (**Section 4**). The paper culminates with a presentation of the ways to inform and construct migration scenarios (**Section 5**), including several examples from the QuantMig work, before concluding (**Section 6**). Each of the substantive sections contains a summary of key findings from the respective parts of QuantMig, as well as related policy recommendations.

¹ See, for example, the “Blueprint”: Commission Recommendation (EU) 2020/1366 of 23 September 2020 on an EU mechanism for preparedness and management of crises related to migration, OJ L 317, 1.10.2020, p. 26–38, <http://data.europa.eu/eli/reco/2020/1366/oj>

1. Uncertain migration

Uncertainty in migration studies, notably in forward-looking and future-oriented ones, is present in many areas – and is itself one of the few certain aspects of migration. Our foundational, conceptual work (Bijak and Czaika, 2020) starts by charting the map of this uncertainty and offering a typology of its sources, making a distinction between the potentially knowable (epistemic) and unknowable (aleatory) uncertainty. The former, encompassing data and measurements, or knowledge of migration drivers and their environments, can be reduced through further research advances. The latter, including individual human actions or the inherent uncertainty of the future, cannot be reduced and needs to be managed instead. As horizons of the analysis extend more into the future, aleatory uncertainty increasingly dominates: this means that especially for longer horizons, migration cannot be reasonably accurately predicted (and hence managed) and instead requires the development of flexible tools for preparedness and adaptation of societies to new and changing circumstances. In any case, decision-makers need to be acutely aware of the uncertainty and its possible consequences and implications, admitting that a lot of this uncertainty is not reducible and thus cannot be controlled.

The challenges of complexity and uncertainty are especially crucial at the interface between migration analysis and policy. As we argue in Czaika et al. (2021), with seven illustrative scenarios of hypothetical EU policy changes, migration driver environments are so complex that the relevant policies cannot be seen in isolation: migration policies impact other areas of the economy and society, and other policies (migration-relevant ones) influence migration indirectly. On their own, migration policies are therefore bound to be insufficient in achieving the proclaimed effects, such as the reduction of flows, and their implementation without taking the driver complexity into account can also bring about many unintended consequences (see Castles, 2004).

In Czaika et al. (2022), we shed more light on the implications of migration-related uncertainty on

European migration policy and governance. We focus on the effects of uncertainty on migration-related policy responses, and on the assessment and communication of this uncertainty to decision-makers. Based on the example of Syrian migration to Europe in the mid-2010s and long-term migration induced by environmental change, we demonstrate the incremental nature of policy changes in Europe. The analysis points to a “pivot towards the *status quo*” – policy inertia – and a “negativity bias”, leading to disproportionately stronger responses to the perceived “unfavourable” migration developments. We note the impact of migration policy itself on increasing uncertainty, through limiting legal migration channels.

To aid and inform policy decisions, several approaches have been proposed to address the uncertainty of migration in forward-looking studies. Based on earlier work (Bijak 2010), we offer an updated review in Barker and Bijak (2020), distinguishing two main groups of methods: deterministic and expert-based approaches, and probabilistic methods, including statistical and econometric techniques. The latter group has the advantage of explicitly handling the uncertainty of migration in a measurable (probabilistic) manner, although the effectiveness of different methods depends very much on the time horizon.

In the very short term, statistical methods bear a promise of offering at least some early warnings before migration trends change radically. Short- to medium-term approaches include time series methods, which can at least approximate the uncertainty in the horizon of a few years ahead. These methods do not work for longer time horizons, necessitating recourse to scenario-based approaches. Scenarios can be also quantifiable and include various “what if” responses to different “shocks” to the broader migration systems. This is something commonly done in macroeconomics, for example in the dynamic stochastic general equilibrium (DSGE) framework, which coherently describes different areas of the economy, both at the macro and micro levels. The various approaches are discussed in more detail in Sections 4 and 5.

Key findings

- Key sources of migration uncertainty can be either reducible (knowable) or irreducible (unknowable). New knowledge or data on migration or its drivers can reduce the former, but the latter, such as inherent uncertainty of the future, requires preparedness and adaptation.
- Migration is weakly predictable, although the levels of uncertainty vary between different types of flows and across time horizons, which require the adoption of different approaches.
- Migration does not follow single drivers, but complex driver environments. Responses should, therefore, include not only single migration policy interventions, but more comprehensive policy packages, including other migration-relevant public policies.
- The uncertainty of governance is compounding the problems in responding to migration challenges. The recent tendency across the EU has been to pivot towards policy status quo, as a safe option, and include incremental policy changes more often.

Recommendations

- Recognising the presence of different types of uncertainty is paramount for tailoring policy responses, which should reflect a realistic understanding of the limits of knowledge and policy action.
- Migration drivers and complex driver environments can be difficult to define and operationalise. An alternative option is to rely on “good enough” approximate models. At the same time, the impact of migration and non-migration policies on both migration and other socio-economic domains needs to be assessed broadly, reflecting the underlying complexity.
- The spectrum of possible policy decisions needs to stretch beyond the status quo, assessing different types of action against the default option (status quo), and openly highlighting the need for preparedness and its trade-off against the costs and other options.
- Forward-looking analytical approaches and possible responses should be tailored to the problem at hand and the decision horizon: short-term responses require early warning models; in the medium term, some forecasting may be feasible; and in the long term, strategic decisions need scenarios. The latter can use complex models, such as macroeconomic models, to ensure coherence.

2. Uncertain explanations

Attempts to describe migration from a theoretical perspective are well known for being context-specific, incomplete, and their disciplinary fragmentation (see, for example, Arango 2000). The existing theories also have too high uncertainty to be useful for predictive purposes. For that reason, rather than suggesting another theory or theories for the purpose of scenario-building, which would be a heroic task anyway, we suggest focusing on a range of empirically testable propositions – stylised facts of migration flows – that could help set or verify scenario assumptions. This approach is in the spirit of Merton’s (1968) middle-range theories: specific, testable and not aspiring to grand explanations, yet offering valuable insights into specific dimensions of processes under study. In a report by Carling et al. (2020), we propose ten such propositions, looking at a range of issues, from perpetuation of flows to voluntary immobility, unpredictability of journeys, and the role of environmental change, conflict, development and policies.

The key element of such stylised facts of migration is human decisions – driven by aspirations but taken under conditions of uncertainty and incomplete information. In Czaika et al. (2021), we propose a four-dimensional conceptualisation of the complex migration decision-making process, with the dimensions including the formation of migration aspirations, the cognitive rules for searching and evaluating information about options, the timing and planning horizons for preparing and realising migratory decisions, and the locus of control and degree of agency in taking migration decisions (see also Castles, 2004). Particularly the last aspect – agency – shifts the perspective from a common illusion of full control of migration through policy means, to the perspectives of migrants, considering their uncertain options. Based on a review of the current state of evidence, we identify

avenues for future empirical research, addressing knowledge gaps along these key dimensions of migration decision-making. These dimensions need to be taken into account in the evaluation of any policy options that are intended to influence – directly or indirectly – migration decisions.

To illustrate the potential of combining the middle-range theory framework with knowledge of human decision-making, and to operationalise it quantitatively, we first make an attempt to formalise various relevant theories of human action, such as the prospect theory (Kahneman and Tversky, 1979) and the theory of planned behaviour (Ajzen, 1991), as discussed in Willekens (2021). These theories are subsequently included in an individual-level (actor- or agent-based) computer simulation model of migration between six regions of the world, implemented in Willekens (2022). The results of the model indicate several interesting insights about the role of decision constraints in translating preferences into actual decisions and migrations. At a methodological level, this exercise confirms that agent-based models can serve as very useful tools for examining the impact of changes to some of the parameters influencing migration flows, for example, policies. As this approach explicitly deals with the complexity of multifaceted migration processes by design, it can help shed light on some of the trade-offs and possible unintended consequences of policy decisions, providing decision-makers with additional, more nuanced information. A discussion of agent-based models in a migration context can be found in Bijak et al. (2021).²

² See, for example, the Bayesian Agent-based Population Studies project, www.baps-project.eu (as of 1 April 2023).

Key findings

- A comprehensive theoretical description of migration is barely possible, so explanation is largely limited to middle-range theories. A crucial step in constructing such theories is to identify stylised facts and verifiable propositions, of which we present ten examples.
- Conceptually, individual migration decisions can be seen in four dimensions: time and decision horizon, available information, level of aspirations, and locus of control.
- This conceptualisation enables the use of knowledge about aspects of the decision process from established theories in other areas of science, for example, modelling emigration process with the theory of action, including prospect theory and theory of planned behaviour.
- Decision processes can be subsequently embedded in computer simulation models, such as agent-based models, to enable testing of the outcomes of different assumptions and scenarios.

Recommendations

- Attempts to look into the future of migration need not overly rely on theories, which would be fragmented anyway, but scenarios would be strengthened by conforming to stylised facts. More focus should be placed on immobility, including involuntary immobility.
- Policies, especially those that intend to influence migration decisions, cannot ignore individual agency, objectives and constraints of potential migrants, and should be aware of unintended consequences of the introduction of policy changes.
- In considering policy responses, decision-makers also need to consider broad knowledge from other domains, such as psychology or economics, which can also apply to migration.
- Computer simulations and related experiments can serve as useful tools for checking possible consequences of migration policies and decisions, including unintended ones, thus making the responses more robust in the face of unexpected events.

3. Uncertain drivers and patterns

3.1 Drivers at origin

With respect to migration drivers and their environments, one thematic focus was on countries of origin: the role played by individuals' aspirations (Aslany et al., 2021, 2022), climate change (Vestby et al., 2022) and conflict (Erdal and Tollefsen, 2023), and the interplay between changes in migration drivers at origin and policies at destination countries, particularly visa policies and migration categories (Soto-Nishimura and Czaika, 2022). In the work on migration aspirations, based on a comprehensive literature review (Aslany et al., 2021), the main interest was to explore how individual characteristics (such as educational attainment or employment status) and contextual factors (such as the quality of public services or the levels of violence and insecurity) help explain who wants to leave and who wants to stay in a country. Overall, 32 determinants of migration aspirations have been identified, including: (1) migration-related factors consistently raising aspirations, reflecting the self-sustaining dynamics of migration flows; (2) effects of country- and community-level developments, albeit relatively poorly documented; (3) weak and ambiguous impact of individual socio-economic factors on aspirations, for example, demographic- and family-related factors (except for age and life course). Overall, the findings confirm that migration aspirations do not directly translate into concrete plans and actual migration, for which they are a necessary, but not sufficient condition.

The work on migration aspirations was further developed through an empirical analysis of their determinants (Aslany et al., 2022). The study addresses how measured and subjective standards of living affect the formation of migration aspirations, which cover a range of thoughts and feelings about future migration, including desires, wishes, intentions and hopes to migrate. Our key contribution is an in-depth analysis of the definitions of standard of living, especially as qualitative evidence suggests that people narrate their standard of living in a variety of ways – for example, in terms of income, ability to cover living costs and secure employment, access to social protection, and the quality of the community. Based

on that, we suggest that this should be captured by a question on "satisfaction with current level of standard of living" in survey tools: by this measure, migration aspirations typically decrease as standards of living improve, and as individuals evaluate their economic well-being positively.

We also looked into the analysis of the role played by climate change on human mobility (Vestby et al., 2022). Gravity models were used to explore the sensitivity of the estimated effect of climatic exposure across different model specifications, with the aim to explore and discuss various estimation choices and their impact on the outcomes. Results indicate that methodological modelling choices have a substantial impact on the estimated effects of temperature and precipitation on international migration flows and are an important cause for the variance of estimated effects reported in published literature. This leads to the fact that evidence of the magnitude and consistency of climate effects on international migration is less clear than published estimates lead us to believe. In addition, published results exploring the predictive power of climate-related variables on migration show that such variables are poor predictors, despite climate change depicting longer-term, slower-onset trends, and thus being better predictable.

Similarly, in Erdal and Tollefsen (2023), we have looked into the determinants of conflict-related migration – often explored in the context of the need to provide humanitarian assistance to people fleeing violence, both in the short term, as well as in terms of long-lasting, viable solutions to the challenges of displacement. We conceptualise conflict and conflict-related migration with respect to time and space and carry out a systematic literature review to illuminate the existing work on this topic. Too often, this work focuses on people fleeing conflict, to the detriment of looking at those staying – whether by choice or involuntarily – and a whole spectrum of mobility patterns in between. In this instance, adopting a broad, human-rights based perspective is critical. Similarly, conflict is also typically treated as a dichotomous var-

iable, losing nuance also with respect to the past and the future of mobility. Crucially, the recognition that most people, even in the face of conflict, do not leave, is largely lacking. To that end, we offer new insights into determinants of conflict-related migration, and suggestions for future research and data collection.

Finally, we explored the interplay between changes in migration drivers in both origin and destination, including policies of destination countries and their effects on the composition of total migration flows (Soto-Nishimura and Czaika, 2022). We found that broader configurations of ever-changing driver environments, for example economic ones, are associated with sometimes fundamental shifts in the composition of international migration flows by category (labour, family, study, asylum and so on). For example, while economic inequality generally increases

emigration, particularly family and labour migration, high urbanisation is a facilitating factor for international students, asylum seekers and irregular migrants. When legal restrictions in receiving countries limit a specific migration category, it often leads to an increase in flows through another channel, both as a consequence of changes in migration policy and through changes in other structural migration drivers, with often unequal effects on migration forms and modes. Such policies also have consequences for migrants already present in the destination countries, including restrictions to fully participate in the labour market if they come through another, more restrictive channel, such as study or asylum. Thus, changing configurations of migration drivers and policies are not only affecting overall numbers of migrants but ultimately leading to changing compositions of both emigrant and immigrant populations.

Key findings

- The vast majority of aspiring international migrants never migrate. The so-called “root causes” of migration drive migration aspirations, rather than actual migration.
- Migration aspirations continually decrease as the standard of living improves and as individuals evaluate their economic well-being positively. Still, there are situations (such as during armed conflict) when there is not much choice but to migrate, and as conflict and violence suppress development, they can increase migration indirectly too.
- Environmental change is more likely to lead to proximate mobility within countries than to international migration. We know less about the magnitude and consistency of climate effects on international migration than what published estimates lead us to believe.
- Operationalisation of conflict in studies of conflict-driven migration is often binary and limited in space and time, largely ignoring other dimensions of conflict and the varying roles of conflict and violence in proactive and reactive migration decisions.
- Changing configurations of migration drivers and policies affect numbers of migrants and ultimately lead to changing compositions of both emigrant and immigrant populations.

Recommendations

- Individuals living fulfilling lives in well-functioning societies are less likely to wish to leave their country of origin. Thus, promoting higher standards of living and levels of development is likely to decrease migration aspirations. Still, the realisation of migration aspirations is also linked to the availability of safe, legal and affordable ways of migrating.
- A person's degree of satisfaction with their current level of standard of living is a good predictor of intention to migrate and should be included in future surveys. More well-off people aspire, to a greater extent, to make a life where they are.
- Most climate mobility is short distance and short term, so most international migration caused by climate exposure occurs between neighbouring countries with fairly similar climatic conditions. Alarmism about potential mass climate migration is not based on scientific evidence and should be avoided by policy-makers.
- Meeting the humanitarian protection needs of people fleeing conflict requires more systematic understanding of how conflict contributes to the whole mobility spectrum between leaving and staying, as well as to the safety and possibility of protection of different groups of civilians, recognising that even in conflict-affected areas, many people choose to stay close to home.
- Improving conditions in countries of origin would decrease emigration, while also changing the composition of migration flows.

3.2 Drivers at destination

Policies and overall conditions in receiving countries affect – to a lesser or greater extent – the intensity of migration flows and their composition in terms of various categories. In our work, we focused on the role of uncertainty in destination countries in altering migration decisions and migration flows. Using the Brexit referendum as a quasi-experimental setting to study the role of policy uncertainty on migration (Di Iasio and Wahba, 2021a), we have also explored the role of natives' attitudes on immigration flows to Europe (Di Iasio and Wahba, 2021b), and factors influencing refugees' decisions on where to go in Europe (Di Iasio and Wahba, 2022). From a policy perspective, we have also studied the evolution of migration policies in EU countries to verify the hypothesis of their convergence over time (Czaika et al., 2021).

The causal impact of policy uncertainty on migration flows and migrant stocks in the UK as well as on the attractiveness of other EU countries as destinations (Di Iasio and Wahba, 2021a) were studied by employing a difference-in-difference strategy to compare EU and non-EU migration before and after the UK Brexit referendum in 2016. Results indicate that policy uncertainty around Brexit (1) reduced migration inflows from the EU to the UK, (2) increased emigration of EU migrants from the UK and (3) reduced the increase in EU migrant stock in the UK. However, there were no spillover impacts on the attractiveness of other EU countries as migration destinations. Overall, the findings confirmed that policy uncertainty after the referendum has had a negative impact on migration in the UK.

In exploring the determinants of refugees' destinations, the analysis of data for 2008–20 allowed us to investigate the role played by policies related to employment rights, processing of asylum applications, attractiveness of the welfare system, economic factors and networks on the destination of asylum seekers within the EU (Di Iasio and Wahba, 2022). The strongest pull factor for asylum seekers to a destination was found to involve social networks, both in terms of previous asylum applicants as well as stock of previous migrants, suggesting that employment bans are not justified as a deterrent for asylum seekers, given their modest association with asylum flows.

Finally, the effects of natives' anti-immigration attitudes on migration flows to EU countries were studied using panel data for migration to the EU between 1995 and 2018, paying attention to potential endogeneity between public attitudes and migration flows (Di Iasio and Wahba, 2021b). The findings suggest a negative causal relationship between anti-immigration attitudes and migration inflows to the EU. In other words, natives' hostility drives away immigration. Although the impact of anti-immigration attitudes is greater for non-EU immigration compared to intra-EU migration, the responsiveness of public attitudes with respect to immigration was found to be higher than the responsiveness of economic drivers to EU migration.

In terms of migration policies in destination countries, we have analysed internal and external migration-relevant policies in 31 European countries between 1990 and 2020 to assess to what extent they converged or diverged in time (Czaika et al., 2021). The analysis involved combining several policy datasets on internal and external migration policies, but also on other migration-relevant policies, identifying linkages between policy categories and

spatial dependence in the formation and evolution of migration policy instruments. The analysis shows that the European migration policy mix is a configuration of policies that seem to develop rather independently from each other in rather incoherent directions – both within as well as between European countries. Some striking patterns of convergence and co-evolution of some policy areas have been identified, but despite efforts towards greater harmonisation for some policy areas or instruments, the broader European “migration policy regime” is still rather fragmented, and a multitude of migration-relevant policies follow only weakly a policy-coherent trend within and across Europe.

We further explored policy questions in an empirical report looking at the changing composition of European migration flows in response to policy changes (Czaika et al., 2021). We looked at how migration flows have been evolving within concrete legal categories – labour, family reunion, education and asylum – and to what extent the flows between these legal pathways were mutually interdependent. The analysis was based on data on bilateral migrant stocks since 1990, flows since 2008 and first residence permits for asylum, labour, family and education migration. We analysed the extent to which migration flow categories are geographically and spatially interconnected. The results demonstrate that spatial and category changes of one migration flow affect the evolution of other flows, their direction and composition, at both the origin and the European destination. These spatial, categorical and intertemporal interdependencies have implications not only for our understanding of the complexity of international migration, but also for the scope and limitations of migration policy in influencing migration flows in certain categorical ways and spatial directions. This calls for more comprehensive policy approaches.

Key findings

- Policy uncertainty around Brexit has had a negative impact on migration in the UK: it reduced migration inflows from the EU to the UK, increased emigration of EU migrants from the UK and reduced net EU migration to the UK, even before the UK formally left the EU.
- There is a negative causal relationship between anti-immigration attitudes and migration inflows to the EU: natives' hostility drives away immigration.
- The strongest pull factor for asylum seekers to a given destination is their social networks, comprised both of previous asylum applicants and previous migrants more generally.
- Despite harmonisation efforts, for some migration policy areas, European migration policy is still fragmented and only weakly coherent.
- Migration flows within different legal pathways into Europe are spatially clustered and categorically interconnected.

Recommendations

- Policymakers should be aware that for host countries, periods of uncertainty in migration policy encourage foreign residents to leave and discourage would-be migrants from coming.
- There is a need to build better social cohesion between natives and immigrants to reduce social tensions and misperceptions about immigration to ensure more harmonious societies. Ensuring a welcoming community for migrants is essential to attract newcomers.
- Employment bans are not justified as a deterrent for asylum seekers, given their modest association with asylum flows.
- Policy interventions on migration flows often produce unintended consequences and side effects. Policymakers must consider the impact that some instruments may have on policymaking processes in other realms and in proximate countries.
- More restrictive rules to apply for a specific type of visa may lead to an (unintended) increase in applications for other types of visas. Governments aiming to influence migration flows in a certain categorical or spatial direction should be aware of interdependencies among different migration entry categories when designing policies.

3.3 Patterns of onward migration

When looking at different aspects of onward migration, and the role played by policies in creating or changing concrete migration dynamics in Europe, we started by exploring studied intra-EU mobility as a whole (Mooyaart and de Valk, 2021). An extensive literature review and descriptive analysis of intra-EU migration using Eurostat data for 2010–2018 was supplemented by a case study of migration during the COVID pandemic in the Netherlands. Both the literature review and the data analyses suggest that a strong characteristic of intra-EU mobility is its circular nature, although there seems to be an increasing group of EU migrants that settle more permanently. This applies in particular to young working-age people coming from southern and eastern EU countries, a higher share of whom are settling

in the destination country rather than returning to their countries of origin.

The work on intra-EU mobility focused on non-European-born migrants is based on harmonised 2014–2019 data produced by the QuantMig project (Boissonneault and Costa, 2022; Aristotelous et al., 2022; see Section 5) and the European Labour Force Survey. The results show that a small group of countries, including the United Kingdom, Germany, France, Spain and Italy, appear to account for a large share of all movements from non-European-born migrants. In addition, the results underscore the particular role of transit country played by southern European countries between South America, Africa and Asia on the one hand, and western Europe on the other.

Key findings

- Although intra-EU mobility has been traditionally characterised by its circularity, there is an increasing group of young working-age EU migrants who settle more permanently in destination countries. This includes those who want to stay, but also those who perceive that they are unable to return to their origin country.
- Southern European countries play a role of transit country for migrants coming from South America, Africa and Asia on the one hand, and western Europe on the other.

Recommendations

- Mobility from southern and eastern EU countries to northern and western EU countries is mainly driven by the economic conditions, welfare and the political situation in the country of origin rather than the conditions in the destination countries. To understand intra-EU mobility, more focus should be put on origin countries, rather than focusing exclusively on destination countries.
- More attention should be given to keeping regions attractive to newcomers. As the share of non-European-born people increases in Europe, migrants as a whole will most likely tend to move to specific countries and specific large cities, while less densely populated regions may become even less likely to receive migrants in the future.

4. Uncertain data, measurements, predictions and scenarios

4.1 Estimating European migration, 2009 – 19

Data on migration flows across Europe is known to be problematic and does not necessarily conform to common definitions and quality standards. A pioneering body of work to produce harmonised estimates for 2002–2008, with the measure of error, based on the reports of different sending and receiving countries, has been done within the IMEM (Integrated Modelling of European Migration) project (Raymer et al., 2013). An important element of the IMEM model was expert opinion on those aspects of data quality that could not be identified from the available meta-information. To inform the estimation

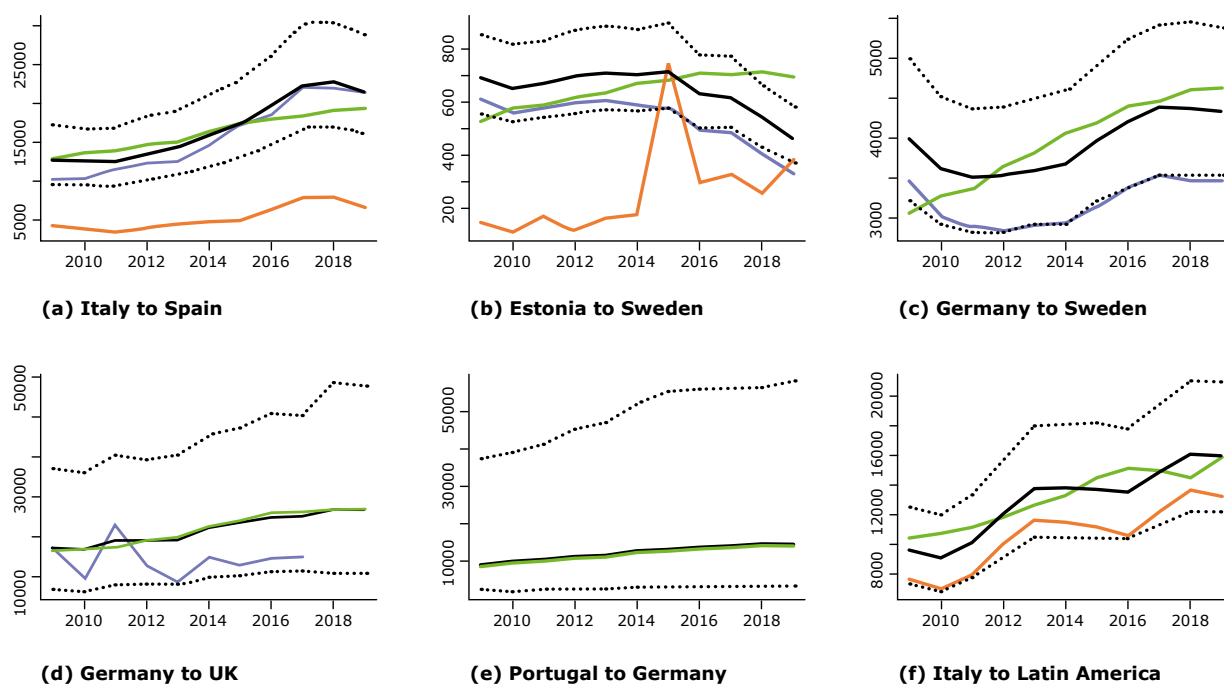
process, we have updated the IMEM expert elicitation study of Wiśniowski et al. (2013). The results, reported in Keilman and Aristotelous (2021), indicate that expert-based information on migration data is still uncertain but at least provides sufficient input for the models, especially for possible undercounting in official migration statistics.

Since the IMEM project, the European migration data landscape has changed, notably as a result of adopting Regulation 862 on migration and asylum statistics in 2007.³ One of the aims of the Regulation was to har-

Figure 1: Sample estimates of selected flows of European migration (medians and 90% uncertainty bounds) under varying levels of data quality and availability.

Source: Aristotelous et al. (2022: p26).

— posterior median
 posterior 0.05-quantile
 posterior 0.95-quantile
 — sending country data
 — receiving country data
 — migration model median



monise migration data across the EU, and in particular, to standardise the definitions, so that long-term migration data corresponds to stays over a period of 12 months.⁴ To update the quality assessment of the secondary data from the IMEM project and examine the impact of Regulation 862 in the period 2009–19, we have carried out an analysis of available meta-information on data and its various characteristics for the collections reported by national statistical offices to Eurostat (Mooyaart et al., 2021). Overall, the comparability of data across Europe has improved, but sometimes at the expense of lower availability. One important example is Germany, one of the largest migration-sending and receiving countries in the EU, whose detailed data on migration flows by origin and destination is not available from Eurostat.

The estimation of flows, by origin and destination within the EU+UK+EFTA system of countries, as well as from and to eight other regions of the world, has been carried out following an updated and refined IMEM methodology (Aristotelous et al., 2022). Figure 1 (Aristotelous et al., 2022: p26) shows examples of estimates for a range of flows with varying characteristics and levels of data availability. Panels (c)–(e) illustrate the high uncertainty resulting from the unavailability of German data from Eurostat. The estimates and their main statistical features (uncertainty bounds) are available in a que-

ryable format from www.quantmig.eu, additionally available in breakdowns by sex or five-year age groups, or by a broad region of birth (EU vs non-EU). The IMEM modelling framework for combining different macro-level (aggregated) migration data proved very versatile and useful. In this case, its application is based on “mirror statistics” reported by sending and receiving countries (where data is available), but it can also be used for different data sources for the same flow. An example application includes combining traditional and non-traditional data, such as digital traces (Rampazzo et al., 2021).

³ Regulation (EC) No 862/2007 of the European Parliament and of the Council of 11 July 2007 on Community statistics on migration and international protection, OJ L 199, 31.7.2007, p. 23–29, with subsequent changes. <http://data.europa.eu/eli/reg/2007/862/oj>.

⁴ We note here that different definitions can imply different predictability levels, as for example short-term flows can be more volatile than long-term migration.

⁵ See Raymer et al. (2013) and www.imem.cpc.ac.uk.

⁶ See, for example, Rampazzo et al. (2021) for combining Facebook and Labour Force Survey data.

Key findings

- Information on migration contained in multiple data sources is insufficient to provide reliable assessment of the true flows and needs supplementing with expert assessment of data quality aspects. Expert-based information is still uncertain but largely (at least weakly) informative, especially about undercounting in official migration data.
- Since the implementation of EC Regulation 862/2007 on migration and asylum statistics, data comparability across Europe has generally improved, but completeness and availability have not, with notable gaps in reporting, including Germany.
- Information from experts and meta-information on data quality, coupled with available statistics on migration flows across Europe, enable the application of a very flexible modelling framework offered by the IMEM model⁵, which produces probabilistic estimates of migration flows with measures of uncertainty. Estimates for 2009–19 are available from quantmig.eu.

Recommendations

- For an assessment of migration data quality, expert knowledge is very useful, but it needs to be triangulated with data of known provenance – ideally coming from different data collection systems, whose features can, in this way, be assessed more thoroughly.
- Despite some progress since the adoption of EC Regulation 862/2007, migration data and metadata availability across Europe needs further improvement. Barriers to improving quality and fuller harmonisation of definitions across the EU need to be particularly examined.
- The uncertainty of the harmonised migration estimates can be large, but is reducible, so this is an area worth investing in at the European level and with partner countries. Approaches used for estimation can rely on “mirror statistics” as well as new data sources, if the latter can be used together with traditional data that has better known features.⁶

4.2 Dealing with future migration uncertainty

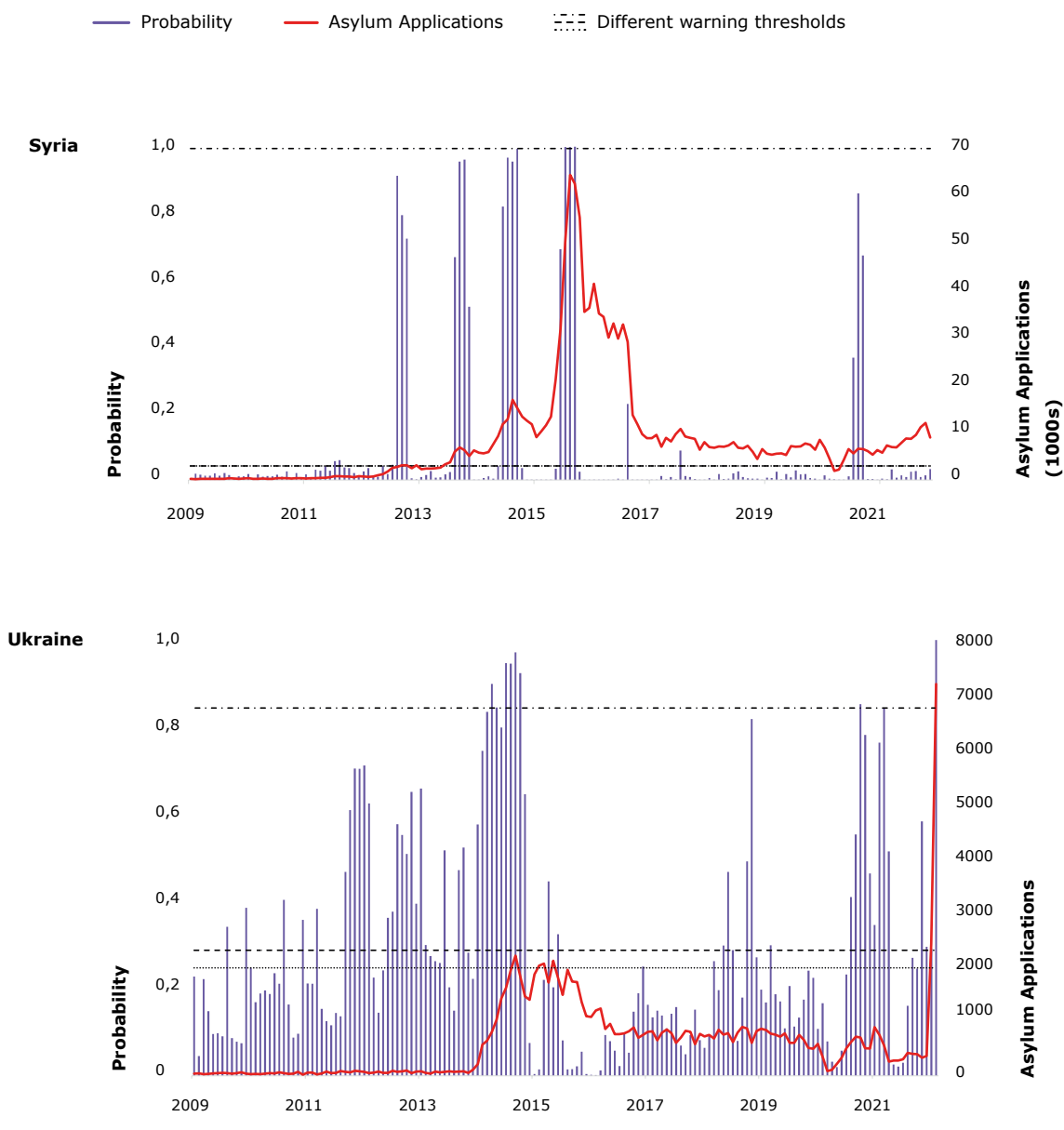
The overview of methods and models in Barker and Bijak (2020), mentioned in Section 1, besides identifying a suite of predictive methods potentially useful across different horizons⁷, revealed an increase in the number and sophistication of approaches in recent years, especially after the 2015–16 surge in migration to Europe largely driven by the conflict in Syria. Particular attention has been paid to short-term views, with early warnings coming to the fore. Still, this does not change the fundamental uncertainty of predictive models and underscores the need for proper matching of methods to problems, understanding the methodological and philosophical limits, and, where possible, treating migration for a whole system of countries jointly, such as in scenarios set with the help of macroeconomic models.

In Barker and Bijak (2021), we have explored in more detail the limits and possibilities of economic and econometric approaches for scenario setting. For short-term horizons, up to five years, we discuss the results of empirical models intended both to forecast migration, as well as to assess the impact of external and internal shocks to the migration systems. The latter approach, with its focus on shock responses, can also be used in the “what if” scenario setting of

migration developments and associated contingency plans and stress testing of policies. Its possible extensions include the addition of expert information, which can include insights absent in the data series. For longer horizons, we examine, first, the effects of an increase in migration on the economy and, second, the effects of an external shock (job automation) on migration processes. By applying dynamic stochastic general equilibrium (DSGE) models, we are able to generate coherent migration scenarios informed by macroeconomic theory. An analysis of responses to shocks in such models offers a tool for assessing the uncertainty of both migration and its economic impacts.

At the other end of the temporal scale, for early warnings, approaches using a single dependent variable have so far been found to be lacking in terms of their predictive capacity. In Barker and Bijak (2022), we present a model-building strategy that uses publicly available data sources, including both traditional (macroeconomic) and new data collections (such as the online Global Database of Events, Language and Tone, GDELT, or Google Trends search data⁸). We have proposed an early warning system for asylum applications in the EU, having tested it on two case studies

Figure 2: Results of selected early warning models for Syria and Ukraine, with predicted probability of “crisis events” shown with purple bars.
Note different scales for both countries. EU asylum data (red line) shown after Eurostat.
 Source: Barker and Bijak (2022: pp 46, 60).



related to the conflicts in Syria and Ukraine, for which we looked for “leading” signals in data up to six months in advance. Examples of the outcomes generated by such models are shown in Figure 2. The results indicate the presence of some predictive signals in a broad set of data, with the models using new data sources alongside traditional ones performing best. Still, the models are very sensitive to the specification, as well as to the operational definition of a “crisis event”, which needs to correspond to specific user

needs and requirements, such as which processes and indicators to focus on to aid the operational response.

⁷ See also Bijak (2010) for a forecasting overview and Napierala et al. (2022) for early warnings.

⁸ Data available at <https://www.gdeltproject.org> and <https://trends.google.com/home>, respectively.

Key findings

- The number and sophistication of tools available for quantitative exploration of a range of different migration futures is increasing, although as expected, the existing approaches are useful mainly for very specific applications and limited in terms of time horizons.
- Forecasting results confirm earlier insights as to the weak predictability of migration flows. Quantifiable theoretical models, such as macroeconomic DSGE (dynamic stochastic general equilibrium) models, can offer useful and coherent insights for scenario setting.
- In early warning models of displacement for Syria and Ukraine, equipped with both traditional and non-traditional data, we were able to detect some advance signals, but the results proved sensitive to model specification, and to defining the response variable and warning threshold.

Recommendations

- As no migration flows exist in isolation, it is recommended that migration scenario-setting efforts focus on multi-country systems, looking at unforeseen events and their implications. One open question for decision-makers is how much uncertainty they are prepared to tolerate, versus how many resources can be committed for preparedness.
- Theory-based models, such as DSGE, can be used for checking responses of the whole systems and stress-testing of different scenarios, similarly as is already done in central banking and financial regulation. For long-term scenario setting, it is also recommended to fuse model-based and expert-based insights, to moderate their respective idiosyncrasies.
- For early warnings, a broad and diverse range of data, both new and traditional, should be used. The response variable or variables (“crisis”) needs to be defined taking into account specific user needs, possibly in different policy areas.

5. Insights from scenarios of future European migration

5.1 Informing scenario assumptions

To prepare the basis for the work on migration scenarios, we have reviewed the existing literature on methodology and practice of scenario setting in the migration domain (Boissonneault et al., 2020). We propose a simple typology of scenario studies, depending on the purpose (predictive, exploratory or normative – related to evaluation and monitoring of targets) and on focus (migration or other aspects). Most of the existing studies were found to be of a quantitative nature, very often based on expert opinion, although with an increasing role played by qualitative, narrative-based scenarios. Hardly any existing studies made a distinction between types of flows or specific routes (see, for example, de Beer, 2008 or Bijak et al., 2019), focusing instead on gross flows as a typical quantity of interest. The review identified challenges with the quantification of qualitative scenario assumptions, be it based on drivers or expert opinion.

As a test case for an alternative approach to scenario setting and quantifying the qualitative assumptions,

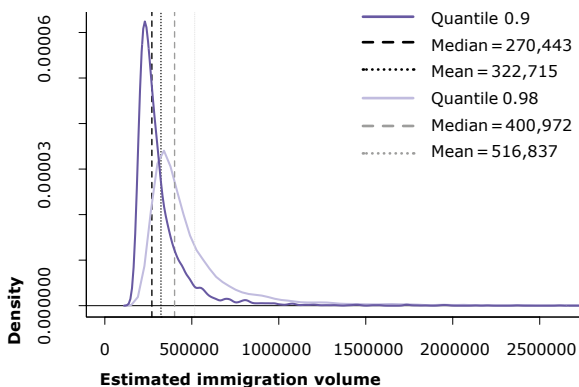
we have subsequently developed and implemented an innovative experimental vignette-based survey of migration professionals based on factorial experimental design (Boissonneault et al., 2022). The survey asked respondents to react to different vignettes depicting scenarios of change in the demographic, cultural, political and economic aspects, and how they would impact migration from the Middle East and North Africa to Europe and return migration until 2030. The survey was resource intensive, especially with respect to expert input, although it achieved good levels of engagement and produced expert-based assessment of the expected changes in family, work, asylum and return migration flows. The method, if implemented on a larger scale for all regions of the world, could provide an alternative way of informing migration scenarios with expert opinion to approaches based on, for example, Delphi studies (Acostamadiedo et al., 2020).

The analysis of the state of the art in migration scenario setting identified important gaps in current

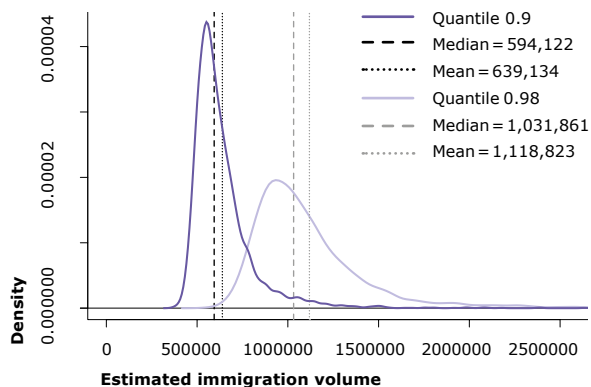
Figure 3: Predictive distributions of migration from North Africa and Latin America to Europe, based on the estimates for 2009 – 19.

“Quantile 0.9” describes once-in-a-decade events, and “Quantile 0.98” twice-in-a-century ones.
Source: Bijak (2023), based on the estimates of Aristotelous et al. (2022).

**Selected quantities for the Pareto distribution:
Immigration from North Africa**



**Selected quantities for the Pareto distribution:
Immigration from Latin America**



methodology and practice. In particular, even though a lot of attention is paid to drivers and narratives, operationalisation of the link between these drivers and migration scenarios is very weak and highly uncertain, largely ignoring the interactions between the migration drivers as such. Hence, for practical reasons, in Bijak (2023) we suggest a shift in perspective: instead of building the scenarios from the presumed driver trajectories, we use the harmonised information about origin-destination-specific flows, obtained in Aristotelous et al. (2022), to derive levels of migration corresponding to certain frequencies of occurrence, such as once-in-a-

decade or twice-in-a-century (quantiles 0.9 and 0.98 from a probability distribution fitted to migration estimates from Section 4). We rely here on the statistical theory of modelling extreme values⁹, and approximate rare events in a similar way as is done in civil contingency planning. Figure 3 shows examples for migration from two regions of the world to Europe.

⁹ For the underlying statistical theory, see, for example, Coles (2001). In our work, we have chosen the Pareto distribution to model rare migration events.

Key findings

- Our review of the state of the art indicated that existing migration scenarios rarely quantify qualitative assumptions formally, especially with respect to the links between the underlying narratives, related migration drivers, and migration as such. This task is very difficult, if at all possible, given the complexity of migration driver environments mentioned above.
- In a dedicated experiment with quantifying scenarios from Middle East and North Africa to Europe by using vignettes, we demonstrated how to systematically supplement and formalise expert opinion on various scenarios through careful experimental design. While the results can help to narrow down the scope of possible future scenarios, they are still bound to miss unexpected events.
- An alternative approach for designing scenarios, at a higher level and thus less resource intensive, involves moving away from drivers and focusing on the magnitude of unforeseen events by looking at features of probability distributions of past series of migration estimates.

Recommendations

- In setting scenarios, as in forecasting, there is a need to distinguish between different types of flows that are characterised by different uncertainty levels, and to provide a systematic way of quantifying the underlying narratives.
- Even though it does not have a built-in capacity for unforeseen events, a vignette experiment can help focus on a subset of flows and drivers more thoroughly and in a systematic way.
- A more general alternative option is to use selected quantiles from the upper tails of the probability distributions of estimates, which can help to approximate the possible magnitude of migration events of various frequencies, for example, once-in-a-decade or twice-in-a-century.

5.2 Migration scenarios for Europe

“What if” scenarios and narrative approaches have become standard in population forecasting and are useful for their interpretability, which facilitates uptake by users. However, as argued in Section 5.1, quantification of the narrative scenarios remains a challenge. We have considered a scenario-generation option that would allow users to co-create scenarios by a similar process to the one described in Section 5.1 in the context of the experimental, vignette-based study (Boissonneault et al., 2022). However, we have decided against it, not only due to the aforementioned large resource implications, but also because such a tool would need to be based on uncertain and oversimplified quantification of migration drivers and their complex interactions, thus leading to a deterministic use of migration drivers and possibly obscuring the picture of future narratives.

To go beyond the commonly used approaches, and inspired by a succession of unexpected large migration events to Europe in the past few years, we explored the option of complementing a narrative-based baseline scenario with model-based sets of quantitative scenarios, which would allow users to explore the potential implications of high immigration events to Europe (Marois et al., 2023). Such immigration events could happen at any time due to human-made or natural disasters, displacing unknown numbers of migrants to different destinations and thus arriving in Europe from different world regions. This data-driven approach embedded in statistical theory of extreme values (Bijak 2023, see Section 5.1) reverts the usual process of first formulating the narrative and then solving the challenge of the quantification of the envisaged narrative. Instead, we provide modellers with statistical estimates of the magnitude of such events and use these as inputs for scenarios in alignment with theoretical understanding of migration processes. As mentioned in Section 5.1, we considered both once-in-a-decade and twice-in-a-century high-migration events.

To better measure the impacts of such migration events on the size and structure of the populations in the EU-27, UK and EFTA countries (EU+) and their labour force, we introduce high-migration events at the exact same time point, but we alternate the re-

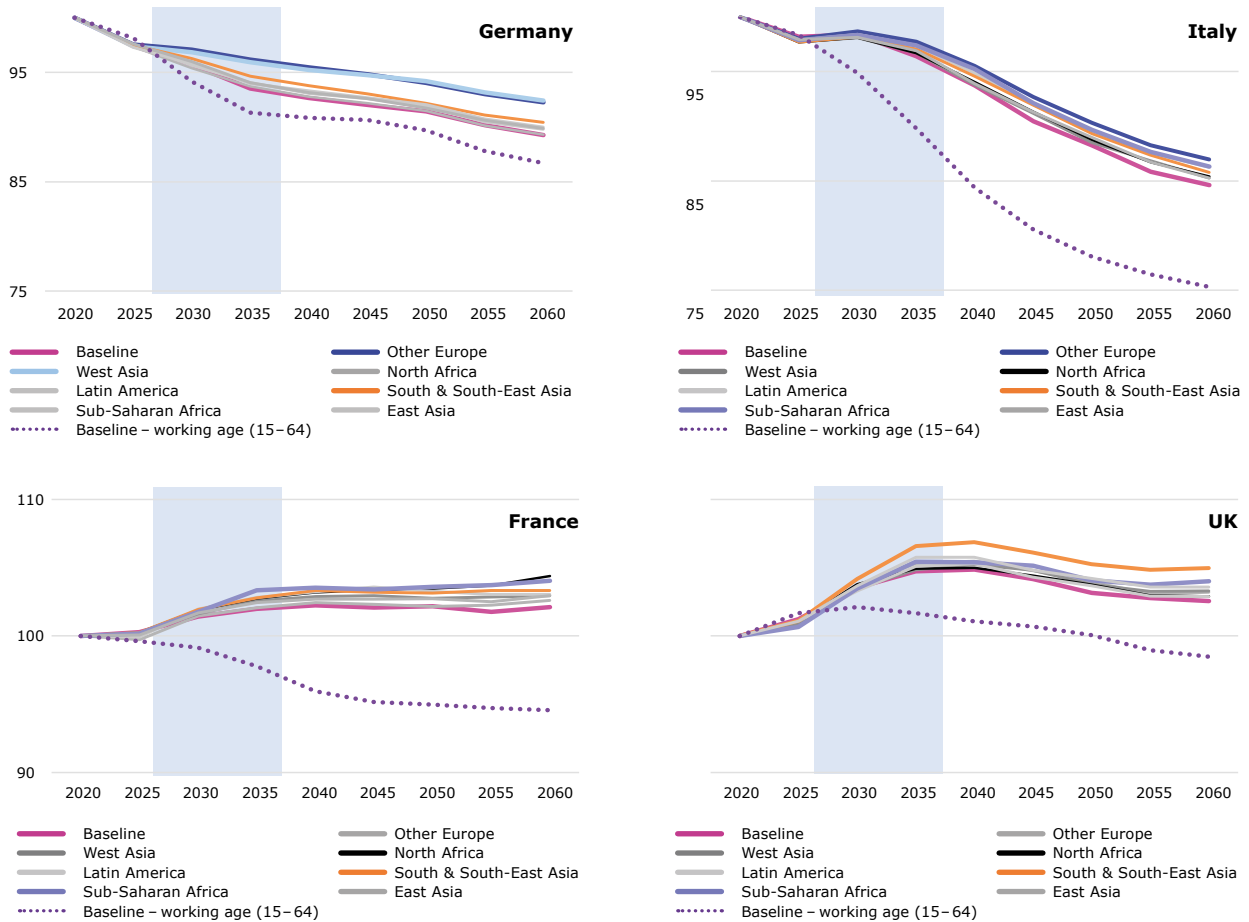
gion of origin of this migration inflow. We have tested the impact of several sets of high-migration events potentially occurring during 2025–29, either as a one-off shock lasting one calendar year or as an initial shock followed by persistence in immigration of people from a given region for a decade, albeit of gradually declining volume in each subsequent year following the initial shock. These events were implemented independently for flows from seven different world regions – Other Europe, North Africa, Sub-Saharan Africa, Latin America, West Asia, South & South-East Asia, and East Asia – thus resulting in 28 scenarios (14 with once-in-a-decade and 14 with twice-in-a-century events, both short and persistent). All scenarios are modelled as additional immigration flows beyond the baseline scenario, in which immigration from each world region into EU+ continues with the same intensity as in 2011–19. Contrasting different scenarios allows us to understand the differentiated impacts of various inflows on destination countries’ working-age population and labour force.

As one might expect, the short impact for a duration of a single calendar year does not leave any lasting imprint on future population sizes and structures. Once-in-a-decade events do not generate sufficiently large flows to leave any sizeable imprint on destination populations. High-migration events that persist over time – for example, through family reunifications, migration networks or newly established migration opportunities – can increase the working-age population and labour force sizes in countries with existing diaspora, but mainly when these events arise in regions of the world with established migration links to the destination country (for example, Other Europe or West Asia for migration to Germany, or South and South-East Asia for the UK; see Figure 4). In absolute terms, even such impacts are relatively small: they would only raise the labour force by a few percentage points.

Policymakers should not thus be too concerned about immigration events of moderate magnitude, but neither should they be overly optimistic about the implications or impacts for the future demographic and labour force outlook of high-migration events of similar magnitude to the so-called “migration crisis” of

Figure 4: Simulated relative change in total labour force (2020 labour force size = 100) and working-age population (dotted line) in selected European countries, persistent twice-in-a-century high-migration events and baseline.

Source: Potančoková et al. (2023)



2015–16¹⁰. Although challenging in terms of its management and absorption of a high inflow in a short time into the society and the labour market, the long-term implications of migration are not a major game-changer due to demographic momentum driving major trends. There is also no need for ungrounded optimism – the proclaimed positive demographic consequences of immigration would necessitate large and sustained immigration in the long term, far beyond what can be reasonably expected (Potančoková et al., 2023; see also Bijak et al., 2008). What our results show, however, is that although population ageing is inevitable, the decline in labour force is not. Most, but not all, EU+ countries will face working-age population decline, but the labour force would decline at a lesser pace or may not decline at all once we consider the continuing education expansion and trends in labour force participation.

Immigration is not a panacea for population decline or declining labour force size. However, that should not discourage policymakers from considering a range of migration and other relevant policies to address specific and realistic policy targets. Distinguishing between realistic and unrealistic targets with respect to immigration is crucial for streamlining resources into those policies that may actually bring about the desired benefits. Immigration policies should also be considered in relation to other policy options, such as economic activation policies, retirement policies or inclusive labour-market policies, including those fostering longer working lives or specifically aimed at the integration of immigrants, in particular immigrant women, into the labour market. The simulations presented above – and soon available at www.quantmig.eu – do not modify the labour force integration trajectories of immigrants and rely on evidence from the past labour

force participation rates. In this sense, the past experience of former immigrants is translated into what we expect for future immigrants from each world region. These results, in combination with our previous work, in which we considered improved (or worsened) economic integration of immigrants, support a stronger focus on inclusive migration and integration policies

(see also Lutz et al., 2019, Marois et al., 2019, Marois and Potančoková, 2020, and Czaika et al., 2021).

¹⁰ This strongly confirms earlier findings in that area, see, for example, Bijak et al. (2008).

Key findings

- Baseline scenario results confirm that international migration plays a key role in population change in Europe. Migration exchange with the rest of the world's regions will gain even more prominence against the backdrop of declining intra-European migration due to population ageing, smaller young cohorts, and reducing intensity of emigration from newer member states.
- Alternative scenarios show that even high-migration events do not leave a lasting imprint on the European working-age population size and projected total labour force unless high immigration persists. An online tool with visualisations of all scenario results will be available at www.quantmig.eu.
- High-migration events followed by persistent flows only slightly alter the projected working-age population and labour force trajectories. That can happen only if the high-migration event is triggered from a region with existing migration ties to the destination country.
- Confirming earlier findings, to slow down population ageing and stabilise labour force dependency ratios in Europe, significantly higher and sustained immigration would be needed than can be reasonably envisaged. Labour force decline, however, is not inevitable and can be less substantial than the projected working-age population decline.

Recommendations

- Despite progress in harmonisation and modelling of migration, detailed information on native-born and different foreign-born populations, and their return patterns, is lacking. In addition, comparative studies are often limited by poor data availability. This impedes more nuanced modelling of European population diversity, and points to future priorities for data collection and harmonisation.
- In our scenarios, high-migration events would have to be of a very large magnitude to leave an imprint on labour supply and long-term demographic trends. As a result, the power of migration to change the fundamentals of labour force dynamics is limited. This needs to be recognised in the policy arena.
- Inclusive policies are paramount, given that the share of the non-EU+ foreign-born population is expected to double and in some main destination countries to reach 30–40% of the total population by 2060 according to the baseline scenario.

6. Conclusions

Overall, the main lessons and findings from the QuantMig work revolve around the ways of analysing and responding to the uncertainty and complexity, and therefore also unpredictability and imperfect understanding, of migration processes and phenomena. Uncertainty demands humility in terms of what is possible and for a clear communication about the limits of what we can forecast. To that end, we have proposed a **blueprint for studying future European migration flows across a range of time horizons**, including the setting of scenarios for future migration. In doing so, we have mapped and advanced the current limits of knowledge with respect to the concepts, explanations, estimates, future early warnings, forecasts and scenarios regarding migration in Europe.

We have also aimed to shift the debate towards the **mainstreaming of migration uncertainty in the political and policy discourse**, and away from either the “illusion of control” of migration or overreacting to specific events, often fuelled by availability of higher-frequency data on some migration processes and not on others.¹¹ In QuantMig, we have made contributions both in substantial and methodological terms, by proposing different analytical perspectives and new tools, as detailed in this white paper. These scientific contributions are accompanied by a tangible project legacy, including a range of online tools and educational materials available on the project website (www.quantmig.eu). This includes databases of migration estimates, scenarios and policies, as well as meta-databases of data on migration and its drivers, and also open-data deposits available on Zenodo (zenodo.org/communities/quantmig).

In policy terms, there are **five high-level recommendations** that stem from the QuantMig findings.

- First, the strategic direction and aims of **migration policies should not focus on numbers**, which are too uncertain, but on overall social or economic objectives that a particular policy is trying to achieve. Different tools and models can help explore broader societal, demographic and economic implications of migration across a range of time horizons.

- Second, the present or future **migration numbers should be the domain of operational planning** and response for concrete policies, which is where their uncertainty needs to be acknowledged and made allowances for. For these purposes, now-casting and early warnings are particularly promising.

- Third, **migration on its own is a means to an end, not a policy target** – in setting policy objectives, different priorities across various areas of government need to be taken into account and openly reconciled. “What if” scenarios can serve as means for testing the impact of policy options and account for longer-term perspectives and foresight.

- Fourth, **migration policy needs to be driven by a particular purpose**, instead of being aimed at short-term headline generation, and to be accompanied by honest communication about uncertainty, to improve preparedness and the understanding of migration and its impacts.

- Fifth, **policy and operational solutions need to be future-proofed by design**, with regular update points and forward-looking exercises becoming part of the “business as usual” routine. This will enable the policy-setting to go beyond immediate responses to emerging crises.

We further emphasise that any solutions aimed at increasing the preparedness and future-proofing of existing policies, as well as operational solutions for dealing with the technical challenges brought about by migration, require additional capabilities and resources – chiefly in terms of money, people and time – and are therefore a matter for policy choice; public consent, given through the electoral system, is a crucial prerequisite for that.

At the technical level, a few recommendations also relate to the use and understanding of unreliable and incomplete migration data for any future-oriented studies. There may be high expectations from the users of such data and analysis, especially with respect to various forms of digital data (mobile phones, social media), but even setting aside the important ethical questions regarding their use, there are many

areas of migration where our knowledge would still be limited, especially wherever the irreducible, aleatory uncertainty is present. Besides, migration data and studies, including forecasts and scenarios, are to some extent social and political constructs, which can be used for political aims, generating risk of responding to the most recent events and headlines rather than taking a broader view. A far better option would be to focus on long-term challenges and preparedness, as opposed to mere reactivity to the most recent and often surprising events. This holds particularly true for the uncertainty concerning the regions of origin.

In the past decade, a lot of focus has been on asylum migration, but most immigrants come through other pathways. Data on differential behaviours of migration cohorts, retention, remigration and return migration rates and patterns, as well as labour market integration pathways, would greatly improve the analysis needed for modelling of multidimensional population and societal change. Making the existing data more interoperable and joined up in an ethically sound and transparent way can be another path towards reducing the epistemic uncertainty. More refined understanding of drivers, socio-economic policies and other enabling environments at the regions of origin would also enable us to better and more quickly pick up on shifts in the patterns of migration flows. A true system model of migration would require much more reliable data on emigration from the origin countries. Last but not least,

any projection needs to be regularly updated in the face of new knowledge and data, so as to manage and ideally reduce some of the uncertainty at the time of its inception.

In addition, from a point of view of modelling broader socio-economic *systems*, integrated modelling of migration aspirations, migration decisions and actions, and their long-term demographic and societal consequences, would additionally require other forms of data, for example, behavioural or ethnographic (see, for example, Bijak et al., 2021). In this way, we could continue using models for policy-relevant experiments, to test potential consequences of specified scenarios or assumptions, while being incrementally better informed, and limiting the part of uncertainty that is reducible through better knowledge. This can also help shift the discourse away from “crisis” mode and towards a more positive and optimistic view of preparedness, thus improving the safety and welfare both of migrants and in host societies. This, however, requires accepting that knowledge of current and future migration can only be approximate, for example, exact to the order of magnitude, and aiming to reduce the uncertainty where possible, or else preparing for the unexpected, which are the crucial lessons from the QuantMig project.

¹¹ We thank Rainer Münz and Marie McAuliffe for drawing our attention to these issues.

List of QuantMig project deliverables

Aristotelous, G., Smith, P.W.F, and Bijak, J. (2022). Technical report: Estimation Methodology. *QuantMig Project Deliverable D6.3*.

Aslany, M., Carling, J., Mjelva, M.B., and Sommerfelt, T. (2021). Systematic Review of Determinants of Migration Aspirations. *QuantMig Project Deliverable D2.2*.

Aslany, M., Sommerfelt, T., and Carling, J. (2022). Empirical Analyses of Determinants of Migration Aspirations. *Quantmig Project Deliverable 2.5*.

Barker, E.R. and Bijak, J. (2020). Conceptualisation and Analysis of Migration Uncertainty: Insights from Macroeconomics. *QuantMig Project Deliverable D9.1*.

Barker, E.R. and Bijak, J. (2021). Uncertainty in Migration Scenarios. *QuantMig Project Deliverable D9.2*.

Barker, E.R. and Bijak, J. (2022). Could We Have Seen It Coming? Towards an Early Warning System for Asylum Applications in the EU. *QuantMig Project Deliverable D9.3*.

Bijak, J. and Czaika, M. (2020). Assessing Uncertain Migration Futures – A Typology of the Unknown. *QuantMig Project Deliverable D1.1*.

Bijak, J. (2023). European Migration Scenarios with Probabilistic Uncertainty Assessment. *QuantMig Project Deliverable D9.4*.

Boissonneault, M. and Costa, R. (2022). The Intra-European Mobility of Non-European-Born Migrants. *QuantMig Project Deliverable D4.3*.

Boissonneault, M., Costa, R. and de Valk, H.A.G (2022). The Future of Migration Between Europe and the Middle East & North Africa under Scenarios of Social Change: A Factorial Survey Among European Migration Professionals. *QuantMig Project Deliverable D7.2*.

Boissonneault, M., Mooyaart, M., de Jong, P., and de Valk, H.A.G (2020). QuantMig: The Use of Migration Scenarios in Future Characterisations: A systematic Review and Typology. *QuantMig Project Deliverable D7.1*.

Carling, J. and Mjelva, M.B. (2021). Survey Instruments and Survey Data on Migration Aspirations. *QuantMig Project Deliverable D2.1*.

Czaika, M., Bohnet, H., and Zardo, F. (2021). The Evolution of the European Migration Policy-Mix. *QuantMig Project Deliverable D5.5*.

Czaika, M., Bijak, J., and Prike, T. (2021). Translating Migration Theory into Empirical Propositions. *QuantMig Project Deliverable 1.3*.

Czaika, M., Bohnet, H., and Soto-Nishimura, A. (2021). Spatial and Categorical Dependence of European Migration Flows. *QuantMig Project Deliverable 5.2*.

Czaika, M., Bohnet, H., Zardo, F., and Bijak, J. (2022). European Migration Governance in the Context of Uncertainty. *QuantMig Project Deliverable 1.5*.

Czaika, M., Erdal, M.B., and Talleraas, C. (2021). Theorising the Interaction Between Migration Relevant Policies and Migration Driver Environments. *QuantMig Project Deliverable 1.4*.

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