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Comparative Analysis of International Migration in Population Projections

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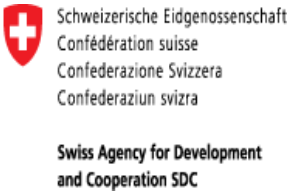

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Comparative Analysis of International Migration in Population Projections*

Thomas Buettner and Rainer Muenz†

Abstract

International migration is a complex phenomenon—often not sufficiently documented, not fully understood, and hard to predict. That has major implications for demographic analysis. This paper compares past estimates and projected future migration flows provided by major producers of global population projections. The comparative analysis clearly highlights some consensus, but also a considerable amount of disagreement about the size and direction of actual migration flows between major sending and receiving countries. Basic assumptions about future flows also significantly diverge. The data sets analyzed in the paper display a higher degree of sophistication in measuring and modeling fertility and mortality compared with the efforts applied to measuring and modeling geographic mobility. In addition, projections beyond 2050 assume a gradual disappearance of international migration (at least on a net basis), which could be interpreted as the result of an eventual convergence of global living standards, but might also be challenged based on the fact that during the past 100 years the number of international migrants has grown more quickly than has the number of people living on our planet.

Key words: International migration, Global migration flows, Spatial mobility, Population projection, Migration estimation, Migration projection.

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1. International Migration Receives Short Shrift in Demographic Projections

Projecting international migration is not an easy task.[1] In many developing countries empirical evidence about past and current migration flows is almost entirely missing, and for a number of developed countries data are also incomplete or unreliable. At the same time international migration in population projections has been, if not neglected, at least treated unsatisfactorily. The dearth of data is partly to blame for this patchy approach, and the often seemingly erratic nature of migratory flows complicates matters further.

However, the unsophisticated treatment of international migration in many population projections cannot be explained simply by the lack of data and the hesitation of demographers and population economists making the projections. There are other reasons as well: Population projections are usually made for nation-states or regions within states. The data fed into such projections are usually also produced within the institutions, regulatory frameworks, and perspectives of each nation-state. Projecting international migration, however, requires that assumptions be made about other nation-states (that is, current and future sending or receiving countries), which is quite often beyond the scope of national or regional projections that treat other countries as "rest of the world."

In addition, our understanding of migration flows, and therefore our ability to predict them, is limited. Social scientists and economists can, to a certain degree, analyze why people decide to emigrate from their native country and arrive at some plausible scenarios for intentions and future movements. Yet it is much harder to explain and understand, let alone to anticipate, the motives behind the selection of particular receiving countries, that is, to model the number and structure of immigrants coming to a particular country, be it on a temporary, permanent, or circular basis, and be it as laborers, dependent family members, or refugees.

One way to tackle complexity is to reduce it by simplifying the pertinent phenomena, which is what demographers and population economists have routinely done in the past. They have used net migration (that is, the difference between immigrants and emigrants) as a proxy for flows of migrants. They have also reduced demographic interaction to net flows between the country under consideration and the rest of the world.[2]

Why would it be important to improve the integration of international migration into demographic analysis? And to apply more sophisticated models covering international migration in global population projections in particular?

- The main reason is that the movement of people across borders has become much more frequent and ubiquitous and involves people from almost all countries.
- Migration gains have become a major part of the demographic dynamics of many developed countries: slowing down population aging, reducing population decline, or replenishing a shrinking labor force.
- For many poorer countries, emigration has become important because their diaspora members working and living abroad are a major source of economic support through remittances.

1. For a discussion of common data deficiencies and possible avenues for improving the account of international migration, see Economic Commission for Europe (2014).

2. A more realistic, but still simplified, approach that includes interaction is the bi-regional migration model, discussed in section 4 of this paper.

- In some parts of the world, refugee flows also play a demographically important role. Refugee movements can be seen as a lifesaving response to dire circumstances beyond individual control.

Box 1. Who Is a Migrant?

Two definitions may apply to the term "international migrant." The definitions differ mainly in the timing of the act of migration, occurring either in the past or in a specific period under analysis.

(a) A migrant is sometimes understood to be someone who was born outside his or her current country of residence. Being now in a country other than the country of birth, he or she must have moved—or migrated—sometime in his or her lifetime. Censuses or labor force surveys are the usual source of this type of information. The moment when the geographic movement between the country of birth and the country of residence took place, however, is not always registered in the respective census or survey and, if known, may have taken place recently or in the distant past. This definition allows the share of foreign-born as a percentage of the total population to be calculated.

(b) A person actually migrating during a specific period is also called a migrant, but here with a clear reference to the timing of the event. This definition allows for the calculation of

This paper compares the role of international migration in several global population projections, the procedures and methods applied, the data involved, and the results generated. In a first step, the databases are documented (section 2), followed by a brief review of estimates of international migration (section 3). Section 4 examines three global population projections with respect to their underlying approaches to generating international migration assumptions. Sections 5 and 6 discuss results of international migration projections, including their impact on future population dynamics. The paper concludes with a summary and suggestions of possible next steps (section 7).

2. Data

This paper analyzes migration estimates and projections published by major producers of global population estimates and projections:

- The United Nations Population Division (UNPD)[3]
- The U.S. Census Bureau (USCB)[4]
- The Wittgenstein Centre for Demography and Global Human Capital (WiC).[5]

3. The UNPD of the Department of Economic and Social Affairs, at the United Nations Headquarters in New York, has the longest record of production of global population estimates and projections. The latest issue of its series of World Population Prospects is the 2015 Revision. See http://esa.un.org/unpd/wpp/index.htm

4. The USCB produces global population estimates and projections through its International Programs center in Washington, DC
See http://www.census.gov/population/international/data/idb/informationGateway.php.

5. The WiC is a joint venture between the World Population Program of the International Institute for Applied Systems Analysis, the Vienna Institute of Demography of the Austrian Academy of Sciences, and the Demography Group and Research Institute on Human Capital and Development at Vienna University of Economics and Business. See http://witt.null2.net/shiny/wittgensteincentredataexplorer

Box 2. Actual Migrants versus Net Migrants

An international migrant is a person who has, according to some legal or other criteria, actually moved his or her usual residence from one country to another. Migrants are the actors in gross migration flow statistics (immigration and emigration).

The concept of net migration does not involve any direct actor; it represents the numerical net effect of inflows minus outflows. For analytical purposes only, net migrants may be defined as the minimum number of persons that would have moved if only immigration or only emigration had taken place. A positive net migration figure may then be understood as net immigration, and a negative net migration figure as net emigration.

The data set produced by the Statistical Office of the European Union (EUROSTAT) is not included in this comparison.[6] The estimates and projections published by EUROSTAT are excluded because they cover only the 31 European countries, including the 28 member states of the European Union.

Also not included are three very important data sets:

- The Organisation for Economic Co-operation and Development (OECD) databases on international migration and the integration of migrants[7]
- The Determinants of International Migration (DEMIG) data set established by the International Migration Institute (IMI) at Oxford University in cooperation with the OECD[8]
- The Migration Modelling for Statistical Analyses (MIMOSA) data set established by a consortium of research institutes.[9]

The OECD data set was not analyzed because it does not contain any projections of future migration flows. Although the OECD has a long tradition of collecting and interpreting migration data from both its member states and selected other countries,[10] it traditionally does not undertake population or migration projections. In anticipation of the 2016 edition of its flagship publication *Perspectives on Global Development*, however, it is discussing inclusion of the likely impact of future migration flows.[11]

Oxford's DEMIG data set comprises new estimates for past immigration and emigration flows for 163 countries (DEMIG total) and migration corridors for 34 reporting countries (DEMIG C2C), which would be of interest, in particular when comparing them with estimates undertaken by other institutions (for

6. The latest population projections prepared by EUROSTAT, entitled EUROPOP 2013, comprise data for all 28 EU Member States, plus data for Iceland, Norway, and Switzerland, covering the period 2013 to 2080. These projections are available online at http://ec.europa.eu/eurostat/web/population-demography-migration-projections/population-projections-/database.

7. http://www.oecd.org/els/mig/oecdmigrationdatabases.htm.

8. http://www.imi.ox.ac.uk/projects/demig.

9. Netherlands Interdisciplinary Demographic Institute; the Central European Forum for Migration Research, Poland; the Southampton Statistical Sciences Research Institute, United Kingdom; Université Catholique de Louvain, Belgium (http://mimosa.cytise.be/).

10. http://www.oecd.org/els/mig/dioc.htm. The OECD also publishes an International Migration Outlook annually.

11. See http://oecd.org/dev/migration-development/Agenda_%20PGD%20Expert%20Meeting%2024-25%20February%202015_PRINTING.pdf.

example, UNPD and WiC). This data set, however, was also not analyzed because IMI at Oxford University is not planning to use it for any projections of future migration flows.[12]

The main objective of the MIMOSA project, funded by Eurostat, was to develop methods to reconcile the differences in international migration statistics in European countries. The project produced estimates of both migration flows and population stocks for six years (2002–07).

The three producers of international population projections that provide access to their data do not necessarily cover all countries and territories of the world. WiC, for instance, has chosen to include only countries with a certain number of inhabitants; UNPD and USCB do not use a threshold for inclusion, but differ somewhat in their classification of countries or territories.[13] As a result, WiC covers 195 countries; USCB covers 220 countries and territories; UNPD covers 233 countries and territories, but reports estimates and projections in the 2015 Revision for only 201 countries[14] (see table 1).[15]

2.1. The Residual Concept of Net Migration

Many national statistical offices and most international agencies use the concept of net migration for formulating migration assumptions in their population projections. This time-honored approach is practical, economical, simple, and most important, possible with existing statistical data. Net migration is a construct that is never directly observable. It is often estimated by applying a residual method, the balancing identity of demography. The residual approach expresses in a formal way the fact that the only components that change the size and composition of a population are

- Births (by adding new people at age zero to the population)
- Deaths (by removing people at all ages from the population)
- Immigration and emigration (by adding people to or removing people from the population at all ages).

If the population at two times and the number of births and deaths between these two times are known or can be reliably estimated, then the net number of immigrants minus emigrants can be obtained by a simple arithmetic operation: net migration gains or losses must be the residual. Only if a country has a well-developed statistical system can net migration be calculated as the difference between observed immigration and emigration.

12. Status as of July 2015. It is assumed that the DEMIG data will become accessible in 2016.

13. Statistical data provided by UNPD and USCB include non-sovereign political entities such as French Guiana; Hong Kong SAR, China; the Palestinian Territories/State of Palestine; and Puerto Rico.

14. Countries with 90,000 or more inhabitants in 2015.

15. In the remainder of the paper, the term “country” is used for statistically represented entities regardless of political status (fully sovereign, semi-sovereign, non-sovereign).

Box 3. Characteristics of the Data Sets from the UN Population Division, the U.S. Census Bureau, and the Wittgenstein Centre

The data made available online or through other channels are generally restricted to a selection of indicators, which puts some constraints on the analysis undertaken in this paper. Data used in this comparative analysis cover all years or periods available, including past estimates and projected future (net or gross) migration flows. All three data producers (the United Nations Populations Division [UNPD], the U.S. Census Bureau [USCB], and the Wittgenstein Centre for Demography and Global Human Capital [WiC]) center their demographic data at midyear. For instance, the UNPD time series starts at midyear 1950, its next population entry refers to midyear 1955, and so on. Demographic events such as births, deaths, and migration are available for five-year periods. The events in the first period occur, therefore, between midyear 1950 and midyear 1955, a five-year period that stretches over six calendar years. The same format applies to the WiC projection data, which begin in 2010.

This arrangement has been customary because of the limited availability of demographic information, especially from many developing countries. An additional benefit is that it "hides" temporary fluctuations and erratic short-term trends. Similar benefits are attached to the use of five-year age groups, which avoid, to a certain extent, the irregularities stemming from inaccurate age responses from censuses, surveys, and vital registration in a number of countries. Therefore, five-year periods and five-year age groups are seen as beneficial because they smooth-out erratic events or response biases.

For the purposes of this paper, data from the USCB were adjusted to refer to calendar years instead of periods between two adjacent midyear dates. To make all data comparable, the demographic data from UNPD and WiC were transformed into single-year data, also adjusted to refer to calendar years.

Past trends in international migration reflect both demographic dynamics and political and socioeconomic changes experienced by a country. Knowledge of past trends in international migration is also an important input for generating assumptions about future trends.

Both USCB and UNPD spend a considerable amount of time regularly producing and updating estimates of past demographic components, for example, births, deaths, and net migration. The approach is seemingly simple, but is actually cumbersome and labor intensive: For any given country, past estimates are obtained by reconstructing past demographic history using the cohort-component method of demographic accounting and projection. Indeed, UNPD's and USCB's time series for the periods before the base year (2015 and 2010, respectively) are actually produced by forward projecting the population from a certain time in the past. This approach ensures that the estimates are internally consistent and are as close as possible to demographic statistics observed in the past. The reconstruction of the demographic past covering a certain period until a specific base year in connection to a particular population projection fills a considerable gap left by official statistics. It is also a useful basis for the formulation of future trends of, in this case, international migration.

Unlike the other producers, WiC has not yet produced past demographic estimates, but relies mainly on data provided by UNPD and EUROSTAT, with the partial exception of international migration. The assumptions of international migration in the 2014 WiC world population projections are based on estimated gross flows during the five-year periods 1990–95 and 2005–10 derived from available stock data of foreign-born populations in about 195 countries (Abel 2013). The availability of those estimated stocks for the vast majority of countries enables WiC to apply a flow-based migration approach and, thereby, avoid some of the pitfalls of

3. Migration Estimates

Immigration and emigration for an individual country rarely if ever balance, so countries may experience gains or losses in population size as a result of net migration.

For the purposes of this paper, a limited number of sending and receiving countries were selected for closer review and analysis. These countries are listed in table 4, with aggregate net migration figures as estimated by UNPD for the period 2005–09. The selection of 12 net receiving countries and 12 net sending countries (see figures 1 and 2) was, to a certain extent, arbitrary and favors large countries with large net migration; however, a few countries that are comparatively small, but experience a large relative impact of net migration are also included (Qatar, Kuwait, and the United Arab Emirates).

For many countries a comparison of past estimates by the main data producers shows similar results in magnitude and direction of net migration. But some countries exhibit significant, even surprising, discrepancies. Considering that all three data producers have access to the same statistical data, the differences can be largely attributed to different institutional constraints and assumptions and their practical application.[16]

3.1. Countries with the Largest Absolute Net Migration, 2005–09

The public perception of international migration is largely framed in absolute numbers. Absolute net migration estimates are therefore analyzed first (see table 5).

Of the 10 countries with the largest net migration losses (that is, the main net sending countries) only 6 are in the top 10 group of each of the three data producers (Bangladesh, China, Mexico, Pakistan, the Philippines, and Zimbabwe). The estimated magnitudes for countries with the largest net migration losses also differ considerably: While UNPD estimates net emigration of about 3.6 million for Bangladesh, USCB and WiC estimate only 2.8 million and 2.9 million, respectively: a difference of about 800,000. India ranks second according to UNPD and first according to WiC, but is not even among the top 10 net sending countries according to USCB.

Similar discrepancies can be identified for countries gaining population as a result of net immigration, (that is, the main receiving countries). Among the 10 largest receiving countries as estimated by the three data producers, only 6 appear in all three top 10 groups (Canada, Italy, Russia, Spain, the United Kingdom, and the United States). The three data producers also do not agree on the magnitude of gains estimated for the largest net receiving countries (except for the United States). For instance, USCB estimates the second largest net migration gain during the period 2005–09 to have occurred in Spain (2.5 million), while UNPD sees the United Arab Emirates as ranking second to the United States. For Russia, the assumed net gains vary by a large margin: UNPD estimates about 2.5 million during the

16. USCB and UNPD have long histories of trying to generate consistent estimates by adjusting, among other factors, census figures for enumeration errors as well as the components of change (births, deaths, net migration). These adjustments are made on the basis of careful analysis of all demographic components involved and after a full reconstruction of the demographic history by age and gender using the cohort-component method. But even if much care is spent analyzing the available data, and if adjustments are made, some level of uncertainty always remains because the actual errors in registering births and deaths and in enumerating populations at censuses are not precisely known. Much of the remaining uncertainty is likely to be absorbed by net migration estimates using the residual method. This explains much of the remaining discrepancy in estimated net migration between the main data producers.

period 2005–09, while USCB estimates some 1.5 million, and WiC estimates an even smaller net gain of only 1.1 million.

One might assume that migration estimates for countries with well-developed statistical systems would show more conformity in direction and magnitude. However, for Estonia (since 2004 a member of the European Union), for instance, UNPD and USCB estimate net migration losses during the period 2005–10 of about 13,000 and 21,000 people, respectively, while WiC estimates almost zero net migration for the same period. For Poland the three sources even estimate opposite signs: WiC estimates net immigration during the period 2005–10, while UNPD and USCB estimate net emigration of a similar magnitude (table 6). Also, even if the three data producers agree on the direction of international net migration, its magnitude may still be significantly different: for Romania, for example, WiC estimates a negative net migration balance (that is, a net loss) almost three times higher than the estimates produced by USCB, while the UNPD estimates are about seven times higher than WiC's.

3.2. Countries with the Largest Relative Net Migration, 2005–09

It is not surprising that, in absolute terms, the most populous countries are among those with the largest migration gains or losses. It is, however, not only the absolute size of migration that matters, but also its magnitude in relation to population size. Hence, when considering the relative magnitude of net migration, a different picture emerges (table 7). Even if only countries with 1 million or more inhabitants[17] are considered, countries with the largest relative impact tend to be much smaller, on average, than countries with the largest absolute net migration (table 5). Migration estimates, whether calculated as a residual (UNPD and USCB) or obtained from simultaneous estimation of gross migration flows (WiC) do not provide a clear picture of past trends.

3.3. Pairwise Comparison of Countries

Comparison of a limited number of countries, selected either by absolute or relative magnitude of net migration, shows a certain degree of variation between the three producers of migration estimates. But what level of variation exists for all countries considered? A crude measure of similarity can be calculated by a pair-wise regression of the net migration rates of one data producer against those of another. A scatter plot of the data provides a visualization of that comparison (see box 4).

Of the three producers of international population projections, only UNPD and USCB are engaged in estimating past migration trends. Past international net migration estimates from the two producers are plotted in figure 3.

The cloud of available estimates organizes itself along the main diagonal, suggesting a certain degree of similarity. But a substantial number of points are not only far away from the main diagonal (showing different magnitudes), but those in quadrants II and IV signal different signs for the net migration estimates.

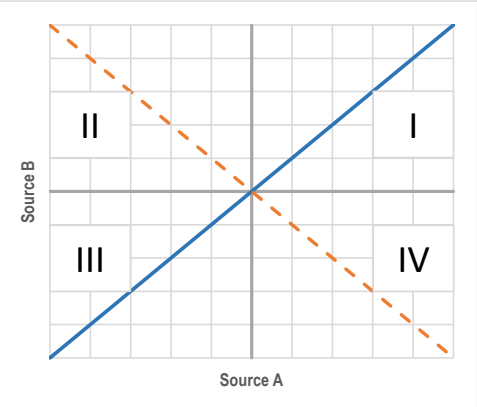
17. Total population in 2010.

Box 4. Comparing Data from Two Different Sources

The comparison of migration data from two different sources can be summarized using a chart that plots pairs of data (each for the same country and time period) from one source against another source in an XY chart (scatter plot). In such a chart, the plotted data may appear in each of four quadrants, numbered counterclockwise according to mathematical custom.

A perfect match in sign and size would show the individual points exactly aligned along the main diagonal (blue line from quadrant III to quadrant I). If not on the main diagonal, but still in quadrants I and III, data would share the same sign, but not be perfectly matched in size. If the data points line up along the second diagonal (red line from quadrant II to quadrant IV) the data pairs would have the same absolute value, but opposite signs, a case very unlikely for the comparison of net migration figures. Finally, cases with opposite signs, but different values are also located in quadrants II and IV.

Schematic chart for data comparison



Combination of signs for two sources and their location in chart

Quadrants	Source A (x-axis)	Source B (Y-axis)
I	**+**	**+**
II	**-**	**+**
III	**-**	**-**
IV	**+**	**-**

4. Comparative analysis of international migration assumptions

The three producers of international population projections each follow their own guidelines, protocols, and methodologies when formulating assumptions about future international migration trends. These guidelines are based on institutional history and experience, and are updated as seen fit to reflect new trends and methods. None of the three producers uses an explicit guiding theory of international migration. At the most general level, the trends are based on the most recent situation, which is allowed to affect the immediate future, after which persisting trends are assumed to be constant, followed by a final period of convergence to zero net migration.[18]

For the formulation of short-term trends, the experts employed by each institution are given considerable room to deviate, if necessary, from the more general guidelines and to alter or adjust the duration of the short-term period. For the medium-term trends, these experts may, for exceptional and well-founded cases, deviate from the assumption of constancy that would be required by the guidelines. As a result, a comparison between data producers does not necessarily show similar trends, let alone the same magnitude of migration. (For a comprehensive summary of assumptions and methods used by the three main producers of international migration projections, see table 8.)

18. The projections prepared by USCB extend only to midcentury, so a final convergence phase is not present.

4.1. United Nations Population Division

The UNPD has the longest institutional history of international population projections. Since 1951, it has produced 24 rounds of its global population estimates and projections. To date, the latest version of its series of World Population Prospects (WPP) is the 2015 Revision, which is the basis for the comparisons in this paper. WPP currently covers 233 countries and territories, making it the geographically most complete data set (see table 1).[19]

Focusing its attentions and efforts on developing countries, a considerable amount of work has been dedicated to establishing consistent estimates of past trends. Because of the lack of official data for many developing countries and changes in the geopolitical landscape of the world, the consistent estimates of past trends are one of the main results of the UNPD's work. Even if the projections are technically not population projections (but "demographic back casting"), they are an important precondition for formulating assumptions about future demographic trends. These estimates of the demographic past have been used, for instance, as the basis for developing models of fertility and mortality trends. However, no such attempts at projecting international migration have been found to be promising so far. The formulation of migration assumptions remains a matter of guesswork and reliance on expert opinion to a striking extent, in contrast to the mathematical, model-based approach in place for fertility and mortality.

The UNPD formulates its assumptions about future net migration by age and gender separately for each country (UNPD 2014, 36–38). These assumptions are based on a variety of sources: official data on net international migration and, if available, total immigration and emigration; data on labor migration flows, family reunion, and refugee flows; estimates of undocumented or irregular migrants; and data on refugee movements (both those seeking refuge and those returning to their home country). The most recent relevant data sources are documented for each country and published on line.[20]

Each of the different types of international migration (regular migration, circular labor migration, refugee movements, and asylum seekers) is considered separately and translated into future trends. In all cases in which regular international migration was stable during the recent past, it is assumed that average levels stay constant until 2050. With regard to asylum seekers, UNPD usually assumes that refugees return to their countries of origin within a time horizon of 5 to 10 years. Similarly, labor migration is considered to be temporary. Returning refugees and labor migrants are appropriately aged and demographically reincorporated into their countries of origin. Finally, trends for each type of migrant, if they exist, are added and become the input into the projection procedure based on the cohort-component method.[21] As a result, net migration levels drop between 2010 and 2020 (as a result of an assumption that current asylum seekers return to their countries of origin) and stay constant until 2050.[22]

19. Although 233 countries are covered, the UNPD 2015 Revision only reports estimates and projections for the 201 countries with 90,000 or more inhabitants in 2015.

20. See the UNPD data sources web page at http://esa.un.org/unpd/wpp/DataSources/.

21. The cohort-component method projects the components of population change (fertility, mortality, migration) separately for each birth cohort (persons born in a given year or period). The base population is advanced each year or period by using projected survival rates and factoring in migration (adding immigrants and subtracting emigrants, or applying net international migration). Each year, a new birth cohort is added to the population by applying the projected fertility rates to the female population.

22. See Excel file "Net number of migrants" available at http://esa.un.org/unpd/wpp/Download/Standard/Migration/.

Migrants are distributed by age and gender according to empirical data or, alternatively, based on models. Both empirical data and model estimates are usually kept constant for the entire projection period. Because little information is generally available about the age of migrants, suitable models are used to estimate their age distribution (Rogers and Castro 1986; UNPD 1989, 65–70). These models distinguish between labor migration and family migration, and they only present net migration.

The UNPD guidelines for international migration allow for variation if a case can be made for assuming a different future path, either for the short run or the long run until 2050. For instance, for countries that are known to actively prohibit or discourage international migration and that actually do not report sizable inflows or outflows of people, zero migration is assumed from the base year 2015 onward.

For the period after 2050, the UNPD's latest guidelines as of the 2015 Revision incorporate a tapering off: net flows of international migration are gradually reduced until they reach 50 percent of the 2050 levels at the end of the projection period (2095–2100). This is a departure from earlier generations of the WPP projections, which assumed that international net migration would not just decline after 2050, but would gradually reach zero by 2095–2100.[23]

Today, on average, about 63 percent of all countries affected by migration are assumed to be net sending countries (that is, negative net migration balance), and the remaining 37 percent are net receiving countries (that is, positive net migration balance).[24]

4.2. U.S. Census Bureau

The International Programs Section of the USCB has been engaged in producing international projections since the 1960s. In 1985, it published its first set of comprehensive estimates and projections (O'Neill et al. 2001). In addition to taking stock of demographic developments throughout the world and calculating future trends, it has also been active in developing tools for demographic analysis and in training staff of national statistical offices, mainly in developing countries.

The current USCB population projections cover 220 countries and territories (table 1). For past estimates, the USCB uses reliable population accounts of the past (usually censuses) as a starting point. As a consequence, the USCB has no uniform base period for all countries.

The guidelines in use at the USCB require distinguishing between different types of migration, for example, permanent (settlement) migration, labor (circular) migration, and refugee movements (USCB 2013). For each of these components, specific assumptions are made, and then combined into the total net migration figure used for the projections. For most cases, refugee and labor migration flows are assumed to be temporary, but exceptions may be made, particularly for specific groups of refugees.

Special assumptions are made for countries that host large populations of temporary labor migrants, as in most Gulf countries. Provided data are available and trends are relatively stable, USCB prepares separate cohort-component projections, one for the native population and one for the foreign-born (or nonnational) population. This approach allows for a more precise account of movements and a differentiation in demographic characteristics of the two projected subpopulations. The two projections are then combined to form the population for the analyzed country as a whole (figure 4).

23. See the documentation for the 2012 Revision at: http://esa.un.org/unpd/wpp/Publications/.

24. Of all countries that exhibit net migration different from zero and a population of 90,000 or more, 118 have been sending countries and 79 receiving countries during 2005–10.

USCB is the only institution of the three reviewed in this paper that does not forcibly balance net migration at the world level. This is a direct effect of the occasional nature of its updating and revision policy: unlike UNPD, USCB updates individual countries as new data become available or a particular demand for up-to-date information emerges. Although this approach reduces the resources necessary to maintain a database of population estimates and projections, it prevents maintenance of a zero world migration balance, since this would make adjustments necessary for, potentially, all other countries every time a single country is updated.[25]

4.3. Wittgenstein Centre

The Vienna-based WiC in 2014 published comprehensive projections of populations by age, gender, and educational attainment.[26]

The base year of this set of projections is 2010, using the 2010 Revision of the UNPD's WPP for population estimates. The WiC projection includes 195 countries with populations of more than 100,000 in 2010 (table 1). Aggregate data are provided for standard UN regions and the world as a whole.

To develop its assumptions, WiC attempted to use a two-step formalized procedure for eliciting expert opinions about future trends of key demographic indicators and variance, which were then to be translated into numerical time series to feed the projections (KC et al. 2013). However, the results from step 1—an online survey of 122 experts from all regions of the world—were quite inconclusive about the levels and variance of international migration and could therefore not be used to specify magnitudes of future migration (Sander, Abel, and Riosmena 2013, 26). In a second step, "meta experts" met to discuss the outcomes of step 1 in qualitative terms and recommended two approaches for projecting future levels and trends (Sander, Abel, and Riosmena 2013, 34):

- A "business as usual" approach for the medium-term scenario
- To account for changes in size and age structure of emigrant populations for sending countries.

As a result, migration rates (immigration and emigration separately) were assumed to be constant over the medium-term period in the projections.

The meta experts also assembled a list of seven key "factors" that most likely will have a strong impact on future migration trends (table 9); however, no attempt was made to assess the likely quantitative impact of these factors.

Like the other data producers, WiC also distinguishes different time periods:

- An initial period for which specific and short-term assumptions, if deemed necessary, are made
- A medium-term period for which a constancy of the parameters is assumed

25. The USCB provides documentation online that summarizes the methods used and assumptions made for preparing the population estimates and projections. In addition, it provides an online database with selected time series of the most relevant results. A country-specific note is also available that provides more detailed information about the most recent data sources used (http://www.census.gov/population/international/data/idb/informationGateway.php.)

26. Available online at http://witt.null2.net/shiny/wittgensteincentredataexplorer/.
Also published in Lutz, Butz, and KC (2014).

- A long-term period over which international migration converges to zero.

There is one significant difference between the assumption made by WiC and the other two data producers: WiC generates migration assumptions on the basis of separately estimated flows of immigrants and emigrants for each country over a five-year period. Flow data for the period 2005–10 for all countries are estimated from a database of migrant stocks by country of origin with a "flows-from-stock methodology" (Abel 2013). To manage the complexity of migration flows between all 195 countries, the WiC approach collapses, for each country separately, the world into the country of emigration (sending country) itself and the rest of the world. The resulting bi-regional arrangement benefits from the use of real occurrence and exposure rates, but it is conceptually questionable for generating net migration figures because it uses a sending-country-centric approach, which has specific shortcomings.

From a demographic point of view, the bi-regional model is clearly better suited for projecting emigration. By using total emigration rates and proportionate age-specific emigration rates, the resulting emigration by age and sex expresses the underlying demographic dynamic of the sending population. If the population is declining, the overall emigration level tends to decline.[27] Conversely, emigration figures tend to increase when constant emigration rates are applied to a growing population, thus reflecting the growth of the pool of potential migrants. Similarly, the changing age composition of the underlying population alters the age composition of the pool of emigrants. Aging populations generate older emigrants, while younger populations produce younger emigrants.

WiC's bi-regional model is clearly less demographically suited for projecting immigration. By generating the flow of people entering a particular country (immigrants) based on the combined immigration rate of the rest of world, the magnitude and the age and sex composition of immigrants does not reflect the demographic characteristics of the (main) sending countries, but instead those of all countries combined (that is, the rest of the world). The rest of the world as a proxy for the sending countries may include countries, even very large ones, that do not even send migrants to a particular receiving country. A similar argument can be made for the population age structure in the rest of the world: it does not necessarily influence the age composition of immigrants entering a particular receiving country.

Another issue in WiC's current implementation is that the emigration and immigration rates driving the projection are anchored on just one estimation period (2005–10). Keeping those rates constant over the projection period until 2060 makes the future quite sensitive to temporary events during the estimation period. The demographers at WiC have, at least partially, corrected those estimates that were deemed to be not suitable for long-term trends by adjusting immigration and emigration rates for 25 countries for the first two projection periods (Sander, Abel, and Riosmena 2013, 36).

The need to adjust migration flow rates indirectly reflects the challenge of using total stock data of foreign-born people to estimate migration flows. Because these stock data refer to a relatively short period—in this case just five years—they are prone to including temporary fluctuations in magnitude, and even direction, of migration. In particular, they may include refugee movements and temporary labor migration that may not reflect long-term trends. This is particularly true for the period 2005–10,

27. The OECD-IMI data base (DEMIG) also uses the concept of emigration rates for more than 200 countries of origin (http://www.oecd.org/els/mig/dioc.htm).

which was marked by the global financial and economic crisis that mainly affected the most developed countries.[28]

As for the long-term trend, that is, the period from 2060 to 2100, the WiC migration projections assume a gradual convergence of all countries to zero net migration by 2095–100. This assumption is implemented not as a convergence of immigration and emigration rates to zero; instead, beginning in 2060, the immigration and emigration rates for each country gradually move toward an average (KC et al. 2013, 39), reaching the same size by 2095–2100: for today's net receiving countries, this means that immigration declines and emigration increases, reaching parity by 2095–2100. The case for net sending countries mirrors that for the net receiving countries: immigration increases and emigration declines.

Overall, WiC's novel approach to migration projections is a valuable contribution to improving on the methodology of such projections, but it requires further refinement.

5. Migration Projections

Population projections are, in a methodological sense, assumptions turned into numbers. Assumptions are descriptions of what is expected for each demographic component. Projections are the outcomes of the combination of expected trends applied to a population composition produced by past demographic events. This section discusses the outcomes of the assumptions for international migration. Despite being of secondary importance from a methodological point of view, the projections regularly grab the most attention while the underlying assumptions are rarely discussed in detail. We should also bear in mind that migration projections are not only the numerical expression of migration assumptions, but are also indirectly affected by the assumptions made for fertility and mortality.

5.1. Projecting Global Migration Levels

An estimate of the absolute number of future migrants can be obtained by taking advantage of the WiC projections. As explained, the world's total number of migrants during a certain period is the total number of either emigrants or immigrants, given that migration at the world level must be balanced. Also, net migration figures may be used as a rough approximation if only net migration figures are available. Table 10 displays gross and net estimates from the projections prepared by WiC for the medium-term period from 2010 to 2060, along with the respective crude rates of gross migration and net migration.

Surprisingly, the total number of migrants projected by WiC appears to remain almost constant over the 50-year projection period, which seems puzzling given the use of constant migration rates and the projected increase in world population for the period 2010–60. Even the somewhat slower overall population growth projected by WiC[29] cannot explain the stable number of migrants shown in table 10.

WiC's projection of a nearly constant amount of migrants between 2010 and 2060 apparently is, at least in part, the result of efforts to balance immigration and emigration at the world level by adjusting

28. Available data show that the financial and economic crisis had a significant impact on international migration flows (for example, IOM 2010).
29. World population, according to WiC projections, will grow by 36 percent, or 2.5 billion people, between 2010 and 2060; the United Nations projections call for an increase of 44 percent, or 3.0 billion additional people, for the period 2010–60.

emigration to match immigration or vice versa. As discussed later, country-level emigration trends suggest that for some countries, the assumed constancy of gross migration rates had to be sacrificed to arrive at balanced world migration.

When comparing WiC gross migration figures with UNPD's net emigration figures for the world and the periods 1990–2010, in section 3 it was shown that both gross migration and net migration for the world exhibited comparable trends, albeit net migration figures were at a significantly lower level (tables 2 and 3). A similar picture emerges for the projection period 2010–50, in which total net migration figures for the world remain relatively stable between 13.7 million and 16.6 million people for each five-year interval, except the first and last periods (table 11).

Among the three producers of international population projections, USCB does not forcibly balance net migration at the world level, thus limiting its utility in the comparisons made in this section.

5.2. Projecting International Migration by Country

Virtually all countries and areas are affected by international migration. All three data producers assume that immigration or emigration will take place in almost all countries (table 12; see examples of country-specific trends in figures 1, 2, 11, and 12).

But how do these assumptions and their numerical representations compare? To analyze global international migration projections, we look at the plausibility, the direction, and the numerical trends assumed by the main data producers.

This section compares country-specific assumptions and projections in three different forms.

- First, a pair-wise comparison of projection figures is performed that shows, in a compact way, how similar or dissimilar the three data producers are in their assumptions of future international migration.
- Second, important international net migration trends are shown for a select number of net sending and net receiving countries.
- Third, the potential effect of international migration on population size is illustrated by comparing the projection results to a scenario that assumes zero migration throughout the projection period.

A compact way to compare migration projections made by different producers is the pair-by-pair comparison in an XY chart. The absolute magnitude of each pair of projected figures is easily visible, and the difference between them is shown as the distance to the main diagonal. Because such an analysis is on a pair-by-pair basis, each producer needs to be compared with the others separately. This paper compares data from UNPD, USCB, and WiC resulting in three pair-wise combinations: UNPD and USCB; UNPD and WiC; and USCB and WiC. The following comparisons are limited to countries that are represented in the projections of both of the two producers being compared (table 1). Also, comparisons are limited to those time periods that are actual projections (2010–15 through 2050). The comparison makes much less sense for those periods during which net migration (absolute or relative) is assumed to converge toward zero.

A comparison between UNPD's and USCB's migration projections (figure 5) shows that a large number of data pairs have the same sign and line up along the diagonal, indicating similarities in magnitude (points are in quadrants I and III). However, a number of data pairs are located in quadrants II and IV, indicating opposite signs. In addition, there are two spurious traces of data points lining up vertically. A closer inspection reveals that they belong to Bangladesh and the United States, shown separately in figure 6.

The USCB data in figure 6 show that Bangladesh changes from a net sending country to a net receiving country while the UNPD projections remain mostly constant and negative. Both USCB and UNPD assume that the United States will remain a net receiving country for the whole projection period, but USCB assumes an increase in net immigration for the United States, while the UNPD assumes a largely constant net immigration level.

The comparison of the UNPD and WiC projections shows the greatest similarities (figure 7). The data pairs follow the main diagonal for the most part, and fewer pairs appear in quadrants II and IV, signaling different signs. But some differences in migration projections are clearly visible, both as differences in direction (sign) and as differences in trends (figure 8).

A comparison of the international net migration projections made by USCB and WiC shows larger differences than those displayed in the comparisons between UNPD and USCB as well as UNPD and WiC (figures 6–9).

For Bangladesh and Pakistan, the WiC projections align vertically, indicating constancy, while the USCB projections show larger changes in magnitude, even a change of sign for Bangladesh. For the United Arab Emirates, the USCB projections also change from positive to negative net migration, while WiC remains positive. And for China, the two data producers show similar trends, but USCB shows much larger net emigration than WiC for the earlier periods (figure 10).

At a global level, migration intensity measured as the gross migration rate (tables 2 and 10) has been estimated to be less than 2 migrants per 1,000 population per year, and even less than 1 migrant per 1,000 population per year for the projection period (figures are based on WiC flow data). Birth and death rates are much higher: about 17 births and about 9 deaths per 1,000 population per year (data from UNPD projections).

5.3. Does Migration Have a Sizable Impact on Future Population Size and Structure?

The UNPD for some time has been producing a reference migration scenario in which fertility and mortality follow the same trends as in the medium or reference projections variant but net migration is set to zero from the base year onward. Such an unlikely (and therefore counterfactual) scenario can be used to illustrate the impact of migration by comparing its results with future population dynamics projected in more likely scenarios. The removal of migration from a projection includes the direct effect of the omitted migration as well as the indirect effect of fewer births and deaths from emigration and additional births and deaths from immigration. These same results cannot be obtained simply by subtracting the total sum of net migration between any two periods (2015 and 2050 in the case shown below).

Taking data from the 2015 Revision of UNPD's WPP, absolute and relative gains and losses by 2050 are shown in tables 13 and 14. The top 10 countries with the largest absolute losses and absolute gains when comparing the medium variant to the no-migration scenario are presented in table 13, showing how many people a country will lose or gain in the medium variant. China, for instance, has about 13.8 million fewer inhabitants by 2050 in the medium variant because of the aggregate effect of net emigration, followed closely by India, Bangladesh, Mexico, and Pakistan.

As expected, relatively large countries display the largest net effects when compared with the no-migration scenario. The same is true for those countries that are projected to gain the most from net immigration in absolute terms. The United States may expect about 48 million more people in 2050 due to net immigration and subsequent births than in the no-migration scenario. The difference is equivalent to about the size of Italy or the United Kingdom (population as of 2010). The second largest

beneficiary of net immigration is Canada, with about 9 million more people than in the counterfactual no-migration scenario. In other words, Canada, under UNPD's medium variant, would gain an additional population about the size of Greece or Belgium (population as of 2010). The United Kingdom, third among the top 10 net immigration countries, would gain almost 8 million people during the 35-year projection period.

Although large countries tend to experience larger net migration gains and losses, quite a few smaller countries are more affected by the relative impact (table 14). American Samoa, Tonga and Tuvalu are small island states that are expected to actually lose 40 to 60 percent of their populations when compared with the no-migration scenario. The countries with the largest relative gains tend to be somewhat larger, which is easy to explain—larger countries attract more migrants than very small ones. Among the larger countries and territories that are expected to gain about 20 percent or more of their 2050 population from net immigration are the United Arab Emirates; Luxembourg; and Macao SAR, China. Of them, only Macao SAR, China, had fewer than a million inhabitants in 2015.

5.4. Balancing the World

With the notable exception of the Democratic People's Republic of Korea (North Korea), countries today are generally not closed to international migration. At the global level, the assumed or projected flows must sum to zero. UNPD, USCB, and WiC, however, apply migration assumptions to each country separately. As a result, migration does not balance automatically at the world level. This outcome is true both for the net-migration approach used by UNPD and USCB and for WiC's flow-based approach.

As mentioned, USCB does not force migration to sum to zero at the global level because of its policy of reviewing and adjusting individual country projections on an ad hoc basis.

UNPD does force total net migration to zero at the global level such that total net outmigration equals total net immigration for both the estimation period (1950 to 2010–15) and for the projection period (2015 to 2100). UNPD's migration projections, however, balance neither the age composition nor male and female net migration.

WiC's flow-based approach is even more challenging. To ensure that immigration and emigration offset one another globally, WiC uses a top-down direct and global approach: Adjustment factors are calculated after each five-year projection step based on age- and gender-specific net flows. These global adjustment factors are then applied to the flows of all countries (KC et al. 2013, 55; Sander, Abel, and Riosmena 2013, 24). As a result, the number of emigrants equals the number of immigrants for all projection periods (except for minor differences due to rounding effects), not only in total, but also for all age groups as well as for males and females. This is, from a comparative point of view, quite remarkable.

WiC's balancing approach introduces additional complexity. WiC's current procedure has two distinct challenges, one for the projection period driven by migration rates (2010–60), and one for the period from 2060 until the end of the projection horizon for which net migration converges toward zero.

First, balancing the migration flows by a global adjustment factor appears to have reversed the intended effects of projecting future migration assuming constant emigration rates for a number of countries. Under the assumption adopted by WiC, a rapidly growing population and a constant gross emigration rate should lead to a proportional rise in the total number of migrants. The figures for Nigeria and Uganda show the effect as expected (figure 13)—total population and projected emigration figures rise proportionally, and the post hoc calculated emigration rates show the expected constancy. But for Bangladesh, which by 2050 will add some 50 million people to its 2010 population

of 148 million, the total number of emigrants is shown to be declining between 2010 and 2060. Similar trends are exhibited by India (figure 13) and other countries.

The second challenge with the innovative approach used by WiC was how to move net migration to zero at the end of the projection horizon. Obviously, balancing migration at the world level can be achieved either by moving both emigration and immigration to zero, or by converging immigration and emigration toward the same non-zero level. In the latter case, migration of a certain magnitude would still occur, but inflows (immigration) and outflows (emigration) would balance: net migration would therefore still converge to zero. The WiC demographers chose the approach that maintains some level of immigration and emigration but eventually results in zero net migration. Because this was done in a wholesale fashion, the exercise results in quite unlikely levels and trends for some countries.

To achieve a net migration level of zero for each country, both flows—immigration as well as emigration—were adjusted. They meet at approximately the average that both components (immigrants and emigrants) had in 2060. For the United States, this means not only a reduction of immigration to levels lower than in 2010, but a rather implausible and significant increase of emigration to a level about triple the magnitude recorded in 2010 (figure 11).

For Pakistan as a sending country, the trends until 2060 are plausible and consistent: migration increases as the population continues to grow, while immigration remains at a very low level reflecting both low GDP per capita and an abundant domestic supply of labor. After 2060, however, the trend is reversed: emigration declines and immigration increases, rising by 2100 to a volume about nine times as high as in 2060 (figure 12).

6. Measuring Migration: Comparison and Conclusion

Past volumes and trends in international migration reflect both demographic dynamics and the political and socioeconomic changes that countries have experienced. Knowledge of past international migration flows is an important input for generating assumptions about future flows.

Both USCB and UNPD make considerable efforts to regularly produce and update estimates of past demographic components, for example, births, deaths, and net migration flows. Despite its seeming simplicity, the approach is cumbersome and labor intensive: For any given country, past estimates are obtained by reconstructing demographic history using the cohort-component method of demographic accounting and projection. UNPD's and USCB's time series for the periods before the base year (2010–15) are actually produced by forward projecting the population from a certain point in the past. This approach ensures that the estimates are internally consistent and are as close as possible to demographic statistics observed in the past. The reconstruction of the demographic past (covering a certain period until a specific base year in connection with a particular population projection) fills a considerable gap left by official statistics. It is also a useful basis for the formulation of future trends of, in this case, international migration.

Unlike the other data producers, WiC has not yet produced past demographic estimates, but relies mainly on data provided by UNPD and EUROSTAT, with the partial exception of international migration. The international migration assumptions in WiC's 2014 world population projections are based on estimated gross flows during the five-year periods between 1990–95 and 2005–10 derived from available stock data of foreign-born populations in about 195 countries (Abel 2013). The availability of those estimated stocks for the vast majority of countries enables WiC to apply a flow-

based migration approach and thereby avoid some of the pitfalls of a purely net-migration-based approach.

6.1. Estimated Global Number of Migrants

At the global level, the sum of all net migration flows can only be zero. The number of emigrants and the number of immigrants must be the same, given that every emigrant from one country sooner or later becomes an immigrant to another country. This is true in reality and should be the outcome of estimates based on the concept of net migration. If gross flows of migrants, that is, immigrants and emigrants, are calculated separately, adjustments must be made to achieve a zero sum flow at the global level.

The comprehensive account of gross migration estimates (Abel 2013) can be used to obtain an approximate number of all international migrants. It shows how many people are actually moving from any given country to another country during a certain period.[30] This estimate is different from the often cited global stock of about 230 million people currently not living in their country of birth (that is, the stock of international migrants, see box 1). The total number of people moving during a certain period to another country is simply the total number of emigrants or immigrants. As discussed, at the global level these two figures must be equal.

According to the estimates published by Abel (2013), there have been between 34 million and 40 million international migrants during each of the four covered five-year estimation periods (1990–2010; table 2). For the whole 20-year period, the estimated number of migrants sums to about 157 million people.[31]

Because net migration is still used by most producers of global, national, and regional population projections, it is interesting to compare net migration figures globally with estimates based on flows. For this exercise, net migration figures may be interpreted in a different way: If for a particular country only immigration would take place, then estimated net migration for that country is positive and equals gross immigration. The same logic holds for emigration without immigration (or return migration): in that case net migration is negative and its absolute value equals gross emigration. In reality, for almost all countries, immigration and emigration occur at the same time, thus creating a difference between gross and net migration. Net migration figures are therefore simply a crude measure, but if real flow data are not available, net migration is next best (see box 2).

Table 3 displays overall net migration for the world as estimated by UNPD, both in absolute and relative terms. Although the magnitude, as expected, is significantly smaller than gross migration, the overall trends are in line with the figures shown in table 2.

A comparison between the volumes listed in table 2 and in table 3 shows that for each of the four five-year periods analyzed, the net-migration-based figures are about 10 million to 11 million lower than the gross migration figures. In relative terms, the crude approach using net immigration figures misses

30. Standard definitions of international migrants require the intention of a minimum stay in the destination country. For this reason, seasonal workers, posted workers, and cross-border commuters are not counted as international migrants.

31. A related measure, called “migration volume,” depicts the total number of migration cases a particular country experiences and is simply the number of immigrants plus the number of emigrants. For the world, migration volume can be interpreted as the total number of migration events observed in all countries during a particular period. Given that the global number of emigrants equals the global number of immigrants, the migration volume is twice the number of either. For the estimates produced by Abel (2013), migration volume amounts to about 314 million migration events during the period 1990–2010.

at least 25–30 percent of all global immigration events. In light of the overall deplorable data situation, this may be seen as sufficiently accurate to provide a sense of magnitude. However, if gross migration estimates are available, they are preferred. Furthermore, the total number of mobile people (including seasonal workers, posted workers, and cross-border commuters) is even higher.

6.2. Synopsis of Comparison

Producers of international migration projections are all affected by the dearth of robust and consistent information about the flow of people and their composition by age, gender, and other characteristics. They all have to make bold assumptions about future trends in international migration that directly reflect the lack or incompleteness of migration flow data. It must be acknowledged, though, that even when sufficient data are available, as in some developed regions, the observed trends might still be erratic, unstable, and not ideal for determining future migration levels or long-term trends.

Migration projections in a more narrow sense are made only for shorter periods, looking 10–15 years ahead. For this short period, an eventual return of refugees and other temporary migration movements are taken into account, and temporary movements of the recent past are discontinued. This applies in a more direct way to UNPD and USCB, and in a more implicit way to WiC. This short-term projection period is just a transition period to a medium-term period defined as lasting until 2050 or 2060. Medium-term trends are primarily based on assumptions that levels or rates of migration will remain constant, often in conjunction with constancy of the age and gender composition of migrants.

Two producers—UNPD and WiC—have published population projections that cover the entire 21st century until 2100. USCB is still using a more modest projection horizon of 2050.

The extension to 2100 creates a challenge for making migration assumptions. Unlike forecasts of fertility and mortality trends, neither UNPD nor WiC appear to have devised tenable approaches to forecasting plausible and realistic migration trends beyond midcentury. As a solution to the absence of plausible long-term scenarios, the two producers have reverted to an implausible, but seemingly less controversial, solution of driving absolute net migration to zero by 2095–2100 (WiC) or 50 percent of its 2050 level (UNPD). It should be noted that WiC lets net migration converge to zero by 2100 by bringing immigration and emigration to the same level as opposed to assuming that migration ceases to occur.

7. The Way Forward

This paper reviews current practices for preparing migration estimates and projections of three main producers of global population projections that publish their results, revealing differences in data bases, methodologies, formats, and assumptions. Demographers and population economists tend to agree that international migration is the least understood and the most erratic of demographic components and is therefore a challenge to address adequately. This affects both our understanding of spatial mobility and our ability to make assumptions about future trends upon which to base population projections.

Projecting future migration volumes and trends is particularly difficult when dealing with developing countries for which data are either unavailable or of poor quality. But even in developed countries with well-established traditions of data collection, measurement of international migration is not without problems of completeness and specificity.

As a result, the rather crude concept of net migration is normally applied to measurements of migration and to formulation of migration assumptions for population projections. Because net migration is not directly observable, it is usually estimated or calculated as a residual, inviting a host of statistical errors and inconsistencies, some of which are not even related to migration. And it is important to understand that net migrants as persons with individual characteristics and behavioral patterns do not exist—net migration is just the numerical difference between immigration and emigration.

The persistent lack of adequate data may have led to some sort of complacency by demographers as well: Because the database is incomplete, inconsistent, or lacking, international migration is treated as a residual; and because the residual concept of net migration (unlike births or deaths) does not represent people, the existing neglect of this component of demographic change is perpetuated in the projection.

To reiterate, the challenges relate not only to the quality and availability of data but extend to the formulation of assumptions about future international migration. Available global projections for the long term just assume the disappearance of migration in one form or another, which could be interpreted as a result of global socioeconomic convergence, but also as a statement that we know too little about the future of geographic mobility and therefore assume that phasing it out is the best proxy for an unknown reality.

Short-term assumptions offer another simple way to generate outlooks by keeping current rates or magnitudes constant. Such an approach when implemented for fertility, mortality, or age structure would be understood as implausible and therefore counterfactual. When it comes to migration, however, this approach is generally accepted.

As a result, existing projections combine highly sophisticated models on fertility, mortality, and demographic aging with much less sophisticated assumptions about migration. In fact, demographers and population economists have treated migration, especially in the field of global population projections, as some sort of "second-class citizen."

The status quo, however, and the above jeremiad about shortcomings, challenges, and disappointments, should not be accepted as a final judgment, but should serve as a starting point for methodological and practical steps to improve the situation. Of course, suggestions have been made and proposals formulated aiming at improving international migration projections: a quarter of a century ago, Rogers (1990) had already formulated his "Requiem for the Net Migrant." Ahlburg, Lutz, and Vaupel (1998) suggested using more systematically formulated migration scenarios to inject a measure of uncertainty into population projections and the wider utilization of expert knowledge in formulating assumptions for, among others, future migration trends. The OECD, for its 2016 Perspectives on Global Development, is using scenarios to provide examples of the likely impact of future migration flows.[32] The International Migration Institute at Oxford University also advocates the use of scenario techniques as a novel approach in its Global Migration Futures project.[33]

32. See the outline for the OECD's First Expert Meeting on Perspectives on Global Development 2016, International Migration and Development

(http://oecd.org/dev/migration-development/Agenda_%20PGD%20Expert%20Meeting%2024-25%20February%202015_PRINTING.pdf).

33. See the International Migration Institute's migration scenario methodology at http://www.imi.ox.ac.uk/projects/gmf/project-approach.

There is also an extended literature that experiments with statistical methods for recovering information about migration flows from accounts of migrant stock (Özden et al. 2011; Vezzoli, Villares-Varela, and De Haas 2014; Abel and Sander 2014) as well as on novel statistical projection models (Bijak 2010; Silverman, Bijak, and Noble 2011). In addition, there is almost universal recognition that, apart from better statistical models, improving the statistical basis of international migration is urgently needed (United Nations Statistics Division 2004; Zlotnik 2005; Xu-Doeve 2006; Santo Tomas, Summers, and Clemens 2009; Economic Commission for Europe 2014).

With few exceptions (Abel 2013; Abel and Sander 2014; Lutz, Butz, and KC 2014), these efforts have focused on countries and regions with relatively well-developed statistical bases, especially countries in Europe, and the European Union in particular (Raymer and Willekens 2008). The treatment of international migration as a truly global issue is still in its infancy. But based on new tools, models, and data sets, a number of next steps can be suggested, as summarized in the remainder of the paper.

7.1. Altering Explicit or Underlying Demographic Assumptions

Improving the data situation is a medium-term project. Better projections, however, could be put in place in a much shorter time. The starting point would be to develop alternative migration scenarios by relaxing the short- to medium-term assumption of constant magnitudes (rates as well as age and gender composition) and the medium- to long-term assumption about the trend toward zero migration.

7.1.1. Magnitude and Rates

By keeping the absolute magnitude of assumed migration constant over time, a projection indirectly assumes declining migration intensity for growing populations. Conversely, for a population declining in size, an assumption of constant migration implies growing migration intensity. We therefore recommend further exploration of an approach that uses migration rates as the defining indicator. Past experience suggests that using net migration rates is not suitable for medium-term or long-term projections. This limitation is especially true for net receiving countries because the net migration gains during one period contribute to population size, which then quasi automatically results in still higher absolute net migration during the next period. The issue of these compounding effects of net migration can be overcome by using immigration and emigration rates separately, and by relating those rates to the respective populations at risk.

In addition, by stipulating an underlying trend toward zero migration, we assume a general convergence of living conditions, wage levels, political stability, and many other factors—a world in which the Millennium Development Goals and Sustainable Development Goals approved by the international community have become reality.

7.1.2. Age Composition

The age composition of international migrants is usually estimated using distributional models of typical age-specific migration. Several of these models have, however, been developed using data on internal mobility observed before 1980 in a few developed countries. The use of these data for international migration and for modeling emigration from developing countries may not be entirely helpful. Although a lack of appropriate data may be a barrier to updating existing models, it may be useful to assume hypothetical, yet plausible, alternative age patterns. Such alternative patterns should at least be used to show the sensitivity of international migration flows to the age of migrants. It would also be useful to apply model age patterns to the population by gender separately instead of splitting total net migration proportionally.

7.1.3. Gender Composition

Recent examples of flows that are dominated either by male or by female migrants—for example, between Egypt and the Gulf States vs. between Southeast Asia and the Gulf States—suggest that for selected migration corridors more attention should be paid to the gender composition of international migrants, including their potential impact on fertility in sending and receiving societies.

7.1.4. Allow for Demographic Diversity of Migrants

Most projection exercises assume that migrants instantly integrate themselves demographically into the receiving society, expressing the same mortality, fertility, and mobility pattern as the receiving population. Treating migrants, at least temporarily, as a subpopulation with different demographic (and other) characteristics, could represent the situation more realistically, and be better suited for the development of policy measures. A fitting example of such a differentiating approach is the treatment of large subpopulations of migrant workers recruited by Gulf countries in the USCB projections.

7.1.5. Explore Directional Change in Migration Flows

One of the weakest underlying assumptions of most current population projections is constancy of directions: Traditional receiving countries remain receiving countries and sending countries keep sending migrants until net migration finally converges toward zero. It might be promising to explore possible directional changes in the international migration system based on specific assumptions for certain countries. Such flow reversals might be caused by a rapid demographic transition, as well as by economic, environmental, and other emerging changes. It seems advisable to consult experts in those areas to formulate sound alternative assumptions. Currently, only the link between migration and climate change receives any attention (see, for example, Laczko and Aghazarm 2009; Government Office for Science 2011).[34]

7.1.6. Implement a Flow-Based Approach

Going beyond the concept of net migration has many advantages. The bi-regional model used by WiC for its global population projections demonstrates some of these advantages: by relating emigration to the underlying population at risk, a meaningful emigration rate can be calculated, which, in turn, is more promising for formulating future trends. However, reducing the complexity of a flow matrix containing all countries as senders and receivers of migrants to a bi-regional model is a heavy compromise, most likely forced by the challenges of data management.

An adjustment to the model may be suggested. Instead of combining all countries with all countries, but then collapsing them into an interaction between just two entities, the following arrangement seems more promising: a model could be developed in which major sending and receiving countries are considered separately in detail on an aggregate corridor base, while the rest of the world could still be projected using a bi-regional model. With such a hybrid approach, the complexity of the modeling task could be controlled.

Another improvement could be to relax the assumption about constancy of rates, as well as the reliance on just a relatively short reference period. WiC's current implementation, for example, bases its assumptions about the level of future migration intensities on just one period (2005–10). An

34. The World Bank's KNOMAD project also has a Thematic Working Group (TWG 11) focusing on migration and climate change.

analysis of the data estimated by Abel (2013), which cover four five-year periods (1990–95, 1995–2000, 2000–05, 2005–10) makes it evident that migration flow figures for many countries vary over time, in some cases to a large extent. Extrapolating the flows that occurred during the period 2005–10 should also be questioned because the financial and economic crisis that took place during these years had a significant impact on migration patterns in crisis-affected countries.

7.1.7. Develop Plausible Scenarios

The previous suggestions to enhance and enrich future migration projections could best be implemented through a scenario approach (Ahlburg, Lutz, and Vaupel 1998). Scenarios better reflect the inherent uncertainty of the migration component of population projections. Scenarios are well suited to combine reasonable combinations of alternative assumptions about age and sex composition and other elements. Such scenarios have the additional advantage that they can usually be communicated as coherent alternative narratives.

7.1.8. Strengthen National Capacity in Developing Countries

A comprehensive review of how national producers of population projections account for international migration is not part of this paper, but a preliminary undertaken during the preparation of this paper suggests that in many countries international migration is either not adequately or not at all accounted for. India, for instance, which today is the second largest migrant-sending country in the world, has determined that it will not take international migration into account because of a lack of data and the supposedly small impact migration would have on its demographic future. Other countries simply adopt the UNPD's assumptions. Many countries do not venture into producing national population projections for lack of institutional capacity, human expertise, and adequate software.

Supporting middle- and low-income countries in the development of both human resources and information technology capacity to formulate sound and consistent migration estimates as well as coherent assumptions about future migration trends would not only benefit the country as it sets its political agenda, but could also contribute to a more functional national statistics system. It might also help today's main receiving countries to better understand future migration potential.

8. Appendix

8.1. Tables

Table 1: Coverage of Estimates and Projections of International Migration, Countries and Territories

ISO	Country or area	UNPD	USCB	WiC*
4	Afghanistan	+	+	+
8	Albania	+	+	+
12	Algeria	+	+	+
16	American Samoa	@	+	–
20	Andorra	@	+	–
24	Angola	+	+	+
660	Anguilla	@	+	–
28	Antigua and Barbuda	+	+	–
32	Argentina	+	+	+
51	Armenia	+	+	+
533	Aruba	+	+	+
36	Australia	+	+	+
40	Austria	+	+	+
31	Azerbaijan	+	+	+
44	The Bahamas	+	+	+
48	Bahrain	+	+	+
50	Bangladesh	+	+	+
52	Barbados	+	+	+
112	Belarus	+	+	+
56	Belgium	+	+	+
84	Belize	+	+	+
204	Benin	+	+	+
60	Bermuda	@	+	–
64	Bhutan	+	+	+
68	Bolivia	+	+	+
70	Bosnia and Herzegovina	+	+	+
72	Botswana	+	+	+
76	Brazil	+	+	+
92	British Virgin Islands	@	+	–
96	Brunei Darussalam	+	+	+
100	Bulgaria	+	+	+
854	Burkina Faso	+	+	+
108	Burundi	+	+	+
116	Cambodia	+	+	+
120	Cameroon	+	+	+
124	Canada	+	+	+
132	Cabo Verde	+	+	+
535	Caribbean Netherlands	@	–	–
136	Cayman Islands	@	+	–
140	Central African Republic	+	+	+
148	Chad	+	+	+
830	Channel Islands	+	–	+
152	Chile	+	+	+
156	China	+	+	+
344	Hong Kong SAR, China	+	+	+
446	Macao SAR, China	+	+	+
158	Taiwan, China	+	+	–
170	Colombia	+	+	+
174	Comoros	+	+	+
178	Congo, Rep. of	+	+	+
184	Cook Islands	@	+	–
188	Costa Rica	+	+	+
384	Côte d'Ivoire	+	+	+
191	Croatia	+	+	+
192	Cuba	+	+	+
531	Curaçao	+	+	–
196	Cyprus	+	+	+
203	Czech Republic	+	+	+
408	Dem. People's Rep. of Korea	+	+	+
180	Dem. Republic of Congo	+	+	+

Table 1 (Continued)

ISO	Country or area	UNPD	USCB	WiC*
208	Denmark	+	+	+
262	Djibouti	+	+	+
212	Dominica	@	+	–
214	Dominican Republic	+	+	+
218	Ecuador	+	+	+
818	Egypt, Arab Rep.	+	+	+
222	El Salvador	+	+	+
226	Equatorial Guinea	+	+	+
232	Eritrea	+	+	+
233	Estonia	+	+	+
231	Ethiopia	+	+	+
234	Faeroe Islands	@	+	–
238	Falkland Islands (Malvinas)	@	–	–
242	Fiji	+	+	+
246	Finland	+	+	+
250	France	+	+	+
254	French Guiana	+	–	+
258	French Polynesia	+	+	+
266	Gabon	+	+	+
270	The Gambia	+	+	+
268	Georgia	+	+	+
276	Germany	+	+	+
288	Ghana	+	+	+
292	Gibraltar	@	+	–
300	Greece	+	+	+
304	Greenland	@	+	–
308	Grenada	+	+	+
312	Guadeloupe	+	–	+
316	Guam	+	+	+
320	Guatemala	+	+	+
324	Guinea	+	+	+
624	Guinea-Bissau	+	+	+
328	Guyana	+	+	+
332	Haiti	+	+	+
336	Holy See	@	–	–
340	Honduras	+	+	+
348	Hungary	+	+	+
352	Iceland	+	+	+
356	India	+	+	+
360	Indonesia	+	+	+
364	Iran, Islamic Rep.	+	+	+
368	Iraq	+	+	+
372	Ireland	+	+	+
833	Isle of Man	@	+	–
376	Israel	+	+	+
380	Italy	+	+	+
388	Jamaica	+	+	+
392	Japan	+	+	+
400	Jordan	+	+	+
398	Kazakhstan	+	+	+
404	Kenya	+	+	+
296	Kiribati	+	+	–
414	Kuwait	+	+	+
417	Kyrgyz Republic	+	+	+
418	Lao PDR	+	+	+
428	Latvia	+	+	+
422	Lebanon	+	+	+
426	Lesotho	+	+	+
430	Liberia	+	+	+
434	Libya	+	+	+

Table 1 (Continued)

ISO	Country or area	UNPD	USCB	WiC*
438	Liechtenstein	@	+	–
440	Lithuania	+	+	+
442	Luxembourg	+	+	+
450	Madagascar	+	+	+
454	Malawi	+	+	+
458	Malaysia	+	+	+
462	Maldives	+	+	+
466	Mali	+	+	+
470	Malta	+	+	+
584	Marshall Islands	@	+	–
474	Martinique	+	–	+
478	Mauritania	+	+	+
480	Mauritius	+	+	+
175	Mayotte	+	–	+
484	Mexico	+	+	+
583	Micronesia, Fed. States	+	+	+
492	Monaco	@	+	–
496	Mongolia	+	+	+
499	Montenegro	+	+	+
500	Montserrat	@	+	–
504	Morocco	+	+	+
508	Mozambique	+	+	+
104	Myanmar	+	+	+
516	Namibia	+	+	+
520	Nauru	@	+	–
524	Nepal	+	+	+
528	Netherlands	+	+	+
540	New Caledonia	+	+	+
554	New Zealand	+	+	+
558	Nicaragua	+	+	+
562	Niger	+	+	+
566	Nigeria	+	+	+
570	Niue	@	–	–
580	Northern Mariana Islands	@	+	–
578	Norway	+	+	+
512	Oman	+	+	+
586	Pakistan	+	+	+
585	Palau	@	+	–
591	Panama	+	+	+
598	Papua New Guinea	+	+	+
600	Paraguay	+	+	+
604	Peru	+	+	+
608	Philippines	+	+	+
616	Poland	+	+	+
620	Portugal	+	+	+
630	Puerto Rico	+	+	+
634	Qatar	+	+	+
410	Republic of Korea	+	–	+
498	Moldova	+	+	+
638	Réunion	+	–	+
642	Romania	+	+	+
643	Russian Federation	+	+	+
646	Rwanda	+	+	+
654	Saint Helena	@	+	–
659	St. Kitts and Nevis	@	+	–
662	St. Lucia	+	+	+
666	Saint Pierre and Miquelon	@	+	–
882	Samoa	+	+	+
674	San Marino	@	+	–
678	São Tomé and Príncipe	+	+	+

Table 1 (Continued)

ISO	Country or area	UNPD	USCB	WiC*
682	Saudi Arabia	+	+	+
686	Senegal	+	+	+
688	Serbia	+	+	+
690	Seychelles	+	+	–
694	Sierra Leone	+	+	+
702	Singapore	+	+	+
534	Sint Maarten (Dutch part)	@	–	–
703	Slovak Republic	+	+	+
705	Slovenia	+	+	+
90	Solomon Islands	+	+	+
706	Somalia	+	+	+
710	South Africa	+	+	+
728	South Sudan	+	+	–
724	Spain	+	+	+
144	Sri Lanka	+	+	+
670	St. Vincent and the Grenadines	+	+	+
275	State of Palestine	+	–	+
729	Sudan	+	+	+
740	Suriname	+	+	+
748	Swaziland	+	+	+
752	Sweden	+	+	+
756	Switzerland	+	+	+
760	Syrian Arab Republic	+	+	+
762	Tajikistan	+	+	+
807	Macedonia, FYR	+	+	+
764	Thailand	+	+	+
626	Timor-Leste	+	+	+
768	Togo	+	+	+
772	Tokelau	@	–	–
776	Tonga	+	+	+
780	Trinidad and Tobago	+	+	+
788	Tunisia	+	+	+
792	Turkey	+	+	+
795	Turkmenistan	+	+	+
796	Turks and Caicos Islands	@	+	–
798	Tuvalu	@	+	–
800	Uganda	+	+	+
804	Ukraine	+	+	+
784	United Arab Emirates	+	+	+
826	United Kingdom	+	+	+
834	Tanzania	+	+	+
840	United States	+	+	+
850	Virgin Islands (U.S.)	+	+	+
858	Uruguay	+	+	+
860	Uzbekistan	+	+	+
548	Vanuatu	+	+	+
862	Venezuela, RB	+	+	+
704	Vietnam	+	+	+
876	Wallis and Futuna Islands	@	+	–
732	Western Sahara	+	+	–
887	Yemen, Rep.	+	+	+
894	Zambia	+	+	+
716	Zimbabwe	+	+	+

Note: + = country covered; – = country not covered; @ = not published, but covered.

* The WiC data set refers to Sudan before South Sudan became independent and is therefore not fully comparable with the updated nomenclature.

Table 2: Estimated Number of Total Migrants, 1990–2010

Period	Total number of migrants	Crude gross migration rate (Migrants per 1,000 population)
1990–95	41,417,869	1.50
1995–2000	34,165,758	1.15
2000–05	39,941,252	1.26
2005–10	41,485,600	1.24
1990–2010	**157,010,479**	

Source: WiC

Table 3: Estimated Net Immigration, 1990–2010

Period	Total net immigration	Crude net immigration rate (per 1,000 population)
1990–95	28,961,783	1.06
1995–2000	23,046,862	0.78
2000–05	27,131,329	0.86
2005–10	30,553,268	0.91
1990–2010	**109,693,242**	**0.90**

Source: UNPD.

Table 4: For Further Analysis: Selected Receiving and Sending Countries, 2005–09

Country	Total net migration 2005–09
Selected net receiving countries	
United States	4,909,795
United Arab Emirates	2,832,498
Spain	2,202,023
Russian Federation	1,974,087
United Kingdom	1,388,650
South Africa	1,332,042
Canada	1,201,627
Italy	1,157,169
Australia	1,030,822
Saudi Arabia	904,124
Qatar	701,029
Kuwait	463,975
Selected net sending countries	
Zimbabwe	−329,326
Peru	−505,129
Morocco	−585,942
Romania	−766,237
Mexico	−941,357
Nepal	−976,312
Indonesia	−1,056,479
Pakistan	−1,221,159
Philippines	−1,615,547
China	−2,249,063
India	−2,787,308
Bangladesh	−3,165,651

Source: UNPD.

Table 5: Top 10 Countries with Largest Net Out-Migration and Net Immigration, 2005–09

Rank	Country	UNPD	Rank	Country	USCB	Rank	Country	WiC*
				Sending countries (net emigration countries)				
1	Bangladesh	−3,165,651	1	Bangladesh	-2,834,143	1	India	-2,959,006
2	India	−2,787,308	2	Pakistan	-2,463,706	2	Bangladesh	-2,903,795
3	China	−2,249,063	3	China	-2,071,284	3	Pakistan	-1,995,202
4	Philippines	−1,615,547	4	Indonesia	-1,489,719	4	China	-1,894,002
5	Myanmar	−1,424,380	5	Mexico	-1,364,207	5	Mexico	-1,804,720
6	Pakistan	−1,221,159	6	Zimbabwe	−977,696	6	Indonesia	-1,280,670
7	Indonesia	−1,056,479	7	Philippines	−749,902	7	Philippines	-1,232,204
8	Nepal	−976,312	8	Morocco	−646,643	8	Zimbabwe	−900,199
9	Mexico	−941,357	9	Nepal	−586,967	9	Peru	−725,026
10	Vietnam	−829,854	10	Peru	−525,198	10	Morocco	−674,985
				Receiving countries (net immigration countries)				
10	Saudi Arabia	904,124	10	Australia	657,925	10	Qatar	857,112
9	Australia	1,030,822	9	Qatar	677,174	9	United Kingdom	1,020,349
8	Italy	1,157,169	8	Canada	898,606	8	Saudi Arabia	1,056,141
7	Canada	1,201,627	7	South Africa	934,115	7	Canada	1,098,479
6	South Africa	1,332,042	6	United Kingdom	961,339	6	Australia	1,124,728
5	United Kingdom	1,388,650	5	Syrian Arab Rep.	1,352,307	5	Russian Federation	1,134,496
4	Russian Federation	1,974,087	4	Russian Federation	1,479,888	4	Italy	1,998,787
3	Spain	2,202,023	3	Italy	1,747,460	3	Spain	2,249,848
2	United Arab Emirates	2,832,498	2	Spain	2,496,953	2	United Arab Emirates	3,076,769
1	United States	4,909,795	1	United States**		1	United States	4,955,675

* Net migration figures for the period 2005–09 were not available from WiC, but have been calculated by using the migration estimates for 2005–10 from Abel (2013).
** Data for the years 2005–09 for the United States are not present in the USCB database.

Table 6: Net Migration Estimates for 31 European Countries, 2005–09

Country	Total net migration		
	UNPD	USCB	WiC*
Austria	165,064	78,295	159,966
Belgium	273,463	63,487	199,966
Bulgaria	−79,030	−135,993	−50,046
Croatia	−9,974	35,540	9,985
Cyprus	47,477	71,677	44,175
Czech Republic	192,479	255,036	240,427
Denmark	79,919	68,448	90,312
Estonia	−16,533	−21,187	−19
Finland	68,602	20,528	72,626
France	543,766	415,630	499,781
Germany	103,036	111,472	549,658
Greece	53,638	125,029	153,984
Hungary	84,104	102,165	74,951
Iceland	6,571	2,163	10,416
Ireland	171,381	247,739	100,000
Italy	1,157,169	1,747,460	1,998,787
Latvia	−89,104	−25,675	−10,027
Lithuania	−137,196	−12,801	−35,519
Luxembourg	37,933	20,753	42,469
Malta	11,548	4,098	5,000
Netherlands	76,907	−4,211	50,032
Norway	160,706	163,855	171,244
Poland	17,863	−88,979	55,540
Portugal	111,950	176,273	149,904
Romania	−766,237	−32,058	−100,077
Slovak Republic	7,363	8,171	36,684
Slovenia	39,847	7,635	22,018
Spain	2,202,023	2,496,953	2,249,848
Sweden	246,879	250,997	265,659
Switzerland	327,354	224,792	182,783
United Kingdom	1,388,650	961,339	1,020,349

* Net migration figures for the period 2005–09 were not available from the WiC database, but have been calculated by using the migration estimates for 2005–10 from Abel (2013).

Table 7: Top 10 Countries with Largest Net Emigration and Net Immigration Rates, 2005–09

Rank	Country*	UNPD	Rank	Country*	USCB	Rank	Country*	WiC**
				Sending countries (net emigration countries)				
1	Albania	−15.0	1	Zimbabwe	−17.0	1	Zimbabwe	−14.0
2	Timor-Leste	−14.2	2	El Salvador	−11.0	2	Timor−Leste	−9.7
3	Georgia	−13.6	3	Timor−Leste	−10.3	3	El Salvador	−9.5
4	El Salvador	−9.6	4	Moldova	−10.2	4	Moldova	−9.3
5	Lithuania	−8.4	5	Albania	−9.7	5	Tajikistan	−8.3
6	Armenia	−8.2	6	Lesotho	−9.4	6	Puerto Rico	−7.8
7	Latvia	−8.2	7	Trinidad and Tobago	−7.6	7	Jamaica	−7.4
8	Puerto Rico	−7.7	8	Kyrgyz Republic	−6.7	8	Nicaragua	−7.1
9	Somalia	−7.6	9	Somalia	−6.2	9	Georgia	−6.8
10	Nepal	−7.5	10	Jamaica	−6.1	10	Somalia	−6.7
				Receiving countries (net immigration countries)				
10	Australia	9.8	10	Ireland	11.3	10	Spain	10.1
9	Jordan	12.0	9	Congo, Rep. of	12.3	9	Australia	10.6
8	South Sudan	17.0	8	Syrian Arab Republic	13.3	8	Oman	11.7
7	Singapore	19.2	7	Cyprus	13.7	7	Liberia	16.9
6	Lebanon	20.7	6	Jordan	14.0	6	South Sudan	17.8
5	Oman	22.6	5	Singapore	17.9	5	Kuwait	21.5
4	Kuwait	36.3	4	Liberia	20.1	4	Singapore	30.5
3	Bahrain	50.9	3	United Arab Emirates	26.2	3	Bahrain	86.5
2	United Arab Emirates	93.6	2	Bahrain	40.8	2	United Arab Emirates	102.8
1	Qatar	117.1	1	Qatar	106.7	1	Qatar	141.5

* Countries with populations of 1 million or more in 2010.

** Net migration rates for the period 2005–09 were not available from the WiC database, but have been calculated by using the migration estimates for 2005–10 from Abel (2013) and the population figures as provided by UNPD for the same periods.

Table 8: Summary of Migration Settings by Data Producer

Topic	Producers		
	UNPD	**USCB**	**WiC**
Time horizons			
Past estimates	1950–2010	Varying	NA
Base year	2015	Varying	2010
Projection period	2015-–2100	-2050	2010–2100
Projection phases			
Short term	Varying (5–15 years after base year), depending on actual situation in country	Varying, depending on migration types	For first two projection periods (2010–15, 2015–20), adjustments for select countries guided by expert panel
Medium term	Constant net migration in most cases.	Constant net migration in most cases, but different assumptions for select countries (Bangladesh, Mexico, United States, for example)	Constant emigration rates for country; constant immigration rates from rest of the world until 2060
Long term	Convergence from 2050 to 2100 to half the level in 2045–50.	No long-term component included	Convergence to zero net migration between 2060 and 2100 by adjusting immigration and emigration such that they have the same magnitude in 2095–2100 at about half the level they had in the beginning. As a consequence, net migration becomes zero.
Coverage			
Number of countries	233 countries and areas	220 countries and areas for the projection period. USCB does not show data for the United States before 2011.	195 countries with 100,000 or more inhabitants, based on estimates obtained from UNPD's 2010 Revision
Age format	Ages 0 to 100, five-year age groups	Ages 0 to 100, single-year age groups	Ages 0 to 100, five-year age groups
Unit of projection			
International migration	Total net migration	Total net migration	Total outmigration rate, total immigration rate from rest of the world
Variants/Scenarios			
	Two migration scenarios • Medium	Medium	Three migration scenarios (Sanders et al. 2013) • Medium

Topic	Producers		
	UNPD	**USCB**	**WiC**
	• No migration		• High • Low
Documentation			
	Online document describing the general methodology (UNPD 2014). Documentation of latest data sources and methods used to derive estimates for base population, fertility, mortality, and migration by countries or areas.	Online document describing the general methodology, plus country-specific notes with latest data sources and methods.	Several working papers. Online version poor.
Age patterns of migration			
Age patterns	Castro net migration models (labor migration, family migration, UNPD 1983), special considerations for return flows of international labor migrants and refugees	Not available	Modified Rogers-Castro (1986) model for regional migration patterns
Sex ratio			
	Uses mathematical models of typical net migration types (family or labor migration) applied to projected total net migration figures	Not available	Uses mathematical models of typical age patterns for two country groups, calculated by multiplying projected population age groups by age-specific migration rates

Table 9: Factors with the Strongest Impact on International Migration Trends

Statements supported by a majority of experts
Remittances will become more important for the economic development of migrant-sending countries.
Temporary labor migration will increasingly compensate for skills shortages in developed countries and thus replace permanent migration.
Major economic recessions or stagnation in industrialized countries will lead to less demand for migrants.
Shifts in cohort size, especially related to the baby boom and bust, will play an important role in shaping international migration levels.
The propensity to move abroad among 15- to 29-year-olds will be particularly high in countries with a large "youth bulge."
International migration will mostly follow established paths and existing migrant networks.
Political instability and oppression in African and Middle Eastern countries will result in more people seeking political asylum in democratic countries.

Source: Sander, Abel, and Riosmena 2013, 34.

Table 10: Comparison of Projected Total Gross and Net Migrants, 2010–60

Period	Total number of migrants	Total number of net emigrants	Proportion of net migrants	Gross migration rate	Net migration rate
			(percent)	(per 1,000 population)	
2010–15	34,193,386	22,781,760	66.6	0.969	0.645
2015–20	32,400,360	21,408,350	66.1	0.872	0.576
2020–25	33,058,407	21,965,940	66.4	0.850	0.565
2025–30	33,659,344	22,357,830	66.4	0.831	0.552
2030–35	34,123,411	22,428,430	65.7	0.813	0.534
2035–40	34,432,808	22,202,250	64.5	0.796	0.513
2040–45	34,533,807	21,699,070	62.8	0.778	0.489
2045–50	34,447,549	21,009,050	61.0	0.761	0.464
2050–55	34,239,803	20,274,250	59.2	0.744	0.441
2055–60	33,944,896	19,500,630	57.4	0.730	0.419

Source: WiC.

Table 11: Total Net Immigration Estimates and Projections, 1950–2050

Period	Total net immigration	Crude net immigration rate
	Estimates	
1950–55	5,621,744	0.43
1955–60	7,546,876	0.53
1960–65	8,828,449	0.56
1965–70	9,852,276	0.57
1970–75	13,014,455	0.68
1975–80	15,965,713	0.76
1980–85	16,161,547	0.70
1985–90	17,355,283	0.69
1990–95	28,961,783	1.06
1995–2000	23,046,862	0.78
2000–05	27,131,329	0.86
2005–10	30,553,268	0.91
2010–15	25,460,715	0.72
	Projections	
2015–20	16,085,002	0.43
2020–25	16,617,690	0.42
2025–30	14,869,507	0.36
2030–35	13,772,190	0.32
2035–40	13,773,728	0.31
2040–45	13,758,181	0.30
2045–50	13,772,666	0.29

Source: UNPD.

Table 12: Countries for Which Data Producers Have Assumed No Migration

UNPD*	USCB	WiC	
Zero net migration		Zero emigration	Zero immigration
Bhutan	Andorra	Bahrain	Micronesia, Federated States
Dem. People's Republic of Korea	Argentina	Burundi	Somalia
Guam	Azerbaijan	Congo, Rep. of	Timor-Leste
Kazakhstan	The Bahamas	Equatorial Guinea	Tonga
Lithuania	Belize	Malta	Zimbabwe
Mauritius	Benin	Singapore	
Mayotte	Bhutan		
Papua New Guinea	Burkina Faso		
	Burundi		
	Central African Republic		
	Côte d'Ivoire		
	Equatorial Guinea		
	Eritrea		
	Faeroe Islands		
	Guinea		
	Guinea-Bissau		
	Iraq		
	Madagascar		
	Malawi		
	Montserrat		
	Papua New Guinea		
	Republic of Korea		
	Saint Helena		
	Serbia		
	Swaziland		
	Thailand		
	Togo		
	Venezuela, RB		

* Data for countries with 90,000 or more inhabitants in 2015.

Table 13: Top 10 Countries with Largest Absolute Migration Impact by 2050

Rank	Country	2050
1	India	−17,461,425
2	China	−13,783,340
3	Bangladesh	−11,644,551
4	Pakistan	−6,879,037
5	Indonesia	−6,546,828
6	Mexico	−5,102,376
7	Philippines	−4,245,539
8	Sri Lanka	−3,548,106
9	Nepal	−3,283,202
10	Nigeria	−3,149,102
10	Spain	3,604,010
9	France	3,864,439
8	Italy	4,746,531
7	Russian Federation	4,824,895
6	Syrian Arab Republic	6,080,019
5	Germany	6,767,007
4	Australia	7,403,255
3	United Kingdom	8,285,201
2	Canada	9,164,957
1	United States	47,977,317

Source: UNPD.

Table 14: Top 10 Countries with Largest Relative Migration Impact by 2050

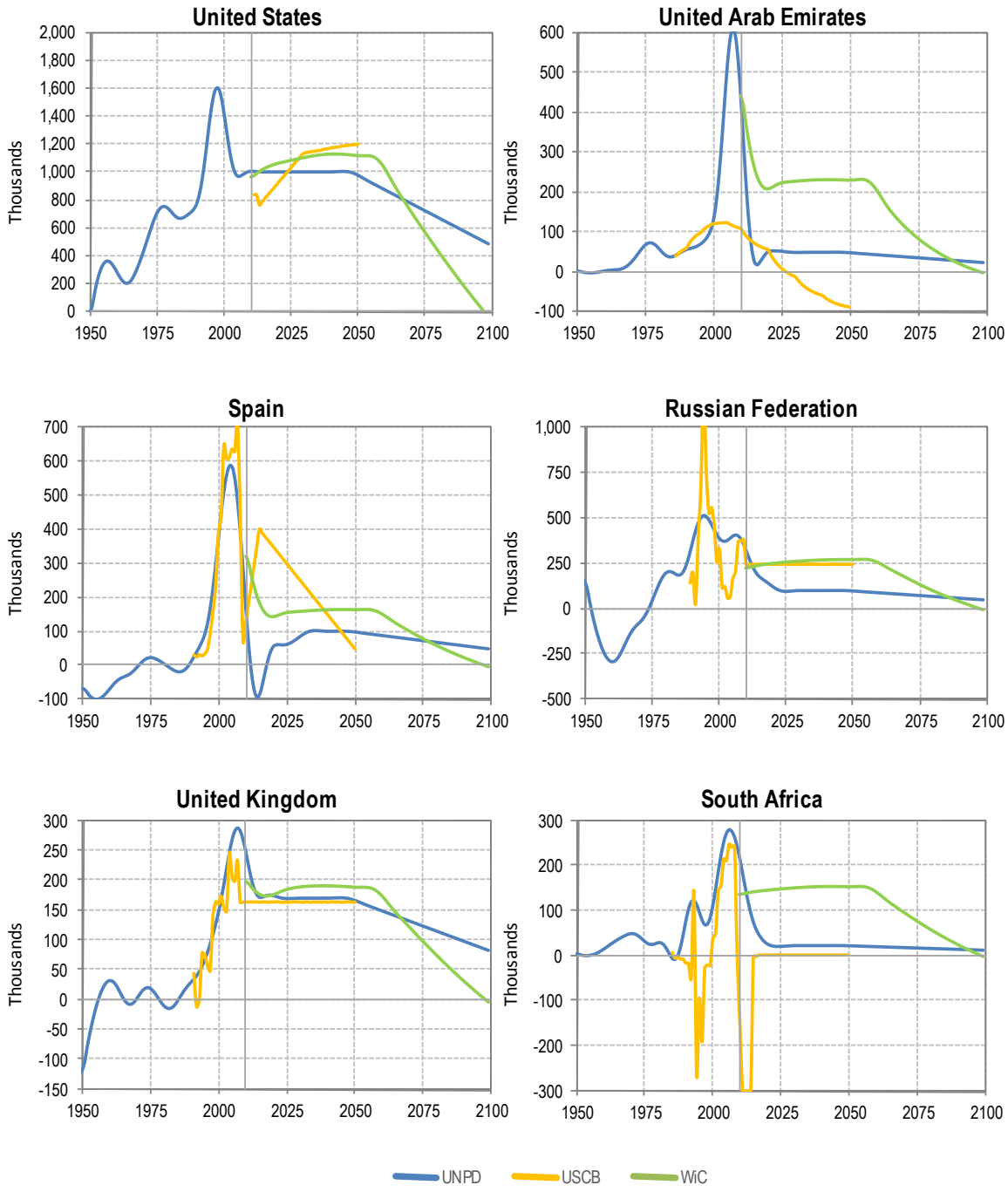
(percent)

Rank	Country	2050
1	American Samoa	−61
2	Samoa	−55
3	Tuvalu	−42
4	Marshall Islands	−41
5	Tonga	−39
6	Lebanon	−36
7	Micronesia, Fed. States	−34
8	Timor-Leste	−28
9	Fiji	−28
10	Jamaica	−26
10	Switzerland	20
9	Canada	21
8	Qatar	21
7	Australia	22
6	Western Sahara	23
5	Cayman Islands	23
4	Monaco	23
3	United Arab Emirates	25
2	Luxembourg	27
1	Macao SAR, China	28

Source: UNPD.

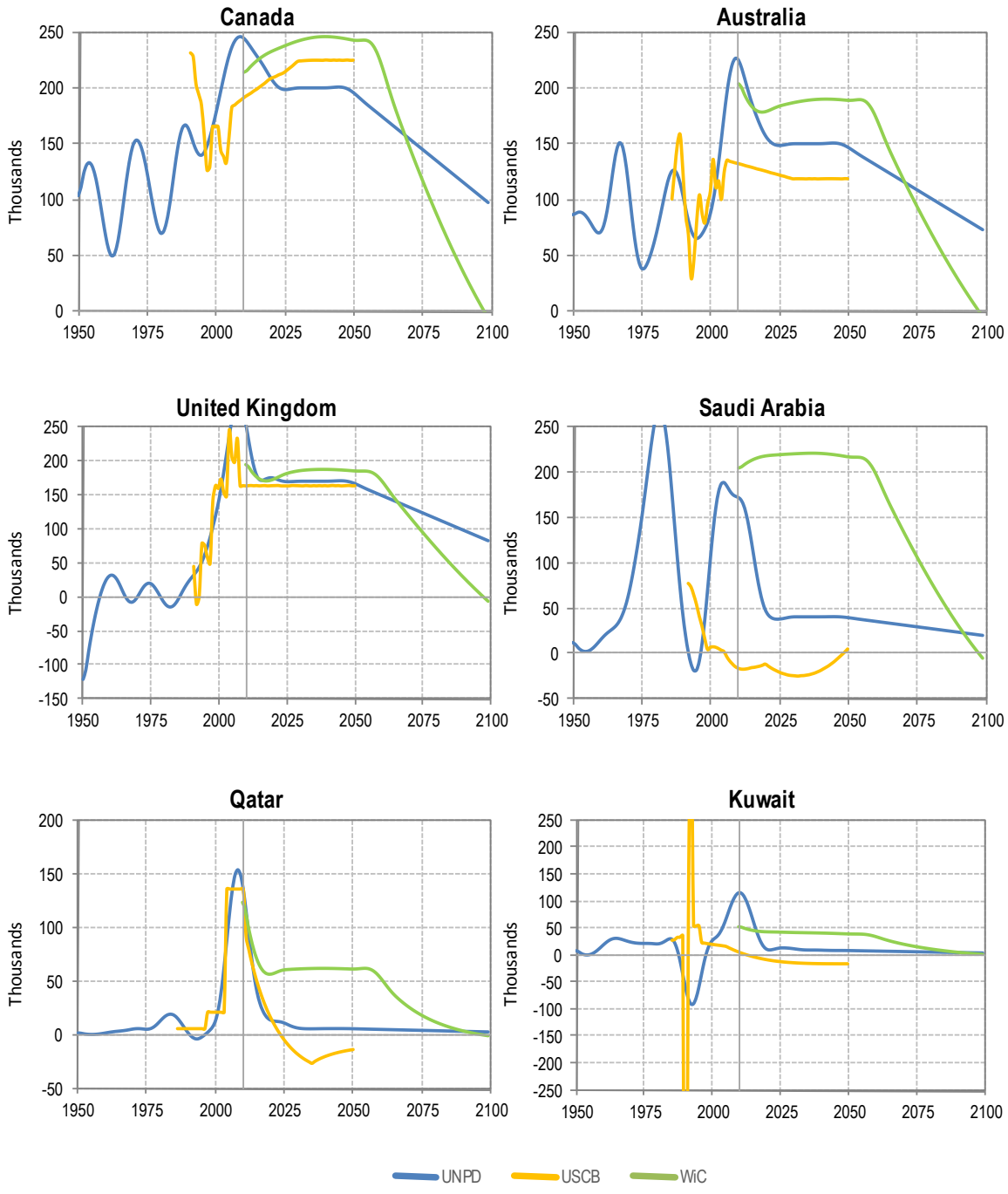
8.2. Figures

Figure 1: Comparison of Net Migration Estimates and Projections, 1950–2100, Net Receiver



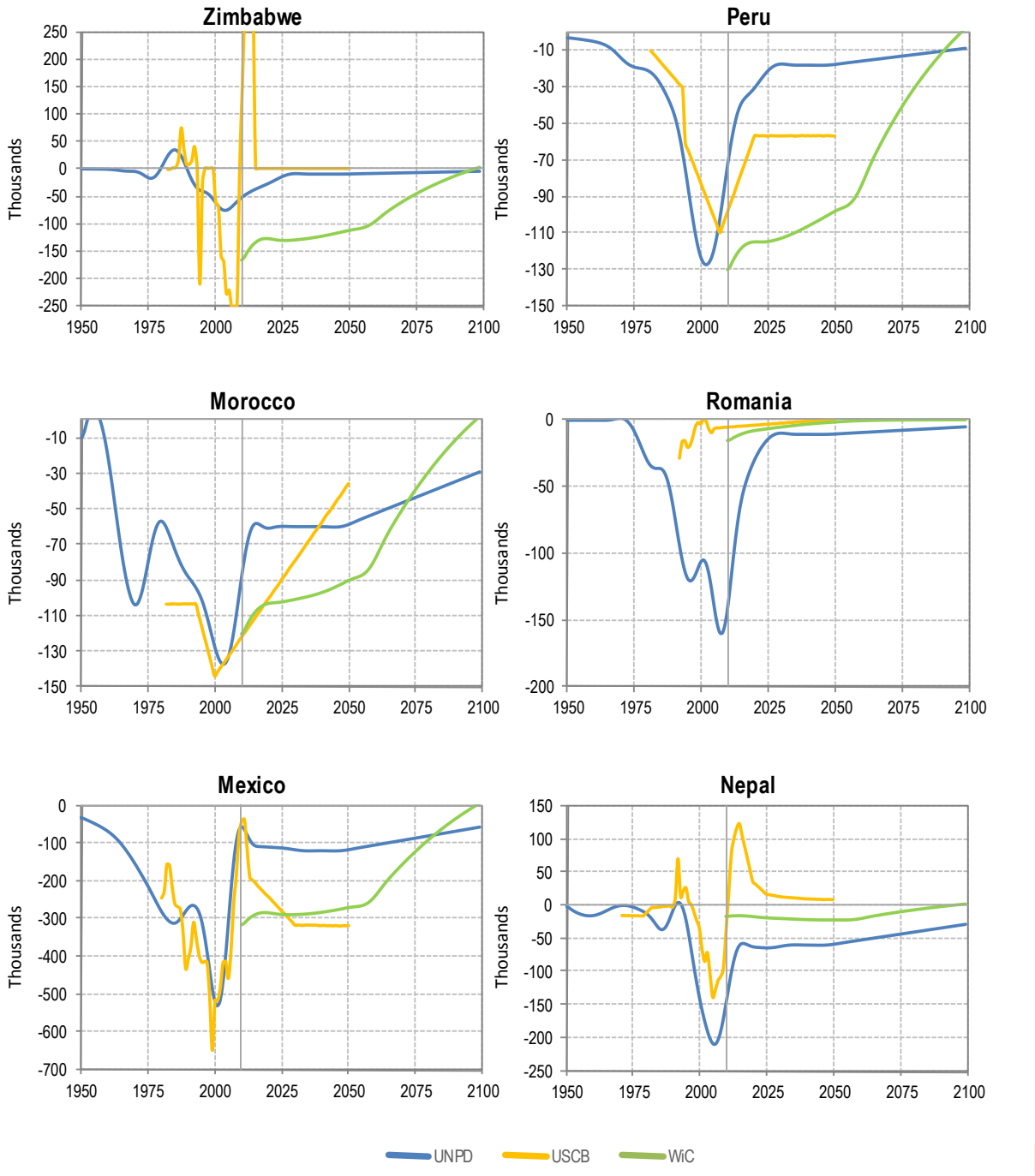
Note: Countries with positive net migration according to UNPD estimates for 2005–09.

Figure 1: Comparison of Net Migration Estimates and Projections, 1950-2100, Net Receiver (continued)



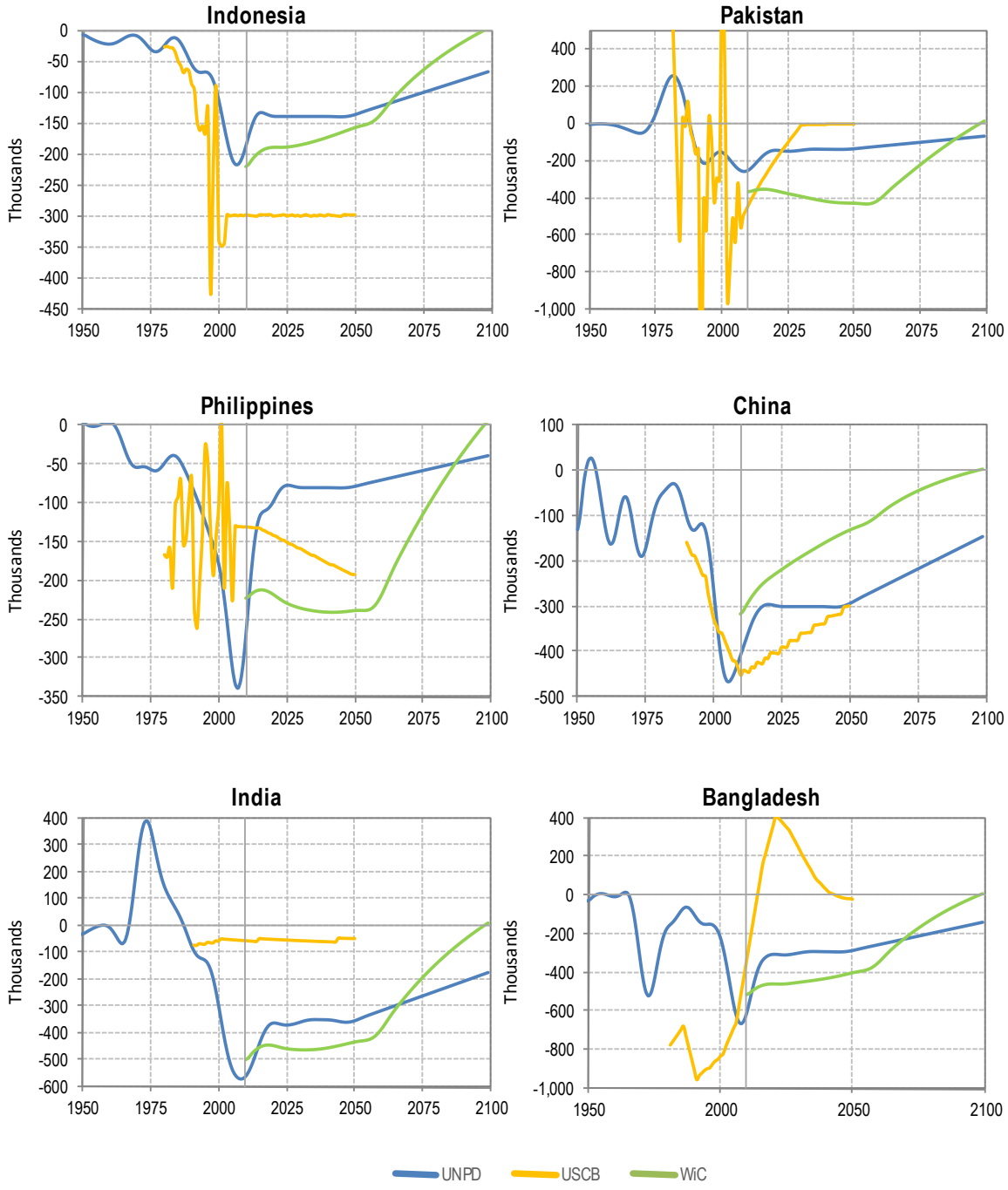
Sources: UNPD; USCB; and WiC.

Figure 2: Comparison of Net Migration Estimates and Projections, 1950–2100, Net Sender



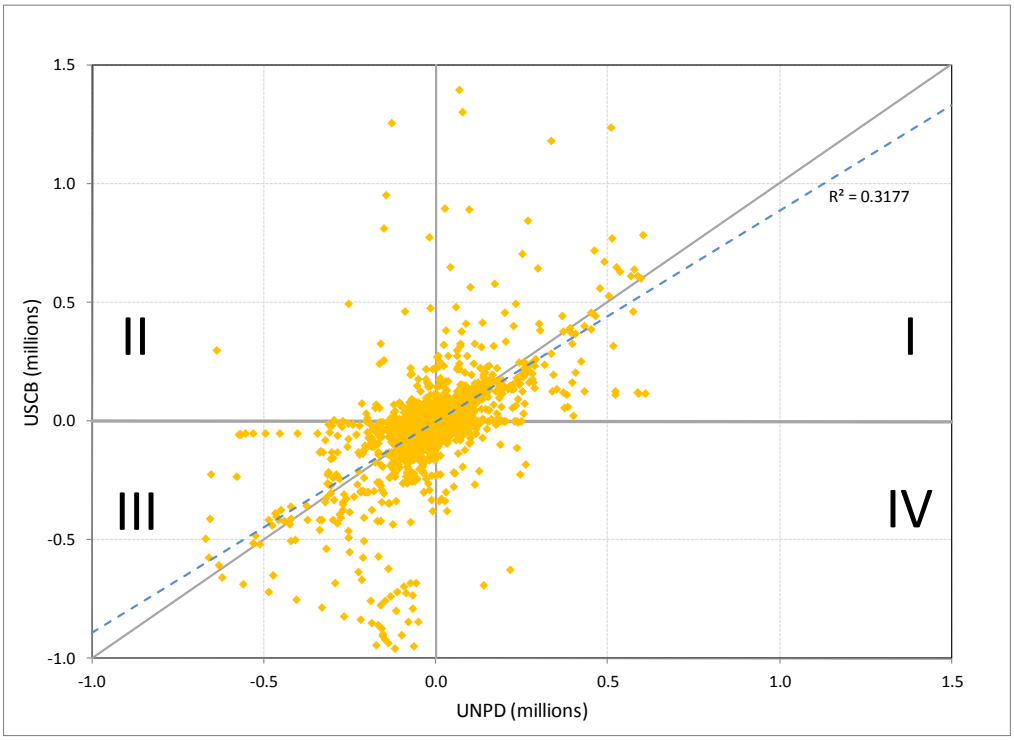
Note: Countries with negative net migration according to UNPD estimates for 2005–09

Figure 2: Comparison of Net Migration Estimates and Projections, 1950-2100, Net Sender (continued)



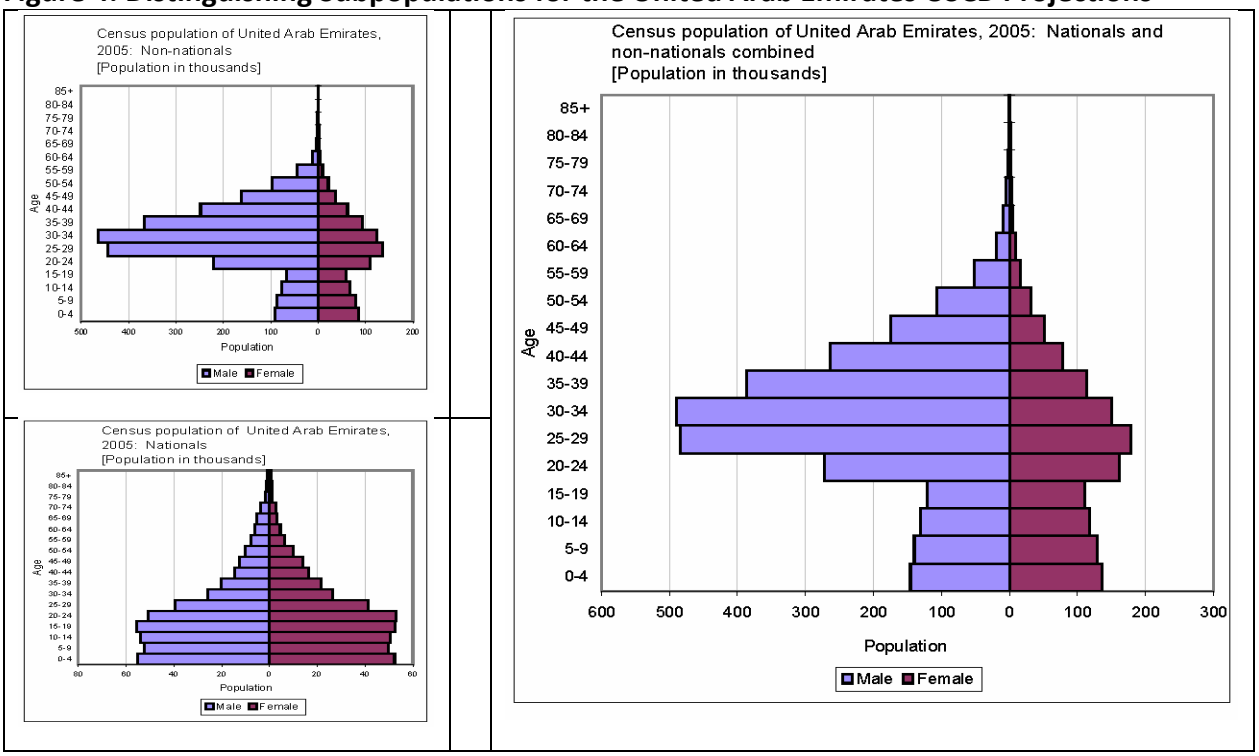
Sources: UNPD; USCB; and WiC.

Figure 3: Comparison of Migration Estimates of UNPD and USCB, 1950–2009



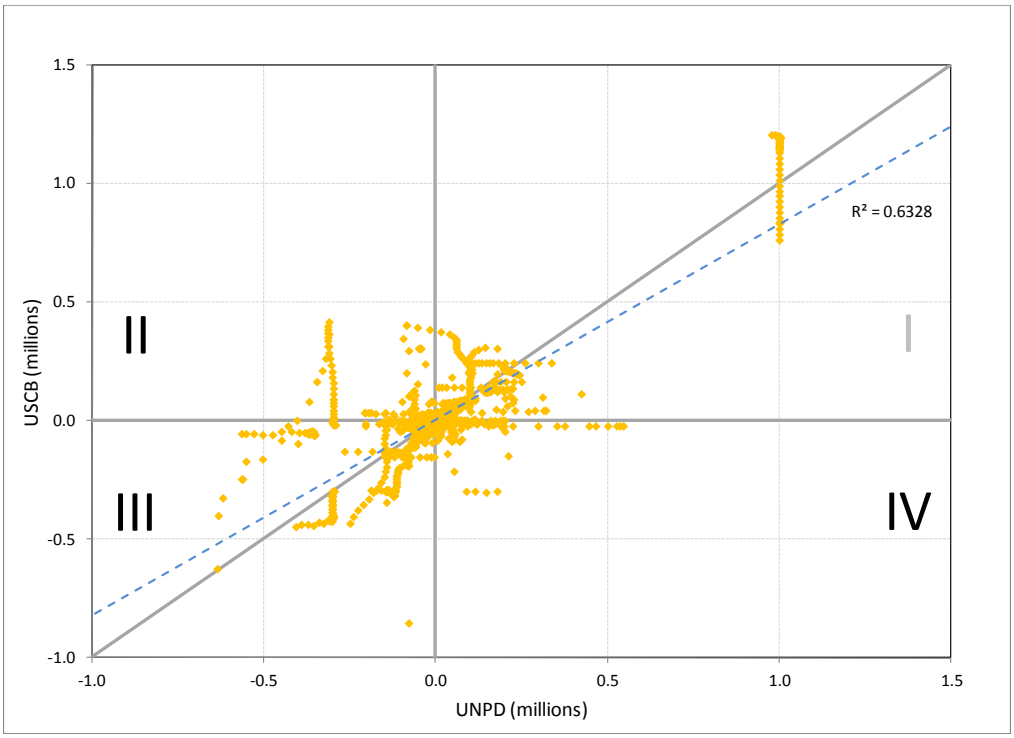
Sources: UNPD; and USCB

Figure 4: Distinguishing Subpopulations for the United Arab Emirates USCB Projections



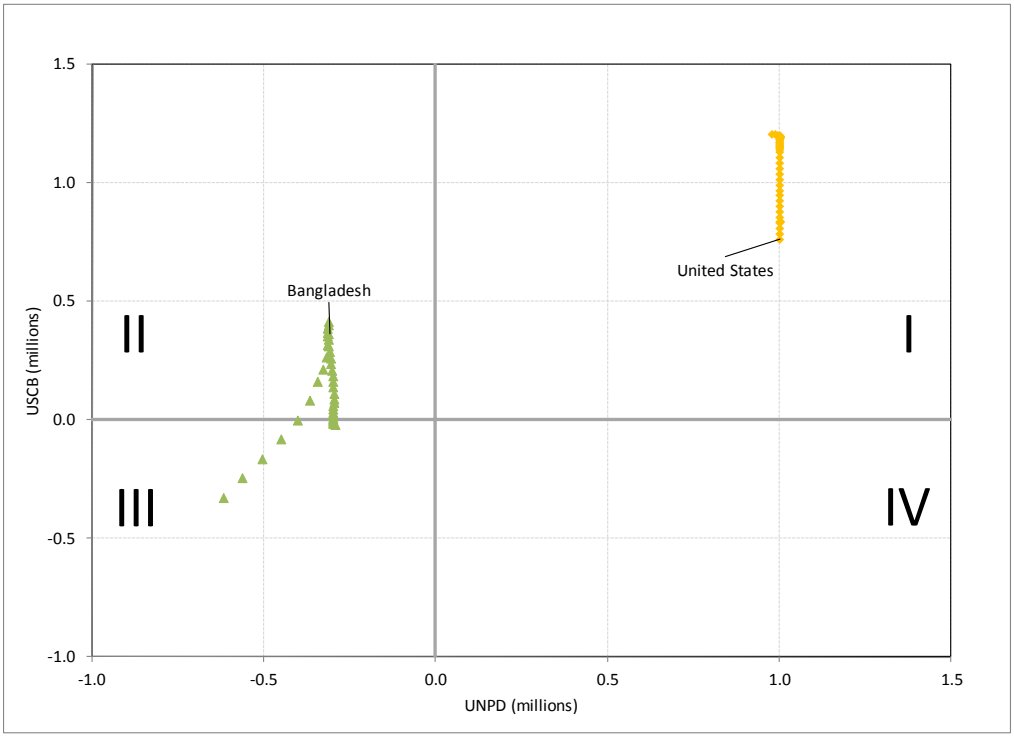
Source: USCB 2013

Figure 5: Comparison of Migration Projections between UNPD and USCB, 2010–50



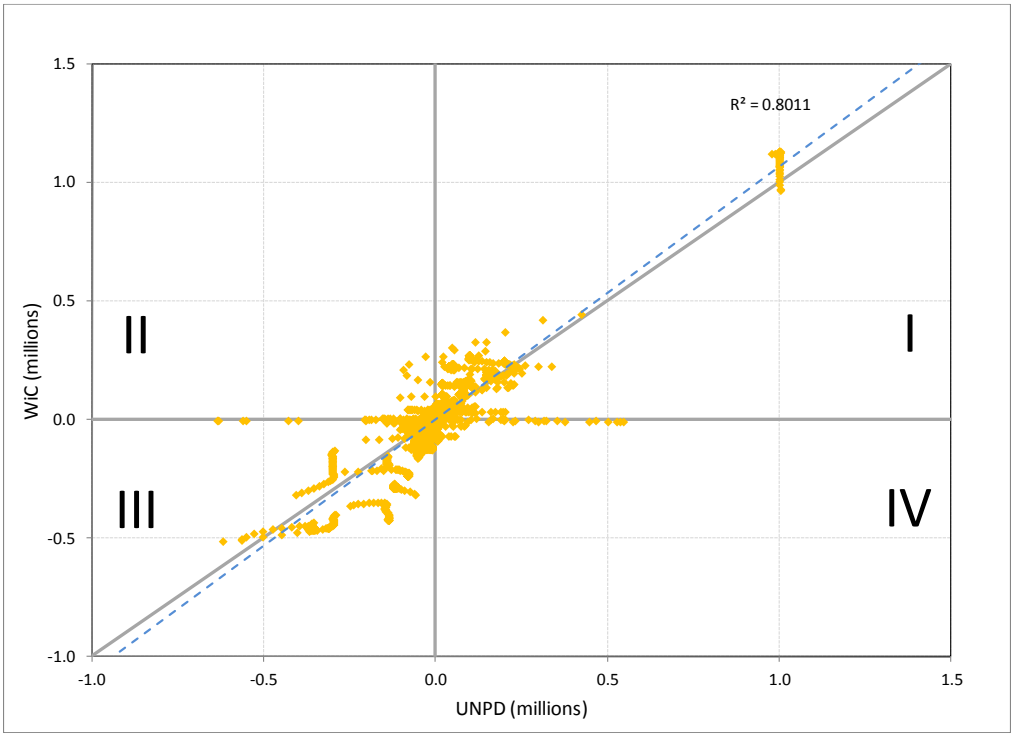
Sources: UNPD; and USCB

Figure 6: Migration Projections by UNPD and USCB for Bangladesh and the United States, 2010–50



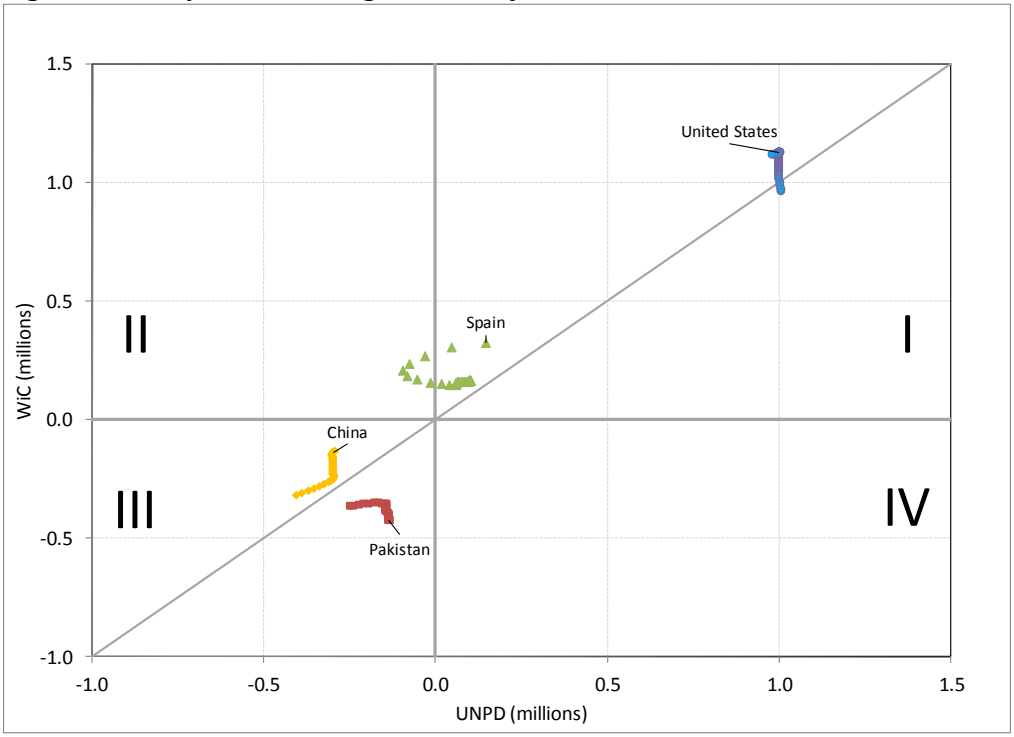
Sources: UNPD; and USCB

Figure 7: Comparison of Migration Projections between UNPD and WiC, 2010–50



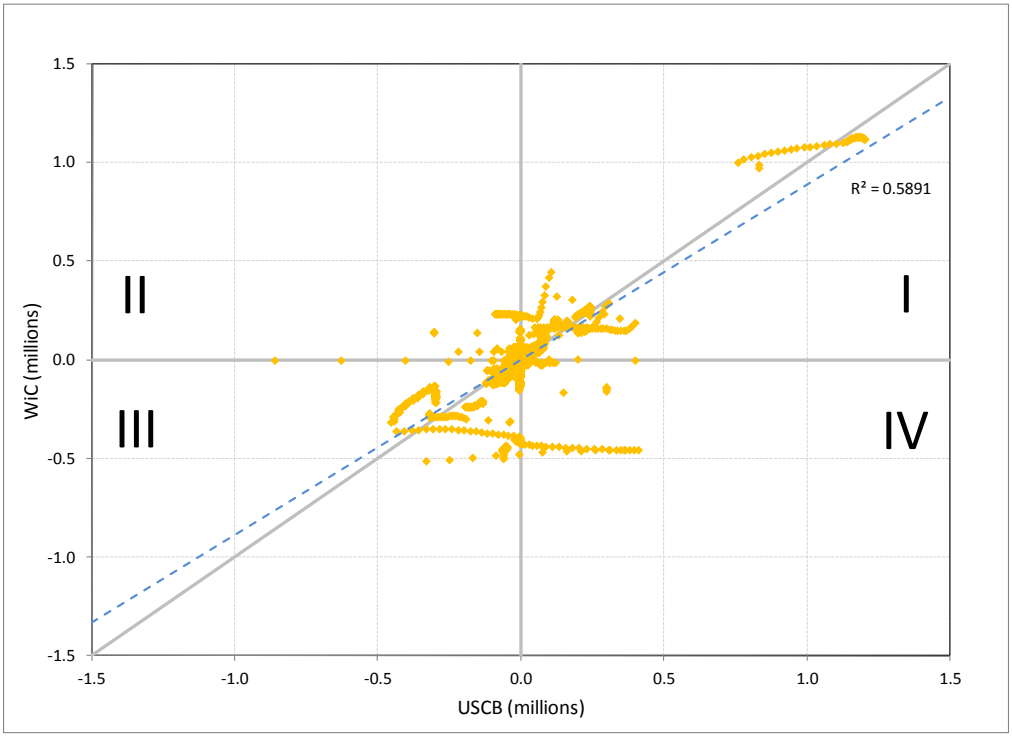
Sources: UNPD; and WiC

Figure 8: Comparison of Migration Projections between UNPD and WiC, Selected Countries, 2010–50



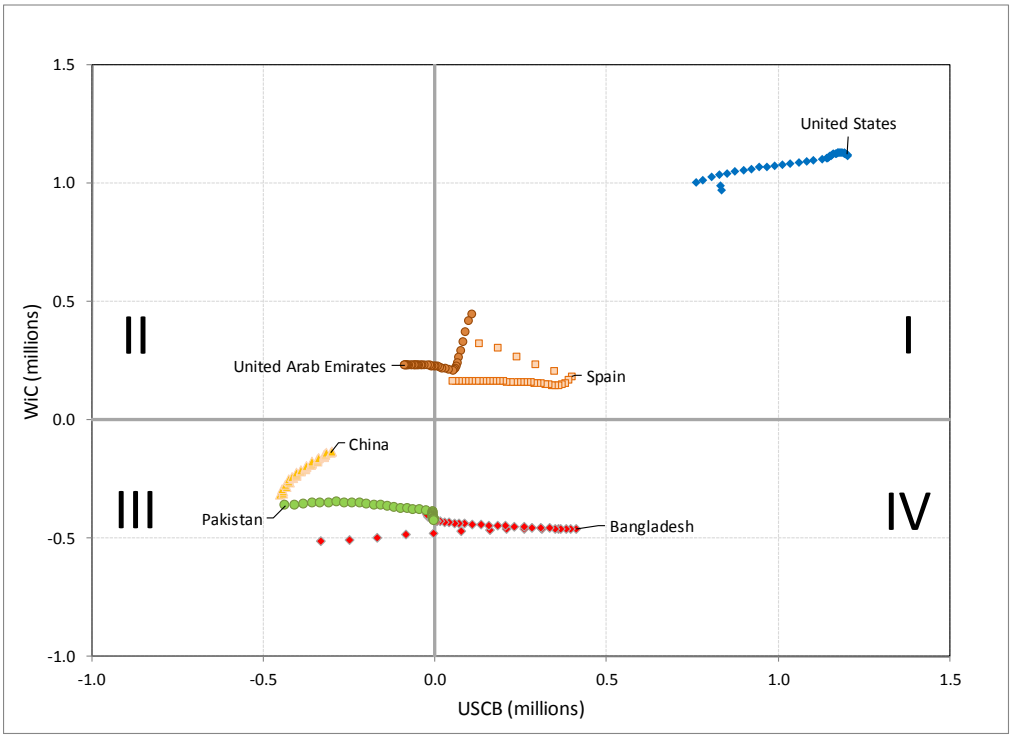
Sources: UNPD; and WiC

Figure 9: Comparison of Migration Projections between USCB and WiC, 2010–50



Sources: USCB; and WiC

Figure 10: Comparison of Migration Projections between USCB and WiC, Selected Countries, 2010–50



Source: USCB; and WiC

Figure 11: Comparison of Migration Flow Projections, 2010–2100, Net Receivers

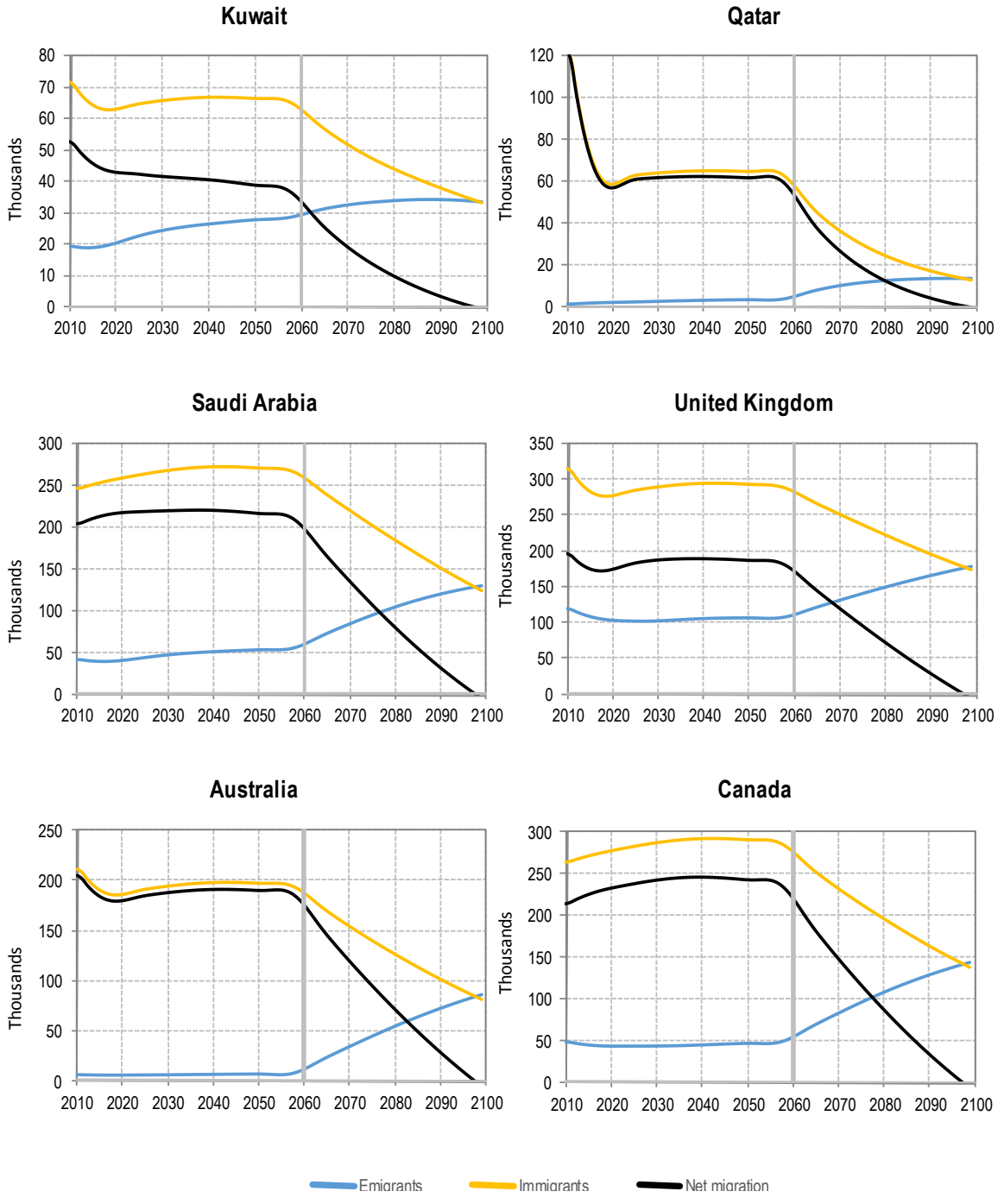
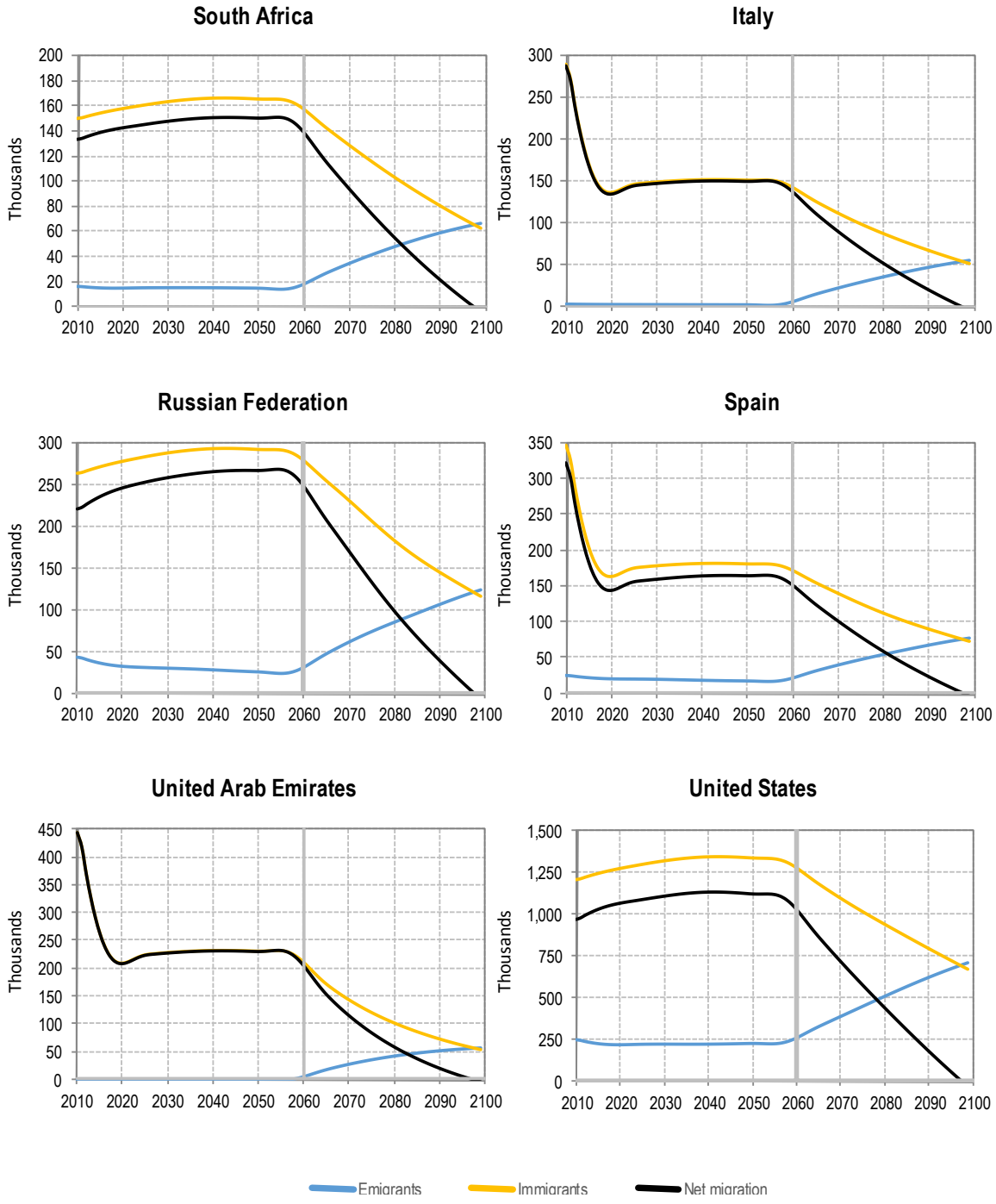


Figure 11: Comparison of Migration Flow Projections, 2010–2100, Net Receivers, continued



Source: WiC

Figure 12: Comparison of Migration Flow Projections, 2010–2100, Net Senders

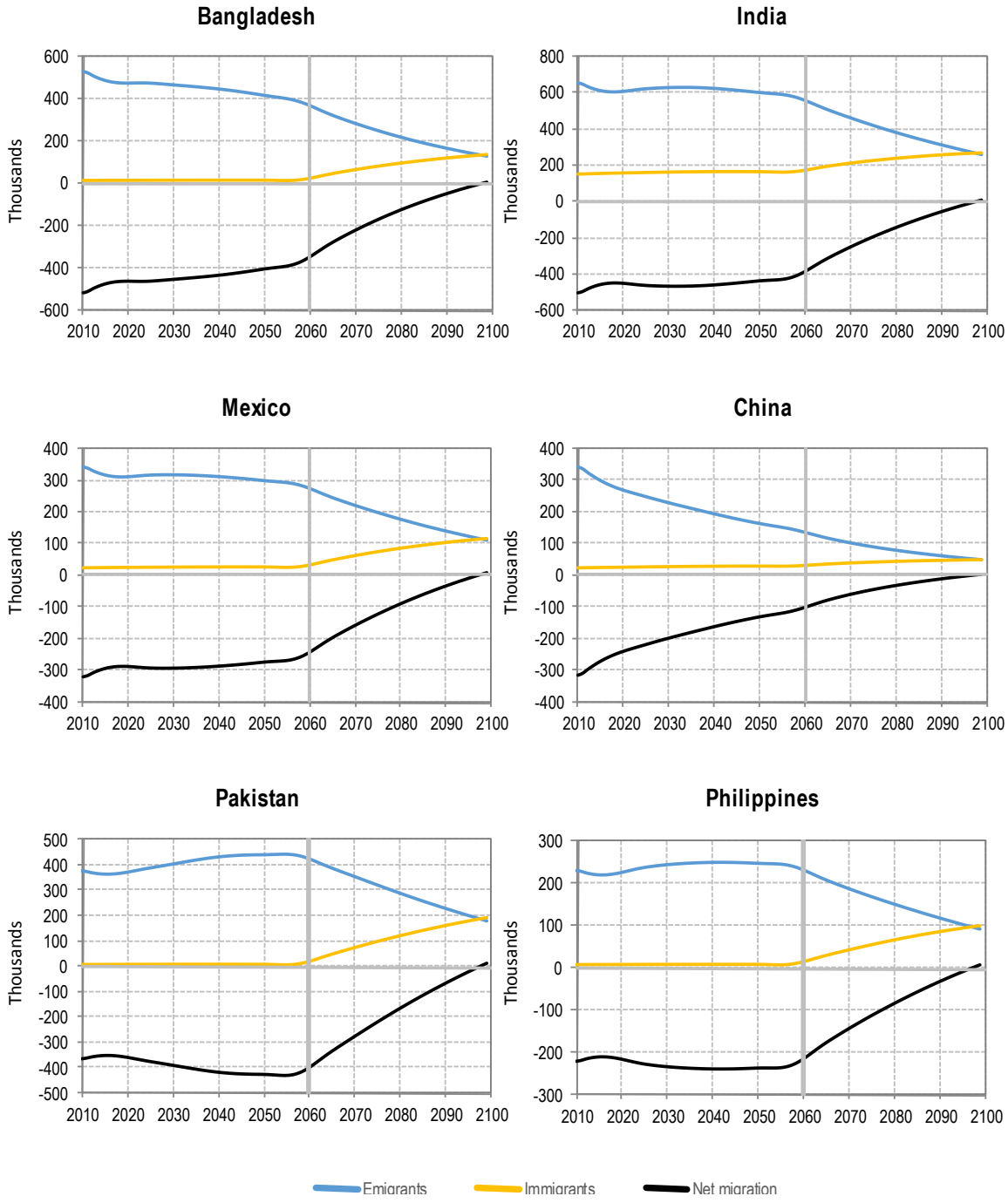
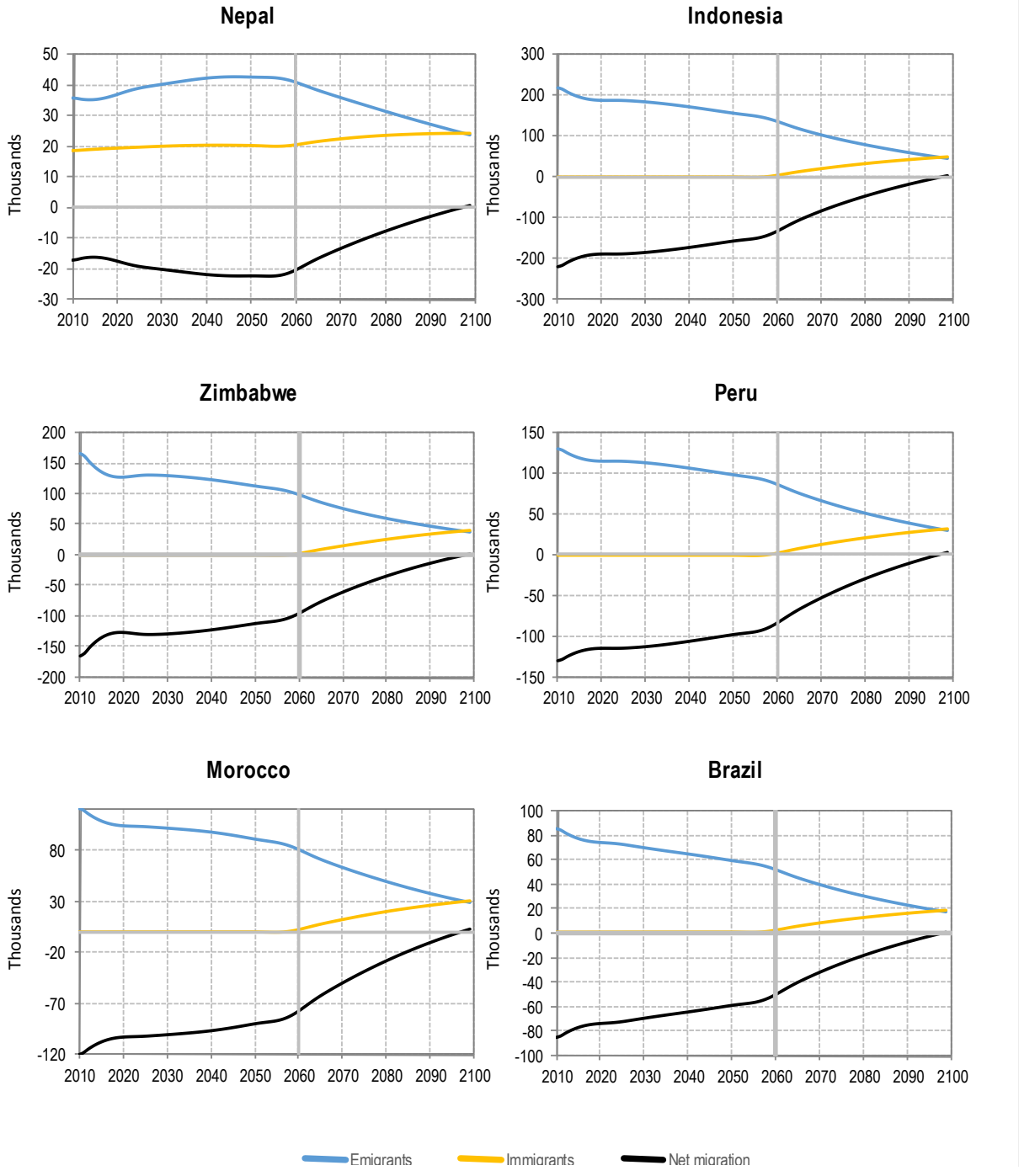


Figure 12: Comparison of Migration Flow Projections, 2010–2100, Net Senders, continued



Source: WiC

Figure 13: Projected Migration Intensities, Selected Countries, 2010–2100

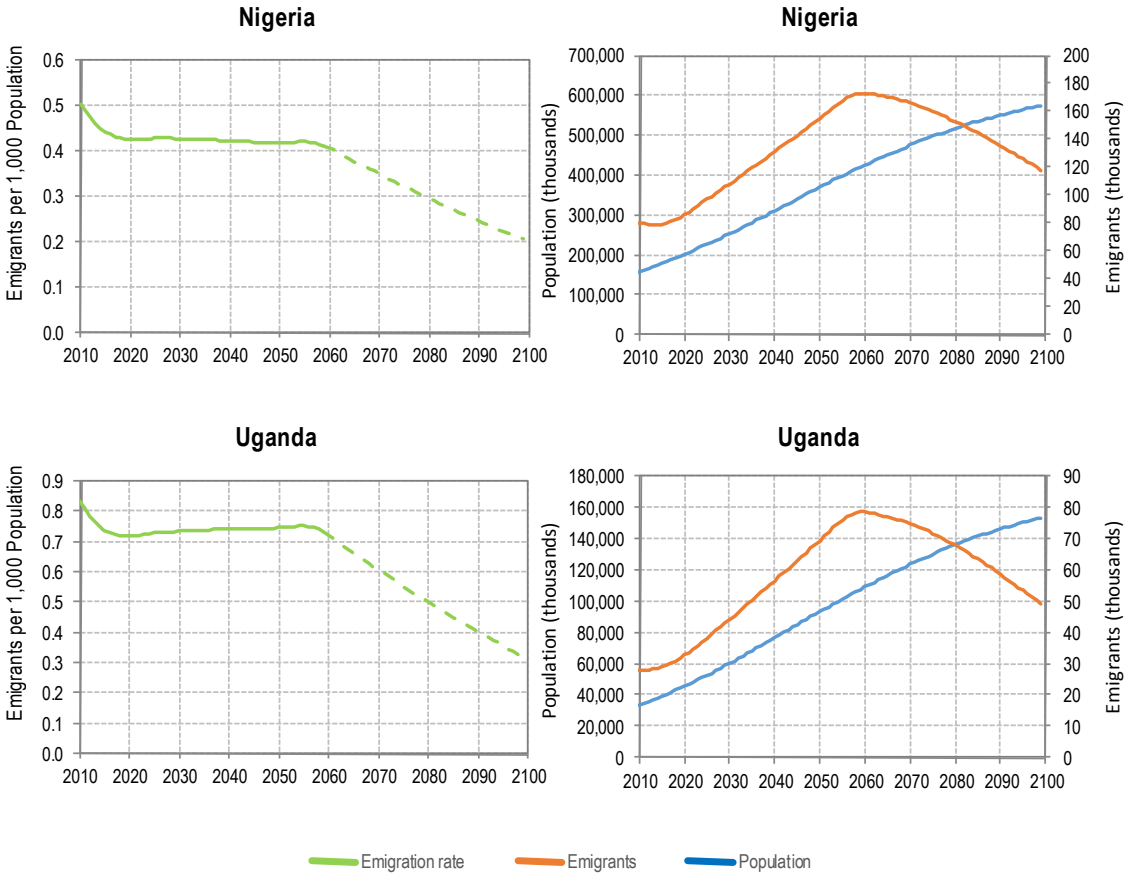
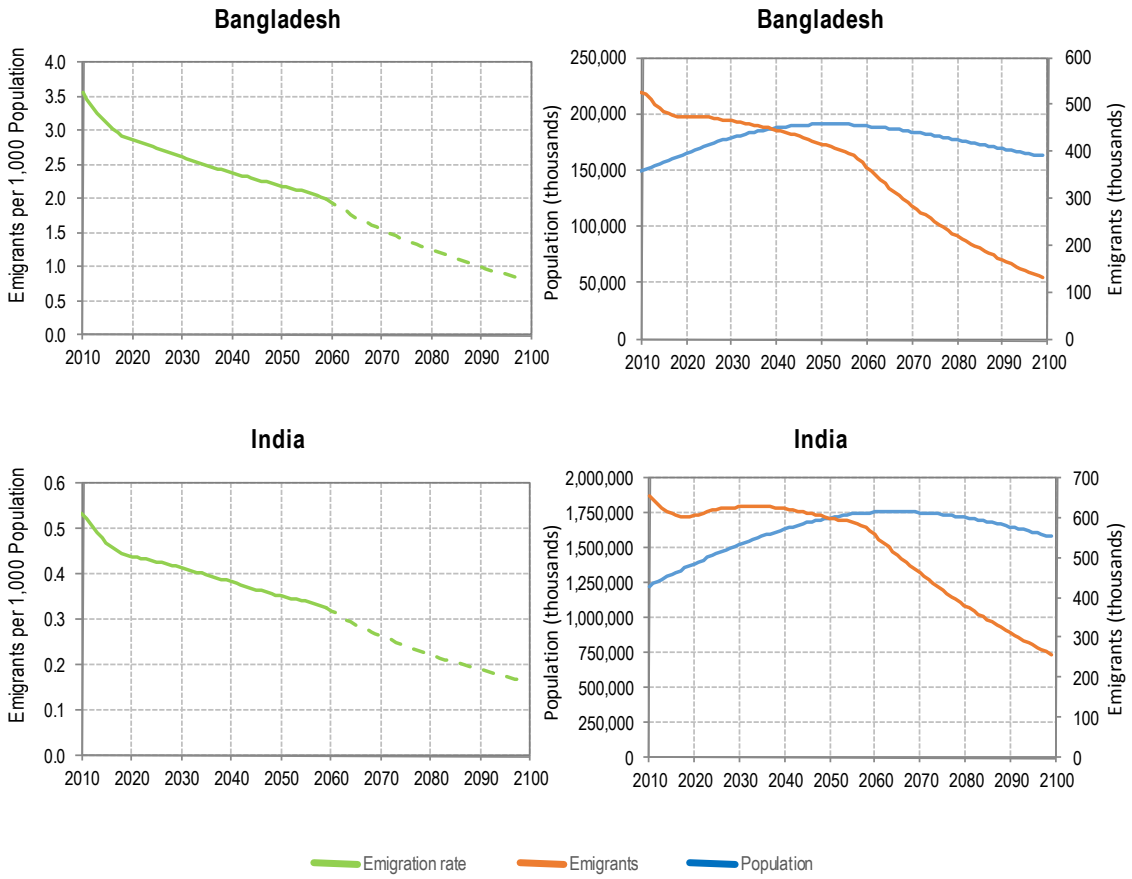


Figure 13: Projected Migration Intensities, Selected Countries, 2010–2100 (WiC), continued



Source: WiC

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