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Stocktaking of Migration Data

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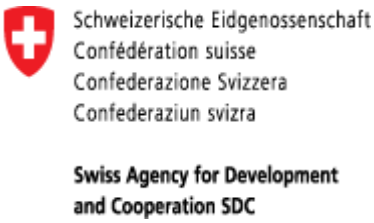

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Stocktaking of Migration Data

Thomas Buettner*

Abstract

Social scientists and policy makers often lament the quality of data on international migration. Besides the lack of robust and comparable data, the field of international migration is beset with conflicting concepts, definitions and often, misleading terminology. This paper attempts a comprehensive stocktaking of international migration data. The focus is on international and long-term migration to purpose the data for international migration projections. It is a broad review of data sources, distinguishing between migration flow statistics and statistics on migrant stocks (migrant or immigrant populations). An overview of estimates on net migration has also been incorporated in this paper.

Migrant flows and migrant stock data originate from two different sources: the first is primary data collection by National Statistical Offices (NSO), and the second is data from subsequent efforts to either improve coverage, compatibility and consistency of raw data or, from efforts to generate estimates by transforming stock data into flow data.

The stocktaking exercise confirms the severe lack of timely, consistent and comparable migration data. The summary view on the migration data landscape results in a number of suggestions to improve migration data. The paper concludes that it would be advisable to follow a multipronged approach in future data collection endeavors, with better collaboration between official statistics and model-based estimation and projections.

Supplementary Information with more details and background information is provided in an accompanying document, *Stocktaking of Migration Data: Catalog*, which is appended after this paper (see Annex).

Key words: Migration data, Migration Flows, Migration Stocks, International Comparison.

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1. INTRODUCTION

This paper is about human movement across national borders and records of this movement in terms of statistics and model estimations. It has been found that the existing data are often not reliable. Data in depositories that house this data—in online databases, websites, online research papers and other electronic formats—are often transitory. The issues with the data are further compounded by the addition of new data resulting in older records disappearing and random changes in links to data sources. Further, new digital technology often results in changes in the layout or format of the data, resulting in a break in continuity with the previously available data.

Human mobility includes, but is not limited to, movement within a country and from one country to another. The 1998 *Recommendations on Statistics of International Migration* enumerates 18 different categories of movements, further subdivided by inflows and outflows and citizens and foreigners [United Nations Statistics Division (1998); p. 11, Box 1]. International long-term migration—the main topic of this paper—is just a small part of that mobility, but it has profound impact on countries.

Table 1: Categories of non-migrant flows

No.	Topic	Note
1	Border workers,	
2	Persons in transit	
3	Visitors (incoming)	Including Tourists, Excursionists, Business travellers
4	Visitors (outgoing)	
5	Diplomatic personnel	Including dependants and domestic employees
6	Military personnel	Including dependants and domestic employees
7	Nomads	
Note:	Sub-categories; Foreigners (Inflows, Outflows), Citizen (Outflows Inflows)	
Source:	United Nations Statistics Division. (1998). Recommendations on Statistics of International Migration. Revision 1. New York: Department of Economic and Social Affairs, Statistics Division, Statistical Papers Series M, No. 58, Rev.1., p. 31, Table 2.	

The paper is written with population projections for countries. This focus narrows the type of migration data evaluated in this paper considerably and disregards many aspects of international mobility. It omits subnational or regional migration which has been an incubator for many approaches and models of migration. The Global Migration Group produced the publication of the 'Handbook for Improving the

Production and Use of Migration Data for Development'[1] under KNOMAD's Thematic Working Group on (TWG) Data and Demographics. This handbook provides guidance to policy makers and practitioners on the measurement of international migration and its impact on development.

Population projections at the national level combine three basic elements of demographic change—birth, death, and international migration—with the initial population to arrive at a future population. This process of population renewal (or reproduction) is a comprehensive process[2] and based on actual population or, in statistical terms, the de-facto population.[3] International migration is necessarily an intrinsic part of this process.

Population projection exercises are well known for approaching international migration with some trepidation. Part of the reason is the dearth of migration data fitting the usual demographic projection models. Another important reason is that international migration, that is the movement of a person or persons from country A to country B, is statistically "… a by-product of specific national administrative systems and to serve specific national administrative purposes." [United Nations (1986); p. 3]. Migration is an international process, where at least two countries are involved and impacted, but the data is generated nationally[4] and this adds to the challenges associated with the data.

Migration is a complex issue. While international migration has been a constant over time, its visibility, diversity and public awareness have clearly increased in recent years. The analysis of international migration is even more challenging because of the erratic use of terminology in both research and public discourse.

The collection of data on population inflows and outflows is relatively easy to process for most countries. Typical points of registration are ports, airports, border control points. Countries with large land borders, however, find it difficult to obtain a complete account of these flows, while countries with open-border regimes can collect such information from foreigners outside the common area (like the Schengen region). Inflows and outflows are defined by crossing an international border at one point in time and, like births or deaths, are a simple event. Taking stock of international migration, especially for "long-term" migrants, is different from simple inflows and outflows, as here the duration of stay in the destination country becomes relevant (see United Nations Statistics Division 1998).

In an ideal world where all countries would have implemented the United Nations recommendations of statistics on international migration,[5] this paper may not even have been necessary and there would be

[1] Global Migration Group. 2017. "Handbook for Improving the Production and Use of Migration Data for Development", Global Knowledge Partnership for Migration and Development (KNOMAD), World Bank, Washington, DC.
[2] All population members are—at least in theory—exposed to the risk of dying, producing children or leaving the population by migrating. Immigrants are, after their arrival, are also exposed to the risks of demographic change.
[3] For administrative and other reasons, population statistics are sometimes produced as de-jure populations, a concept that is less suitable for the real demographic dynamics.
[4] Administratively, immigration is often placed in the jurisdiction of the ministry of the interior.

solid scientific investigation on the size, structure, geographic distribution, and long-term trends in international migration.

Unfortunately, little progress has been made on uniform collection and ensuring the quality and the consistency of international migration data. International migration poses a vexing array of problems. Humanitarian and development issues intersect with issues of brain drain/gain, along with problems of integration, both, into labor markets and society at large. This is further complicated by instances of xenophobia and restrictive immigration policies. There is still a dearth of practical and robust evidence about the volume, geography, and composition of international migration. The usage of the terms migration, migrants, refugees etc. is confusing. This may, in part, be caused by the interdisciplinary nature of migration. Demographers, sociologist and economists use different terminologies and definitions.

This lacunae is not observed in the movements of goods and capital which are globally monitored and analyzed. In fact, there is a fairly complete account of annual remittance flows from migrants available annually from 2010 to 2017 in bilateral matrices, and from 1980 to 2020, the data is classified separately for inflows and outflows[6] (for example, (World Bank 2019)). However, data on the movement of people is scant even in countries with developed statistical systems.

Since this paper is primarily concerned with international migration, labor migration and refugee movements are briefly touched upon. Undocumented migration as well as undocumented migrants are beyond the scope of this stocktaking exercise. From a statistical standpoint, international migration, defined as the change of "usual residence," is hard to establish. International migration understood as actual movement of a person or groups of persons from one country to another is registered only in a small part of the world. For all other purposes, it is "recovered" after the fact, by analyzing census records and other survey instruments and designating people with foreign citizenship or those citing a different country of birth as migrants.

There is a huge body of literature that attests to the lack of availability and quality of international migration data. Examples are, inter alia, Statistical Commission 2019; United Nations 2004, 2018b; United Nations Statistics Division 2004; Zlotnik 1987) (Willekens 2019, 1994. The International Office of Migration (IOM) has compiled a lucid collection of data on international migration (https://migrationdataportal.org/themes). This paper may be seen as a useful addition to IOM's data references.

The paper discusses international migration flows and migrant populations (stock) data, and touches on net migration. It provides an overview of important data sources, their characteristics, availability, and utility, without delving into technical details. Supplementary information is presented in a document entitled " Stocktaking of Migration Data: Catalog ", which contains information about technical details (see Annex).

[6] https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data

Each of the different migration data types are further distinguished by the method by which they are produced and registered. The deliberations start with data produced by statistical agencies (raw data), followed by those data estimates that are the product of a secondary process of estimation, which transform, adjust, and impute missing data, if necessary. The paper concludes with a discussion of major gaps in international migration data, followed by suggestions for short-run and long-term improvements.

2. MIGRATION AND MIGRANTS

The latest effort to harmonize the definitions and categories related to international migration used by statistical systems and to make these definitions usable took place in the late 1990s. The result was of this effort was the 'Recommendation on International Migration' issued in 1998 (United Nations Statistics Division 1998). It was based on a comprehensive review of past and present efforts and experiences, summarized by (Bilsborrow et al. 1997). This review recalled[7] that these efforts dated back to the 1920s,[8] when the International Labor Conference in 1922 called for uniform definition of the term "emigrant" as well as uniform methods to record information on emigration and immigration (Bilsborrow et al. 1997, 1). A 1932 International Labor Organization (ILO) conference first proposed the definition of international migrants to distinguish between permanent and temporary migration. The conference suggested that "when the removal is for one year or more the migration should be regarded as permanent migration" and "when the removal is for less than a year the migration should be regarded as temporary, frontier traffic being excluded" (Bilsborrow et al. 1997, 1–2).

It is noteworthy that previous attempts to harmonize definitions of statistics on migration introduced new important types of mobility,[9] making the data collection process complex. Further efforts by the global statistical system to register migration in its many forms and expressions more accurately and comprehensively are underway. Preparations for an update to the 1998 recommendations are currently under process. These recommendations will factor in new aspects of international migration, such as movements within a common transnational travel area (Schengen area), undocumented migrants, asylum migration (Hatton 2020) and unaccompanied underage migrants.

For a review of current data collection efforts, see the UN report (Statistical Commission 2019). Even in "statistically advanced" regional groups like the European Union, data on migration flows are deficient,

[7] based on (United Nations 1949).

[8] "The imperfections of migration. statistics and the recognition of the need for their improvement have prompted many efforts to establish uniformally acceptable definitions and efficient collection procedures for these statistics. During the nineteenth century and at the beginning of the twentieth, some consideration was given to migration statistics by the International Statistical Institute at its sessions of Vienna in 1891, Budapest in 1901 and Berlin in 1903, and again at the sessions held at Rome in 1926, Warsaw in 1929 and Madrid in 1931. Migration statistics were also considered at the International Conference on Emigration and Immigration at Rome in 1924, and at the Commercial Conference of the Inter-Parliamentary Union held at Rio de Janeiro in 1927. An analytical summary of the salient points in these recommendations is given in "Problems of Migration Statistics" published by the United Nations in 1949. (United Nations 1949)" quoted from (United Nations Statistics Division 1953).

[9] For instance, the 1979 Recommendation had not considered asylum seekers (United Nations Statistics Division 1979).

or, as Willekens puts it "… adequate data do not exist" (Willekens 2019). A report by the Secretary General of the United Nations prepared for the "Global Compact for Safe, Orderly and Regular Migration" (United Nations 2018a) summarizes the global availability of migration data and the diversity of global migration (United Nations 2018b).

One caveat to summarizing migration data is terminology which tends to be misleading and confusing. According to IOM, "At the international level, no universally accepted definition for 'migrant' exists. Rather it may be seen as an umbrella term, not defined under international law, reflecting the common lay understanding of a person who moves away from his or her place of usual residence, whether within a country or across an international border, temporarily or permanently, and for a variety of reasons. The term includes several well-defined legal categories of people, such as migrant workers; persons whose particular types of movements are legally defined, such as smuggled migrants; as well as those whose status or means of movement are not specifically defined under international law, such as international students [International Organization for Migration (2019); p. 132].[10]

International migration begins with persons moving from one country to another, for various reasons and by many means. For the correct recording of international migrants (flows), time or duration and place or residence play a key role. Place or residence is used to identify who is an international migrant. An international migrant is "…defined as any person who changes his or her country of usual residence." [United Nations Statistics Division (1998); p. 9].[11]

One of the most critical dimensions for accurate statistical representation of migration has been the distinction between a long-term and a short-term migrant. The current Recommendations on Statistics of International Migration (United Nations Statistics Division 1998) define these categories as follows: " A person who moves to a country other than that of his or her usual residence for a period of at least a year (12 months), so that the country of destination effectively becomes his or her new country of usual residence. From the perspective of the country of departure the person will be a long-term emigrant and from that of the country of arrival the person will be a long-term immigrant" [United Nations Statistics Division (1998); p. 10]. Short-term migrants are defined as persons who move to a country other than that of their usual residence for a period of at least 3 months but less than a year (12 months)[12] [United Nations Statistics Division (1998); p. 10].

Statistics on migrant stocks are comparable to the concept of "lifetime migration," used in studies of internal migration. Ravenstein discussed and explored the concept of lifetime migration in the late 19th century (Rees and Lomax 2020); an early discussion can be found in Manual VI of the United Nations (United Nations 1970).

[10] https://www.iom.int/who-is-a-migrant

[11] the Recommendation defines usual residence: A person's country of usual residence is that in which the person lives the country in which the person has a place to live where he or she normally spends the daily period of rest. Temporary travel abroad for purposes of recreation, holiday, business, medical treatment or religious pilgrimage does not entail a change in the country of usual residence.

[12] Movements for purposes of recreation, holiday, visits to friends and relatives, business, medical treatment or religious pilgrimage are not included.

Through their movement, migrating people connect two or more countries. Migration has a profound impact on the individual or group that has moved, and it has differing effects on the countries involved. In order to register actual movements of people and their subsequent effects, some coordination and harmonization of concepts, classification, and methods is essential. The International Labor Office, the United Nations and its predecessors (League of Nations, International Labor Office, both in Geneva) have been trying to elevate migration statistics to the rigor and consistency of the demographic component of births and deaths, with limited success. Immediately following WWII, the United Nations and its Statistical Commission[13] assembled data on the movement of migrants and refugees in the aftermath of WWII and continued to review, adapt and expand the guidelines, recommendations, standards, and good practice of international migration statistics [see, for example, Annex A in (Global Migration Group 2017)].

The UNHCR, concerned about terminology, makes a clear distinction between refugees and migrants: "Refugees are people who cannot return to their country of origin because of a well-founded fear of persecution, conflict, violence, or other circumstances that have seriously disturbed public order, and who, as a result, require international protection. The tendency to conflate refugees and migrants, or to refer to refugees as a subcategory of migrants, can have serious consequences for the lives and safety of people fleeing persecution or conflict." [UN High Commissioner for Refugees (UNHCR) 2018]. This distinction between refugees and migrants was earlier acknowledged by the UN General Assembly in the New York Declaration for Refugees and Migrants (United Nations Statistics Division 2017).

[13] The Statistical Division is servicing the Statistical Commission.

3. MIGRATION DATA

This paper is about international migration data sources, their availability, their geographic coverage, timeliness, and quality. There exist many recommendations, reports, and papers on all or some aspects of the availability, quality, and coverage of international migration data. A rather "forgiving" account of the collection of international migration statistics was prepared by the United Nations Statistics Division (UNSD) in 2004 as part of the Demographic Yearbook Review 2004. A corresponding review was presented in in the 2004 edition of *World Economic and Social Survey (*United Nations 2004). Both reviews listed the number of countries that provided information on migrant stock at least once per decade.[14] The Demographic Yearbook Review also listed the number of countries that provided statistics on long term emigrants and immigrants at least once during the 1970s-90s. In 2006, an overview of databases on international migration and migrant stock was compiled by several international bodies and other institutions. It was published in Annex 7 of Poulain, Perrin, and Singleton 2006. Other stocktaking of migration data in Europe was published n Kupiszewska and Nowok 2008, and Nowok, Kupiszewska, and Poulain 2006).

This paper has compiled information from several international bodies, research groups and individual researchers. The condition for inclusion was the focus on global or regional (supra-national) data. The Catalog accompanying this paper lists the various data sources included in this exercise. A distinction is made between migration flow data, migration stock data, and net migration estimates, in that order.

3.1 Migration Flows

International migration is directly registered as a flow movement between two countries. In demographic terms, it is a removal of individuals from the population process in the country of origin (not necessarily the country of birth or citizenship) and an entry into the population process of the receiving country. Official statistics register such a movement as international or long-term migration if the move constitutes a change in the person's usual residence, which is linked to a stay of at least one year. It is therefore not straightforward to recognize a long-term immigrant or emigrant, because the duration of stay cannot easily be established at the time of the movement (departure and arrival). Definitional challenges aside, migration flows are the most authentic statistics available that have immense relevance for policy making, as well as for demographic dynamics of the countries involved.

3.1.1 Flow Statistics

Data on flows of migrants are discussed in two general categories, classified on the basis of how they are produced. First, data generated from statistical agencies by enumerating arrivals and departures (long-term) are flow statistics. As this paper focuses on the efforts of international organizations, the data is secondary—that is, the data has been collected by national authorities and later submitted to or retrieved by international organizations.

Statistical systems register inflow and outflow of populations with a variety of tools. The OECD lists population registers, residence and/or work permits, and specific surveys [OECD, 2019; p. 294] as main

[14] The reported period was the calendar decade in the former, and the census decade in the latter.

sources of flow data. Besides the OECD, the Catalog accompanying this paper lists several efforts by United Nations Commissions and other international bodies to measure this flow. Unfortunately, statistics on long-term international migrants remains limited. Countries with robust and efficient statistics offices can collect data on international migration in some detail. However, it has been observed that even in these countries—notably in Europe, United States, Australia and New Zealand—the quality of data for immigration is superior while data on emigration is often deficient due to under enumeration (Kupiszewska & Nowok, 2008). Developing countries, on the other hand, are largely not capable of capturing international migration flows.

3.1.1.1 UNSD

The UNSD collects data on migrant flows from NSOs. The data may be collected by registering international arrivals or international departures (by intended length and location of stay), in different formats and by different instruments. Since its first issue, the Demographic Yearbook has published data on international migration as submitted by NSOs but ceased tabulating them in printed form after 1989. Statistics on international migration are now available in an online database. Unfortunately, the online database does not continue where the printed tables left off resulting in a gap in coverage for several data series.

3.1.1.2 EUROSTAT

EUROSTAT collects data on migration (flows) and migrant population (stocks) from its member countries, and selected non-member countries in Europe. Migration flow data is classified into three groups: immigration, emigration and change of citizenship (acquisition and loss of citizenship). In addition, data on migrant population is also collected. EUROSTAT's data is available through an online database, which enables easy access to migration data. For detailed information please refer to the Catalog.

3.1.1.3 OECD

The Organization for Economic Cooperation and Development (OECD) provides several databases on international migration flows and migrant stocks at: http://www.oecd.org/els/mig/oecdmigrationdatabases.htm. The four groups of data available from OECD are:

1. OECD International Migration database (includes flow and stock data)

2. Continuous Reporting System on Migration (SOPEMI/CICREDI)

3. Database on Immigrants in OECD countries (DIOC) (Stocks)

4. Indicators of Immigrant Integration

3.1.1.4 ILO

ILO maintains labor force related indicators of international migration as International Labor Migration Statistics (ILMS) as a subset of their voluminous data base. The data is available in several formats for download and online views. This data is mainly sourced from national labor force surveys or similar surveys.

3.1.2 Flow Estimates

Responding to the scarce availability of comprehensive flow statistics by origin/destination country, researchers have developed various methods of estimating migration flows based on the available statistics on migrant flow or migrant stock. Initially, researchers focused on internal migration and then moved on to the area of international migration.

Migration flow estimates are derived data. They may be based on existing, albeit deficient or incomplete and inconsistent flow statistics and can be adjusted, corrected and completed by various methods. Alternatively, migrant flow statistics may be based on migrant stock data by differencing two migrant stock data several years apart, employing different methods and assumptions.

Adjusting and updating existing flow statistics requires minimum data coverage, which is limited to advanced statistical systems like in the European Union. The methods of estimating coherent sets of flow bilateral flow matrices from empirical flow data are discussed in the Catalog in connection with the projects MIMOSA (Beer et al. 2010; Raymer and Abel 2008), IMEM (Raymer et al. 2013), and DEMIG (Vezzoli, Villares-Varela, and De Haas 2014).

Efforts at estimating flows from stocks can be traced back to the works of Rogers and Willekens (Rogers 1967; Rogers, Raymer, and Willekens 2002; Willekens 1983, 1999). At the international level, this work has been pioneered by Abel, Cohen and Azose and Raftery (Abel 2009, 2016; Abel and Cohen 2019; Azose and Raftery 2019). For a summary of the models and methods see (Raymer 2007) and (Abel and Cohen 2019). Migration flow estimates are based on measures of migrant stock are therefore derivative estimates.

Abel and Cohen (Abel and Cohen 2019) distinguish six methods.[15]

Table 2: Stock-to-flow estimation methods

No.	Type	Method	Note
1	Contingency tables	Contingency tables	1
2	Stock differencing	Stock differencing, drop negative	2
3	Stock differencing	Stock differencing, reverse negative	3
4	Migration rates	Migration rates	4
5	Demographic accounting	Demographic accounting, minimization	5
6	Demographic accounting	Pseudo Bayesian demographic accounting,	6
Notes:	See following literature for more information.		
1	Willekens, F. (1999). Modeling Approaches to the Indirect Estimation of Migration Flows. From Entropy To EM. Mathematical Demography, 7(3), 239–278.		
2	Beine, M., Docquier, F. & Özden, Ç. Diasporas. J. Dev. Econ 95, 30–41 (2011); Bertoli, S. & Fernández-Huertas Moraga, J. The size of the cliff at the border. Reg. Sci. Urban Econ. 51, 1–6 (2015)		
3	Beine, M. & Parsons, C. R. Climatic factors as determinants of international migration. Scand. J. Econ. 117, 723–767 (2015).		
4	Dennett, A. In Global Dynamics 125–142, https://doi.org/10.1002/9781118937464.ch7 (John Wiley & Sons, Ltd, 2016)		
5	Abel, G. J. Estimating global migration flow tables using place of birth data. Demogr. Res. 28, 505–546 (2013); Abel, G. J. & Sander, N. Quantifying global international migration flows. Science (6178) 343, 1520–1522 (2014).		
6	Azose, J. J. & Raftery, A. E. Estimation of emigration, return migration, and transit migration between all pairs of countries. Proc. Natl. Acad. Sci. 116, 116–122 (2019).		
Source:	Abel and Cohen 2019		

3.2 Migrant Stocks

3.2.1 Stock Statistics

Statistical data on migrant stocks are well established as the main source of information on global long-term migrants and this is primarily because of the easy availability of this data. Reports by the United Nations on international migration are based on migrant stock estimates[16]. Migration stock data

[15] Raymer lists four main models: the iterative-proportional-fitting technique, the gravity model, the spatial-interaction model, and the log-linear model.

[16] See, for example, the Reports of the 2018 Secretary General to the General Assembly entitled "International Migration and Development" (United Nations 2018b), the Report to the Statistical Commission with the title

facilitates comprehensive and relatively in-depth analysis[17] whereas the scarcity of flow data makes it difficult to gain a global perspective on migration.

Migrant stock data are mainly obtained from census data, and, where available, population registers or nationally representative surveys [United Nations (2020); p. 4]. Because of the nature of population censuses and surveys, data from these statistical instruments are not continuous but refer to dates when the census and surveys were planned and executed.

3.2.1.1 UNSD

The United Nations Statistics Division is mandated to collect, from national authorities, all statistical information relevant to the United Nations. Data are collected through a system of census questionnaires sent to countries. The statistical data are then checked for content errors and published in several outlets: The Demographic Yearbooks (an annual publication), select topical data in tabulated form (occasionally, in Excel) and in the data mart; UNdata[18].

3.2.1.2 UNPD

The United Nations Population Division has a compiled migration database named Global Migration Database (GMD). The database is a comprehensive collection of empirical data on the number of international migrants by country of birth and citizenship, sex and age as enumerated by population censuses, population registers, nationally representative surveys and other official statistical sources from more than 200 countries and territories. The data was retrieved from the Statistics Division's databases, official publications available from resource centers, libraries and the internet. The database is currently available, but in a dormant state. Access is cumbersome and possible only for single records.

3.2.1.3 EUROSTAT

EUROSTAT collects data on migration (flows) and migrant population (stocks) from its member countries, and some other countries in Europe. EUROSTAT's data are available through an online

"International Migration Statistic" (Statistical Commission 2019), and the "Report of the Secretary-General on new trends in migration: demographic aspects (E/CN.9/2013/3)" to the 2013 Session of the Commission on Population and Development (Commission on Population and Development 2013)].

[17] Of the 183 countries or areas for which national questionnaires for the 2010 census round (2005−2014) are available, 178 included at least one question on international migration. Data on immigrant stocks, as measured by the number of foreign-born or the foreign population in a country, for the period 2005–2014 are available for only 125 of the 178 countries or areas that collected migration information in population censuses. When data are further disaggregated by country of birth or citizenship, the number of countries or areas with available data is 100. When data are disaggregated by educational attainment of migrants, only 51 countries or areas have such data. Note that some countries or areas might still have data available but have not yet reported it to the United Nations. [Statistical Commission (2019); p2, footnote 3].

[18] https://data.un.org/Host.aspx?Content=About

database, which enables easy access to migration (and other) data. Migrant population[19] (stocks) data are available by country of birth/citizenship (Indicator family *demo_pop*).

3.2.1.4 OECD

OECD publishes data on migrant populations (migrant stock) in several formats. Synopsis tables are published in the flagship publication *International Migration Outlook*. The tables are also available as Excel tables (in French and English)

The complete set of data on international migration stocks is housed in OECD's *International Migration Database.*

3.2.1.5 UNHCR

The UN Refugee Agency (UNHCR) maintains a Refugee Population Statistics Database[20] on several relevant categories of displaced population stocks:

- Population figures (UNHCR data on displacement)
- Asylum applications (Asylum claims submitted)
- Asylum decisions (Decisions taken on asylum claims)
- Solutions (Solutions for refugees and IDPs)
- Internally displaced persons (Internal displacement due to conflict and violence, obtained from IDMC)
- Palestine refugees under UNRWA's mandate (Registered Palestine refugees (obtained from UNRWA)

3.2.2 Stock Estimates

Stock estimates are, in contrast to original or raw data on migrant stock, adjusted, harmonized and, if necessary, completed using reasonable imputations.

3.2.2.1 UNPD

Starting in the early 1980s, the United Nations Population Division pioneered a systematic collection of statistics of migrant populations, or migrant stocks, from censuses, population registers and surveys. The original migrant stock data are maintained in the GMD (see the section 3.2.1.2 on Migrant Stock Statistics). This data is the basis for a widely recognized and valuable set of migrant population estimates, International Migrant Stock. The latest edition of the International Migrant Stock database extended its coverage and now has data from 1990 to 2020, reported quinquennially. The original data—from 201 countries—are adjusted for reference years. The estimates also required harmonization of various definitions of a migrant (mostly foreign born, alternatively citizenship) and the inclusion of refugees. For more details see [United Nations, 2020; pp. 4-5], also see information in the accompanying Catalog. Despite the immense usefulness of migrant stock estimates for public discourse and

[19] EUROSTAT uses the term **Migrant Population**, see https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics
[20] See: https://www.unhcr.org/refugee-statistics/

international policy evaluation, it has several of significant caveats. For the few countries without any data, similar countries were used as a model. If there was only one data point, growth rates of migrant stock of destination country groups were used to impute stock estimates for all seven data points. If there were two or more data points available interpolation and extrapolation were used.

3.2.2.2 World Bank

The World bank is active in migration analysis, estimation, and migration policy support. (For an overview, see World Bank 2019). The World Bank invested considerable effort to produce a set of migration matrices for stocks by origin and destination. There are several different datasets based on raw data compiled by the United Nations GMD. The data has been enhanced, completed, and corrected and more recent data has been added. An effort was also made to extend the estimates back to 1960. In their report (Özden et al., 2011) the authors present a dataset for 226 countries of origin and destination, by age and sex and for the reference years 1960, 1970, 1980, 1990, and 2000. Subsequently, the number of countries covered was extended to 232 countries for origin and 231 countries of destination.

The Migration and Remittances team and KNOMAD also produces bilateral migration data sets for the reference years 2010, 2013 and 2017. This bilateral matrix was initially presented in the South-South Migration and Remittance report that presented results from an ongoing effort to improve data on bilateral migration stocks.[21]

(https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data)

The data are also presented in the Migration and Remittances Factbook. The factbook presents the numbers and facts behind international migration and remittances, drawing on authoritative publicly available data. It provides a comprehensive picture of emigration, immigration, and remittance flows for 214 countries and 15 country groups.

(https://openknowledge.worldbank.org/bitstream/handle/10986/23743/9781464803192.pdf)

The Migration and Remittances Unit of the World Bank conducted household surveys in collaboration with institutions and individuals in Burkina Faso, Kenya, Nigeria, Senegal, South Africa, and Uganda. The main findings of the surveys and the methodology are found in Plaza, Navarrete and Ratha (2011). (https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data)

[21] *"Ratha, Dilip; Shaw, William. 2007. South-South Migration and Remittances. World Bank Working Paper No. 102. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/6733 License: CC BY 3.0 IGO."*

3.2.2.3 OECD

The OECD has compiled comprehensive estimates of migrant stock data in an initiative entitled **D**atabase on **I**mmigrants in OECD **C**ountries (DIOC) and the extended version includes select non-OECD countries (DIOC-E). The compiled data sets include numerous additional characteristics that allow for deeper analysis and better understanding of migration processes of the countries covered: demographic characteristics (age and gender), duration of stay, labor market outcomes (labor market status, occupations, sectors of activity), fields of study, educational attainment and the place of birth.

3.2.2.4 Brain Drain and Educational Attainment

An increasingly important aspect of international migration is the selective force it may assert on the educational composition of countries impacted by migration, both countries of origin and countries of destination. Researchers tried to determine whether the flow of (highly) qualified people between less and more developed countries has positive or negative effects for both the countries involved. For the purposes of this investigation, the educational composition of migrations was included in extensive data collection and estimation processes. Adding additional dimensions such as educational attainment faces stiff challenges due to limited migration data and nonconformant definitions of educational status/outcomes. Here only a brief overview of estimates in this area are given, not the developmental impacts. For details, see the Catalog at 4.2.3.

3.3 Net Migration

Net migration is a non-observable entity. Net migration is the difference between the number of immigrants and the number of emigrants. In many cases, however, net migration is an ex-post calculation after a census or a register count, being the statistical residual between two known population figures plus birth minus deaths. Some years ago, Rogers wrote a eulogy for the net migrant (Rogers 1990), but to little avail. Net migration is still the dominant migration measure in international population projections[22].

Eurostat produces net migration figures by taking the difference between total population change and natural change; the statistic is referred to as *net migration plus statistical adjustment*. Such a net migration measure is therefore affected by all the statistical inaccuracies in the two components of this equation, especially population change.

(See: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Net_migration).

3.3.1 Net Migration Estimates

Net migration as a residual measure is not observable and cannot be obtained as original statistics cannot be obtained. A brief description of the production and availability of net migration is presented below.

[22] See (Buettner and Muenz 2016) for a recent comparison of global net migration estimates and projections.

3.3.1.1 United Nations Population Division

The United Nations Population Division (UNPD) provides estimates of international net migration for 235 countries or areas for 150 years, from 1950 through 2100, at five-year intervals[23]. The data for 1950 to 2020 are estimates, while the net migration figures for 2020 to 2100 are projections based on simple assumptions. [United Nations (2019); p. 5-6]. UNPD publishes figures of total international net migration, both sexes combined. UNDP data for net migration by sex and age groups are available internally, but not published.

3.3.1.2 Unites States Census Bureau

The Unites States Census Bureau (USCB) prepares global population estimates and projections for 228 countries by calendar year. Net migration data is published as Net Migration Rate, that is the number of net migrants per 1,000 of the mid-year population. Complete coverage in terms of net migration begins after 2013 as before that year, the indicator is mostly absent from the data base (United States Census Bureau. International Programs 2020; as of December 2020).

3.3.1.3 EUROSTAT

EUROSTAT calculates net migration[24] estimates (with statistical adjustments) from 1960 in calendar years for the 27 current EU Members, the UK, the four European Free Trade Association (EFTA) countries, plus 17 other European countries (including Turkey). Note that the calendar year coverage is incomplete, especially before 1996[25].

3.3.1.4 Joint Research Centre of the EU

The Joint Research Centre (JRC) and Knowledge Centre on Migration and Demography (KCMD) of the EU recently published a technical report with new estimates of net migration using high spatial resolution. This publication is the first part of a broader JRC project aimed at analyzing the relation between climate change, population distribution and related migration. The report uses demographic indirect estimation techniques based on population data from the JRC Global Human Settlement Layer (GHSL) to estimate five-year net migration from 1975 to 2015 at a spatial resolution of about 25 km. (See Alessandrini, Ghio, and Migali 2020).

3.3.1.5 National Center for Atmospheric Research (NCAR)

The NCAR Community Demographic Model (Nawrotzki 2014; Nawrotzki and Jiang 2015) includes the multiregional population/urbanization projection module. The use of flow data in the model did not seem feasible, so an attempt was made to estimate net migration profiles by age and sex (termed,

[23] UNPD's estimates and projections of net migration are republished:
* UNdata for the period 1950-2100.
* World Bank World Development Indicators for the period 1960 to 2020.
[24] <https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Population_change>
[25] Table Population change—Demographic balance and crude rates at national level[demo_gind] Last update: 11-02-2021.

incorrectly, net migration flows). It is suggested that future exercises should include migrant flows instead of net migration.

3.3.1.6 Center for International Earth Science Information Network (CIESIN)

In 2011, CIESIN prepared subnational and international net migration estimates, by ecosystem from 1970 to 2010. (Center for International Earth Science Information Network (CIESIN) 2011) Because of the lack of globally consistent data on migration, CIESIN employed indirect estimation methods. A combination of data on spatial population distribution for five years (1970, 1980, 1990, 2000, and 2010) and subnational rates of natural increase were used to calculate net migration estimates. A geospatial analysis allowed to produce detailed global maps.

3.3.2 Net Migration Projections (Excurse)

Net migration data is also produced for population projections by all providers of global and regional population projections. These projections are based on past estimates and sometimes other covariates. An interesting statistical approach is presented by Alessandrini, Ghio, and Migali (2020), for estimating a high-resolution net migration dataset for a 25 x 25 km grid. The estimation approach uses the residual method based on the demographic balance equation and some very simple assumptions. Nawrotzki and Jiang (2015) also made an attempt to estimate net migration for countries around the year 2000. The somewhat misleading terminology refers to net migration flows and is based on a differencing approach to migrant stock data.

3.3.2.1 Institute for Health Metrics and Evaluation

The first global population projections produced by the Institute for Health Metrics and Evaluation (IHME) contain net migration estimates and projections for 195 countries from 2018 to 2100.[26] Net migration projections were generated by fitting a time-series model with covariates (socio-demographic index, crude population growth rate, and deaths from war and natural disasters) to national net migration rates. Past net migration estimates were taken from the UN's 2017 Revision of UNPD's World Population Prospects but are not included in the published datasets.

3.3.2.2 University of Washington

A group at the University of Washington developed models for the projection of net international migration in a probabilistic fashion (Azose and Raftery 2015). These models were an improvement to the UN's approach of projecting all countries separately, which unavoidably resulted in non-zero net migration of the world level. The Raftery models avoid that problem.

[26] Data are available, in varying time coverage for the period 1950 to 2017, at http://ghdx.healthdata.org/record/ihme-data/global-population-forecasts-2017-2100

3.4 Unconventional Sources

Most of the data sources discussed so far have been part of or are related to the data collection efforts by national statistical authorities. Migration flows, both internal as well as international, have been registered for a longtime, albeit by a few countries. A time-tested instrument—the population census—is still the primary data source for information on the stock of migrant populations for most countries. To overcome the scarcity of official migration data, sophisticated techniques and models have been suggested and tested to arrive at migration flow estimates (see 3.1.2.).

Here are some instruments and sources that may yield better migration data by utilizing unconventional data sources and advanced technology

3.4.1 Big Data

Big data is a relatively new field, promising new insights in many areas. The term big data is often used to describe extremely large datasets that require novel ways to process them using new computing power.

The UN-based Global Migration Group (GMG), in 2017, acknowledging the lack of a commonly accepted definition of big data, stated it "… can be broadly described as anonymized data inadvertently created and stored—usually in private companies' databases—every time a mobile phone call is made, a text message sent, an Internet search run, or a social media update posted … The analytical capacity required to process the large amount of data coming from these sources is also unprecedented; advanced computational methods are needed to extract meaning from such data…(Global Migration Group, 2017, p. 22). The GMG identified three categories of data sources as most relevant: i) cell phone calls, texts and transfers activity and ii) internet-based activities, information, communication and financial services and iii) remote sensor data from satellite images (Global Migration Group, 2017, pp. 222–223). Administrative records, such as visa applications, special social assistance and naturalization records could also be subject of Big Data analysis[27].

Big data may be especially useful for following movements of people in distress who have been forced to leave their homes and have become internally displaced or international refugees. Tracking undocumented migration could be another area where big data could be used as undocumented or irregular migrants are virtual invisible in established registration procedures but may be active users of internet service.

Big data has become entrenched in the public realm. Some recent big data efforts relevant for migration are:

- The United Nations Statistics Division has created a *Global Working Group on Big Data for Official Statistics*, which has been meeting regularly since 2014. At its global meeting in 2020, one topic was dedicated to "Using big data for SDGs[28]—mobile data for tourism, migration,

[27] The DEMIG project (see 3.1.2, and the accompanying Stocktaking Catalog) compiled, in addition to migration data, a database on visa application to infer potential migration.
[28] Refers to the United Nations seventeen Sustainable Development Goals established in 2015.

population and transport" https://unstats.un.org/unsd/bigdata/conferences/2020/ IOM: https://migrationdataportal.org/themes/big-data-migration-and-human-mobility

- Rango and Vespe (Rango and Vespe 2017) reported on the workshop the workshop *"Big data and alternative data sources on migration: from case studies to policy support"*[29], organized by European Commission's Knowledge Centre on Migration and Demography (KCMD and IOM's Global Migration Data Analysis Centre (GMDAC).
- GMDAC's migration data portal summarizes big data's potential for enhancing knowledge about human mobility [https://migrationdataportal.org/themes/big-data-migration-and-human-mobility].
- The UN Global Pulse is the UN Secretary-General's initiative on big data and artificial intelligence for development, humanitarian action and peace. [https://www.unglobalpulse.org/]

3.4.2 Remittances

The World Bank/KNOMAD has collected, estimated and analyzed the inflow and outflow of remittances. The data, compiled into spreadsheets is available on the World Bank's website[30] and may be useful as auxiliary data for the estimation and validation of migration flow models. The data on remittance outflows and inflows from a country are based on officially reported data in the IMF Balance of Payments.

The World Bank/KNOMAD produces a Bilateral Remittances Matrix. Given the increasing awareness of the importance of remittances in developing countries, there was a need to produce estimates of bilateral remittance flows. The World Bank first undertook analytical work on bilateral migration and remittances in the context of an inquiry into the size of South-South flows compared to South-North flows in 2006. The simple approach was to allocate inward remittances to a country in proportion to its stock of migrants in various destination countries, per capita income (in purchasing power parity (PPP) terms) in the destination countries, and the per capita income (PPP terms) in the origin countries. This methodology is explained in the paper South-South Migration and Remittances,[31] a blog on this topic and the KNOMAD FAQs.

[29] Big Data and Alternative Data Sources on Migration | Knowledge for policy (europa.eu)
[30] <https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data>; see also: <https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-and-remittances-publications>
[31] http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1110315015165/SouthSouthMigrationandRemittances.pdf

4 MAJOR GAPS, SUGGESTIONS, CONCLUSIONS

4.1 Major Gaps

Most international migration scholars acknowledge large gaps in the data on global mobility, particularly international migration flows.

The meagre availability of reliable, complete, and timely statistical data is further complicated by the virtual absence of uniform and comparable definition of migration-related concepts. These problems have existed for many decades. Even in the 1920s, efforts to reach an agreement on uniform definitions of migration statistics (then on the term “emigrant”) were attempted, but not successful. Subsequent attempts to improve both definitional clarity and empirical coverage were marginally successful.

Conflicting interests of states, organizations and individual actors could be at the crux of the problem (see Hansen 2014). One explanation could lie in the fact that international migration concerns at least two countries—the country of origin and the country of destination. Yet international migration is often dealt with as an internal problem.[32] International migration is also a politically sensitive issue for all countries involved. To manage this sensitivity, confidentiality requirements for migration data are stricter than that for other demographic components, like births or deaths.

The most reliable statistical data on international migration is the static data collected from censuses. and in some countries, population registers and representative surveys. Lifetime migration (migrant population or migrant stock) dominate the international global discourse. In contrast, data on migrant moves, e.g., flow data, are largely in the domain of national concern in the countries that receive migrants. The Continuous Reporting Systems on International Migration Flows (SOPEMI, SICREMI), for example, is only available for a select number of receiving countries that have robust and stable statistical systems. EUROSTAT[33], like SOPEMI is also able to produce valid migration flow- as well migrant stock data. Richer countries that record this data also have ownership of this data. Due to the political and humanitarian aspects of refugee movement, their coverage is much better and necessarily includes developing countries.

Among the available statistics on international migration, migrant stock data is more widely available and for many more countries than data on migrant flows. Migrant stock data are available for about 94% of countries (218 out of 232) for the period of the last two census rounds (United Nations, 2019, pp. 4–5)[34]. However, the time gap between censuses, usually ten years, implies movements of migrants between the enumerations go unrecognized. Censuses may miss the mobility/international migration of natives (e.g., citizens of a country or persons born in that country, depending on the definition). Estimating the underlying migrant flows from this data is therefore only possible by making strong

[32] Overwhelmingly placed under the administration responsible for interior affairs.
[33] A brief overview about the migration data availability in the realm of EUROSTAT is given by (Santamaria and Vespe 2018).
[34] The last two census round cover the period 1995-2004 (2000 census round) and 2005-2014 (2010 census round).

assumptions about return migration, intermediate migration, etc. (Abel and Cohen 2019; Azose and Raftery 2015).
It is understandable that, because of better availability, international migration researchers have resorted to using migrant stock data as a proxy for international migration. Consequently, migrant stock data have dominated the international discourse, unfortunately by applying a confusing array of terms.

4.2 Suggestions

4.2.1 Strengthening the Statistical Basis

First, there is a need to undertake more effort to produce reliable and sufficient data on international migration. The request for better data is a common thread in statistical and scientific literature. It is pronounced in a series of recommendations issued by the UN Statistical Commission, plus in various Demographic Yearbooks of the UN and as well as in the Global Compact on Migration (United Nations 2018a).

Developing countries need special support in this matter, especially more reliable and sustained funding for their statistical agencies. Despite the tireless efforts of national statisticians, their institutions, conferences, expert groups and United Nations commissions, there has been little progress on the quality of data, and sometimes efforts have been thwarted by new forms of migration. While the nomenclature of the 1970s missed the category of refugees, the current recommendations pay short thrift to undocumented migrants, the reduced importance of national borders, as in the European Union, and double citizenship, etc. The blind spots in the nomenclature are mirrored by the scarcity of statistical data representing them.

Endre Sik (Sik 2012) attested that the quest to improve migration statistics had limited chances of succeeding. Willekens was equally gloomy regarding one of the more advanced statistical systems in the European Union[35] (Willekens 2019). Progress in registering international migration, especially immigration and emigration flows, is likely to remain slow.

International migration is not part of the existing vital registration statistics and institutional arrangements. It is surprising, from a demographic vantage point, because (international) migration changes the profiles of age, sex and other characteristics of populations, both for receiving and sending countries. It also directly affects levels and trends in fertility and, albeit to a lesser extent, mortality. Let's consider, for the sake of argument, international migration is a demographic event. Clearly, emigration removes people from the population of the sending country, not only by number, but also by age and sex. Seen this way, emigration is equivalent to deaths (for the sending country). Emigrants eventually turn into immigrants, adding themselves to the receiving country. Hence, they may be compared to births, with the important difference of not being of age zero on arrival. Migrants who

[35] "In Europe, the monitoring and management of migration flows are high on the political agenda. Evidence-based monitoring calls for adequate data, which do not exist. The sources of data on international migration differ significantly between countries in Europe and the initiatives to improve data collection and produce comparable data, including new legislation, did not yield the expected outcome. p. 231"

leave one country and arrive in the receiving country impact the demographic trends of both the countries. Obviously, (international) migration is not an administrative or an economic issue; it is a 'vital' demographic one, too.

4.2.2 Consolidation through Cooperation

The most informative statistic on international migration continues to be migration flow data. Realizing the great technical difficulty and definitional complexity associated with obtaining/producing/generating statistical data on international migration flows, two proposals may be entertained.

First are some suggestions to improve flow statistics. National Statistical Offices should be called upon to consider the implementation of a system like the Inter-Nordic Migration Agreement [Poulain, Perrin, and Singleton, 2006; p. 113; Kupiszewska and Nowok, 2008; Nowok, Kupiszewska, and Poulain, 2006]. Under this agreement, countries of northern Europe share their data on emigration with receiving countries in that group. Willekens discussed in detail possible approaches to improve the quality and coverage of migration flow data by, inter-alia, combining several data sources[36] (Willekens 1994), The second set of suggestions relate to improving the standard tool of enumerating foreigners in a census, e.g., stock statistics. The most comprehensive instrument to obtain migration data are still the decennial censuses. Censuses cover most countries of the world. Improvements in coverage and harmonization of concepts could make this data source even more useful. Censuses are not merely about numbers: they are an important instrument to make literally everybody count and to establish and maintain a person's identity.

4.2.3 Validation and Reconstruction of Migration Dynamics

After the collection of empirical data, the process of estimation begins. Statisticians in national/international offices are very reluctant to improve, adjust, or complete their data beyond standard procedures as official statistics are a very sensitive issue. If the goal is to produce reliable, plausible and complete accounts of international migration, then the incomplete empirical data should be the starting point of serious analysis and modeling. Such an approach to stepwise transformation of empirical information into a more comprehensive and consistent set of data could be named the cascading or tandem model.

The first level of such a model is the collection, cleaning and documenting of first-line empirical data from national authorities, including their aggregation in central places, such as EUROSTAT, OECD, and the UN Statistics Division. The second step or level should be to continuously process all available information in a separate step and at a central institution to adjust, harmonize, and impute/estimate missing information. There is a working model along these lines in the United Nations Secretariat. Demographic data from the statistics division (and other sources) are processed by the population division, producing the World Population Projections (including a complete and consistent account of the period from 1950 to the latest Revision). There is a virtual firewall in place between the UN Statistics Division and the Population Division, ensuring that official statistics remain unchanged. The two

[36] Willekens mentions censuses, surveys (labor force surveys, migration surveys, etc.) and administrative records (e.g., general population register; special purpose registration, such as the registration of asylum seekers, refugees and/or foreign labor; drivers' licences; tax records; work permits; etc.).

datasets—official and estimated and projected—would thus create a data universe that is transparent, authentic and consistent.

This effort could be even expanded and refined by including estimated flow data into an accounting framework of demographic components and populations, eventually for all countries of the world. Again, this would follow the recently established procedure of UNPD. The UNPD currently reconstructs the demographic history of all countries by forward projecting the populations aiming at matching intermediate census results. UNPD's current process uses age-specific fertility and mortality estimates, plus net migration estimates by age and sex to arrive at an internally consistent reconstruction of the demographic history for each country (United Nations 2019). Needless to say that such a complex estimation process requires several iterations and adjustments of the indicators involved.

Combining estimates of population stock. with estimated migration flows between countries within a projection model[37] and inserting those into the reconstruction exercise just described could yield a very powerful instrument for modeling and even projecting international migration dynamics.

4.2.4 Better Documentation

The comprehensive and complex databases maintained by the United Nations Statistics Division (UNdata), EUROSTAT and OECD (SOPEI, SICREMI) are powerful tools for finding relevant data on international migration. Identifying the needed datasets, understanding their coverage, and missing data is, however, a cumbersome task. It would be helpful for the user to find a data summary document, accompanying the data and metadata. This could be a listing of countries for which a particular indicator or statistic is available, the year the data references (and which years/dates are missing). An overview about demographic details (age, gender) would also be valuable.

4.2.5 Easing Access to Data

In the past, international migration statistics have been compiled and summarized exclusively in printed form, notably as special chapter in the Demographic Yearbook prepared by the UNSD. Data in printed form are resilient to change and have an extended shelf life. Their utilization, however, is cumbersome and time consuming. Beginning with the Demographic Yearbook 1989, the publication of migration data was removed from it and transferred to the online database now called UNdata. This move to a modern medium allowed easy access for everybody and better utilization of the data for analytical purposes. Similarly, European Union/EUROSTAT offer online databases on international migration, as does the OECD. Online databases have significant advantages, but, at the same time, pose some difficulty for the external user: Their mechanism for bulk downloading is often limited,[38] the available filter mechanisms are somewhat limited, and in some cases, attributes are not documented. In any case, obtaining large datasets form online resources imply some significant adaptation work for the user. Here, a user survey targeted to the research community could produce valuable suggestions.

[37] It is worth mentioning that Norway (regularly) projects its population including the population by immigrant background (Gleditsch et al., 2021).
[38] UNdata has a download limit of 100,000 records, which is only a small portion of some complete datasets.

Migration statistics prepared by international agencies, research groups and others are confronted with a changing political geography. There have been numerous changes in the number and composition of countries, their status, and their (official) names. Countries have split to form independent entities; yet others have united to form one country. One such major geopolitical discontinuity was the emergence of independent states during the process of decolonization mainly in the 1960s and 1970s, another was the end of the cold war that gave rise to several new and independent countries. This geopolitical dynamic thus is a challenge to researchers studying trends, causes and impacts of international migration. The Population Division of the United Nations, for instance, chose to reflect the geopolitical status present at each of their revisions for their historical time series. Germany is now shown united throughout; the Soviet Union is absent and visible only by their successor states. Other organizations may maintain the actual history of countries in their statistical listings, with breaks in time series properly noted. Of lesser concern, but still a problem for comparability and utility, is the use of outdated or organization-specific country names, which requires a cumbersome process of translating these into a reference list of country names for comparison. A practical, but not very easy solution would be to use ISO country codes exclusively or in combination with short forms of the country name. Besides the original listing of the country codes by the International Standardization Organization,[39] the UNSD maintains a list of current and past "Standard Country or Area Codes for Statistical Use (M49).[40]

4.2.6 Human Migration Database

The GMD data repository could collect, review, summarize and present both original data on stocks and flows from, say, 1950 onward, and the ad-hoc estimates of stock and flows that have been prepared by international bodies and individual groups of researchers. Such a Global Mobility Database could be modeled after the well-established *Human Mortality Database* (Human Mortality Database, n.d.; Jdanov et al. 2019) or the similar *Human Fertility Database* (Human Fertility Database, n.d.). A lesson from these two ambitious and highly useful projects is to also prepare parallel collections of official data estimates and results of research groups that differ from the unified data contained in them (See the Human Fertility Collection at: https://www.fertilitydata.org/cgi-bin/index.php and the Human Life Table Database at: https://www.lifetable.de/cgi-bin/index.php).

4.2.7 Sustaining Projects

This review has shown that second-line estimation, modelling and harmonizing of existing statistical data are an extremely valuable contribution to policy formulation, program design and support. It also serves well to enhance awareness through public discourse. Indeed, the main data source for the international arena are the continually updated estimates of migrant stock data prepared by the United Nations Population Division. Other very informative efforts have had mostly limited funding and covered, therefore, only a limited number of years. These ad-hoc efforts have contributed a great deal to establish new approaches to improve and enhance methods and techniques for the estimation of migration data. However, their contribution towards improving the empirical understanding of

[39] Country codes are available in alpha2, alpha 3 and numeric format, see https://www.iso.org/iso-3166-country-codes.html

[40] https://unstats.un.org/unsd/methodology/m49/

migration dynamics was unfortunately limited. By transferring certain approaches, methods and tasks to a long-term group or institution, there could be more sustained improvements in the data.

4.2.8 Consider More Migration Drivers

4.2.8.1 Climate Change

Climate change is a stark contemporary and future global challenge. International migration, caused by critical changes in climate and environment, are neither well defined nor fully understood. Including climate change as a driver of human mobility, including international migration, in modeling and projecting population processes is clearly important.

The European Commission, under the umbrella of the *Knowledge Centre on Migration and Demography*, has recently launched a project named **CLICIM** (**CLI**mate **C**hange **I**nduced **M**igration) that endeavors to generate evidence on the relationship between climate change and population dynamics in Africa, with migration being an important part. See: <<https://knowledge4policy.ec.europa.eu/migration-demography/climate-change-induced-migration-clicim-project_en>.

As initial step for analyzing the relation between climate change, population distribution and related migration, Alessandrini et al. prepared a high-resolution mapping of net migration for the world at a 25 by 25 km grid, combining different data sources, including censuses and satellite data (Alessandrini, Ghio, and Migali 2020)

4.2.8.2 Labor Migration

Labor migration is, for many countries, an important factor of development. Migrant workers are often also international migrants under the criteria of the UN's 1998 Recommendations (United Nations Statistics Division 1998). Recognizing labor migration in its entirety may help improve the understanding of the determinants and consequences of international migration as well.

4.2.8.3 Migration Shocks

International migration does not follow a smooth path. Instead, annual migration data exhibit fluctuations and, sometimes, sharp increases and decreases. The causes for the fluctuations are many: natural disasters like earthquakes, drought and flooding or economic crises and armed conflicts. Some of these events, and the migration movements triggered by them, are temporary and often local, but some have an impact on an international scale. For a proper accounting of such shocks a better registration is needed.

4.2.8.4 Undocumented Migrants/Migration

Undocumented (irregular, illegal) migration[41] is an ever-increasing component of human mobility. It has tremendous impact on the countries concerned (countries of origin and destination, and transit countries), and for the people involved. Undocumented migrants are victims of human rights violations, and may risk being exploited. Undocumented migrants are invisible and often difficult to reach.

There is a huge gap between the number of people wishing to move from poor nations to wealthier countries and, the willingness of these countries to offer legal pathways to immigrate. It is therefore likely that the number of undocumented migrants will increase in the future.

4.3 Conclusion

This paper has discussed a wide array of data—whether first-line statistics or model-guided estimates—on international migration. The evolution of size, direction, and impact of international migration in the past half-century has been sketchy at best and visible mostly at the endpoints of movements, as migrant stocks.

International migration is clearly a challenge for politicians, researchers, and statisticians. International migration is also a highly sensitive issue that not only touches upon identity, national interest, and well-being, it also has implications for international humanitarian law and solidarity. Because of its complex nature, international migration has not been treated at par with areas like trade and finance. Even after more than a century of attempts to integrate international migration into regular statistics in a comprehensive and neutral way, it seems likely that improvements in official statistics on international migration will be slow and incremental. Therefore, it is advisable to establish a system of corresponding efforts to gain sufficient information on the flow of people and on the impact they have on both sending and receiving countries and societies.
From the stocktaking exercise in this paper, it appears that despite increasing efforts to improve the basis of empirical/statistical migration data, there is still a need for a multi-pronged effort and innovative approaches to supplement existing statistics. In fact, nascent efforts in this regard have been taking place, but in a fragmented and ad-hoc way. Through better coordination, sustained funding, and endurance, international migration data could not only get better visibility, it could also lead to a deeper understanding of migration dynamics. This would not only provide a better grasp of past events, but also help develop robust and plausible hypotheses about future trends.

[41] IOM defines it as "…Movement of persons that takes place outside the laws, regulations, or international agreements governing the entry into or exit from the State of origin, transit or destination."(International Organization for Migration, 2019, p. 116)

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ANNEX

Stocktaking of Migration Data: Catalog

Thomas Buettner

Abstract

The supplementary information in this document contains a more detailed account of available data sources for the paper entitled Stocktaking of Migration Data. It covers data on migration flows, migrant stocks and net-migration, distinguishing between original or raw data and estimates derived from the raw data.

Key words: Migration data, Migration Flows, Migration Stocks, International Comparison.

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1 INTRODUCTION

The paper is a companion to the KNOMAD Working Paper entitles "Stocktaking Migration Data." It documents migration data publicly available. To be included, they should be collected, estimated, and published by international organizations, ad-hoc research groups and researchers (sources). The Catalog does not cover data published directly by National Statistical Offices (NSO).
This Catalog is organized by important characteristics of international migration data. It distinguishes between original or official statistics (issued by NSOs) and estimates, based on raw, but altered, completed, imputed, or modeled data). It also makes a distinction between migration flows and migrant stock. Some sources publish both original statistics and adjusted or modeled estimates. Since the statistics and derived estimates are listed separately, theses data sources are listed repeatedly.
There are many forms and types of (international) mobility. We are interested in the projection of international migration, which excludes many short-term, circular, and seasonal movements. For an overview about the main categories of international movements that also distinguish between residents and non-residents, see (United Nations Statistics Division 1985, 5). For a comprehensive exposition of categories of international movements, see the last revision of Recommendations on Statistics of International Migration (United Nations Statistics Division 1998a).

As has been noted already many decades ago, the topic of international migration statistics is characterized by a multitude of different definitions of what constitutes a migrant or the migrant stock, as there are many different types of human mobility that share the property of crossing an international border. To bring transparency and comparability to this unruly mobility universe, the United Nations and its Statistics Divisions has engaged in providing recommendations on international migration statistics for all countries. There have been until now three installments of these recommendations, in 1953 (United Nations Statistics Division 1953) , 1976[1] (United Nations Statistics Division 1979b), and 1998 (United Nations Statistics Division 1998a) . Reacting to an ever more complex field of human experience, the UNSD has begun the preparations for a revision of the Recommendations (United Nations Statistics Division 2020).

To make use of the Catalog easier, we follow the current broad definitions used for the Demographic Yearbook (United Nations Statistics Division 1998b, 32):

Table 3: Classification of Immigrants and Emigrants

No.	Immigrants	Emigrants
1	Long-term immigrants,	Long-term emigrants,
2	Short-term immigrants,	Short-term emigrants,
3	Residents returning after working abroad for less than a year (i.e., short-term emigrants returning)	Non-residents departing after working in the country for less than one year (i.e., short-term immigrants departing)
4	Nomads	Nomads.

[1] See, for example, the Global Migrant Origin Database
http://www.sussex.ac.uk/Units/SCMR/drc/research/typesofmigration/global_migrant_origin_database.html

Not discussed here are categories of international arrivals and departures like tourists, excursionists, refugees, diplomatic and consular representatives. There is also an open-ended category "special categories", which may include any of the following: temporary foreign workers (seasonal workers, contract workers, border crossers), foreign students, dependants, etc.[2]

2 DATA SOURCES

2.1 National Statistical Offices

National Statistical Offices (NSO) are the primary sources for statistical data on migration. Some international agencies like UNHCR are collecting data for refugees and asylum seekers, especially for those under UNHCR's direct responsibility (refugee camps).
This Catalog does not include the activities of NSO's but focus on international organizations and agencies that collect and disseminate migration data form national sources. This restriction on secondary sources was required to gain an overview of the international dimension of migration, and because of limited resources to engage in a full-fledged investigation.

UNSD maintains a list of NSOs at: https://unstats.un.org/home/nso_sites/
The NGO Open Data Watch also offers a list (with links) of NSOs:
https://opendatawatch.com/knowledge-partnership/%E2%80%8Bnational-statistical-offices-online/

2.2 United Nations

The United Nations and its specialized agencies, funds and programmes assemble international statistical information on a variety of topics. The central entity for national statistics is the United Nations Statistics Division (UNSD) of the Department of Economic and Social Affairs. Other entities collect and estimate special statistics according to their mandates and activities. Since activities and concerns of different United Nations actors sometimes intersect or overlap, efforts have been made to consolidate the estimation process between various entities by establishing inter-agency groups.[3]

The United Nations (UN) system is one of major data providers and users of international migration data. The system comprises the UN itself, plus many funds, programmes, specialized agencies, and related organizations. The following entities are considered in this Catalog and the corresponding stocktaking paper.

United Nations Secretariat

The United Nations Statistics Division (UNSD) and the United Nations Population Division (UNPD) are engaged in collecting, estimating and projecting key indicators of international migration. They are part the Department of Economic and Social Affairs, which is part of the UN's Secretariat.

[2] There are 232 countries of origin, but 231 countries of destination, omitting the Holy See.
[3] The 2019 Revision ended with estimates for the year 2019, thus breaking the standard format of quinquennial time references.

Regional Commissions
The five Regional Commissions under the jurisdiction of ECOSOC are promoting economic and social cooperation and development among its member states, The Regional Commissions are the United Nations Economic Commission for Europe (ECE), the United Nations Economic Commission for Africa (ECA), the United Nations Economic Commission for Latin America and the Caribbean (ECLAC), the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), and the United Nations Economic and Social Commission for Western Asia (ESCWA).

Funds and Programmes
Many Funds and Programmes of the UN System use data on migration in their work, but do not collect or produce estimates.

UN Specialized Agencies
The UN specialized agencies are autonomous international organizations working with the United Nations. Two of them are engaged in analyzing and preparing estimates of international migration, namely the International Labor Organization and the World Bank.

Other Entities and Bodies
Other Entities and Bodies that act under the umbrella of the United Nations that are actively engaged in collecting and analyzing specific migration data are the United Nations High Commissioner for Refugees (UNHCR) and the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA).

The international Organization for Migration (IOM), as a Related Organization, is the leading inter-governmental organization in the field of migration and dedicated to migration policies, trend analysis and collection of special migration data.

2.2.1 Secretariat

2.2.1.1 Statistics Division

The United Nations Statistics Division (UNSD) is mandated to collect and distribute all national statistics that are important to the United Nations. It also has the function to advise National Statistical Offices (NSO) and other relevant bodies on definitions, classifications and methodologies (check).In term of the statistics on international migration, UNSD collects and disseminates official national data on international migrant flows and stocks through Demographic Yearbook data collection, elaborates and suggests international standards and methods related to international migration statistics, assist countries in enhancing their capacity on migration statistics, and coordinates statistical programmes and activities through the United Nations Expert Group on Migration Statistics.

UNSD reviewed in 2004 the situations as related to international migration data (United Nations Statistics Division 2004). The results were not promising. Only few countries ever reported migration data according to UN recommendations and questionnaires. UNSD supports the international statistical system by preparing recommendations of best practice, guidelines, special manuals, and training

workshops. One of the latest such efforts, and still in the making, is the *Handbook on Measuring International Migration through Population Censuses* (United Nations 2020a), ultimately replacing and earlier version (United Nations 2017a). It is noteworthy that the handbook includes both migration flows and migrant stock. Under the umbrella topic of Demographic and Social Statistics[4], UNSD collects, compiles, and disseminates official demographic and social statistics on a wide range of topics. Data have been collected since 1948 through a set of questionnaires dispatched annually to over 230 national statistical offices and have been published in the Demographic Yearbook collection. The Demographic Yearbook disseminates statistics on population size and composition, births, deaths, marriage, and divorce, as well as respective rates, on an annual basis. The Demographic Yearbook census datasets cover a wide range of additional topics including economic activity, educational attainment, household characteristics, housing characteristics, ethnicity, language, foreign-born and foreign population. The available Population and Housing Censuses' datasets reported to UNSD for the censuses conducted worldwide since 1995, are now available in UNdata, a comprehensive data warehouse.
http://data.un.org/Explorer.aspx?d=POP

2.2.1.2 Population Division

The United Nations Population Division (UNPD) of the Department of Economic and Social Affairs (UNDESA) prepares estimates of migrant stock for each country using the data provided by the United Nations Statistics Division; produces estimates of international migration flows to and from selected countries and undertakes regular studies on national policies on international migration and assesses the impact of international migration on development. In addition, its population estimates and projections for all countries of the world are often used in analyses of international migration as denominator/reference population.
https://www.un.org/en/development/desa/population/migration/index.asp

2.2.2 Regional Commissions[5]

2.2.2.1 Economic Commission for Africa

The Economic Commission for Africa (ECA)[6] offers a limited selection of data on international migration and relies on estimates made by the Population Division of the United Nations. The most recent African Statistical Yearbook 2019 (Economic Commission for Africa 2019) lists Total international migrants for 2000, 2005, 2010, and 2017. The data presented are taken from "Trends in International Migrant Stock: The 2017 Revision" and represent to total emigrants (people born in an African country and living

[4] In many cases, the available data required some form of redistribution to ensure that the reported data were consistent with the standard country or area codes. The most common reason for redistribution was that the data contained at least one description of origin spanning more than one country, area, or region. In addition, a significant number of datasets included a description of origin that was not part of the standard list of countries or areas. Various methods were used to standardize the place of origin.
[5] See: https://research.un.org/c.php?g=98272&p=5600641
[6] https://www.uneca.org/

elsewhere). (https://www.afdb.org/en/documents/document/the-african-statistical-yearbook-2019-109564).

2.2.2.2 Economic Commission for Europe

One of the earliest attempts to compile bilateral or 'double-entry' matrices of migration flows between countries dates back 1975, when the United Nations Economic Commission for Europe published such matrix for its member countries for the year 1972 [reproduced in [United Nations Statistics Division (1978); p. 16]. The production of this matrix was continued, albeit on a restricted and confidential basis, for the years 1976, 1977, 1978, 1979, and 1980 (Kelly 1987). The matrices for the years 1981, 1982,1983, and 1984 were finally made publicly available (the matrices for 1984 in [Kelly (1987)].

The Economic Commission for Europe (ECE)[7] maintains a clearing House on Migration Statistics. It is working as a platform for data exchange on migration statistics for countries of Eastern Europe, Caucasus, and Central Asia (EECCA). The Clearing House was established with the purpose of improving the understanding of migration processes and the systems of measuring migration in the region. The data are presented as submitted by national statistical offices, without adjustments https://w3.unece.org/PXWeb2015/pxweb/en/STAT/STAT__30-GE__99-MCH_1/.

2.2.2.3 Economic Commission for Latin America and the Caribbean

The Economic Commission for Latin America and the Caribbean (ECLAC)[8]
The Publication Demographic Observatory (Observatorio Demografico), prepared by CELADE (Population Division of ECLAC) for 2018 presents immigration tables for 19 Latin American countries extracted from population censuses of the 2000 and 2010 decades (Economic Commission for Latin America and the Caribbean (ECLAC) 2018). The tabulated data are from the Programme International Migration in Latin America (IMILA), in Spanish: https://celade.cepal.org/bdcelade/imila/

2.2.2.4 Economic and Social Commission for Asia and the Pacific

The Economic and Social Commission for Asia and the Pacific (ESCAP[9] like most other Regional Commissions does not collect migration data from NSOs, but republishes UNPD data on migrant stock for countries in their region (https://www.unescap.org/stat/data)

2.2.2.5 Economic and Social Commission for Western Asia

The Economic and Social Commission for Western Asia (ESCWA)[10] maintains a data platform named *United Nations Data Hub for the Arab Region*[11]. It makes available two indicators related international

[7] https://www.unece.org/info/ece-homepage.html
[8] https://www.cepal.org/en
[9] https://www.unescap.org/
[10] https://www.unescwa.org/
[11] https://data.unescwa.org/content/c500a981-a1f4-46c4-91c1-cc3743c5b3e6

migration: Intentional migrant stock, and refugee population in the Arab region, the first copied from UNPD, the second from UNHCR. Data are not documented.

2.2.3 International Labor Organization

The International Labor Organisation (ILO) collects and compiles international labor migration statistics. Data are available online.[12]

Data are available for both flows and stock of international labor migration. The focus of the database is on population in working age (as nationally defined) and both by citizenship and country of birth. Data are given for single calendar years, but gaps are shown when data are missing. The geographic and time coverage is limited and incomplete. For some data series, no countries of origin are available, but aggregated regions. The latest ILO Global Estimates on International Migrant Workers has been published in 2018 (International Labor Office 2018). It contains results and the methodology used to compile the datasets.[13]

The online database comprises data on flow and stock data related to the labor force. Its interface is easy to navigate, and it is providing an option for bulk download.

2.2.4 World Bank

The World Bank has a rich ecosystem of data related to its wide range of activities. Data are available in online databases, thematic tabulation (in Excel or other formats and in substantive reports. International migration is one key area. It includes global matrices of bilateral migrant stocks, spanning the period 1960-2000, plus for the reference years 2010, 2013, and 2017. These data are in Excel format. https://databank.worldbank.org/home.aspx

Migration related data can also be found in in the online database World Development Indicators for international migrant stock and for personal remittances (paid and received). The database on Global Bilateral Migration contains estimates of migrant stock data (1960-2000).

Additional data on international migration is available under the heading Migration and Remittances Data https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data

2.2.5 UNHCR

The Office of the United Nations High Commissioner for Refugees (UNHCR) collects and compiles data on asylum seekers and refugees more specifically on asylum applications, refugee status determination,

[12] The adjustment acknowledges the border closures and severe restrictions and disruptions to international travel, especially in the initial months of the pandemic. In the absence of systematic empirical data on the effects of the pandemic on international migration, the mid-year 2020 stock estimates were derived under the assumption that there was no increase or decrease in the number of international migrants between 1 March and 1 July, 2020, namely during the last four months of the estimation period. The estimated impact of the pandemic on the 2020 stock estimate was computed as the difference between the counterfactual estimate of migrant stock made following the standard methodology described above (as if there had been no pandemic) and the value calculated assuming no change in the number of international migrants between 1 March and 1 July 2020.

[13] This period is commonly referred to as 2010 round of population censuses.

recognition rates, refugee populations and movements, demographic characteristics (age and sex) as well as major refugee locations (camps, centers, urban areas, etc.). https://www.unhcr.org/data.html.

2.2.6 UNRWA

The United Nations Relief and Works Agency for Palestine Refugee (UNRWA) provides statistics about Palestinian refugees (about 5.6 million registered as of 2020), plus agency installations, budget, and staff for the programs in its areas of operations in Jordan, Lebanon, the Syrian Arab Republic, and the Occupied Palestinian Territory.
https://www.unrwa.org

2.2.7 International Organization for Migration

The International Organisation for Migration (IOM) collects and publishes various data including on internal displacement, missing migrants, and migration governance, and collects, uses, analyzes, and publishes primary and secondary data across a wider range of migration topics.
https://migrationdataportal.org/themes/iom-data-overview.
IOM has established in 2017 a dedicated center for migration data and data analysis entitled Global Migration Data Analysis Centre (GMDAC) as the main hub for these activities (https://gmdac.iom.int/).
IOM also operates a Displacement Tracking Matrix DTM project (https://dtm.iom.int/about). It entails four main components: (i) mobility tracking; (ii) flow monitoring; (iii) registration and (iv) surveys.

2.3 EUROSTAT

EUROSTAT (European Statistical Office) assembles and publishes data on migration (immigration, emigration), migrant populations (migrant stock), and related topics such as acquisition and loss of citizenship. EUROSTAT covers a limited geographic range of 32 countries (27 EU members, 4 EFTA countries, and still the UK).
A link to NSO addresses covered by EUROSTA is presented at: https://ec.europa.eu/eurostat/web/links

2.4 OECD

OECD presents its data on international migration threefold: First in a comprehensive database (https://data.oecd.org/) that contains a large numbers of topics, from Agriculture to Society (https://stats.oecd.org/). Under the heading of *Society,* it provides access to data on Demography, Inequality, Migration, Population by Region, and Social Protection. Navigating the OECD data platform offers many ways and views to find and save a specific dataset. The database is available online, has a user-friendly, but complex, user interface and allows registered users to store individual queries.
The OECD International Migration Database (OECD 2021) provides official statistics on stock and flow data focusing on OECD receiving countries plus few associated countries:
http://www.oecd.org/els/mig/keystat.htm.

Table 4: International Migration Database (OECD)

No.	Indicator	Destination	Origin	Years	Period
1	Inflows of foreign population by nationality				
2	Outflows of foreign population by nationality				
3	Inflows of asylum seekers by nationality				
4	Stock of foreign-born population by country of birth				
5	Stock of foreign population by nationality				
6	Acquisition of nationality by country of former nationality				
7	Inflows of foreign workers by nationality				
8	Inflows of seasonal foreign workers by nationality				
Note:					
Source:	https://stats.oecd.org/Index.aspx?DataSetCode=MIG				

The second way data are presented is in customized tabulations which are based on subsets of the main database but focus on a topic with limited scope and coverage.

Finally, the OECD data are published in reports and working papers that entail analyses, explanations and summaries. The report entitled International Migration Outlook is the flagship publication for migration data (OECD 2019).

2.5 Other Sources

2.5.1 Gallup World Poll

Gallup established in 2005 a research group "Gallup's Migration Research Center" which is conducting, analyzing and disseminating the results of Gallup's World Poll on intentions to migrate.

Gallup citizens in 160 countries, representing more than 98% of the world's adult population, and consists of more than 100 global questions as well as region-specific items. It includes the following global indexes: law and order, food and shelter, institutions and infrastructure, good jobs, wellbeing, and brain gain. Gallup also works with organizations, cities, governments, and countries to create custom items and indexes to gather information on specific topics of interest. Gallup interviews approximately 1,000 residents per country. The target population is the entire civilian, non-institutionalized population, aged 15 and older. Gallup asks each respondent the survey questions in his or her own language to produce statistically comparable results. Gallup uses telephone surveys in countries where telephone coverage represents at least 80% of the population. Where telephone penetration is less than 80%, Gallup uses face-to-face interviewing (Esipova, Ray, and Srinivasan 2010; Esipova, Ray, and Pugliese 2011).

For the use of survey data for analyzing potential migration, see (Laczko, Dag Tjaden, and Auer 2017). For a review article on migration intentions and mobility of younger people see: (Milasi 2020),

2.5.2 Academic Sources

There have been a host of projects and initiates by researcher, individually or as groups, in projects to extracts valid information on international migration with the given data (statistics and estimates). These projects have the advantage of bundling the expertise and capacities of scientist to develop methods and procedures to enhance and improve on existing data. Examples are given below, though they are not exhaustive. These initiates have also serious deficiencies: They are often limited by temporal funding, changing, or disappearing web access, missing updates, and thus often become a lighthouse project, innovative, inspiring, but solitary.

This catalog covers the following projects created by academic projects and researchers:

3.2.2 Abel, Cohen
3.2.3 Azose, Raftery
3.2.4 DEMIG (International Migration Institute, University of Oxford)
3.2.5 IMEM (NORFACE Research Programme on Migration)
3.2.6 MIMOSA (European Unison)
4.2.4 Brain Drain Estimates (several researchers)

3 MIGRATION FLOW DATA

Migration flow data document the actual movement of people from one country to another. Capturing actual migration flows is fraught with several difficulties and challenges. For many countries, statistical data on migrant flows are unavailable, either not published or not registered. Even if such data are produced, they do not necessarily apply the United Nations recommendation. For example, according to UN recommendations a migration move (long-term migration) implies a duration of stay of at least one year in the destination country.
As mentioned earlier, this paper distinguishes between (official) statistics and estimates. The former is obtained by NSOs or similar official entities, while the latter is data that has been adjusted, completed/imputed, harmonized. Here we focus firsts on migration flow data from (official) statistics.[14]

3.1 Flow Statistics

3.1.1 UNSD

The United Nations Statistics Division collects data on migrant flows from NSOs. The data may be collected by registering international arrivals or international departures (by intended length and location of stay), in different formats and by different instruments.

Since its first issue, the DYB published data on international migration as submitted by NSOs but ceased to tabulate them in printed form with 1989 issue. Statistics on international migration are still collected

[14] All localities include non-country destinations (regions), while countries refers exclusively to county-country pairs

but made now available in electronic form in an online database. Unfortunately, the online data base does not continue where the printed tables ended and leaves a gap in coverage for several data series.

3.1.1.1 Demographic Yearbook Collection

The Demographic Yearbook prepared by the Statistics Division of the United Nations has published statistics on international migration on several occasions, in different formats, definitions and for different time periods. Comparability is also somehow limited by geographic changes, while continuity is hampered by the emergence of new independent states or the unification of states to form one entity. https://unstats.un.org/unsd/demographic-social/products/dyb/#statistics

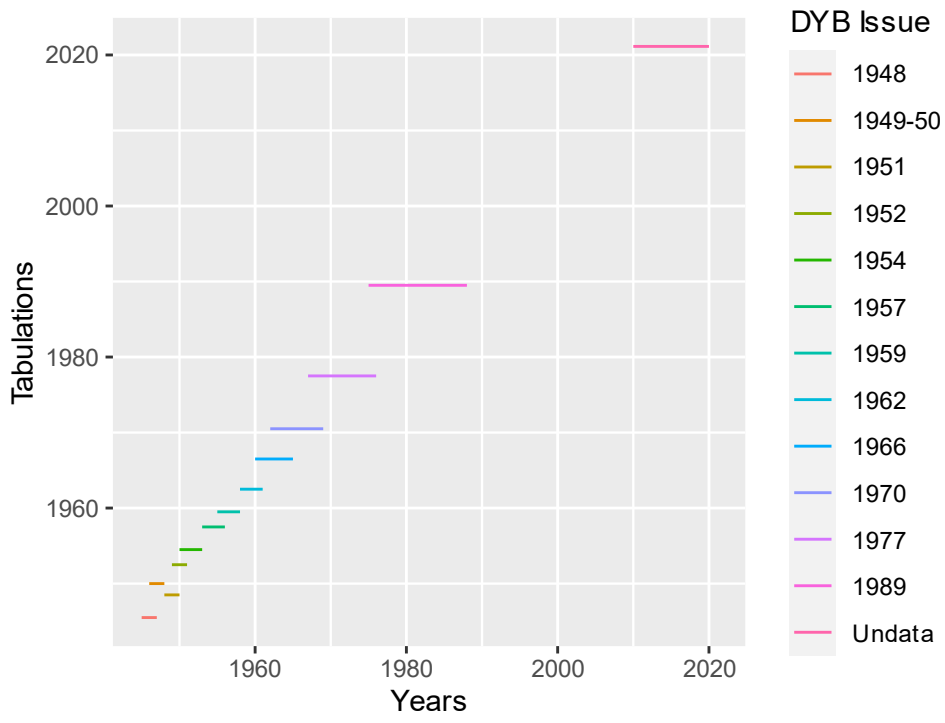
There have been just two editions of the Demographic Yearbook with a **Special Topic of International Migration**, namely the yearbooks 1977 (United Nations Statistics Division 1979a), and 1989 (United Nations Statistics Division 1991). DYB 1996 also had a chapter on international migration.

Data on flows have been collected by the Demographic Yearbook but have been judged as very incomplete and inconsistent. For a detailed description, see the 1996 Demographic Yearbook, the last one containing the topic of international migration (United Nations Statistics Division 1998b).

The temporal coverage of migration data in the Demographic Yearbook by Revision and the online Database UNdata is shown in

Figure 2 for international long-term emigrants by age and sex. The figure does not show the number of countries reporting that statistics, only the general availability.

Figure 1: Data availability for international migrants by age and sex



3.1.1.2 UNdata

The dissemination of demographic data has increasingly been accomplished by the Statistics Division online data mart platform (UNdata)^[http://data.un.org/}. The interface to its comprehensive data collections is accessible at http://data.un.org/Explorer.aspx. The large database contains 18 different topics, including data generated by other UN organizations and agencies.

UNSD provides several datasets on international travel and migration inflows and outflows, and on incoming and departing international migrants by several characteristics, as reported by the national authorities to the UN Statistics Division through an annual data collection program. Data may be downloaded in either tabular form or database record formats for the reference years 2010 to the present as available. The user should be aware that the database records are reflecting the most recent data (in UNdata), while the synopsis tables end with data for the year 2016.

The UNSD web site on International travel and migration statistics in record form, covering the years 2010 to 2017 (https://unstats.un.org/unsd/demographic/products/dyb/dyb_mf/dyb_mf.htm) contains links to select data tables in UNSD's database "UNdata," plus a link to a collection of those data in Excel. The Excel data can be found on the website termed "All tables (plus synoptic and summary tables." The table of contents is reproduced in Table *5*.

Table 5: Migration data in UNdata database

No.	Topic	Records	Countries	Years	Period

1	Inflows by purpose of staying abroad and sex	1055	25	10	2010-2019
2	Inflows by reason for admission and sex	3990	54	10	2010-2019
3	Outflows by purpose of going abroad and sex	1384	27	10	2010-2019
4	Outflows by status at time of departure and sex	1998	33	10	2010-2019
5	Number of departing international migrants by citizenship status, age and sex	14876	34	10	2010-2019
6	Number of emigrating citizens by future country of usual residence and sex	32914	23	10	2010-2019
7	Number of incoming foreign migrants by country of citizenship and sex	55189	43	10	2010-2019
8	Number of incoming international migrants by previous country of usual residence and sex	38657	29	10	2010-2019
9	Number of incoming migrants by citizenship status, age and sex	19571	46	10	2010-2019
Source:	https://unstats.un.org/unsd/demographic/products/dyb/dyb_mf/dyb_mf.htm	Accessed 2021.02.22			

The online data should be used with caution, as the database design may be viewed as irritating, mixing single data records with aggregate data. The data itself may be of different types, as indicated by numerous footnotes. For example, the table on "Number of emigrating citizens by future country of usual residence and sex" contains data for departures, e.g., in addition to long-term emigrants those of tourists, business travel etc.[15]

The availability of past migration flow data was documented in a 2004 Demographic Yearbook Review that included summaries of migration flow data (see

Decades	**1971-1980**	**1971-1980**	**1971-1980**	**1981-1990**	**1981-1990**	**1981-1990**	**1991-2000**	**1991-2000**	**1991-2000**
Header	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**
Regions	Emigrants	Immigrants	Total countries and areas	Emigrants	Immigrants	Total countries and areas	Emigrants	Immigrants	Total countries and areas
Africa	7	7	58	3	4	56	6	4	56
America, North	6	7	37	3	4	37	6	7	37
America, South	2	6	15	1	3	14	3	5	14
Asia	3	5	45	3	3	43	8	9	50
Europe	20	21	38	23	23	38	27	28	48
Oceania	3	5	29	3	4	28	2	3	25
Total	41	52	222	36	41	216	52	56	230

[15] See, for example, the Global Migrant Origin Database http://www.sussex.ac.uk/Units/SCMR/drc/research/typesofmigration/global_migrant_origin_database.html

Decades	1971-1980	1971-1980	1971-1980	1981-1990	1981-1990	1981-1990	1991-2000	1991-2000	1991-2000
Header	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**
Source:	United Nations Statistics Division. (2004). United Nations Demographic Yearbook review. National reporting of age and sex-specific data Implications for international recommendations.								

Table *6*).

Table 6: Number of countries providing data on long-term migrants, by decades 1970-2000

Decades	1971-1980	1971-1980	1971-1980	1981-1990	1981-1990	1981-1990	1991-2000	1991-2000	1991-2000
Header	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**	**No. of countries and areas reporting**	**No. of countries and areas reporting**	**Total countries and areas**
Regions	Emigrants	Immigrants	Total countries and areas	Emigrants	Immigrants	Total countries and areas	Emigrants	Immigrants	Total countries and areas
Africa	7	7	58	3	4	56	6	4	56
America, North	6	7	37	3	4	37	6	7	37
America, South	2	6	15	1	3	14	3	5	14
Asia	3	5	45	3	3	43	8	9	50
Europe	20	21	38	23	23	38	27	28	48
Oceania	3	5	29	3	4	28	2	3	25
Total	41	52	222	36	41	216	52	56	230
Source:	United Nations Statistics Division. (2004). United Nations Demographic Yearbook review. National reporting of age and sex-specific data Implications for international recommendations.								

3.1.2 ILO

The International Labor Organization (ILO) collected a large amount of international migration data directly and indirectly related to the working age population. The main data sources for a comprehensive array of indicators are national Labor Force Surveys or similar surveys.

It started these efforts with the 2015 Revision of global estimates of migrant workers, with a special focus on migrant domestic workers (International Labor Office 2015). Replacing the 2015 edition, the current 2017 edition (International Labor Office 2018) (as of 2018) is focused on international migrant workers and omits international migrant domestic workers.

ILO defined, as much as possible, the target statistics clearly and uniformly: In all countries, where possible, a migrant is defined as a foreign-born person (rather than a non-citizen). Apart from this, the estimates are confined to workers in the usually resident population and generally do not cover irregular migrants due to the existing data collection practices in some countries. For more, see: (International Labor Office 2018. p. 39); https://www.ilo.org/global/publications/books/WCMS_652001/lang--

en/index.htm. For data see: https://ilostat.ilo.org/topics/labor-migration/. Migration related flow indicators are listed in Table *7*: Migration-related flow indicators in ILO database

Table 7: Migration-related flow indicators in ILO database

No.	Topic	Records	Countries	Years	Period	Periodicity
1	Inflow of foreign-born working-age population by sex and country of birth	2680		28	1992-2019	Annual
2	Inflow of working-age non-citizens by sex and country of citizenship	5964		39	1980-2018	Annual
3	Inflow of foreign-born working-age population by sex and education	912		28	1992-2019	Annual
4	Inflow of working-age non-citizens by sex and education	1196		19	2000-2018	Annual
5	Inflow of nationals returned from abroad by sex and country of previous residence	1591		10	2009-2018	Annual
6	Inflow of foreign-born employed persons by sex and economic activity	1013		23	1997-2019	Annual
7	Inflow of employed non-citizens by sex and economic activity	1594		18	2001-2018	Annual
8	Inflow of foreign-born employed persons by sex and occupation	713		23	1997-2019	Annual
9	Inflow of employed non-citizens by sex and occupation	1345		18	2001-2018	Annual
10	Outflow of nationals by sex and country of destination	902		22	1997-2018	Annual
11	Outflow of nationals for employment by sex and country of destination	862		40	1980-2019	Annual
12	Outflow of nationals for employment by sex and education	539		20	1999-2018	Annual
13	Outflow of nationals for employment by sex and economic activity	381		10	2010-2019	Annual
14	Outflow of nationals for employment by sex and occupation	754		15	2004-2018	Annual
Source:	https://www.ilo.org/ilostat-files/Documents/SUB_MIG_en.html (Accessed 2021.02.22)					

3.1.3 EUROSTAT

EUROSTAT collect data on migration (flows) and migrant population (stocks) from its member countries, plus select other countries of Europe. There are three main groups of migration flow data: Immigration, Emigration, Change of Citizenship (acquisition and loss of citizenship).

In addition, data on migrant population are also collected. EUROST's data are available through an online database, which enables and eases the access of migration (and other) data, with few caveats.

3.1.3.1 Immigration

Table 8: Immigration indicators (EUROSTAT)

No.	Topic	Records	Countries	Years	Period	Origin
1	Immigration by age and sex (migr_imm8) [1990-2018]	228291	33	30	1990-2019	
2	Immigration by five year age group, sex, and citizenship (migr_imm1ctz) [1998-2018	8235611	46	22	1998-2019	244[16]
3	Immigration by five year age group, sex and country of birth (migr_imm3ctb)	6212936	33	12	2008-2019	250[17]
4	Immigration by age , sex and broad group of citizenship (migr_imm2ctz)	613469	45	22	1998-2019	4[18]
5	Immigration by age, sex and broad group of country of birth (migr_imm4ctb)	558820	33	12	2008-2019	4[19]
6	Immigration by sex, citizenship and broad group of country of birth (migr_imm6ctz)	333378	24	12	2008-2019	227[20]
7	Immigration by sex, country of birth and broad group of citizenship (migr_imm7ctb)	351634	24	12	2008-2019	247[21]
8	Immigration by five year age group, sex, and country of previous residence (migr_imm5prv)	6619481	45	22	1998-2019	
9	Immigration by age group, sex and level of human development of the country of citizenship (migr_imm9ctz)	331539	33	7	2013-2019	
10	Immigration by age group, sex and level of human development of the country of birth (migr_imm10ctb)	305735	33	7	2013-2019	
11	Immigration by age group, sex and level of human development of the country of previous residence (migr_imm11prv)	273462	33	7	2013-2019	
12	Immigration by broad group of country of previous residence (migr_imm12prv)	844	32	7	2013-2019	
Source:	Migration and migrant population statistics—Statistics Explained (europa.eu)					

See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics

[16] Including former countries (USSR, etc.), but excluding aggregates. The total number of entities is 287
[17] Including former countries (USSR, etc.), but excluding aggregates. The total number of entities is 298
[18] Categories: Total, reporting country, foreign country, unknown
[19] Categories: Total, reporting country, foreign country, unknown
[20] Including former countries (USSR, etc.), but excluding aggregates. The total number of entities is 279
[21] Including former countries (USSR, etc.), but excluding aggregates. The total number of entities is 296

3.1.3.2 Emigration

Table 9: Emigration indicators (EUROSTAT)

No.	Topic	Records	Countries	Years	Period
1	Emigration by age and sex (migr_emi2) [1990-2018]	217566		30	1990-2019
2	Emigration by five year age group, sex and citizenship (migr_emi1ctz)	8381403		22	1998-2019
3	Emigration by five year age group, sex and country of birth (migr_emi4ctb)	5753534		12	2008-2019
4	Emigration by five year age group, sex, and country of next usual residence (migr_emi3nxt)	6313454		22	1998-2019
5	Emigration by broad group of country of next usual residence (migr_emi5nxt)	6313454		22	1998-2019
Source:	Migration and migrant population statistics—Statistics Explained (europa.eu)				

See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics

3.1.3.3 Citizenship

Table 10: Acquisition and loss of citizenship (EUROSTAT)

No.	Topic	Records	Countries	Years	Period
1	Acquisition of citizenship by sex, age group and former citizenship (migr_acq)	8081076		21	1998-2018
2	Residents who acquired citizenship as a share of residents non-citizens by former citizenship and sex (%) (migr_acqs)	8081076		21	1998-2018
3	Acquisition of citizenship by sex, age group and level of human development of former citizenship (migr_acq1ctz)	299974		6	2013-2018
4	Loss of citizenship by sex and new citizenship (migr_lct)	92986		11	2008-2018
	Migration and migrant population statistics—Statistics Explained (europa.eu)				

See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics

3.1.4 OECD

The Organization for Economic Cooperation and Development (OECD) provides several databases on international migration flows and migrant stocks at:
http://www.oecd.org/els/mig/oecdmigrationdatabases.htm.

The three group of data are shown in Table 9.

Table 11: OECD databases on international migration

No.	Topic	Notes
1	OECD International Migration database	Includes flow and stock data
2	Continuous Reporting System on Migration	SOPEMI/CICREDI
3	Database on Immigrants in OECD countries	DIOC, DIOC-E (Stocks)

The DIOC/DIOC-E data are presented under the heading *Migration Stock Estimates.*

3.1.4.1 OECD International Migration database

For this Catalog, only the first two topics will be presented/listed. These databases are the evidence basis for the OECD's annual flagship publications "International Migration Outlook." The latest issue as of this writing was the 43rd report of the OECD's Continuous Reporting System on Migration, published in 2019 (OECD 2019).

The OECD International Migration database (http://www.oecd.org/els/mig/keystat.htm) is presenting migration data in two formats and technologies: six preformatted excel tables covering inflows, outflows, migrant stocks and number of change in status (acquisition of nationality).
[Data are presumably in 1,000; some cells c0ntain value = zero]

On the same page, there is a link to the online database offering full range selection criteria. More data by country of origin available.[22]

Table 12: Inflows of foreign population into selected OECD countries and Russia

No.	Topic	Records	Countries	Years	Period
	Table A.1. Inflows of foreign population into selected OECD countries and Russia	407	38	11	2008-2018
	Table A.2. Outflows of foreign population from selected OECD countries		27	11	2008-2018
	Table A.3. New asylum requests into OECD countries and Russia		38	11	2008-2018
Note:	Tables as presented in "International Migration Outlook"				
Source:	http://www.oecd.org/els/mig/keystat.htm				

[22] https://stats.oecd.org/Index.aspx?DataSetCode=MIG

Table 13: Migrant Flow Data in the International Migration Database

No.	Topic	Countries	Years	Period
1	Inflows of foreign population by nationality	238/37	26	1995-2020
2	Outflows of foreign population by nationality	238/37	26	1995-2020
3	Inflows of asylum seekers by nationality	238/37	26	1995-2020
4	Acquisition of nationality by country of former nationality	238/37	26	1995-2020
5	Inflows of foreign workers by nationality	238/37	26	1995-2020
6	Inflows of seasonal foreign workers by nationality			
Source:	International Migration Database (oecd.org)			

3.1.4.2 SOPEMI

The Continuous Reporting System on Migration (known under its French acronym, SOPEMI, from Système d'observation permanente des migrations) was established in 1973 to provide the OECD member countries with a mechanism for the timely sharing of information on international migration, the collect of migration statistics as well as the improvement of their comparability, and to serve the basis for an annual OECD report on international migration. Its Latin-American branch is known under the acronym Continuous SICREMI (*Reporting System on International Migration in the Americas*). OECD's annual flagship publications International Migration Outlook (the latest being the 2021 edition) is based on the data collection efforts of the SOPEMI community of national correspondents and the resulting database known as *International Migration Database* (see above). The publication as well as the database provide statistical information on immigrant stocks and flows, immigrants in the labor market, and migration policies. Country profiles and targeted publications provide even more detailed information. Unfortunately, while the online IMD database is freely accessible, the International Migration Outlook publication is not (requiring a fee or an institutional access path).

https://bluehub.jrc.ec.europa.eu/Catalogues/info/dataset/sopemi

3.1.4.3 SICREMI

Continuous Reporting System on International Migration in the Americas (SICREMI).
See: International Migration in the Americas: Fourth Report of the Continuous Reporting System on International Migration in the Americas (SICREMI) 2017.

3.2 Flow Estimates

3.2.1 UNPD

UNPD has estimated its dataset called **International Migration Flows to and from Selected Countries** in three Revisions: 2005, 2008 and 2015. The 2015 Revision contains time series data on the flows of international migrants as recorded by 45 countries (43 for emigration flows), a considerable increase as compared to the 29 (2008 Revision) and 15 (2005 Revision) countries.

Source: United Nations. (2015). International Migration Flows to and from Selected Countries: The 2015 Revision (No. POP/DB/MIG/Flow/Rev.2015). New York.

Table 14: International Migration Flows to and from Selected Countries, by Revisions

Revision	Countries covered	Intention to stay	Time coverage
2005	15		
2008	29	11	1980-2009
2010	43	11	1980-2009
2015	45	24	1980-2013

Previous Revisions with reference years 2008 and 2005 are no longer available; existing links are re-directed to the 20015 Revision.

Source: https://www.un.org/development/desa/pd/data/international-migration-flows

3.2.2 Abel, Cohen

3.2.2.1 Abel, Cohen 2019

Abel and Cohen (Abel and Cohen 2019) presented a new set of international migration flow estimates plus a comparison of several methods. It appears that in this new estimation, the results are much closer to Azose and Raftery (Azose and Raftery 2019). Note that Abel[23] has updated the 2019 estimates four times with the new 2019 revision of the UN's World Population Prospects, the two revisions of the UN's Migrant stock that were released after the original publication, and corrections for Serbia, Montenegro, Sudan and South Sudan for past periods (available at Guy Abel's personal website (Bilateral international migration flow estimates for 200 countries | Guy Abel) (Abel 2021).

3.2.2.2 Previous work by Abel

Abel produced several datasets with estimated migration flows for all countries and for the EU. By 2017, this migration data was the most comprehensive one. It is based on several migrant stock datasets and different (corresponding) Revisions of UNPD population estimates (Abel 2017). An earlier version is (Abel 2016).

[23] See, for example, the Global Migrant Origin Database
http://www.sussex.ac.uk/Units/SCMR/drc/research/typesofmigration/global_migrant_origin_database.html

Migration flow estimates were calculated by Abel (Abel 2010), based on his PhD thesis for 15 EU countries. He used some modern optimization methods to harmonize existing migration flow data, and then the EM algorithm to derive some model-based imputations where there is no existing flow data. The results the EU15, 2002-2006 are provided in a Google spreadsheet: https://docs.google.com/spreadsheet/ccc?key=0AlVTDLs9SzZ0dFlSdzR6aWxVLUVaU2xEMHhLQ19EREE&hl=en_US#gid=2

3.2.3 Azose, Raftery

Azose and Raftery (Azose and Raftery 2019) proposed propose a novel method for estimating migration flows between all pairs of countries that allows for decomposition of migration into emigration, return, and transit components. Current state-of-the-art estimates of bilateral migration flows rely on the assumption that the number of global migrants is as small as possible. The authors relaxed this assumption, producing complete estimates of all between-country migration flows with genuine estimates of total global migration. The results suggested that the total number of individuals migrating internationally has oscillated between 1.13% and 1.29% of the global population per quinquennium5-year period since 1990. The novel estimation technique considers the empirical finding that return migration and transit migration are a significant part of total migration: the paper estimates that about roughly one of four migration events areas a return to an individual's country of birth. In the most recent time period, the authors estimated particularly large return migration flows from the United States to Central and South America and from the Persian Gulf to south Asia. For related methodology see (Azose and Raftery 2018).

3.2.4 DEMIG

Researchers associated with the International Migration Institute (IMI) compiled two novel migration flow databases as part of the DEMIG (**DE**terminants of International **MI**gration) project from a wide range of primary archival and digital sources. For the database called DEMIG TOTAL, data on total immigration, emigration and net migration were assembled. The DEMIG C2C ('country-to-country') database covers bilateral migration flow data for a select number of countries[24]. For more information on the DEMIG project see (Vezzoli, Villares-varela, and De Haas 2014).

3.2.4.1 DEMIG TOTAL

DEMIG TOTAL[25] reports immigration, emigration, and net migration flows for up to 161 countries covering various periods of time from 1815 to 2011, disaggregating total flows of citizens and foreigners whenever possible. The dataset allows for quantitative analysis of the long-term evolution of international migration. The available data are placed inside a matrix listing 235 countries (rows) and 197 single years (columns). Data are sparse, and many countries or years do not have any data. DEMIG TOTAL was compiled as part of the DEMIG project (Determinants of International Migration: A

[24] See, for example, the Global Migrant Origin Database http://www.sussex.ac.uk/Units/SCMR/drc/research/typesofmigration/global_migrant_origin_database.html

[25] There are 232 countries of origin, but 231 countries of destination, omitting the Holy See.

Theoretical and Empirical Assessment of Policy, Origin and Destination Effects).0DEMIG TOTAL follows a simple layout and is made available in Excel format.

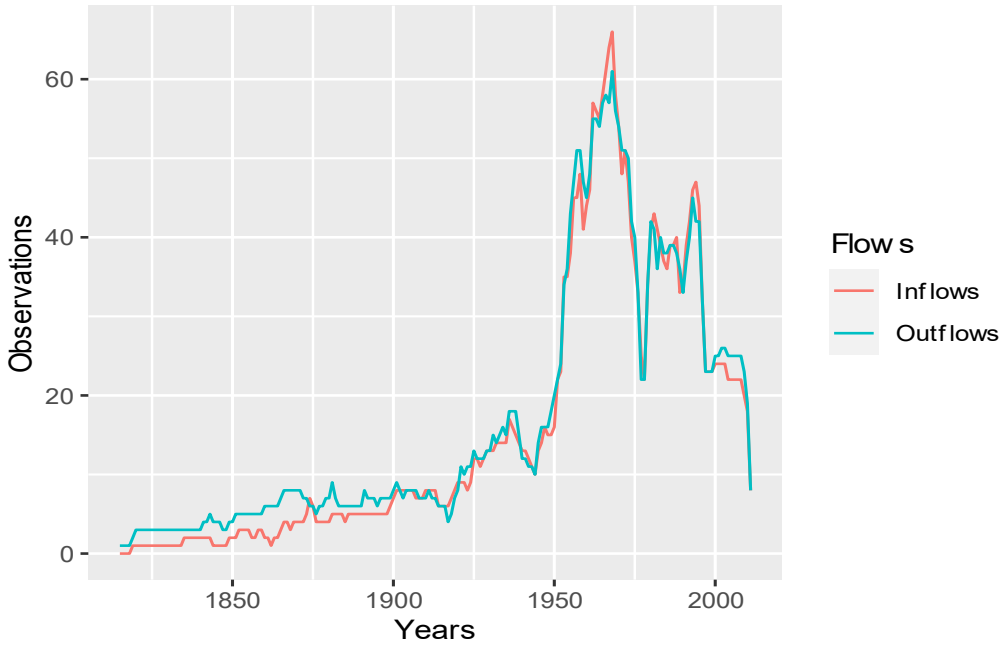
Table 15: Content of DEMIG-Total

	Migration type	**Total Inflows**			**Total Outflows**		
	Coverage	1815-2011	1950-2011	1990-2011	1815-2011	1950-2011	1990-2011
	Total number of countries	233	233	233	233	233	233
	Number of Countries with at least one data point	141	138	60	135	132	59
	Proportion I	60.5%	59.2%	25.8%	57.9%	56.7%	25.3%
	Proportion II	0.3%	1.0%	1.2%	0.3%	0.9%	1.2%
Source:	Source						
Citation	DEMIG (2015) DEMIG TOTAL, version 1.5. Oxford: International Migration Institute, University of Oxford.						

It is no surprise that there are no data for most countries most of the years covered. Expressed as a percentage of countries which have a data point in a specific year,

Figure 2 shows the extreme variability of coverage over time.

Figure 2: Countries with data on in- and outflows, 1815-2011



3.2.4.2 DEMIG C2C

The DEMIG C2C (country-to-country) database[26] contains bilateral migration flow data for 34 reporting countries and from up to 236 countries over the 1946–2011 period. It includes data for inflows, outflows, and net flows, respectively for citizens, foreigners and/or citizens and foreigners combined, depending on the reporting countries. The DEMIG C2C database was compiled through extensive data collection and digitalization of historical national statistics as well as current electronic sources. It provides a unique opportunity to construct migration flows from many origin countries to the 34 reporting countries, as well as return flows.[27]

The DEMIG C2C (country-to-country) database was compiled between 2010 and 2013 as part of the DEMIG project (Determinants of International Migration: A Theoretical and Empirical Assessment of Policy, Origin and Destination Effects). It tracks data for 34 reporting countries and up to 236 countries by citizenship, birth, or origin/destination for the period between 1946 and 2011.

DEMIG C2C contains data that have been reported by the respective national statistical offices since the post-Second World War period, either in printed or electronic format. As a result, the data have undergone a significant process of digitalization, format standardization and verification. However, data have largely been retained as reported by national statistical offices, except for of a minimum amount of harmonization of names of countries, residuals, and aggregates to simplify and reduce the list of countries.

The DEMIG C2C database[28] is provided in an Excel file which includes three separate worksheets: Inflows, Outflows and Net Flows. It presents data for 34 reporting countries and to up to 236 included countries.

Table 16: Content of DEMIG C2C

No.	Topic	Records	Countries/D	Countries/O	Years	Period	Coverage
1	Inflows foreigners	700115	22	236	74	1932-1938, 1945-2011	75789

[26] The 2019 Revision ended with estimates for the year 2019, thus breaking the standard format of quinquennial time references.

[27] In many cases, the available data required some form of redistribution to ensure that the reported data were consistent with the standard country or area codes. The most common reason for redistribution was that the data contained at least one description of origin spanning more than one country, area or region. In addition, a significant number of datasets included a description of origin that was not part of the standard list of countries or areas. Various methods were used to standardize the place of origin.

[28] The adjustment acknowledges the border closures and severe restrictions and disruptions to international travel, especially in the initial months of the pandemic. In the absence of systematic empirical data on the effects of the pandemic on international migration, the mid-year 2020 stock estimates were derived under the assumption that there was no increase or decrease in the number of international migrants between 1 March and 1 July, 2020, namely during the last four months of the estimation period. The estimated impact of the pandemic on the 2020 stock estimate was computed as the difference between the counterfactual estimate of migrant stock made following the standard methodology described above (as if there had been no pandemic) and the value calculated assuming no change in the number of international migrants between 1 March and 1 July 2020.

No.	Topic	Records	Countries/D	Countries/O	Years	Period	Coverage
2	Outflows	553783	21	236	74	1932-1938, 1945-2011	68151
Source:	OECD						
Citation	DEMIG (2015) DEMIG C2C, version 1.2, Limited Online Edition. Oxford: International Migration Institute, University of Oxford						

3.2.5 IMEM

The IMEM Project (**I**ntegrated **M**odeling of **E**uropean **M**igration) had two outcomes. First, a Bayesian statistical model for migration flow data that allows to incorporate auxiliary information on the associations between origins and destinations of migration (e.g., language, borders, and distance), and to estimate missing patterns. Second, the model estimated flow data that reconciled the differences, shortcomings, and inconsistencies of reported international migration data. The model allowed to deal with multiple sources for the same data flows and the inclusion of expert judgments. The results were tables of migration flows among 31 countries in the European Union (EU) and European Free Trade Association (EFTA), as well as to and from the rest of the world. The estimated migration flows employ as much as possible the concept long-term migrants as defined in the Recommendations on Statistics of International Migration (United Nations 1998). Estimated flows are presented by country of origin, country of destination, age, and sex, for the years 2002 to 2008, and include also measures of uncertainty. For a discussion, see (Raymer et al. 2013; Wiśniowski et al. 2013, 2016)

http://www.norface-migration.org/currentprojectdetail.php?proj=3

Data tables and related charts are available online, but retrieval is complicated (country by country!). To publish the data requires special permission from the authors for publication (check).

Suggested citation is:
IMEM (2013) Integrated Modelling of European Migration Database. Available at http://www.imem.cpc.ac.uk (data downloaded on [date]).

The Integrated Modelling of European Migration (IMEM) database:
http://www.imem.cpc.ac.uk/Default.aspx

3.2.6 MIMOSA

The MIMOSA project (**MI**gration **MO**delling for **S**tatistical **A**nalyses) is an example of a discontinued source of data. While publications that emanated from the project are still accessible, the resulting estimates of harmonized and adjusted migration flows between European countries are no longer available. The project introduced a new methodology for rectifying inconsistent international migration flow data in Europe (Beer et al. 2010; Raymer and Abel 2008)

The MIMOSA study included international migration between 31 European countries[29]. For each year between 2002 and 2005, later extended to include 2006 and 2007, a flow matrix was created with 31 countries (EU 27 + 4) and an entity labelled Rest of the World. Raw data were entirely obtained from EUROSTAT. Citizenship includes the categories: citizenship of country of residence, citizenship of another EU member state and non-EU citizenship. Country of birth includes the categories: native born, born in another EU Member State, and born in a non-EU country.

[29] Consiting of the EU 27 as of January 2007—30 June 2013, plus the EFTA countries Iceland, Liechtenstein, Norway and Switzerland.

The MIMOSA project was a relatively large effort—4 institutions and 16 researchers—participated: The project was carried out by four European research institutes:

Netherlands Interdisciplinary Demographic Institute (NIDI), The Netherlands
Central European Forum for Migration Research (CEFMR), Poland
Southampton Statistical Sciences Research Institute (S3RI), United Kingdom
Université catholique de Louvain (UCL), Belgium.
The project started in January 2007 and ended in December 2009.

The available publication dealing with MIMOSA give some more details (Raymer and Abel 2008) and (Beer et al. 2010)

MIMOSA

Table 17: Content of the MIMOSA database

No.	Datasets	Years	Period	Notes
1	Migration matrix of flows by origin/destination, sex and age	6	2002-2007	
2	Immigration and emigration by citizenship, sex and age	6	2002-2007	
3	Immigration and emigration by country of birth, sex and age	6	2002-2007	
4	Population by citizenship, sex and age	7	2002-2008	
5	Population by country of birth, sex and age	6	2002-2007	
Notes:				

3.2.7 Miscellaneous

This section contains two auxiliary approaches to estimate migration flows. The first one, on remittances flows, may be employed to calibrate and verify estimation models. The second one, by Cohen at al. is an example of an explorative modeling attempt trying to extract information about a model of international migration from limited data.

3.2.7.1 Remittances

Large efforts have been made to uncover the monetary impact international migration has on sending countries. This task, pioneered by the World Bank's Migration and Remittances initiative, looks at the flow of money, not people.

A large collection of datasets have been assembled, available as Excel spreadsheets, beginning with bilateral remittances matrices (2010-2017 annually), and from 2017 to 2020 separately for inflows and outflows.
https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data

3.2.7.2 Cohen et al.

(Cohen et al. 2008) proposed a model to estimate migration flows based on very sparse data. This model was not used (yet) to completely estimates or project flows for all countries covered. The authors collected annual immigration and emigration data from statistical records of 11 countries, covering a period of 45 years (from 1960 to 2004). These flow data were placed into a framework of 228 destination countries and 195 origin countries, for which population data and geographic distances between them were used as independent variables. In a follow-up study on determinants of migration flow into and from industrialized countries (immigration into 17 and emigration from 13 industrialized countries), Kim and Cohen (Kim and Cohen 2010) found that certain demographic factors (population and infant mortality) and geographic distance to be the most influential determinants, while Social and historical determinants were less influential.

4 MIGRANT STOCK DATA

Information on migrant stocks play an oversized role in scientific, political, and public discourse. Because data on international migrants (in all their forms) are widely missing, migrant stock—or life-time migrants—are used as a proxy. Possible barbecue international decennial census program is an unqualified success story. See (United Nations 2017a) for background and methods to obtain migration data from censuses.

4.1 Migration Stock Statistics

4.1.1 United Nations Statistics Division (UNSD)

UNSD collects a wide array of statistics on migrant stocks. These data collection, mainly from censuses or population registers, are the basis for much of what is known and discussed regarding international migration. Migrant Stock Statistics are part of the Demographic Yearbook Collection and are also presented in record form in UNSD's online database UNdata.

4.1.1.1 Population Census Datasets

The Statistics Division collects and presents census data collected worldwide. The Census Datasets contain (raw) data on migrant stocks by several characteristics and are available at https://unstats.un.org/unsd/demographic-social/products/dyb/#censusdatasets. The data are linked to corresponding UNdata database tables. https://unstats.un.org/unsd/demographic-social/products/dyb/#censusdatasets

Data on migrant stock collected from national population censuses for the 1990 round (1985-1994) and the 2000 round (1995-2004) of censuses are available in electronic format on the Demographic Yearbook Special Census Topic Volume 3: International Migration Characteristics. (https://unstats.un.org/unsd/demographic/products/dyb/dybcens.htm#MIGR)

Table 18: Foreign population (non-citizens) by country of citizenship, age, and sex

No.	Topic	Records	Countries	Years	Period	[Total, both sexes)	Destination	Origin
1	Economically active foreign-born population by occupation, age, sex and urban/rural residence	71734	66	21	1995-2016	18713		
2	Foreign population (non-citizens) 15 years of age or over by country of citizenship, educational attainment and sex	161624	45	11	2001-2017	54342		
3	Foreign population (non-citizens) by country of citizenship, age and sex	799021	104	23	1995-2017	268190		
4	Foreign-born population 15 years of age or over by country/area of birth, educational attainment and sex	215852	55	13	2001-2018	72528	55	279

No.	Topic	Records	Countries	Years	Period	[Total, both sexes)	Destination	Origin
5	Foreign-born population by country/area of birth, age and sex	1242364	121	25	1995-2019	430332	118	239
6	Native and foreign-born population by age, sex and urban/rural residence	57827	145	25	1995-2019	14960		
7	Population by citizenship status, age and sex	34399	134	23	1995-2017	11533		
Source:	http://data.un.org/Explorer.aspx?d=POP							
	https://unstats.un.org/unsd/demographic-social/products/dyb/#censusdatasets							
	Accessed 2021.02.22							

4.1.1.2 Demographic Yearbook System

The United Nations Statistics Division in 1994 published a technical Report to review the collection and dissemination of international migration statistics collected through the Demographic Yearbook System. The following tables present the results up to the year 2000 (to be expanded!?) for migrant stock statistics.

Table 19: Countries and areas that provided statistics on foreign-born to the United Nations Demographic Yearbook at least once, 1971-2000

Decades	1971-1980	1971-1980	1981-1990	1981-1990	1991-2000	1991-2000	2001-	2001-
Regions	**Countries and areas reporting**	**Total number of countries**	**Countries and areas reporting**	**Total number of countries**	**Countries and areas reporting**	**Total number of countries**	**Countries and areas reporting**	**Total number of countries**
Africa	15	58	7	56	7	56	21	
America, North	24	37	15	37	6	37	29	
America, South	11	15	7	14	6	14	18	
Asia	17	45	13	43	7	50	31	
Europe	11	38	14	38	12	48	64	
Oceania	18	29	12	28	3	25	21	
TOTAL	96	222	68	216	41	230	184[30]	
Note:	America, North comprises Northern America, The Caribbean, and Central America.							
Source:	United Nations Statistics Division. (2004). United Nations Demographic Yearbook review. National reporting of age and sex-specific data Implications for international recommendations.							

[30] Contains double counts (more than one census during decade). Unique countries 127

Table 20: Countries and areas that provided statistics on country of citizenship and sex to the United Nations Demographic Yearbook at least once, 1971-2000

Decades	**1971-1980**	**1971-1980**	**1981-1990**	**1981-1990**	**1991-2000**	**1991-2000**	**2001-**	**2001-**
Regions	Countries and areas reporting	Total number of countries	Countries and areas reporting	Total number of countries	Countries and areas reporting	Total number of countries	Countries and areas reporting	Total number of countries
Africa	16	58	19	56	10	56		
America,								
North	16	37	23	37	10	37		
America, South	9	15	10	14	5	14		
Asia	15	45	18	43	5	50		
Europe	10	38	18	38	13	48		
Oceania	14	29	14	28	3	25		
TOTAL	80	222	102	216	46	230		
Source:	United Nations Statistics Division. (2004). United Nations Demographic Yearbook review. National reporting of age and sex-specific data Implications for international recommendations.							

Table 21: Countries and areas that provided statistics on Foreign-born population by country of birth, age, and sex to the United Nations Demographic Yearbook at least once, 1971-2000

Decades	**1971-1980**		**1981-1990**		**1991-2000**		**2001-**	
Regions	Countries and areas reporting	Total number of countries	Countries and areas reporting	Total number of countries	Countries and areas reporting	Total number of countries	Countries and areas reporting	Total number of countries
Africa	5	58	10	56	3	56		
America,								
North	8	37	7	37	9	37		
America, South	4	15	1	14	6	14		
Asia	10	45	4	43	10	50		
Europe	1	38	8	38	11	48		
Oceania	7	29	3	28	3	25		
TOTAL	35	222	33	216	42	230		

Decades	**1971-1980**		**1981-1990**		**1991-2000**		**2001-**	
Source:	United Nations Statistics Division. (2004). United Nations Demographic Yearbook review. National reporting of age and sex-specific data Implications for international recommendations.							

4.1.1.3 UNdata

The online accessible data series on the UNdata platform is very versatile and rich in indicators covered[praise], but at time cumbersome and confusing. Bulk download is not possible (a download limit of 100,00 records is implemented), is occasionally produces HTTP 404 errors (not found). The API, which would allow users to access the data directly via software is restricted and its documentation is complex. The data may be retrieved in an XML format entitled SDMX (Statistical Data and Metadata eXchange).

4.1.2 United Nations Population Division

The Population Division has compiled the **U**nited **N**ations **G**lobal **M**igration **D**atabase (UNGMD) is a comprehensive collection of empirical data on the number of international migrants by country of birth and citizenship, sex and age as enumerated by population censuses, population registers, nationally representative surveys, and other official statistical sources from more than 200 countries and territories in the world. The data contained in the database were derived from numerous sources, including the Demographic Yearbook, produced by United Nations Statistics Division, tabulations collected by the Population Division as well as official publications available from resource centers, libraries and the internet."

The official website[31] is extremely restrictive in accessing its data. Currently, it allows only one record at a time (one country of origin, one country of destination, one property/characteristic). It offers the following quick links:

1. Stocks by origin—Detailed
2. Stocks by origin—Time series
3. Stocks by destination—Detailed
4. Stocks by destination—Time series

The database is currently dormant but is expected to be revised and updated soon.

4.1.3 ILO

The International Labor Organization (ILO) collected a large amount of international migration data directly and indirectly related to the working age population. The main data sources for a comprehensive array of indicators are national Labor Force Surveys or similar surveys.

[31] See, for example, the Global Migrant Origin Database
http://www.sussex.ac.uk/Units/SCMR/drc/research/typesofmigration/global_migrant_origin_database.html

It started these efforts with the 2015 Revision of global estimates of migrant workers, with a special focus on migrant domestic workers (International Labor Office 2015). Replacing the 2015 edition, the current 2017 edition (International Labor Office 2018) (as of 2018) is focused on international migrant workers and omits international migrant domestic workers.

ILO defined, as much as possible, the target statistics clearly and uniformly: In all countries, where possible, a migrant is defined as a foreign-born person (rather than a non-citizen). Apart from this, the estimates are confined to workers in the usually resident population and generally do not cover irregular migrants due to the existing data collection practices in some countries. For more, see: (International Labor Office 2018. p. 39)
https://www.ilo.org/global/publications/books/WCMS_652001/lang--en/index.htm
For data see: https://ilostat.ilo.org/topics/labor-migration/

Table 22: Migration-related stock indicators in ILO database

No.	Topic	Records	Countries	Years	Period	Periodicity
1	Working-age population by sex, age and place of birth	156247		30	1991-2020	Annual
2	Working-age population by sex, age and citizenship	134544		27	1994-2020	Annual
3	Working-age population by sex, education and place of birth	122053		30	1991-2020	Annual
4	Working-age population by sex, education and citizenship	104047		27	1994-2020	Annual
5	Stock of nationals abroad by sex and country of residence	331		27	1993-2019	Annual
6	Foreign-born working-age population by sex and country of birth	3905		20	2000-2019	Annual
7	Non-citizen working-age population by sex and country of citizenship	4602		20	2000-2019	Annual
8	Labor force by sex, age and place of birth	145419		30	1991-2020	Annual
9	Labor force by sex, age and citizenship	126716		30	1991-2020	Annual
10	Labor force participation rate by sex, age and place of birth	145147		27	1994-2020	Annual
11	Labor force participation rate by sex, age and citizenship	126169		27	1994-2020	Annual
12	Employment by sex, age and place of birth	145227		30	1991-2020	Annual
13	Employment by sex, age and citizenship	126399		31	1990-2020	Annual
14	Employment by sex, economic activity and place of birth	163505		30	1991-2020	Annual
15	Employment by sex, economic activity and citizenship	134381		26	1995-2020	Annual
16	Employment by sex, occupation and place of birth	133793		28	1993-2020	Annual
17	Employment by sex, occupation and citizenship	119318		26	1995-2020	Annual
18	Employment by sex, status in employment and place of birth	119318		26	1995-2020	Annual
19	Employment by sex, status in employment and citizenship	1126399		31	1990-2020	Annual
20	Employment-to-population ratio by sex, age and place of birth	144748		27	1994-2020	Annual
21	Employment-to-population ratio by sex, age and citizenship	125293		27	1994-2020	Annual

No.	Topic	Records	Countries	Years	Period	Periodicity
22	Employed foreign-born persons by sex and country of birth	3226		28	1992-2019	Annual
23	Employed non-citizens by sex and country of citizenship	3451		20	2000-2019	Annual
24	Unemployment by sex, age and place of birth	120251		27	1994-2020	Annual
25	Unemployment by sex, age and citizenship	104522		27	1994-2020	Annual
26	Unemployment rate by sex, age and place of birth	120165		27	1994-2020	Annual
27	Unemployment rate by sex, age and citizenship	104329		27	1994-2020	Annual
28	Mean nominal monthly earnings of employees by sex and place of birth	3027		27	1994-2020	Annual
29	Mean nominal monthly earnings of employees by sex and citizenship	1427		27	1994-2020	Annual
30	Persons outside the labor force by sex, age and place of birth	146014		27	1994-2020	Annual
31	Persons outside the labor force by sex, age and citizenship	126659		27	1994-2020	Annual
Notes:						
Source:	Source: https://www.ilo.org/ilostat-files/Documents/SUB_MIG_en.html					
	Accessed 2021.02.22					

4.1.4 EUROSTAT

EUROSTAT collect data on migration (flows) and migrant population (stocks) from its member countries, plus select other countries of Europe. There is one divers' group of data on migrant population. EUROST's data are available through an online database, which enables and eases the access of migration (and other) data, with few caveats.

Migrant populations[32] (Stocks)

Table 23: Population by country of birth/citizenship

No.	Topic	Records	Countries	Years	Period
1	Population on 1 January by age group, sex and citizenship (migr_pop1ctz)			23	1998-2020
2	Population on 1 January by age group, sex and country of birth (migr_pop3ctb) [1998-2019]			23	1998-2020
3	Population on 1 January by age, sex and broad group of country of birth (migr_pop4ctb)			23	1998-2020
4	Population on 1 January by sex, citizenship and broad group of country of birth (migr_pop5ctz)			12	2009-2020
5	Population on 1 January by sex, country of birth and broad group of citizenship (migr_pop6ctb)			12	2009-2020
6	Population on 1 January by age group, sex and level of human development of the country of citizenship (migr_pop7ctz)			7	2014-2020
7	Population on 1 January by age group, sex and level of human development of the country of birth (migr_pop8ctb)			7	2014-2020
8	EU and EFTA citizens who are usual residents in another EU/EFTA country as of 1 January (migr_pop9ctz)			5	2016-2020
Source:	Migration and migrant population statistics—Statistics Explained (europa.eu)				

See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Migration_and_migrant_population_statistics

[32] See, for example, the Global Migrant Origin Database http://www.sussex.ac.uk/Units/SCMR/drc/research/typesofmigration/global_migrant_origin_database.html

4.1.5 OECD

4.1.5.1 International Migration Outlook

OECD publishes data on migrant populations (migrant stock) in several format. Synopsis tables are published in the flagship publication *International Migration Outlook*. The tables are also available as Excel tables (in French and English)

Table 24: Stocks of foreign-born population in OECD countries and in Russia

No.	Topic	Records	Countries	Years	Period
1	Table A.4. Stocks of foreign-born population in OECD countries and in Russia		38	11	2009-2019
2	Table A.5. Stocks of foreign population by nationality in OECD countries and in Russia		34	11	2009-2019
3	Table A.6. Acquisitions of nationality in OECD countries and in Russia		37	11	2008-2018
Note:	Tables as presented in "International Migration Outlook"				
Source:	http://www.oecd.org/els/mig/keystat.htm				

The basis of the summary tables shown above is OECD's online *International Migration Database*, containing two different concepts of migrant stock data: by country of birth and by nationality / citizenship.

Table 25: Migrant Stock Data in the International Migration Database

No.	Topic	Records	Countries	Years	Period
1	Stock of foreign-born population by country of birth				
2	Stock of foreign population by nationality				
Note:	Not included are				
Source:	International Migration Database (oecd.org)				

4.1.6 United Nations High Commissioner for Refugees (UNHCR)

The UN Refugee Agency (UNHCR) maintains a Refugee Population Statistics Database[33] on several relevant categories of displaced population stocks:

1. Population figures (UNHCR data on displacement)

[33] https://www.unhcr.org/refugee-statistics/

2. Asylum applications (Asylum claims submitted)
3. Asylum decisions (Decisions taken on asylum claims)
4. Solutions (Solutions for refugees and IDPs)
5. Internally displaced persons (Internal displacement due to conflict/violence, obtained from IDMC)
6. Palestine refugees under UNRWA's mandate (Registered Palestine refugees, obtained from UNRWA)[34]

In addition to the web-based database on displaced persons, UNHCR publishes regularly Statistical Yearbooks, now at its 16th edition. UNHCR registers refugees (and other people of concern), but not directly refugee flows. It does calculate/report changes in stock during a year. For the case of international migration, the first category on internationally displaced populations is relevant. The UNHCR's population database is quite comprehensive; it covers data for the period from 1951 (for a limited number of countries) up to 2020. In total, data are listed for 202 origin countries and 185 receiving countries.[35] The database on refugees[36] under UNHCR mandate has data for both the countries of origin and the countries of receiving refugees.

Table 26: UNHCR statistics of refugees by country of origin and destination

Countries involved	Number
Countries of Origin 202	202
Countries of Asylum 185	185

For definitions used for data collections, see Expert Group on Refugee and Internally Displaced Persons Statistics 2018.

4.2 Migrant Stock Estimates

4.2.1 Unite Nations Population Division (UNPD)

Beginning in the 1980, UNPD began collecting migrant stock data from censuses in a systematic way, using mostly census data collected by the Statistics Division of the United Nations (UNSD). These raw data have periodically been updated and harmonized for the Migrant Stock series of publications. This

[34] https://www.unrwa.org/resources/about-unrwa/unrwa-figures-2020-2021

[35] The adjustment acknowledges the border closures and severe restrictions and disruptions to international travel, especially in the initial months of the pandemic. In the absence of systematic empirical data on the effects of the pandemic on international migration, the mid-year 2020 stock estimates were derived under the assumption that there was no increase or decrease in the number of international migrants between 1 March and 1 July 2020, namely during the last four months of the estimation period. The estimated impact of the pandemic on the 2020 stock estimate was computed as the difference between the counterfactual estimate of migrant stock made following the standard methodology described above (as if there had been no pandemic) and the value calculated assuming no change in the number of international migrants between 1 March and 1 July 2020.

[36] This period is commonly referred to as 2010 round of population censuses.

effort stimulated and inspired other institutions and researchers to complement, extend and revise stock estimates, and ultimately estimate flows from migration stock data[37].

International migrant stock 2020 The United Nation Population Division prepared new estimates of International Migrant Stock in 2020 (United Nations 2020b) for 232 countries[38], replacing the 2019 Revision[39]. It provides estimates of the international migrant stock by age, sex and origin for the mid-point (1 July) of each year: 1990, 1995, 2000, 2005, 2010, 2015 and 2020 (available at https://www.un.org/development/desa/pd/content/international-migrant-stock). The 2020 Revision expands the details of the estimates by providing for all datasets separately data for males and females and both sexes combined.

For all 232 countries and areas, the estimates of the international migrant stock for 2020 were adjusted to account for the impact of the COVID-19 pandemic.[40]

[37] See, for example, the Global Migrant Origin Database http://www.sussex.ac.uk/Units/SCMR/drc/research/typesofmigration/global_migrant_origin_database.html

[38] There are 232 countries of origin, but 231 countries of destination, omitting the Holy See.

[39] The 2019 Revision ended with estimates for the year 2019, thus breaking the standard format of quinquennial time references.

[40] The adjustment acknowledges the border closures and severe restrictions and disruptions to international travel, especially in the initial months of the pandemic. In the absence of systematic empirical data on the effects of the pandemic on international migration, the mid-year 2020 stock estimates were derived under the assumption that there was no increase or decrease in the number of international migrants between 1 March and 1 July 2020, namely during the last four months of the estimation period. The estimated impact of the pandemic on the 2020 stock estimate was computed as the difference between the counterfactual estimate of migrant stock made following the standard methodology described above (as if there had been no pandemic) and the value calculated assuming no change in the number of international migrants between 1 March and 1 July 2020.

Table 27: International Migrant Stock 2020

No.	Topic	Origin	Destination	B	C	R	I	NA
1	International migrant stock at mid-year by sex and by region, country or area of destination, 1990-2020		232	183	46	137	6	
2	International migrant stock at mid-year by sex and by region, country or area of origin, 1990-2020		235					
3	International migrant stock at mid-year by sex and by region, country or area of destination and origin, 1990-2020	232	231	192	17	118	32	
4	International migrant stock at mid-year by age and sex and by region, country or area of destination, 1990-2020		235	183	46	137	6	3
	Code	Basis for estimates						
	B	Foreign-born population.						
	C	Foreign citizens.						
	R	Refugees, persons in refugee-like situations, asylum seekers (UNHCR, UNRWA) added to the estimates,						
	I	Imputed: no data on international migrants for the country or area concerned available						
	NA	Not available						
	Author's calculations based on published Excel data							
Source:	https://www.un.org/development/desa/pd/content/international-migrant-stock							
	Accessed 2021.02.22							

The documentation for the 2020 Revision of International Migrant Stock provides a summary table about the availability of empirical data (United Nations 2020b, table 1, p. 5), counting the availability of at least one data source between 2005 and 2014.[41]

The data are provided neatly formatted in Excel worksheets, with notes. It would be helpful, however, if the same data would be available n a database format, preferably in 3rd normal form, as text file in Excel format (CSV).

Table 28: Total migrant stock[42]

Year	All localities	Countries only	Coverage (%)
1990	152,986,157	144,345,823	94%
1995	161,289,976	153,812,479	95%
2000	173,230,585	166,166,855	96%
2005	191,446,828	183,626,163	96%
2010	220,983,187	212,225,951	96%
2015	247,958,644	237,039,802	96%
2020	280,598,105	267,940,954	95%

[41] This period is commonly referred to as 2010 round of population censuses.
[42] All localities include non-country destinations (regions), while countries refer exclusively to county-country pairs

4.2.2 OECD

4.2.2.1 DIOC/DIOC-E

OECD has compiled comprehensive estimates of migrant stock data in an initiative entitles Database on Immigrants in OECD Countries (DIOC) and the extended version that includes select non-OECD countries (DIOC-E). The datasets include numerous additional characteristics that allow for deeper analysis and better understanding of migration processes of the countries covered: demographic characteristics (age and gender), duration of stay, labor market outcomes (labor market status, occupations, sectors of activity), fields of study, educational attainment, and the place of birth (see table below).

The datasets, available as Excel files (CSV Format), are accompanied by methodological notes and analytical data with emigration rates (proportion of immigrants. Also presented are working papers, related Migration Data Briefs, and more.

Database on Immigrants in OECD countries (DIOC):

Provides comprehensive and comparative information on a broad range of demographic and labor market characteristics of immigrants living in OECD countries as well as in several non-OECD countries (DIOC extended or DIOC-E).

Table 29: Database on Immigrants in OECD countries

No.	Indicator	DIOC 2000/01	DIOC extended (DIOC-E) 2000/01	DIOC 2005/06	DIOC 2010/11	DIOC extended (DIOC-E) 2010/11	DIOC 2015/16[43]
1	Number of countries	28	100	27	40 (33)	91 (88)	35
2	Country of residence	x	x	x	x	x	x
3	Country of birth	232	232 (*)	231	231	236 (*)	230
4	Nationality	x	x (*)	x	x	x (*)	x
5	Gender	x	x	x	x	x	x
6	Age	x	x	x	x	x	x
7	Educational attainment	x	x	x	x	x	x
8	Field of study	x			x		
9	Duration of stay	x		x	x		x

[43] For the 2015/16 edition of DIOC, raised confidentiality concerns forced the authors separate countries of residence and countries of birth into two separate files. As a result, the countries of residence show no country of birth but the region/continent the recorded person originated. Likewise, the file with country of birth figures is related to OECD, not their member countries.

No.	Indicator	DIOC 2000/01	DIOC extended (DIOC-E) 2000/01	DIOC 2005/06	DIOC 2010/11	DIOC extended (DIOC-E) 2010/11	DIOC 2015/16[43]
10	Labor force status	x	x	x	x	x	x
11	Occupation	x	x	x	x		x
12	Sector of activity	x			x		
Note:	For DIOC-E 2000/01 and 2010/11, in some countries, immigrants are identified based on nationality and not country of birth. Nationality is not separately available for these datasets. For the 2015/16 edition of DIOC, raised confidentiality concerns forced the authors separate countries of residence and countries of birth into two separate files. As a result, the countries of residence show no country of birth but the region/continent the recorded person originated. Likewise, the file with country of birth figures is related to OECD, not their member countries.						
Source:	http://www.oecd.org/els/mig/dioc.htm						

Other data sources

Other databases:
1. Database on Immigrants in OECD and non-OECD Countries: **DIOC** [Reference years 2000/01, 2005/06, 2010/11, 2015/16].
See: "http://www.oecd.org/els/mig/dioc.htm"
2. Comprehensive Migration Matrices by Education Level and Gender [EXCEL only, no documentation]
3. Global Bilateral Migration Database, 1960—2000. Global matrices of bilateral migrant stocks spanning the period 1960-2000, disaggregated by gender and based primarily on the foreign-born concept are presented.
4. Migration Database with Gender Breakdown, 1990—2000. A gendered assessment of the brain drain, by F. Docquier, A. Marfouk, B.L. Lowell (2007)
5. Migration Database with Age of Entry, 1900-2000. Measuring international skilled migration: new estimates controlling for age of entry, by M. Beine, F. Docquier and H. Rapoport, (2007)
6. Panel Data on International Migration, 1975-2000. Tendances de long terme en migrations internationales: analyse à partir de 6 pays receveurs, Manuscript in French, Université Catholique de Louvain. C. Defoort (2006).
7. Medical Brain Drain, 1991- 2004. Modeling the effect of physician emigration on human development by A. Bhargava, F. Docquier and Y. Moullan, (2010).
8. Extended Bilateral Migration Database, 2000—Joint OECD—World Bank [verify]

4.2.3 World Bank

4.2.3.1 Bilateral Migration Matrices

An overview of migration data published on the WB migration data web site (dated November 16, 2017, retrieved June 2018):
https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data

Table 30: Bilateral Migration Matrices

Migration data	Status
Bilateral Migration Matrix 2017	OK
Bilateral Migration Matrix 2013	OK
Bilateral Migration Matrix 2010	OK
Bilateral Migration Database 1960-2000	OK
Panel Data on International Migration, 1975-2000[44]	NA
Extended Bilateral Migration Database—Joint OECD—World Bank	DIOC-E

[44] The link to "Panel Data on International Migration, 1975-2000" above is broken on mentioned website. It can be found on https://dataCatalog.worldbank.org/dataset/world-panel-data-international-migration-1975-2000
Release Date: November 8, 2011; Last Updated: November 20, 2013.

Bilateral migration matrices (migrant stock)are available at the Migration and Remittances Data website: https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data

Bilateral Migration Matrix 2017
http://www.knomad.org/sites/default/files/2018-04/bilateralmigrationmatrix20170_Apr2018.xlsx
Data in table are shown as referring to 2017.

Bilateral Migration Matrix 2013
http://pubdocs.worldbank.org/pubdocs/publicdoc/2015/10/38881445543162029/bilateral-migration-matrix-2013-0.xlsx

Bilateral Migration Matrix 2010
http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1110315015165/T1.Estimates_of_Migrant_Stocks_2010.xls

Global Bilateral Migration Database 1960-2000
Data are accessible through a query in the online database. They are documents as follows:
Text Box
Global matrices of bilateral migrant stocks spanning the period 1960-2000, disaggregated by gender and based primarily on the foreign-born concept are presented. Over one thousand census and population register records are combined to construct decennial matrices corresponding to the last five completed census rounds. For the first time, a comprehensive picture of bilateral global migration over the last half of the twentieth century emerge s. The data reveal that the global migrant stock increased from 92 to 165 million between 1960 and 200 0. South-North migration is the fastest growing component of international migration in both absolute and relative term s. The United States remains the most important migrant destination in the world, home to one fifth of the world's migrants and the top destination for migrants from no less than sixty sending countries. Migration to Western Europe remains largely from elsewhere in Europe. The oil-rich Persian Gulf countries emerge as important destinations for migrants from the Middle East, North Africa and South and South-East Asia. Finally, although the global migrant stock is still predominantly male, the proportion of women increased noticeably between 1960 and 200 0.

http://data.worldbank.org/data-Catalog/global-bilateral-migration-database
https://databank.worldbank.org/source/global-bilateral-migration

The bilateral migration database comprises 231 countries of origin and destination, plus a specially coded origin category “Refugees” (no origin country given); no data/estimates given. #### Joint OECD-World Bank
Panel Data on International Migration, 1975-2000
https://microdata.worldbank.org/index.php/Catalog/390
Documentation: Schiff, Sjoblom (2013). World-Panel Data on International Migration 1975-2000.p df

This dataset, a product of the Trade Team—Development Research Group, is part of a larger effort in the group to measure the extent of the brain drain as part of the International Migration and Development Program. It measures international skilled migration for the years 1975-2000. The methodology is explained in: "Tendance de long terme des migrations internationals. Analyse à partir des 6 principaux pays recerveurs," Cécily Defoort. This data set uses the same methodology as used in the Docquier-Marfouk data set on international migration by educational attainment. The authors use data from 6 key receiving countries in the OECD: Australia, Canada, France, Germany, the UK, and the US. It is estimated that the data represent approximately 77 percent of the world's migrant population. Bilateral brain drain rates are estimated based observations for every five years, during the period 1975-2000

4.2.3.2 Extended Bilateral Migration Database—Joint OECD—World Bank

The *Extended Bilateral Migration Database—Joint OECD—World Bank* is listed at https://www.worldbank.org/en/topic/migrationremittancesdiasporaissues/brief/migration-remittances-data, but the link http://go.worldbank.org/5G554IF6C0 is broken.
Presumably, the title refers to OECD's DIOC-E databases for the reference years 2000/2001 and 2010/2011.

4.2.3.3 Miscellaneous

The World Bank also holds a large amount of microdata from surveys, of which some include data on migration. The topic of microdata will not be explored here.

4.2.4 Brain Drain Estimates

An increasingly important aspect of international migration is the selective force it may assert on the educational composition of sending and receiving countries. Researcher tried to determine whether the flow of (highly) qualified people between less and more developed countries has positive or negative affects both for countries involved. For this investigation, the educational composition of migrations was included in extensive data collection and estimation processes. Adding additional dimensions such as educational attainment meets stiff challenges due to limited migration data and nonconformant definitions of educational status/outcomes. Here only a brief overview of estimates in this area are given, not the developmental impacts. The following studies and datasets have been compiled since the beginning of this century. The analyses are all based and presented as on stock data for (select) OECD countries.

Table 31: Data collection by educational attainments (named after main authors)

No.	Database	Source
1	BCM (2013)	http://www.abdeslammarfouk.com/bcm-database.html
2	DMOP (2011)	http://www.abdeslammarfouk.com/dmop-database.html
3	DM (2004-2006)	http://www.abdeslammarfouk.com/dm-database.html
4	DLM (2007-2009)	http://www.abdeslammarfouk.com/dlm-database.html

4.2.4.1 BCM database

The BCM database (Brücker, Capuano, Marfouk) of the IAB (Institut für Arbeitsmarkt- und Berufsforschung, the German Institute for Employment Research) provides information on the structure of immigration in 20 OECD countries, by origin and destination, sex, and education level, in absolute values and in percentage of source countries labor force (emigration rates) for the years 1980-2010 (5 years intervals). Although data have been collected for countries with particularly good statistical systems, the overall availability of original data was limited to 68%, or 95 country/time datasets against 140 for full coverage. For 45 datasets, the figures were imputed. (Brücker, Capuano, and Marfouk 2013)

The dataset consists of three major files:

1. Total number of foreign-born individuals aged 25 years and older, living in each of the 20 considered OECD destination countries, by year, gender, country of origin and educational level. Educational levels are distinguished in low, medium, and high skilled.
2. Migration by gender: Total number of foreign-born individual (all age groups as a whole), living in each of the 20 considered OECD destination countries, by gender and country of origin.
3. Emigration rates: Proportion of migrants over the pre-migration population (defined as the sum of residents and migrants in each source country), by gender, skill level and year. Age group: 25 years and older.

The data are accessible at the IAB (Institut für Arbeitsmarkt- und Berufsforschung, the German Institute for Employment Research) website: https://www.iab.de/en/daten/iab-brain-drain-data.aspx and at Abdeslam Marfouk Personal Website[45]

4.2.4.2 DMOP Database

The DMOP database contains a bilateral database with estimates of international migration stocks by gender, education level, origin, and destination. Based on existing databases of OECD host countries in 1990 and 2000, the DMPOP database expanded coverage by collecting or estimating data on all non-OECD destinations. The DMPOP database contains comprehensive 195 by 195 country matrices of international migrant stock for the years 1990 and 2000, distinguishing migrants by gender and education (college educated and the less educated). (Docquier et al. 2011). The database seems no longer be available online.

4.2.4.3 DM database

The DM dataset (Docquier, Marfouk) provides information on the structure of migration to the OECD countries in the form of migrant stock, by origin and education level, in absolute values and in percentage of source countries labor force (emigration rates) for the years 1990 and 2000 (Docquier and Marfouk 2004), (Docquier and Marfouk 2006)
Data are online at http://www.abdeslammarfouk.com/dlm-database.html:

[45] http://www.abdeslammarfouk.com/bcm-database.html

4.2.4.4 DLM database

The database prepared by Docquier, Lowell, and Marfouk (Docquier, Lowell, and Marfouk 2009) (DLM database) focuses on the structure of immigration to OECD countries, by origin, gender and education level, in absolute values and in percentage of source countries labor force (emigration rates) for two periods (1990 and 2000). The DLM database is based on and an extension of the DM database (Docquier, Lowell, and Marfouk 2007), (Docquier, Lowell, and Marfouk 2009). Data are online at http://www.abdeslammarfouk.com/dlm-database.html:

Another database prepared by Beine, Docquier, and Rapoport in 2007 had a special topic of controlling for age of entry (Beine, Docquier, and Rapoport 2007). The associated database is documented in the Supplemental Appendix, but the link to the online database (in Excel) is broken.

4.2.4.5 Migrant stock estimates by educational attainment

(Artuc et al. 2015; Brücker, Capuano, and Marfouk 2013; Docquier et al. 2011)

The 2015 publication by Artuc, Docquier, Özden, and Parsons (Artuc et al. 2015) claimed to be, for the first time, a global overview of human capital mobility through bilateral migration stocks by gender and education in 1990 and 2000, and calculation of nuanced brain drain indicators. (Data associated with the article are behind a paywall or require an account with publisher).

5 NET MIGRATION

All projects to project the world's population that include all countries need to include migration estimates. Most such projections (and estimates) employ net migration. (see Buettner, Muenz …..).

5.0.1 United Nations Population Division (UNPD)

The United Nations Population Division generates periodically its flagship publication *World Population Projections*, with 2019 Revision the most recent one (United Nations 2019b). This publication includes estimates of net migration for all countries off the world, for a period of 150 years, from 1950 to 2100. It is also available online at the Population Division's website https://population.un.org/wpp/.

5.0.2 Joint Research Centre of the EU

The Joint Research Centre (JRC)—Knowledge Centre on Migration and Demography (KCMD)—of the EU recently published a technical report with new estimates of net migration at high spatial resolution. The publication is presented as a first step of a broader JRC project aimed at analyzing the relation between climate change, population distribution and related migration. The report uses demographic indirect estimation techniques based on population data from the JRC Global Human Settlement Layer (GHSL) to estimate five-year net migration from 1975 to 2015 at a spatial resolution of about 25-by-25 km. See (Alessandrini, Ghio, and Migali 2020)

5.0.3 Azose, Raftery

Azose and Raftery proposed a Bayesian model for the projection of net migration (Azose and Raftery 2015) for all countries, broken down by age and sex. Notably, the model produces ranges of uncertainty. In addition, the trajectories for all countries are constrained to satisfy the requirement of zero global net migration.

5.0.4 National Center for Atmospheric Research (NCAR)

The NCAR Community Demographic Model (Nawrotzki 2014; Nawrotzki and Jiang 2015) includes the multiregional population/urbanization projection module. The use of flow data in the model seemed not feasible, so an attempt was made to estimate net migration profiles by age and sex (termed, incorrectly, net migration flows). It is suggested that future research should include migrant flows instead of net migration.

5.0.5 Center for International Earth Science Information Network (CIESIN)

In 2011, CIESIN prepared net migration estimates, both subnationally and internationally, by ecosystem over the four decades from 1970 to 2010 (Center for International Earth Science Information Network (CIESIN) 2011). Because of the lack of globally consistent data on migration, CIESIN employed indirect estimation methods. A combination of data on spatial population distribution for five time point (1970, 1980, 1990, 2000, and 2010) and subnational rates of natural increase was used to calculate net migration estimates. A geospatial analysis allowed to produce detailed global maps. The main findings were: Most out-migration occurs over large rural areas, whereas areas of net in-migration are typically urban.

- Coastal ecosystems have experienced the highest levels of net in-migration.
- Inland Water ecosystems have experienced the second highest levels of net in-migration.
- Island ecosystems have high levels of outmigration.

6 ANNEXES

6.1 Abbreviations

Abbreviation	Name	Remarks	Source
CELADE	Latin American and Caribbean Demographic Centre (Centro Latinoamericano de Demografía)	Population Division of United Nations Economic Commission for Latin America and the Caribbean (ECLAC)	https://www.cepal.org/en/work-areas/population-and-development
CIESIN	Center for International Earth Science Information Network		http://ciesin.org/
DEMIG	Determinants of International Migration		
DIOC	Database on Immigrants in OECD countries		
DTM	Displacement Tracking Matrix (IOM)		
ECLAC	Economic Commission of Latin America and the Caribbean		
EUROSTAT	European Statistical Office		https://ec.europa.eu/eurostat/web/main/home
GBMD	Global Bilateral Migration Database	Source	
GMDAC	Global Migration Data Analysis Centre (IOM)	Source	
IAB	Institut für Arbeitsmarkt- und Berufsforschung	Institute for Employment Research. Nürnberg, Germany	(Institute for Employment Research)
ILO	International Labor Organization		
IMEM	Integrated Modeling of European Migration		
IOM	International Organization for Migration		https://www.iom.int/
GMDAC	Global Migration Data Analysis Centre	Part of IOM's Department of International Cooperation and Partnerships	https://gmdac.iom.int/

Abbreviation	Name	Remarks	Source
JRC	Joint Research Centre (JRC), the European Commission's science and knowledge service		
KNOMAD	Global Knowledge Partnership on Migration and Development	Implemented through multi-donor trust fund established by the World Bank	https://www.knomad.org/
MIMOSA	MIgration MOdelling for Statistical Analyses		
NCAR	National Center for Atmospheric Research		
OECD	Organization for Economic Cooperation and Development		
SICREMI	Continuous Reporting System on International Migration in the Americas	Affiliate of SOPEMI	
SOPEMI	Système d'observation permanente des migrations	Continuous Reporting System on Migration	
UNGMD	United Nations Global Migration Database		https://www.un.org/development/desa/pd/data/global-migration-database#:
UNHCR	United Nations High Commissioner for Refugees		https://www.unhcr.org/
UNPD	United Nations Population Division	Population Division of the Department of Economic and Social Affairs	https://www.un.org/development/desa/pd/
UNSD	United Nations Statistics Division	Statistics Division of the Department of Economic and Social Affairs	https://unstats.un.org/home/
WB	World Bank	World Bank Group	https://www.worldbank.org/en/home

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