Innovations in International Migration for use in Global Population Projections

Nikola Sander & Guy J. Abel

Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU),
Wohllebengasse 12-14, Vienna, 1040, Austria
E-mail: nikola.sander@oeaw.ac.at; guy.abel@oeaw.ac.at
Paper to be presented at the PAA Annual Meeting, April 11-13

Abstract

Advances in projecting international migration have been hindered by a lack of adequate data. Consequently, international projection-making agencies commonly use simplistic assumptions of net-migration measures derived as residuals from demographic accounting. However, past net migration can be often volatile and are known to introduce inaccuracies when projecting populations. This paper presents a set of global population projections to 2060, focusing on alternative international migration assumptions. Expert-based assumptions about fertility, mortality and migration developed for the new edition of the global population projections produced by the Wittgenstein Centre for Demography and Global Human Capital are combined to project each country's population. An earlier version of these projections by age, sex, and also educational attainment was published by Lutz and colleagues in 2007. We overcome the limitations of using net-migration models and zero convergence assumptions by drawing on a first-of-a-kind set of estimated quinquennial bilateral migration flows developed by Abel (2013). Using a multiregional cohort-component projection model, alternative future migration trends are explored based on a set of 'what-if?' scenarios. The results point to strong effects of population decline and ageing on projected emigration flows and highlight differences in the future level and distribution of populations around the globe between a constant-rates, a zero flows, and two 'what-if' scenarios.

1 Introduction

International migration is an important driver of population growth in many countries Lee (2011) and a major source of uncertainty in demographic projections. Data on international

migration flows is often limited in availability and comparability Kelly (1987); Salt (1993); Nowok *et al.* (2006). Consequently, global projection models are often based on net migration measures derived as residuals from demographic accounting. Future assumptions of net migration in projection models are often simplistic: where past patterns of net migration are not utilised and future projections of related variables ignored. For example, the United Nations assumes future net migration rates for all countries will gradually tend to zero, despite sustained increases in net migration in many developed countries.

Our paper is part of a bigger project on the development of a new set of Wittgenstein Centre for Demography and Global Human Capital (WiC) population projections, firstly by age and sex for 196 countries, and, second, by age, sex and educational attainment for 180 countries in the world. An earlier version of these projections was published in 2007 KC *et al.* (2010). The new WiC projections draw on substantially refined baseline data for fertility, mortality, migration and education, and assumptions that were derived from argument-based opinions of experts from all around the world collected through a web survey and an expert meeting.

The accurate projection of migration in the long run is one of the most difficult challenges in population forecasting. To improve the error in projections that is attributed to the migration component, three issues are of particular importance: the baseline data, the assumptions about future trajectories, and the way migration is modelled in the projections. This paper presents the first results of projections for 196 countries for the period 2010 to 2060, carried out using directional migration probabilities in a multi-regional cohort-component framework. Drawing on a new set of estimated migration flow tables Abel (2013), we explore the differences in projected size and age structure of populations under a set of four alternative assumptions about future migration intensities and patterns.

2 Data

This paper departs from the common practice of focusing on convergence of net migration rates towards zero. Instead we apply a multiregional projection methods to forecast global population for the period 2010-2060. The baseline migration data for the projection model are obtained from the application of a methodology to estimate global bilateral flow tables from known migration stock totals detailed in Abel (2013). What follows in this section is a brief overview of the general methodological concept, in order to allow the reader to broadly understand how the estimated migration levels by age and sex, required for the projection model, are derived.

The estimation of global migration flow tables is based upon linking sequential migrant stocks tables to derive the flow estimates to meet their differences. Stock data are, in comparison to international migration flow data, far easier to measure and more widely available, both across time and countries. This is reflected in the World Bank or United Nations migration stock data which include bilateral records from over 200 nations and back over five decades Özden *et al.* (2011); Nations (2012). In comparison, the 2010 revision of bilateral international migration flow data released by the United Nations Henning & Hovy (2011) covers only 43 nations,

predominately developed world countries, from the last two decades.

The greater availability of migrant stock data makes it an invaluable source of information on migrant patterns. The flows-from-stock methodology introduced in Abel (2013) links bilateral migrant stock data over time. Estimates represent the number of migrant flow transitions that are required to meet differences in migrant stock totals. For example, if a migration stock increases between two time periods, the minimum migrant flows to meet this change is estimated. At a global level, changes in all migrant stocks are considered simultaneously, and hence a complete and comparable set of bilateral migration flows are derived. Auxiliary data for changes in migrant stock populations from births and deaths are also accounted for using standard demographic procedures.

The application of this methodology to obtain the baseline migration flow data took advantage of recently published data by the United Nations Nations (2012) on bilateral migrant stock tables, by sex, at the start of each of the last three decades (1990, 2000 and 2010) for 230 countries. In order to estimate five year transition flows duing the base year period for the global projections, bilateral migrant stock tables for each sex were required in 2005 alongside the tables for 2010 from the United Nations. These mid-decade table were estimated by interpolating between each bilateral stock in 2000 and 2010. The flows-from-stock methodology was then run to obtain bilateral migrant transition flow tables by sex over the 2005-09 period.

As there was no information on migrant stock populations by age, we were unable to estimate any age-specific flows using the flows-from-stock methodology. Instead we derived estimates by age groups by assumimg all flows followed a seven parameter migration age schedule of Rogers and Castro to disaggregate each estimated flow in our bilateral table. The parameters for the age schedule matched closely to those of the fundamental parameter set given by Rogers and Castro, which were proposed after fitting schedules to internal migration data. To reflect our international application, we made some alterations to some parameter values, dependent on the country of origin. For all flows leaving OECD countries and Gulf States we varied parameters in the age schedule to provide a older labour force peak, and lower elderly migration rates. For flows leaving other countries we varied parameters in the age schedule to provide a more pronounced labour force peak, and lower elderly migration rates. Given the age-schedules, where the sum of the age-specific migration rates summed to unity, we multiplied through our assumed age specific rates during the 5 year interval to each origin-destination-sex table. This resulted in an array of origin-destination migration flow tables by sex and age. Finally, in order to obtain migration inputs into all countries in the projection model, we summed across all origin rows (and destination columns) in our flow table array to provide estimates of emigration (and immigration) to our selected countries, by age and sex. Figures 1 and 2 depict estimated immigration and emigration rates for the total population in the jump-off period 2005-09, calculated as percentage of the population in 2005.

3 Expert Views on future migration

A set of alternative assumptions about future international migration were developed based on expert views on the future trajectory of migration that were collected using an extensive online questionnaire (referred to as source experts hereafter) and a two-day expert group meeting (referred to as meta experts hereafter). The online questionnaire was sent to all members of international population associations in mid-2011. Overall, we obtained about 500 responses, 122 of which were for the migration module. Table 1 shows the distribution of the across world regions for which responses were given. There was a reasonable spread across countries, with a considerable share of resposes for the United States.

Table 1: Questionnaire responses by world region

World region	responses
North America	29
Western Europe	21
Latin America	17
Central and Western Asia	15
Southern and Eastern Europe	15
East and Southeast Asia	10
Africa	9
Oceania	6
TOTAL	122

The objective of the questionnaire was to obtain experts' views on the likely impact of a set of 30 arguments pertaining to future immigration and emigration levels to/from a country of their choice.[1] The impact that these arguments may have on migration were formulated in a neutral way without explicitly referring to their likely consequence on migration. The arguments aim to combine the various pull and push forces prevailing in more developed and less developed countries, including economic growth, demographic change, policy development and climate change. For example, one argument on economic growth reads: "Remittances will become more important for the economic development of migrant-sending countries". A full list of the arguments pertaining to five different forces is given in the Appendix. The arguments were grouped into five clusters. Towards the end of the online questionnaire, respondents were asked to assign weights of relative importance to each of these clusters. This sums up to 100%

[1] In the migration module, respondents were asked to give a point estimate and point estimate plus an 80% range for average annual numbers of net migrants in their chosen country in 2025-30. Unfortunately, United Nations net numbers of migrants were given in the questionnaire for the period 2005-09, as our new estimates of migration flows were not yet completed by the time the survey was conducted. Moreover, respondents noted problems with setting the 80% range using the web interface, which may explain a large degree of disagreement among respondents about future net migration levels for individual countries. We therefore found the assessment of the impact of arguments more beneficial for setting assumptions on immigration and emigration than the point estimates for future net migration

for all clusters combined. We computed the mean cluster weights over all respondents and countries, as they showed only minor regional differences.
For each of the 30 arguments, the experts were asked:

1. Based on your understanding of current scientific knowledge and with reference to the period up to 2030, do you think the argument is... (very likely to be wrong to very likely to be right)

2. If the above argument were completely true, what effect would this have on future levels of immigration? (strongly decreasing to strongly increasing)

3. If the above argument were completely true, what effect would this have on future levels of emigration? (strongly decreasing to strongly increasing)

Three key outcomes are provided:

1. Validity, ranging from 0 to 1 gives an indication whether a given argument is likely to be true, based on five predefined response options and the validity score attached to them.

2. Impact, assessing the hypothetical influence of a given trend on migration. The predefined range was from -1 (strongly negative) to +1 (strongly positive).

3. Net impact, assessing validity and impact in combination. This was calculated by multiplying the validity score with the impact score.

The results from the online questionnaire were complemented by an expert group meeting held at the University of Colorado at Boulder in autumn 2011. The participants, representing different geographic regions, scientific disciplines and areas of expertise included 11 meta experts, 2 representatives of the University of Colorado and 3 representatives of the WIC. Selected results from the online questionnaire were presented to the meeting participants to serve as a basis for discussion. All participants stressed the importance of departing from convergence to zero assumptions and making plausible assumptions about future migration flows. They also emphasized the need for more adequate data on contemporary migration flows. The lack of flow data and the dominance of zero convergence scenarios in existing global population projections meant that discussing future levels of immigration and emigration for each country in the world was a too ambitious task. In considering the issues related to the dearth of existing migration projections that could have served as a basis for discussions about future numbers of migrants, the aim of the meeting was to elaborate in qualitative rather than quantitative terms on the likely future trajectory of migration flows to and from the major world regions. The meeting participants (or meta experts) identified seven arguments from the online questionnaire that best capture the key determinants of migration that are likely to be most influential. In several round table discussions, we then asked the meta experts to comment on the relative importance of these arguments in shaping migration to and from world regions. We derived

aggregate scores representing the relative impact on a score from -1 for strongly negative to 1 for strongly positive.

Figures 3 and 4 show the mean net impact over all source experts on immigration and emigration for world regions and selected countries (outer circle), as well as the meta experts' views (inner circle). The results are visualised using Circos Krzywinski *et al.* (2009). Source experts' net impacts are calculated as simple averages over all respondents from a given country or region. The arguments are arranged by cluster in a circular layout. Each argument is denoted by its ID (which is also given in the appendix table) and the abridged argument text. The width of each cluster corresponds to its mean weight as stated by the respondents. Source and meta experts gave the economic and demographic clusters of arguments the strongest weight in terms of their impact on future migration. The least impact was attributed to the climate cluster, partly reflecting current uncertainty about future impacts.

The 7 key arguments identified by the meta experts as having the strongest impact on future trends were also given a strong impact by the source experts. Overall, meta and source experts were mostly in agreement as to the strength of the impact of arguments on future migration. The general picture is one of positive impacts of arguments on migration, resulting in an increase in migration levels over time. Economic recession and student visa systems are the only arguments expected to result in a decline of immigration to the more developed countries in Europe and North America, while several arguments pertaining to demographic, costs and policy dimensions are expected to increase migration. The validity scores of these most important arguments suggest that they are likely to be true (scores not shown).

4 Assumptions

The development of assumptions on future immigration and emigration for each country in the world was primarily based on (a) meta experts suggesting a 'business as usual scenario' to be most appropriate as a medium scenario, and (b) the net impact scores for the seven key arguments identified by the meta experts.

A 'business as usual' scenario assuming jump-off period rates to remain constant was suggested during the expert group meeting. Hence, our medium scenario assumes immigration and emigration rates estimated for the period 2005-09 to remain constant throughout the projection horizon until 2060. We make assumptions for rates rather than absolute numbers to take into account changes in the population size and age structure of origin populations. For example, using migration rates assumptions, we ensure that emigration from strongly ageing and weakly growing populations in Eastern Europe will decrease over the projected period. Adjustments are made to the constant rates assumption for 25 countries where rapid changes to migration trends occurred in the last decade that are unlikely to persist until the year 2060. For example, we assume a decline in immigration to Spain in the first two projected periods as a result of the recent economic recession.

The net impacts of key arguments on migration discussed in the previous section were

translated into two 'what-if' scenarios. The "Shifts in Global Economic Power" (referred to as 'shifts' scenario hereafter) scenario assumes a prolonged recession in North America and Europe, whereas strong economic growth prevails in East and Southeast Asia. As a result, immigration shifts from North America and Western Europe to the regions of strong economic growth. Assumptions under this scenario are based on the mean net impact of argument 1-7 "Economic recession" on immigration and emigration.

The "Divergence in in Economic, demographic and political pathways" scenario (referred to as 'divergence' scenario hereafter) assumes a rapid recovery of economies in the Western societies, causing income differentials to further widen. Moreover, migrant networks are assumed to result in continuing migration from less to more developed countries, where labor and skill shortages that arise from population ageing lead to increasing demand for immigrant workers. Assumptions under this scenario are based on the mean net impact of arguments 1-4 "Labour and skill shortages", 2-3 "Water conflicts", 3-3 "Youth bulge", 4-5 "Established networks" and 5-2 "Political instability".

The mean net impact scores were directly translated into a set of multipliers shown in Figure 5. The multipliers cause overall migration to decrease under the 'shifts' scenario, and to increase under the 'divergence' scenario. They were used to alter the base period (2005-09) immigration and emigration intensities under both scenarios. The same multipliers are applied to all countries in a given world region in the first two projection periods (2010-14 and 2015-19). The rates in 2025-19 are then kept constant throughout the projection horizon to 2055-59. Figure 6 shows the assumptions on future immigration and emigration under alternative scenarios for six selected countries.

The projection results for the 'what-if' scenarios are compared to a zero migration and a constant rates scenario. All four migration assumptions were combined with the medium fertility and mortality assumptions recently developed for the 2013 edition of the WiC global population projections.

5 Results

Our results demonstrate a number of differences in the future numbers and geographical distribution of populations around the globe between a constant-rates, a convergence to zero net, a zero flows and two 'what-if' scenarios assuming changes in migration patterns.

Figure 7 depicts the projected populations by world region under alternative scenarios. Differences are small but still noticeable, especially for the destination regions in North America and Europe. The traditional destination regions show stronger population growth under the 'divergence' scenario than under the 'shifts' scenario, whereas east Asia's population experiences stronger growth under the 'shifts' scenario. Populations in Europe and North America show the weakest growth under the zero migration scenario.

Figure 8 shows the projected numbers of migrants for selected countries. The results can be readily compared to the assumed immigration and emigration rates for these countries shown in

Figure 6. Using a medium scenario based on rates rather than numbers emphasizes the effects that changes in population size and age structure tend to have on emigration numbers.

Figures 8d, 8e and 8f compare the effects of a constant rates assumption for three countries with very different future population growth trajectories. Malaysia is predicted to grow steadily with only minor ageing of its population. Therefore, the predicted numbers of emigrants are almost stable over the projection horizon. In our multiregional modelling framework, numbers of immigrants depend on the size of the rest-of-the-world population. This approach certainly has its drawbacks, but appears to be more plausible than making immigration numbers dependent on the destination population. Comparing projected numbers of emigrants for Bulgaria (Figure 8e) and Burkina Faso (Figure 8f) highlights the strong effects of population growth on emigrant numbers. In Bulgaria, the predicted ageing of the population is so strong, that emigrant numbers plummet, whereas immigration increases slightly as a result of world population growth. Therefore, the country is predicted to change from a net emigration to a net immigration country by 2055-59. Figure 9 shows that the effect of population ageing and decline on emigration from Bulgaria is more pronounced for the younger age groups, with the decrease in emigration being most noticeable for young children and young adults aged 20 to 29 years. Immigration increases slightly over the projected period and world population ageing results in a slight right-shift of the immigrant age profile.

The effects of population ageing and decline on migrant numbers are also evident in several other countries. Figure 10 depicts the contribution of projected population change between 2010 and 2060 under the constant rates and the zero migration scenarios. Several eastern European countries are projected to have a higher population growth under the constant rates scenario than under the zero migration scenario. Although Bulgaria, Belarus and Ukraine had higher emigration than immigration levels in 2005-09, the projected number of emigrants declines over time due very low fertility levels. In contrast, the projected number of immigrants increases as the population in the rest of the world grows. Therefore, populations in countries with slightly negative net-migration in 2010 and negative natural population growth are projected to record less growth under a zero-migration scenario.

The world's population is in the midst of a fundamental transition from population growth to population ageing. Our projections have shown that international migration flows are likely to play a major role in redistributing population and, consequently, in determining the future trajectory of major emigration and immigration countries. While it seems unlikely that we will see the development of completely new migration patterns over coming decades, shifts in age structures of populations will almost certainly impact on the size of country-to-country flows. Our projections have also shown the potential impacts of shifts in the global economic power on migration trends, with China moving towards becoming a net immigration country. Our survey results reveal a remarkable agreement on the factors that are most likely to shape future migration. Based on their collective judgement, we are more likely to see an increase in global migration levels than a decrease, unless current economic problems remain unsolved.

Acknowledgments

The authors thank the source experts who responded to the online questionnaire and the meta experts who participated in the expert group meeting in Boulder, Colorado. The interpretation of responses and expert views on future migration is of course the sole responsibility of the authors. We also thank Fernando Riosmena, Raijshree Shresta, William P. Butz, Samir KC and numerous colleagues from the Wittgenstein Centre for their comments and assistance.

References

Abel, Guy J. 2013. Estimating Global Migration Flow Tables Using Place of Birth Data. *Demographic Research*, **28**(18), 505–546.

Henning, Sabine, & Hovy, Bela. 2011. Data Sets on International Migration. *International Migration Review*, **45**(4), 980–985.

KC, Samir, Barakat, Bilal, Goujon, Anne, Skirbekk, Vegard, & Lutz, Wolfgang. 2010. Projection of populations by level of educational attainment, age, and sex for 120 countries for 2005-2050. *Demographic Research*, **22**(Mar.), 383–472.

Kelly, John J. 1987. Improving the Comparability of International Migration Statistics: Contributions by the Conference of European Statisticians from 1971 to Date. *International Migration Review*, **21**(4), 1017–1037. ArticleType: research-article / Issue Title: Special Issue: Measuring International Migration: Theory and Practice / Full publication date: Winter, 1987 / Copyright © 1987 The Center for Migration Studies of New York, Inc.

Krzywinski, Martin, Schein, Jacqueline, Birol, \.Inan\cc, Connors, Joseph, Gascoyne, Randy, Horsman, Doug, Jones, Steven J., & Marra, Marco A. 2009. Circos: An information aesthetic for comparative genomics. *Genome Research*, **19**(9), 1639–1645.

Lee, Ronald. 2011. The Outlook for Population Growth. *Science*, **333**(6042), 569–573.

Nations, United. 2012. *Trends in International Migrant Stock: Migrants by Destination and Origin*.

Nowok, Beata, Kupiszewska, Dorota, & Poulain, Michel. 2006. Statistics on international migration flows. *THESIM: Towards harmonised European statistics on international migration*, 203–231.

Özden, Caglar, Parsons, Christopher R., Schiff, Maurice, & Walmsley, Terrie L. 2011. Where on Earth is Everybody? The Evolution of Global Bilateral Migration 1960–2000. *The World Bank Economic Review*, **25**(1), 12–56.

Salt, J. 1993. *Migration and population change in Europe.* Tech. rept. 19UNIDIR/93/23. United Nations Institute for Disarmament Research, (UNIDIR), New York, USA.

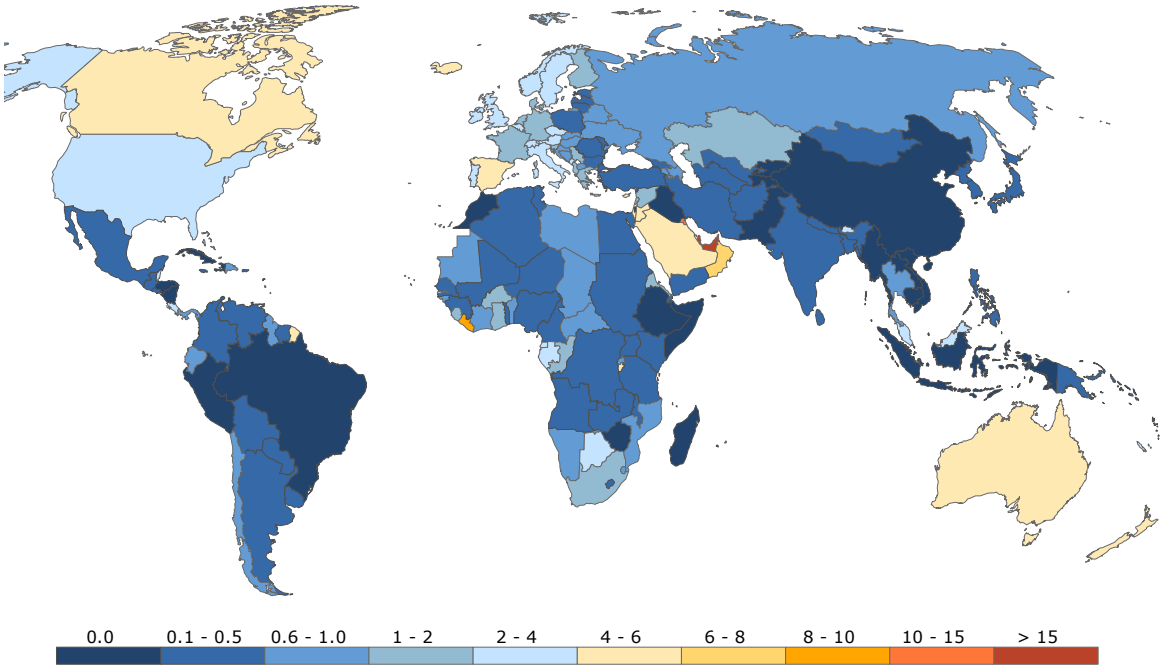

Figure 1: Estimated immigration rates in % of destination population, 2005-09.

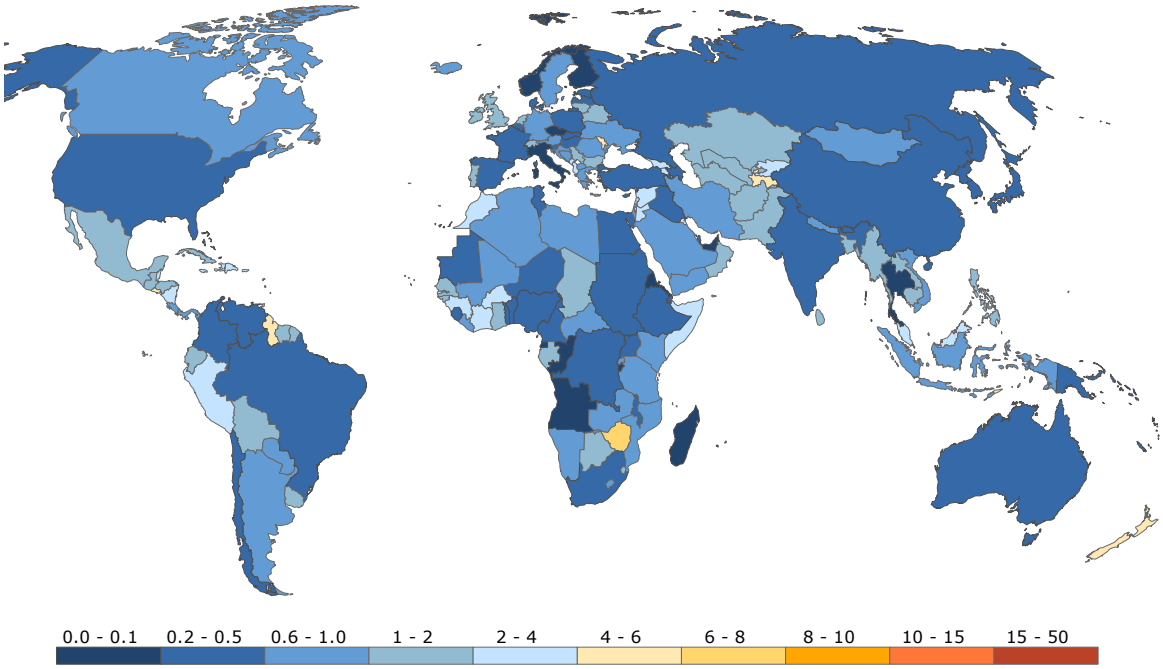

Figure 2: Estimated emigration rates in % of origin population, 2005-09.

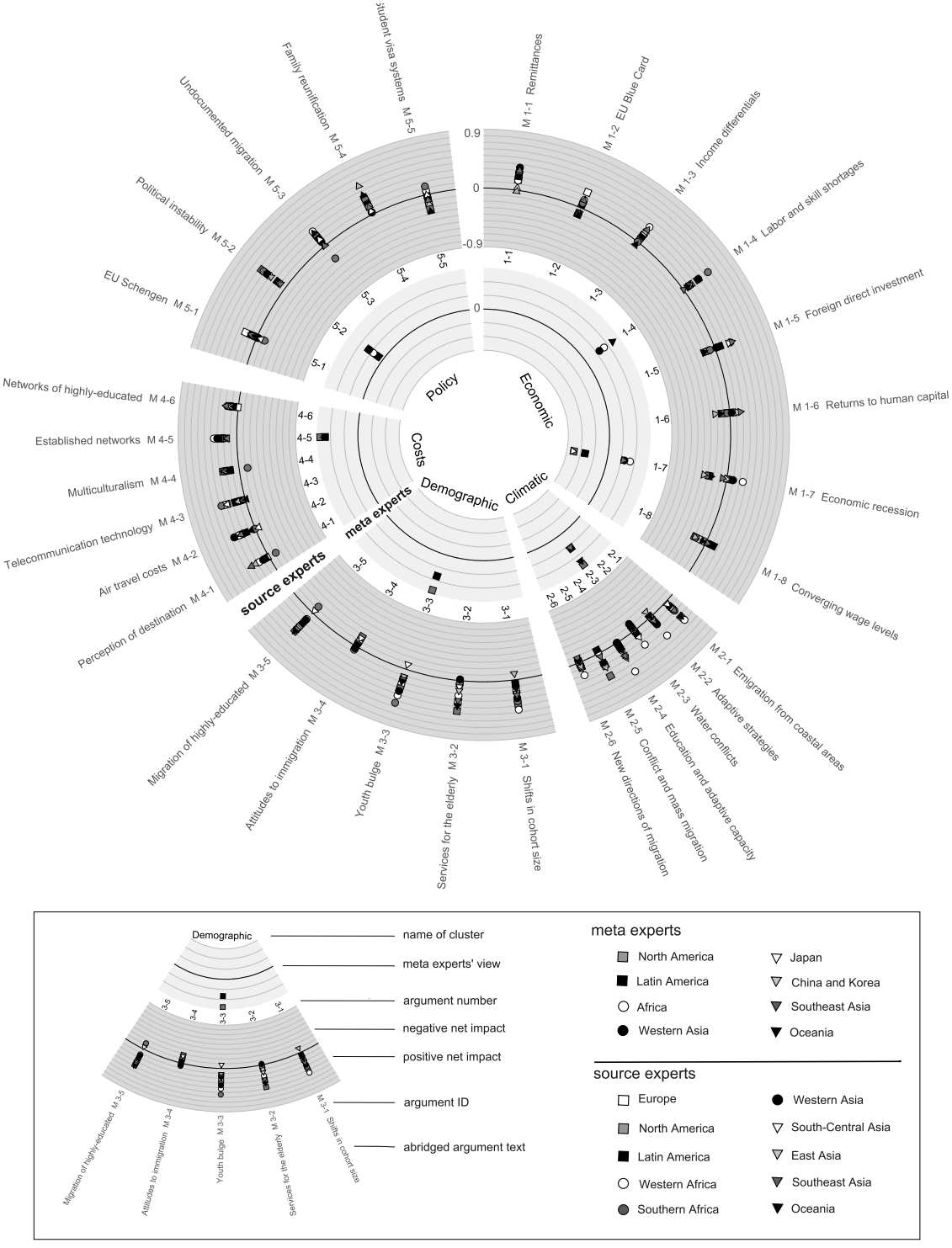

Figure 3: Net impact of arguments on immigration by world region.

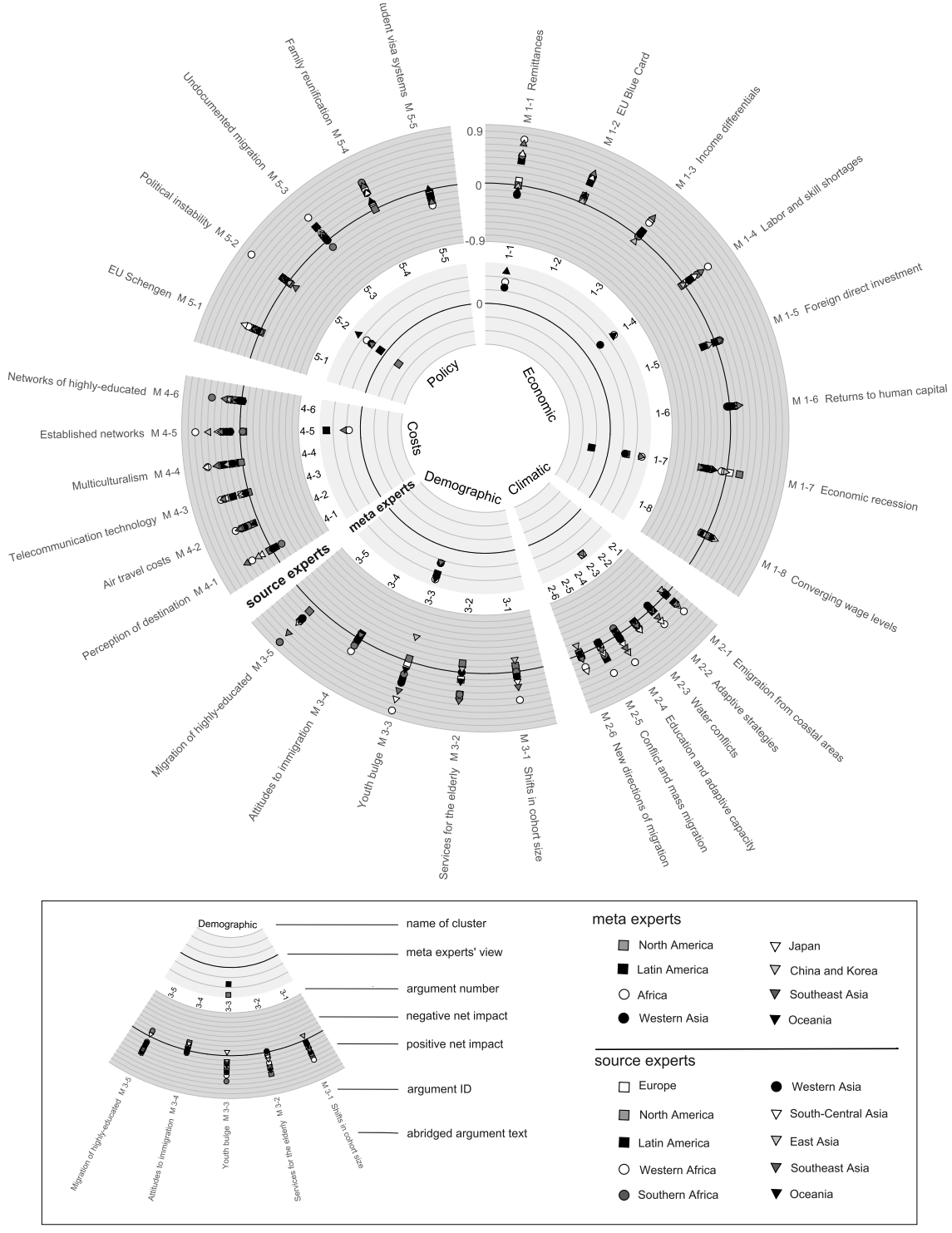

Figure 4: Net impact of arguments on emigration by world region.

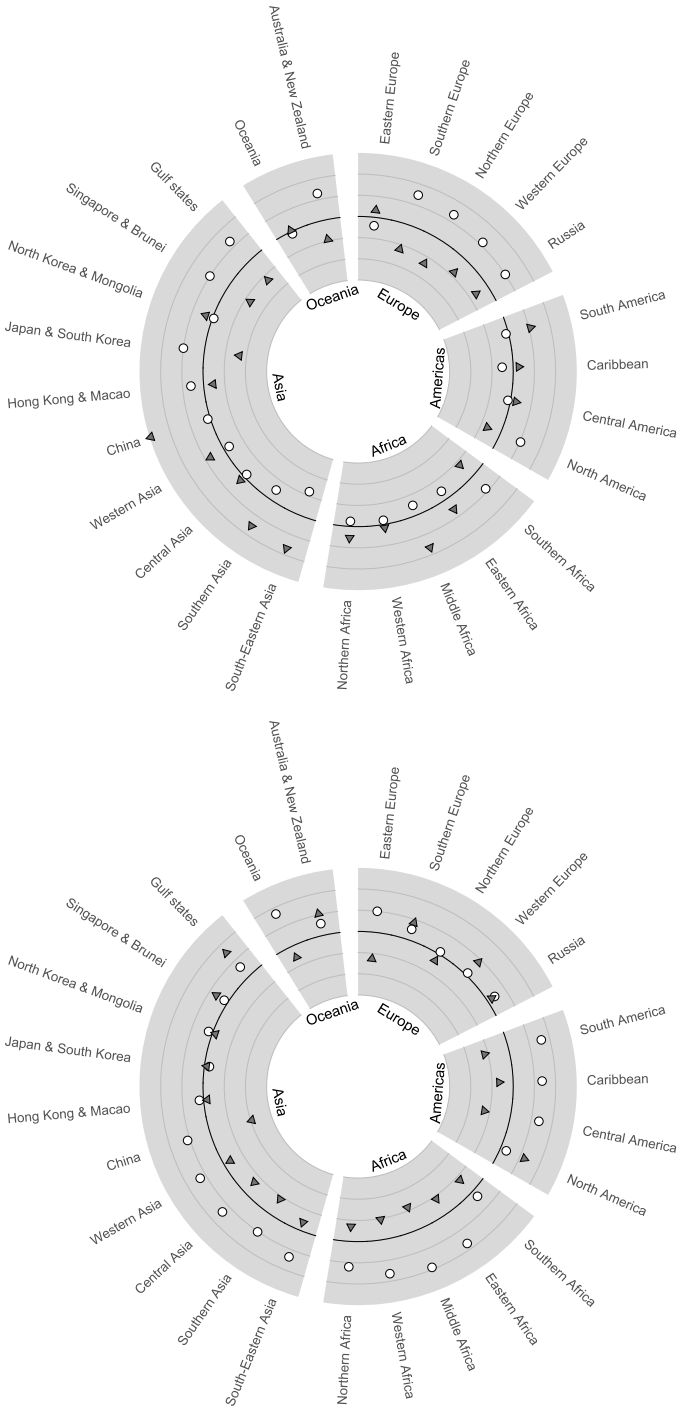

Figure 5: Multipliers on immigration (top) and emigration (bottom) for the 'shifts' scenario (dark grey triangle) and the 'divergence' scenario' (white circle) derived from expert views, by world region. Multipliers inside the solid line cause migration to decrease, multipliers outside the solid line cause migration to increase.

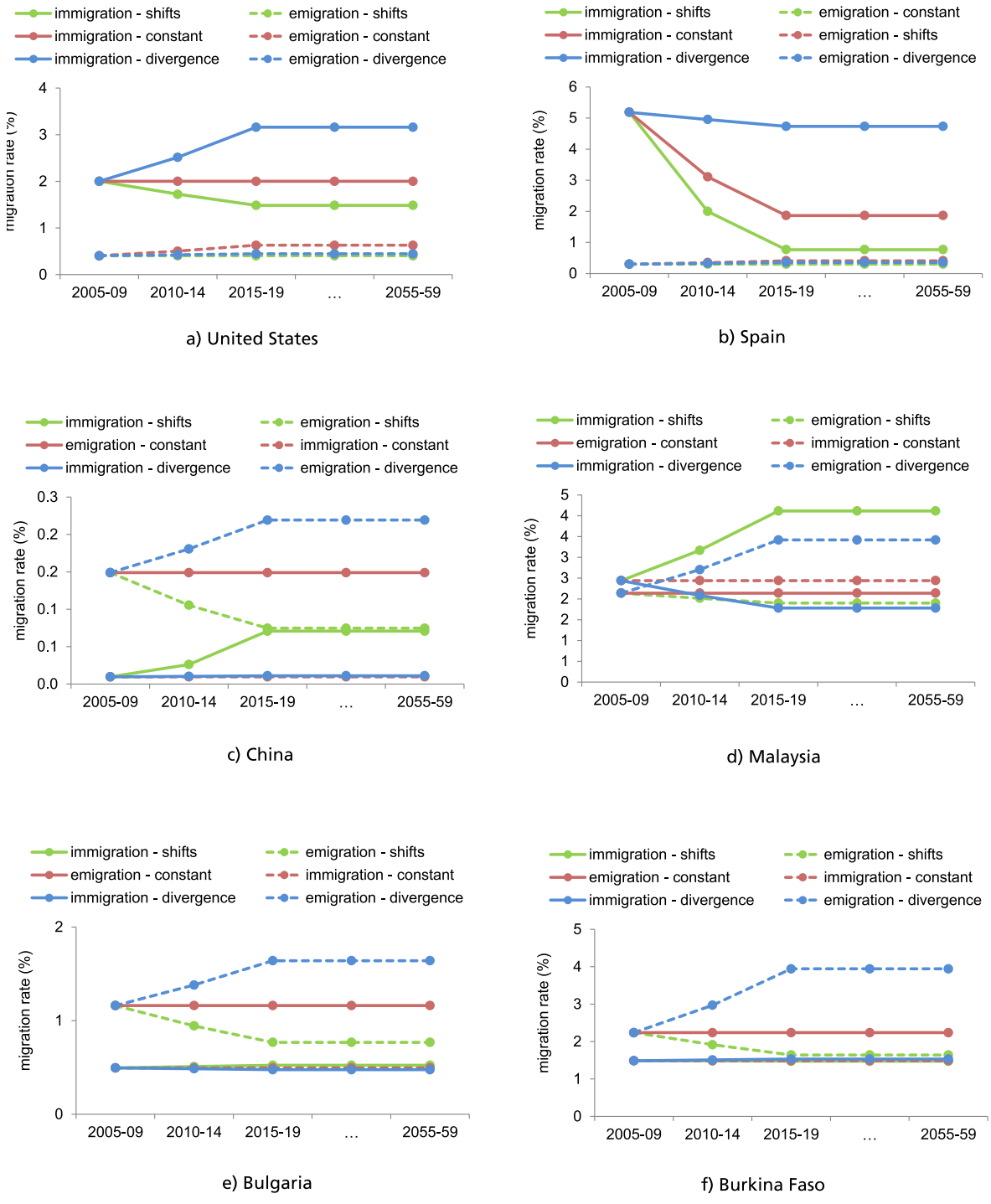

Figure 6: Assumed rates of immigration and emigration under alternative scenarios, 2010-14 to 2055-59.

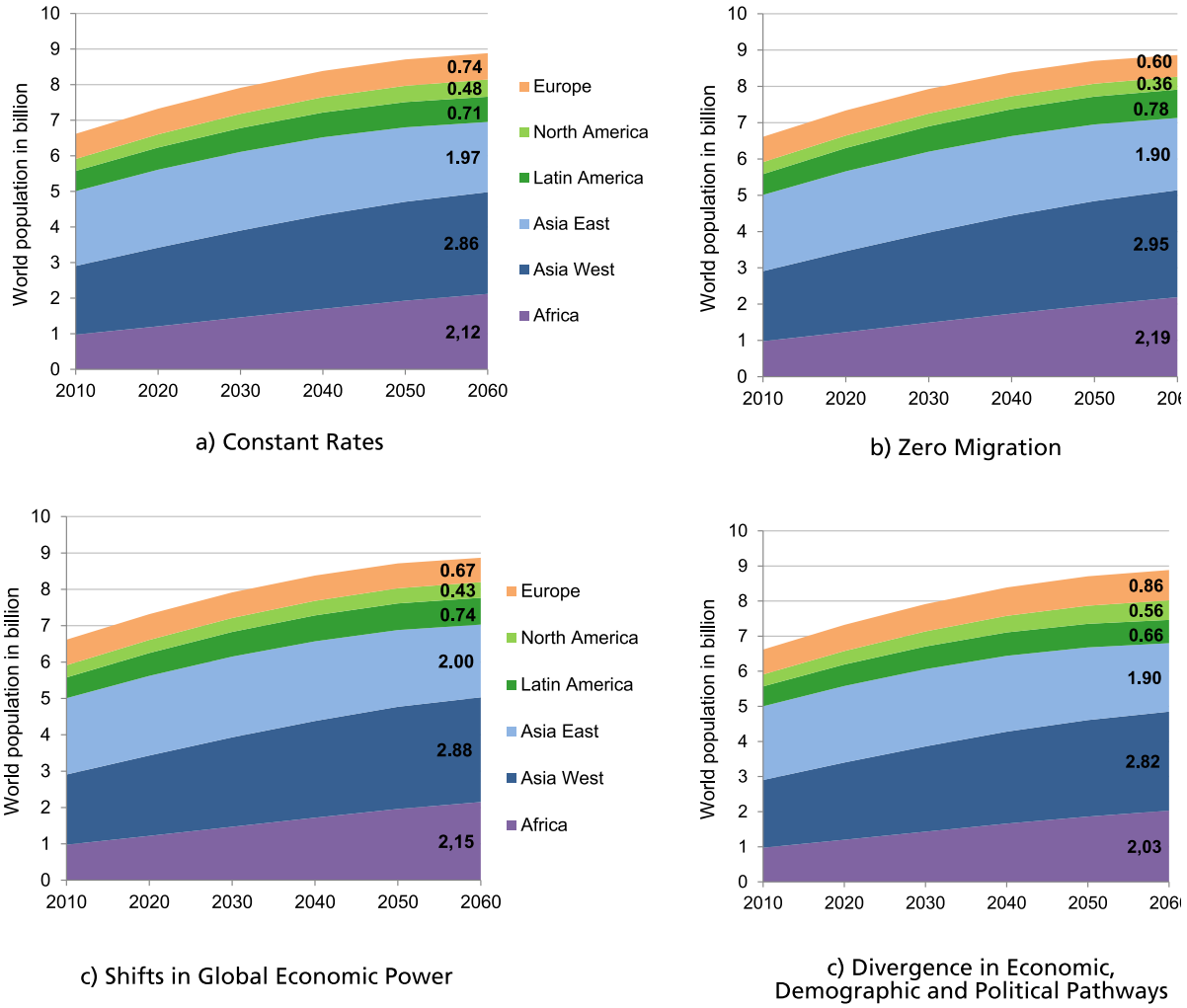

Figure 7: Projected world populations by major region under alternative migration scenarios.Labels indicate population in millions in each region in 2060.

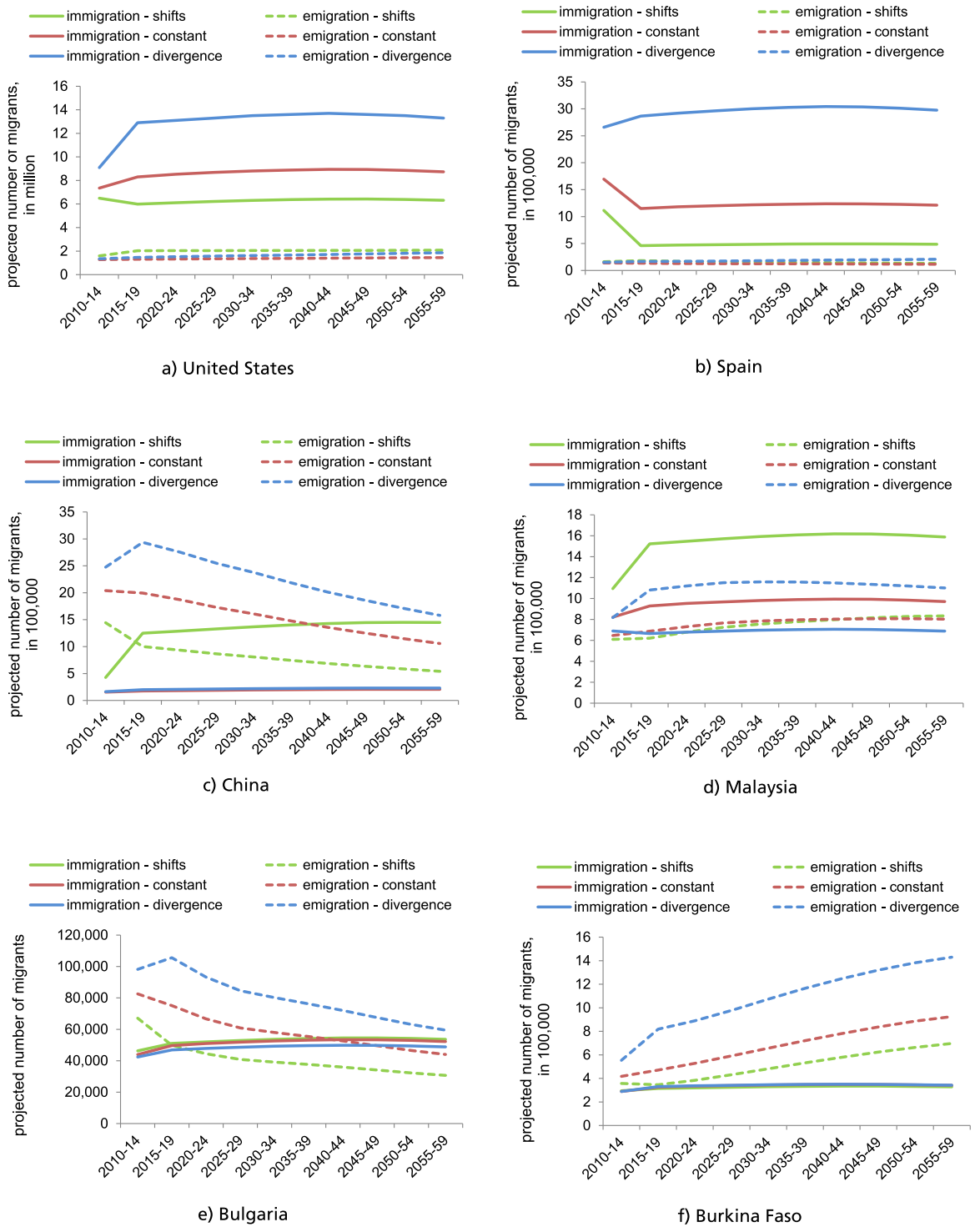

Figure 8: Projected number of immigrants and emigrants for selected countries under the constant rates scenario, 2010-14 to 2055-59.

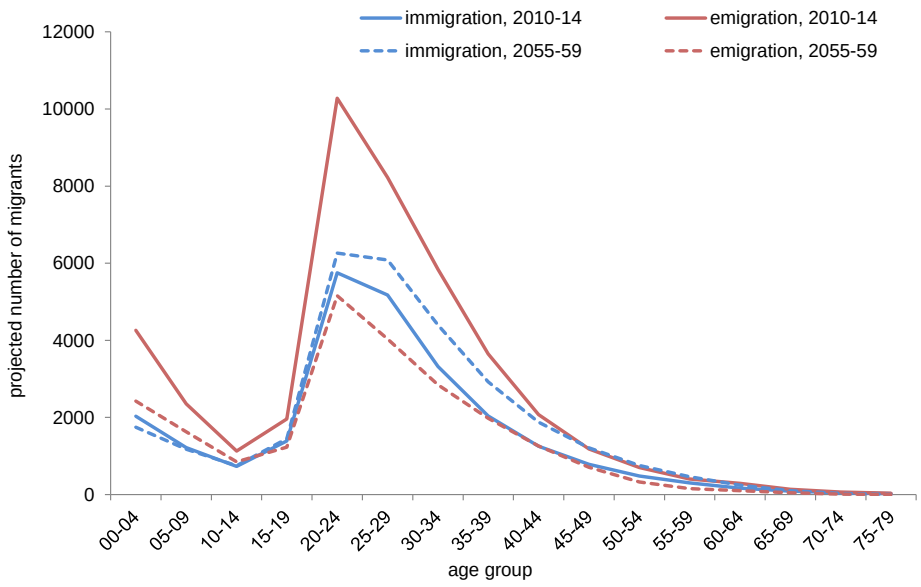

Figure 9: Projected number of immigrants and emigrants by age for Bulgaria, 2010-15 and 2055-59, under the constant rates scenario.

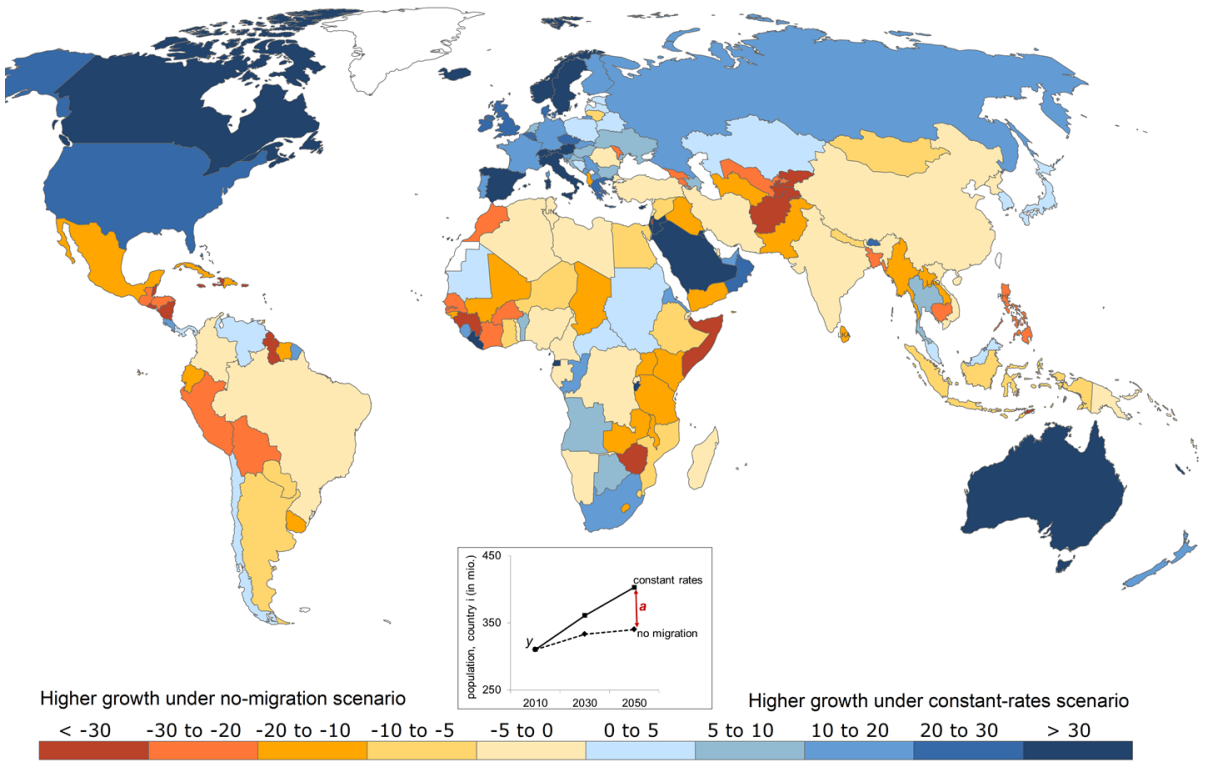

Figure 10: The contribution of migration to projected population change, 2010-2060: comparing constant-rates and zero migration scenario. Calculated as the difference in population growth between the two scenarios (a/y)

Appendix I: List of Arguments in Migration Online Questionnaire

1) ECONOMIC DEVELOPMENT

1.1 Remittances will become more important for the economic development of migrant-sending countries.

1.2 The EU "Blue Card" skilled immigration scheme will attract more highly-qualified migrant workers from non-EU countries on a temporary basis.

1.3 Per capita income differentials between Asian countries will further widen.

1.4 Temporary labor migration will increasingly compensate for skills shortages in developed countries and thus replace permanent migration.

1.5 Foreign direct investment in developing countries as a stimulus to economic growth will rectify the imbalance between supply and demand in the labor market in those countries.

1.6 There will be a global convergence in returns to human capital.

1.7 Major economic recessions/stagnation in industrialized countries will lead to less demand for migrants.

1.8 Global wage levels will converge in the long run.

2) CLIMATE CHANGE

2.1 International migration from low-lying coastal areas and small islands in the developing world will increasingly be driven by the negative impacts of climate change.

2.2 Populations in the Mediterranean region that are negatively affected by climate change will be successful in developing adaptive strategies.

2.3 Governments of North Africa and the Middle East will find peaceful resolutions to intensifying water and land-use conflicts.

2.4 Relatively better educated populations will have a higher adaptive capacity to the negative impacts of climate change.

2.5 Climate change will lead to conflict in poor countries and mass migration of asylum seekers to countries in the North.

2.6 Climate change will lead to new directions of migration such as from India or the Middle East to Siberia.

3) DEMOGRAPHIC FACTORS

3.1 Shifts in cohort size, especially related to the baby boom and bust, will play an important role in shaping international migration levels.

3.2 Strategies for ensuring the provision of adequate health and care services to the growing elderly populations in OECD countries will increasingly draw on immigrant workers.

3.3 The propensity to move abroad among 15 to 29 year olds will be particularly high in countries with a large "youth bulge".

3.4 Aging societies will be less open to immigration from different cultures.

3.5 More highly educated people will be more likely to migrate.

4) COST OF MIGRATION

4.1 Populations in developing countries will develop a more realistic perception of life in developed countries through information technology.

4.2 Air travel and international freight will become less expensive, thus reducing the financial costs of migration.

4.3 Communication technologies will be a viable alternative to face-to-face communication with friends and relatives left behind, thus reducing the psychic cost of migration.

4.4 Increasing multiculturalism in developed countries will reduce the linguistic and cultural barriers to migration.

4.5 International migration will mostly follow established paths and existing migrant networks.

4.6 Migrant networks are not as relevant for the migration of more educated people.

5) MIGRATION REGIMES AND POLICY

5.1 Among countries of the European Union, freedom of movement will make it impossible for governments to influence migration.

5.2 Political instability and oppression in African and Middle Eastern countries will result in more people seeking political asylum in democratic countries.

5.3 Developed countries will be largely unsuccessful in reducing undocumented migration through the tightening of immigration policies and the strengthening of border controls.

5.4 Family reunification policies in Western societies will support the right of a family to live together in the destination country.

5.5 Rich countries will tighten their student visa systems.