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Quantifying the International Bilateral Movements of Migrants

Christopher R. Parsons¹, Ronald Skeldon², Terrie L. Walmsley³ and L. Alan Winters⁴

Abstract

This paper presents five versions of an international bilateral migration stock database for 226 by 226 countries. The first four versions each consist of two matrices, the first containing migrants defined by country of birth i.e. the foreign born population, the second, by nationality i.e. the foreign population. Wherever possible, the information is collected from the latest round of censuses (generally 2000/01), though older data are included where this information was unavailable. The first version of the matrices contains as much data as could be collated at the time of writing but also contains gaps. The later versions progressively employ a variety of techniques to estimate the missing data. The final matrix, comprising only the foreign born, attempts to reconcile all of the available information to provide the researcher with a single and complete matrix of international bilateral migrant stocks. Although originally created to supplement the GMig model (Walmsley and Winters 2005) it is hoped that the data will be found useful in a wide range of applications both in economics and other disciplines.

Key Words: Migration data, bilateral stock data,

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Winters

Introduction

The economics literature increasingly recognizes the importance of migration⁵ and its ties with many other aspects of development and policy. Examples include the role of international remittances (Harrison et al 2003) or those immigrant-links underpinning the migration-trade nexus (Gould 1994). More recently Walmsley and Winters (2005) demonstrated utilising their GMig model that a small relaxation of the restrictions on the movement of natural persons would significantly increase global welfare with the majority of benefits accruing to developing countries.

It is somewhat surprising therefore that few attempts have been made to collate detailed and comparable bilateral migration data. Where attempts have been made typically no distinction is made between the foreign population measured by country of birth, and those recorded by their nationality, despite the large disparities that often exist between these series. Previous endeavours display a number of failings which impede further research at the global level; e.g. data collection often falling short of transparent or undue focus on particular regions. Only the United Nations adopts a truly global view when summarizing international migrant movements, but its work provides only total migrant stocks for each country.

This paper attempts to rectify these shortcomings of the literature and initially presents four versions of two matrices for 226 by 226 countries, the first of which records foreign population by country of birth and the second by nationality, which, for the purposes of

⁵ The term migration and immigration and migrant and immigrant are used interchangeably throughout.

the paper is treated analogous to citizenship⁶. Though countries employ many different methods for collecting and presenting these data, we attempt to reconcile these methods to create as full and comparable a dataset as is currently possible. It is recognized that alternative versions of the data will be of different value depending upon the user. The data are therefore presented in a transparent fashion so that readers may choose which version best suits them. The first version, for example, simply contains the raw data with some minor adjustments and will be of more use to a demographer. The later versions contain far more bilateral entries, and despite individual entries being less accurate, and other entries being crude approximations, will prove more useful to the applied economist. Version 5, although covering only the foreign born, represents as full a picture of bilateral international migrant stocks as the data permits. By presenting the data in this way it is hoped this paper will provide a rich resource for future research.

The following section describes who qualifies as a migrant under both of the definitions utilised in this paper. This will provide the unfamiliar reader with the background to interpret the statistics contained herein. Section 3 investigates the sources of migration statistics, and while it is not the aim of the paper to elucidate all of the nuances between the techniques used to collect migration data, this section should give the reader a sense of the heterogeneity that exists among the available statistics⁷. Section 4 outlines the different versions of the matrices that can be found in the statistical annex, while the final section provides some summary statistics of the results obtained.

Who counts as a migrant?

For the uninitiated it can be confusing as to who actually qualifies as a migrant, not least because of the broad range of classifications used to define them. Migrants may be

⁶ UN (1980b) defines a person's citizenship as their legal nationality. Following from this, here no distinction is made between citizenship and nationality, and thus no notion of belonging or of political or legal *participation* is employed.

⁷ For a full treatise of this subject readers are referred to Bilsborrow et al (1997).

recorded in terms of their residence (including their country of previous residence), their citizenship, the duration of their time spent abroad⁸, the purpose of their stay (i.e. visa type) and their birth place (Bilsborrow et al 1997), plus, additionally, other definitions on occasion such as migrants' ethnicity. The UN (1998) defines a migrant as 'any person who changes his or her country of usual residence', though residence may refer to both a change of residence or residential status. Tourists, and business travellers among others, are not included in migration statistics, as these movements do not involve changing one's usual place of residence. Tourists are recorded in separate statistics and business visitors contribute to the non-migrant population.

Statistically, the migrant population can be equated directly with the number of foreigners; either those recorded by country of birth, the foreign born, or that fraction of the population with foreign nationality, the foreign population. The confusion over migrants is exacerbated by the fact that a migrant's nationality need not be the same as their country of birth. Thus one may be born domestically but qualify as a foreign national, or conversely, may be born a national but still be characterised as foreign born. Table 1 conveniently summarizes the various possibilities as to who constitute part of the foreign population under each definition i.e. who is considered a migrant, when only two countries are considered, Ireland and the UK. Only domestic nationals residing in their home country of birth do not qualify as immigrants under one or other of the definitions. The foreign born comprise both national and foreign citizens, and represent first generation migrants. The foreign population may include subsequent generations of migrants along with those born domestically with foreign nationality. To reiterate for clarity, children at birth typically hold the citizenship of their parents and thus when born in a country other than that of their parents' country of nationality they may be classified

⁸ Though it is increasingly recognized that distinguishing between shorter and longer term migrants is useful for policy making etc. this division is ignored here since generally censuses fail to make this distinction. Indeed seldom do countries accurately distinguish these alternative series.

as migrants without having ever moved!⁹ For example the child of an Indian migrant born in England will most likely have Indian nationality¹⁰. While their parents will, until they become naturalised, be recorded as migrants under both definitions, their child may only be a migrant as defined by nationality. However, while a migrant's citizenship may change, their place of birth is fixed over their lifetime. Therefore defined strictly by country of birth, a migrant must have at some point in their life moved to be classified as an international migrant. From a strictly theoretical perspective the foreign born definition may be viewed as a superior measurement since movement is the very essence of migration. The nationality definition is commonly used in other social sciences however since nationality data give a better indication of *when* the migration took place.

Table 1. Summary as to who qualifies as a migrant

	UK Born UK Nationality	UK Born Irish Nationality	Irish Born UK Nationality	Irish Born Irish Nationality
Residing in UK	DOES NOT QUALIFY AS MIGRANT	Not foreign population by country of birth	Foreign population in UK by country of birth	Foreign population in UK by country of birth
		Foreign population in UK by nationality	Not foreign population by nationality	Foreign population in UK by nationality
Residing in Ireland	Foreign population in Ireland by country of birth	Foreign population in Ireland by country of birth	Not foreign population by country of birth	DOES NOT QUALIFY AS MIGRANT

⁹ This is not always the case and depends on individual country's' immigration and naturalisation policy.

¹⁰ Since the British Nationality Act 1981, birth in the UK does not guarantee British citizenship, which may be obtained through birth, descent, registration or naturalisation (see <http://www.uniset.ca/naty/BNA1981revd.htm>)

	Foreign population in Ireland by nationality	Not foreign population by nationality	Foreign population in Ireland by nationality	
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One problem arising from these definitional issues is encountered when dealing with former colonies. Taking Portugal as an example, many Portuguese nationals are born abroad in one of Portugal's former colonies as outlined in table 2. Care should be exercised when one wishes to investigate any of the former colonial powers therefore, as a large proportion of foreign born migrants may have domestic nationality.

Table 2. Disparities between the foreign born and foreign migrants for Portugal and her former colonies

Foreign Born migrants		Foreign migrants		Migrants born outside Portugal with other nationality	
Brazil	49891	Brazil	31869	Brazil	18022
Mozambique	76017	Mozambique	4685	Mozambique	71332
Angola	174210	Angola	37014	Angola	137196
Cape Verde	44964	Cape Verde	33145	Cape Verde	11819
Guinea-Bissau	21435	Guinea-Bissau	15824	Guinea-Bissau	5611
Sao Tome and Principe	12490	Sao Tome and Principe	8517	Sao Tome and Principe	3973
Macau	2882	Macau	71	Macau	2811
Timor Leste	2241	Timor Leste	137	Timor Leste	2104
Total Foreign born	384130	Total Nationality	131262	Total FB-Nat	252868

Sources of migrant stock data

A multitude of techniques is employed to measure immigration including registers, permits and surveys. Immigrant stocks¹¹ however are usually recorded by demographic methods that measure the total population. Two definitions of the total (resident) population are commonly cited. The *de facto* population refers to all persons *physically present* in the country at a certain point in time; those that have been resident for a particular length of time, which usually ranges from between 3 months to 1 year. The *de jure* population measures all those persons who are either *usually present*, or qualify as *legally resident* at a particular moment. The two key methods for measuring migrant stocks, whether measured as the stock of foreign population or foreign born, are the census and the population register¹². These are both typically (though not always, especially in the case of censuses) based on the *de jure* concept of total population. Traditionally countries collect data on either the foreign born or the foreign population though in recent years there has been growing recognition of the value of obtaining both series.

The census, a retrospective system for surveying the entire population at a single point in time, is generally considered the most comprehensive record of the total population. Although primarily a tool for compiling stock data, flows may be indirectly inferred from the inclusion of questions asking where people used to live in the past. They are usually carried out decennially and therefore produce sparse time series, although it is not uncommon for countries to carry out micro censuses based on a smaller sample (e.g. 5%) in non-census years. Perhaps the greatest strength of censuses when measuring the migrant population, besides their universal coverage, is their limited scope in the questions asked which facilitates comparability across countries. Although virtually every

¹¹ Note this paper omits detailed discussion of immigrant flows, readers are referred to OECD 2002 & 2003.

¹² Residence permits and other social surveys are also used although we do not generally draw on them in this paper due to the availability of data derived from censuses and population registers.

country in the world conducts censuses, invariably they are carried out on different dates within census 'rounds' that usually span a decade. The latest (2000) round of censuses that includes nearly all countries¹³ started in 1995 and was due to be completed by 2004.

Population registers are continuous reporting systems for recording populations, both domestic and foreign, and where they are implemented there is a legal obligation for all persons to register themselves with the appropriate local authority. Whilst providing information with much greater frequency than censuses they are additionally useful in that they can be used to measure both stocks and flows (though typically in order to calculate stocks, data from registers must be combined with reliable census data which provides the stock for the base year). They have also proved cost effective as demonstrated by the 2000 Singapore census where information from the registers was combined with a sample census. Few countries maintain population registers though they have seen somewhat of a revival of late, and are most commonly found in North-Western Europe (specifically Scandinavia) and East Asia.

The comparability of migrant statistics

Generally immigrant stock statistics are easier to interpret than data on migrant flows,¹⁴ although even they are plagued by a high degree of heterogeneity. The UN recommendations (1998) are, in the main, not adhered to. Until significant progress in standardizing international practices is made, the disparities between various countries' methods will hamper any comparison of the statistics. That is not to say that no interpretation of the data can be made however, simply that there are unavoidable inaccuracies associated with both individual countries' data collecting practices, the tools

¹³ Those not partaking include: Afghanistan, Columbia, Peru, North Korea, Myanmar, Bhutan, Taiwan, Uzbekistan, Tajikistan, Moldova, Bosnia and Herzegovina, Western Sahara, Guinea-Bissau, Liberia, Togo, Nigeria, Chad, Cameroon, Gabon, Sudan, Ethiopia, Eritrea, Somalia, Angola, Democratic Republic of Congo, and Madagascar. (Source: UN, <http://unstats.un.org/unsd/demographic/sources/census>).

¹⁴ For a succinct and detailed discussion the reader is referred to OECD 2003.

used to record migrants, and with the actual statistics themselves. Variation exists between different data sources, across countries and even on occasion between data recorded in the same source over time (Bilsborrow et al 1997). An extreme example would be the most recent census of China, which records only around 29,000 migrants since the Chinese definition of migration differs substantially from standard practice. For all these reasons a certain margin of error is inevitable.

Problems exist with both *de jure* and *de facto* concepts of the total population. *De jure* measures depend upon the legal system in the recording country, and the definition used to classify residents. These obviously vary significantly across countries. Indeed if countries automatically grant legal residence to a person born within their borders a person may be recorded twice under this definition if their place of usual residence lies outside their country of birth. Moreover those included sometimes differ between countries, some nations for example include short term workers while others omit them (UN 1994). *De facto* measures are conceptually less problematic but are complicated by the fact that the cut-off point, the threshold after which a nation defines a person as a migrant, differs widely across countries.

Disparities in collection practices include surveying on different dates or omitting different categories of people¹⁵. Problems associated with the tools used to record the statistics include population registers recording different kinds of migrants, a lack of standardization between the questions asked during the census, and alternative country coding used to record the responses. Across Central Asia and Eastern Europe, questions relating to the foreign population often refer to ethnic nationality; and frequently countries respect different legal boundaries, for example. The UN (1980b) recommends that migrants should be enumerated according to the borders in existence

¹⁵The UN notes for example, that developed countries generally include refugees in their censuses whilst these are largely omitted from developing countries' surveys.

at the time of survey. Over time however, borders are redefined, and new countries created. Those interviewed may simply not be aware of the changes. Indeed a foreign born migrant, resident for many years, may classify themselves as native even when they should in fact be otherwise classified, thus biasing results. In other instances the non-response level of migrants may be very significant and as census takers are often poorly trained mistakes will likely go undetected. During the 1969 Kenyan census for example 78,756 individuals did not respond to the place of birth question, high relative to the 158,692 that stated they were foreign born (Bilsborrow et al 1997).

The problem of illegal immigration is no doubt large. This is difficult to measure and will distort any official migration figures. A pertinent example is Russia, a 'migration magnet' in recent years and the country with the longest border with approximately 450 official border posts. Feasible calculations estimating the number of illegal migrants residing in the Russian Federation range from 3.5 to 6 million persons (Heleniak 2002), though there is no real way of ever accurately knowing. In the United States (which arguably conducts the most comprehensive census), the number of illegal immigrants is simply estimated using assumption based models. Numerous migrants will therefore remain unrecorded, not least because it is not in their interest for the authorities to know they are residing illegally. A small proportion of illegal residents who have, at some point been registered or otherwise recorded, will be picked up by future registers once their visas or permits to stay expire however.

The rate of naturalisation also negatively impinges upon the quality of migration statistics. This varies significantly between countries, and differences in a countries' propensity to offer citizenship impacts potentially very seriously upon migration statistics as recorded by nationality. Naturalisations in South-East and Eastern Asia for example are rare, so much so that in many cases foreign nationality data can be directly equated to the foreign born. In these countries first generation migrants and additionally

immigrant births contribute almost solely to the foreign population. Indeed, in the specific case of Japan, migrants of even older generations still need to apply for citizenship, a lengthy and arduous process. Largely due to increased marriages between Japanese and foreigners the number of naturalisations has increased steadily though the figure is still comparatively very low. Conversely, in countries such as Belgium where naturalisations are far more common, additional migrants and immigrant births likely contribute significantly to the domestic population as foreign citizens become naturalised. For our purposes the disparity between two immigration systems will impact upon the proportion of the foreign relative to the national population. Finally it should be noted that the way in which immigration statistics are measured has caused several discontinuities in the data. Examples of events which have created these structural breaks include the disintegration of the former U.S.S.R, Yugoslavia, and Czechoslovakia and the British handing back of Hong Kong to the Chinese. All of these events produced millions of additional international migrants overnight as new boundaries were drawn and new nationalities created.

Collected Data

In light of the preceding discussion, without further international co-operation and compliance to a fully accepted and standardized set of conventions, any comparison of migrant stocks will be less than perfect. There is little choice but to collect the data that individual countries themselves compile in its rawest form, despite the heterogeneity that exists, and record it. As well as those issues already discussed this includes having to treat *de jure* and *de facto* censuses as equivalent, to accept the alternative aggregations that countries use, when recording dependencies for example¹⁶, and to initially acknowledge alternate country coding. By drawing up a hierarchy of preferred dates,

¹⁶ For example the number of Puerto Ricans in the United States will not be recorded as they count as Americans.

sources, and definitions to be strictly adhered to, the data can then be revised in a number of ways creating an assortment of different versions suitable for different users. The aim of this study was to include as many of the worlds' migrants as possible, to assign them *all* to specific countries with the highest degree of accuracy and to produce as full and comparable a bilateral database of international migration stocks as is possible under current data dissemination. In its current form the data should be easy to interpret, suitable for a wide range of academic uses and easy to update should further material become available. In most cases data were recorded from their original source. Data from the latest census round were preferred, as these are considered most comparable at the global level, although they were not always available due to the significant lags that often exist between the timing of censuses and their publication. Data on both foreign born and foreign nationals were collected where feasible¹⁷. Population registers were then drawn upon where censuses were unavailable for the years 2000/2001¹⁸. In some cases where neither source was available, data were obtained from reliable secondary sources that cite the original¹⁹. Some regions of the world provide significantly better data than others, and some simply does not exist. While the data for Europe, the Americas and much of Oceania is of a fair standard, the data for parts of Asia and much of Africa are of more dubious quality; due to political sensitivities and low census budgets. Table 12 in Annex 1 provides a summary of the raw data collected, whether the data are bilateral and the corresponding sources and years.

¹⁷ As the two series are presented separately the diagonals of each matrix will represent those domestically born residing at home or alternatively those of domestic nationality residing at home and will therefore not be counted as migrants.

¹⁸ 2000/01 was decided upon since the vast majority of censuses from the latest round refer to these dates.

¹⁹ These include the Organisation for Economic Development, the Migration Policy Institute, the Economic Commission for Latin America and the Caribbean, the Department for International Development, the International Labour Organisation, and the United Nations together with various national statistics bureaus.

Versions

Each version of the database contains two matrices covering 226 by 226 countries²⁰, one recording the foreign born, the other the foreign population; with the exception of the final version, which only covers the foreign born. Incrementally the versions encompass information derived from the original data to supplement the matrices with additional coefficients of interest. Version 1 contains all of the raw data collected with a few adjustments. In the sources drawn upon in this paper it is common for migrants that cannot be assigned to a specific country of birth/nationality to be recorded in remainder categories that typically have the prefix 'Other'. In Version 1 as there is no basis on which to assign these migrants, the 'Other' categories, which often contribute significantly to the overall total are simply reported below the matrix in the relevant (host nation) column. Moreover, in a few other cases large 'unknown' categories were recorded in the original source, for example the German data collected from the OECD. These 'unknowns' were completely removed from the matrices since it is unclear whether they actually constitute migrants, and will most likely comprise the domestic population. Where countries used country coding referring to the USSR, Czechoslovakia or Yugoslavia, and where bilateral information on migrants' destination post break-up was available, these aggregated totals were distributed on the same basis, implicitly assuming therefore that migration trends remained the same after break-up. Zeros were entered where countries were not referred to at all. Dependencies and recoded countries were also aggregated up into one of the 226 countries included in the database, see table 3.

²⁰ In addition to the 226*226 matrices, data aggregated up into the 87 GTAP regions, which corresponds to the GTAP database version 6, may be obtained from the authors. This aggregation will likely smooth over some of the inaccuracies contained in our more heavily interpolated matrices.

Table 3. Summary of Aggregation of dependencies and recoded states

<i>Regions/State</i>	<i>Affiliated to/Recoded as</i>
Vatican/ Holy See	Italy
Azores	Portugal
Cocos Island	Australia
Pitcairn	UK
British Indian Ocean Territory	UK
Channel Islands	UK
Isle of Man	UK
Tahiti	French Polynesia
Santa Domingo	Dominican Republic
Hawaii	USA
Western New Guinea	Indonesia
Canary Islands	Spain
Northern Cyprus	Cyprus
Ascension	St Helena
Jammu	India
Kashmir	India
Isla Providencia	Columbia
Galapagos Islands	Ecuador
San Andres Isla	Columbia
Western Sahara	Morocco
St Martin	Netherlands Antilles
Svalbard and Jan Mayen Islands	Norway

Version 2 tackles the data for Russia. The only information available was stock data from the final Soviet census²¹ (1989) which recorded the foreign born and bilateral flows by country of last permanent residence, together with the UN figure for the total number of foreign born for 2000. As Russia is home to the second largest population of international migrants (UN 2003) it is important for it to be included. Any reconciliation would only be an approximation due to the difference in definitions between the stock

²¹ The data from the 2002 Russian census was unavailable at the time of writing.

and flow data, and the lack of data on the number of returning migrants and their mortality rate. Following Head and Ries (1998) the rate of attrition, which includes the numbers of migrants who die or leave the country is assumed constant. Using a simple stock-flow formula (1), the rate of attrition, δ , was calculated such that when the 1990-1999 flows were added to the 1989 stock data the resulting total matched that of the UN. This rate was then used to calculate the remaining bilateral stocks for 2001 from the 1989 census data. Though crude, this estimation was considered better than omitting the data or simply using the UN (2003) total. Russia's foreign born migrant stock was estimated to include 12,881,925 migrants. Recently Russia's migrant stock has mirrored that of her dwindling population (Heleniak 2002) and at the very least the projected figure captures this trend.

$$(1) \quad S_t = (1 - \delta)S_{t-1} + F_{t-1}$$

Where: S_t = Immigrant stock at time t.

F_t = Immigrant flow at time t.

δ = Rate of attrition.

Version 3 additionally disaggregates jointly reported country groups where no migration data were available, (including those break-up countries not yet disaggregated), splitting them according to population share²². Though a rudimentary estimation, as migrants are more likely to emigrate from countries in close proximity at the regional level (Harrison 2003), it was deemed a reasonable exercise. For example in the 1996 New Caledonia census one category recorded is 'Melanesia' which in this instance includes 86,788 unassigned migrants from Fiji, Solomon Islands, and Papua New Guinea. Vanuatu is not included since it constitutes a separate heading in the census. Table 4 demonstrates how these migrants for New Caledonia were distributed across these countries in direct

²² These were by-and-large small remainder categories that overlapped with larger 'other' categories, those disaggregated in versions 5.

proportion to their populations. Table 5 outlines those countries that regions are assumed to comprise of²³.

Table 4. New Caledonia migrant split based on population shares for Melanesia

Country	Population (1996)	% Total	%*No. Caledonian	No. migrants
		Melanesian population	migrants	assigned
Fiji	786,603	13.4924	11709.82	11710
Solomon Islands	410,641	7.0436	6113.037	6113
PNG	4,456,781	76.4463	66346.19	66346
Total	5,829,952	100	86788	86788

Table 5. Splits by population

<i>Region/Country Group</i>	<i>Split into:</i>
USSR	Estonia, Latvia, Lithuania, Russian Federation, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, and Ukraine.
Yugoslavia	Serbia and Montenegro, Bosnia and Herzegovina, Croatia, Slovenia, and Former Yugoslavian Republic of Macedonia.
CSFR	Czech Republic and Slovakia.
Dominicans	Dominica and Dominican Republic
Other United States Island Areas and Puerto Rico	Guam, Marshall Islands, Northern Marianas, Federated States of Micronesia, American Samoa, US Virgin Islands, Puerto Rico
Korea	North and South Korea
South Asia	India, Bangladesh, Sri Lanka, Pakistan
Middle Eastern countries	Turkey, Bahrain, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Palestinian Territory, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, Yemen, Cyprus
West Indies	Anguilla, Antigua and Barbuda, Barbados, British Virgin Islands, Dominica, Grenada, Guadeloupe, Guyana, Jamaica, Martinique, Montserrat St Vincent and the Grenadines, , St Lucia, St Kitts and Nevis, Trinidad and Tobago and US Virgin Islands
Polynesia	American Samoa, Cook Islands, French Polynesia, Niue, Pitcairn Islands, Samoa, Tokelau, Tonga, Tuvalu, Wallis and Futuna Islands
Melanesia	Fiji, New Caledonia, Solomon Islands, Vanuatu, and PNG

²³ Jointly reported countries, those recorded by name, for example 'Botswana and Swaziland' are omitted from table 5.

South East Asian countries	Brunei, Cambodia, East Timor, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam
UK dependent territories	Anguilla, Bermuda, British Indian Ocean Territory, British Virgin Islands, Cayman Islands, Falkland Islands, Gibraltar, St Helena, Montserrat, Pitcairn Islands, Turks and Caicos Islands
Commonwealth Caribbean	Jamaica, Trinidad and Tobago, Dominica, St Lucia, Grenada, Barbados, Antigua and Barbuda, St Kitts and Nevis, Anguilla, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos Islands, Bahamas
French Equatorial Africa	Chad, Gabon, Congo, Central African Republic
Micronesia	Federated States of Micronesia, Kiribati, Northern Marianas, Guam, Marshall Islands, Palau, Nauru
Other Western Asia	Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Palestine, Oman, Qatar, Saudi Arabia, Syria, Turkey, UAE, and Yemen
Southern Africa	South Africa, Botswana, Namibia, Lesotho, and Swaziland.
Arab gulf co-op council	Bahrain, Oman, Qatar, Saudi Arabia, Kuwait and U.A.E.
Other Arab	Algeria, Comoros, Djibouti, Egypt, Eritrea, Iraq, Iran, Jordan, Lebanon, Libya, Mauritania, Morocco, Palestine, Somalia, Sudan, Syria, Tunisia, and Yemen.
Indian Ocean	Reunion, Mayotte, Madagascar

Version 4 removes nationality headings which implement ethnic background to distinguish migrants, for example 'Crimean Tatars'. These categories proved difficult to assign geographically and as they most likely refer to the domestic population, were removed entirely from the dataset, and their numbers subtracted from the country totals. These had previously been included to facilitate research on ethnicity. Other headings referring to totals largely incorporating nationals were likewise removed. This included those persons who possess dual nationality and ambiguous 'ignored' totals. Additionally Srivastava (2003) was drawn upon to supplement the database with information on the estimated number of migrants from India abroad in the Middle East.

Version 5, the fullest, though arguably the least accurate set of data, supplements the foreign born matrix with further coefficients derived from the additional information content in the nationality matrix, augments the foreign born matrix with the UN (2003) totals where simply no other data were available, reconciles all of the remainder categories: all before scaling all the older data, that were recorded before 2000 to UN

(2003). As each of these steps represents a large adjustment Version 5 is split up (5a-5c). Taking the decision to produce a single matrix utilising the foreign born definition was based on the fact that a greater number of countries report data by place of birth and additionally because this definition is theoretically superior in terms of assessing actual movements of migrants.

Version 5a

The UN (2003) data set, covering migrant stocks for the year 2000, is generally considered the most comparable source on international migrant stocks, despite some of the data being extrapolated from older sources. Indeed it is still held in high esteem even though where no foreign born data are available numbers are interpolated from data based on nationality and ethnicity concepts. Though the data presented here should on the whole be more up-to-date, due to the fact that a greater proportion of the latest round of censuses is drawn upon. Where no other data were available it was deemed sensible to use the UN data for country totals.

A high degree of correlation has been previously understood to exist between the foreign born and the foreign population as measured by nationality (Harrison 2003). If this is indeed the case then it would be feasible to use the additional information content of the nationality matrix to supplement that of the foreign born. First it was important to check this association existed in relation to the data collected. This was done by examining those 35²⁴ countries where data were available for both the foreign born and the foreign population. A technique, based on the entropy measure devised by Walmsley and McDougal (2004), was used to compare the foreign born and nationality shares to ensure this association existed in our data (see Annex 2).

²⁴ In fact there are 36 countries for which both nationality and country of birth data was collected but Hong Kong was dropped for the purpose of this calculation. This was due to the fact that under the foreign born definition there are over 2 million Chinese migrants resident in Hong Kong but zero under the nationality concept since the passing over of Hong Kong to China from the UK.

This methodology calculates the differences in the shares between the foreign born matrix and the nationality matrix as the equally weighted average of the simple share from a particular coefficient in the foreign born matrix multiplied by the natural log of the ratio of that share, to the equivalent share in nationality matrix. The two major advantages of this technique are firstly that it is possible to compare shares between two tables whilst ignoring any zero entries; and that secondly, the differences between two large shares are given less weight than the same absolute difference in two relatively smaller shares. On average the entropy difference between shares for the 35 countries for which data were available for both the foreign born and the foreign nationality was negligible.

Having found that the series were indeed highly correlated, the shares from the nationality matrix were multiplied by the UN totals in the foreign born matrix for those countries where no bilateral information was available. South East and East Asian²⁵ countries with detailed bilateral data were not subjected to this treatment, as naturalisations are so rare that it is fair to assume that these data may be directly equated to the foreign born population. We calculated the magnitude of the margin of error of treating foreign nationals as equivalent to the foreign born²⁶ to be approximately 1.22% for Japan, and 0.15% for South Korea. The foreign born coefficients for those 58 countries which until now had only nationality data (there are lots of cases where FB data is missing, the distinction between these and the others is that these have nationality data) were therefore filled.

²⁵ Namely: Japan, Korea, Macau, the Philippines, Thailand and Myanmar.

²⁶ These were calculated as the number of naturalisations divided by the total number of foreign nationals.

Version 5b

Residual categories, those labelled with the prefix ‘Other’, are common in the reported data. First we distinguish between two types of ‘other’ categories²⁷: ‘other regions’, where ‘other’ is applied to a subset of countries such as other South America and other West Africa; and ‘All other’, which includes all other countries. As the study aims to assign every migrant to a specific country systematically, these migrants that numbered approximately 12 million and 9 million respectively under nationality and foreign born definitions were distributed according to a countries’ propensity to send their nationals abroad (2).

$$(2) P_r = \frac{M_r}{\sum_{s \in \text{other}} M_s}$$

Where: P_r = Country r’s propensity to send residents abroad.

M_r = The number of migrants abroad from country r.

M_s = The number of migrants abroad from countries in s.

This propensity represents a share, and all the propensity shares sum to one. The remainder categories were therefore disaggregated by multiplying these propensity shares, for those countries contained within an umbrella remainder heading, by the total number of migrants to be redistributed.

An illustrative case is that of Portugal. All migrants in the 2001 Portuguese census had been designated to specific countries with the exception of those 6 migrants falling under the heading ‘Other Oceania’. The remaining 6 migrants simply had to be shared out between the countries of Oceania. Following (2) the propensity to send migrants anywhere abroad was calculated for each of these countries. Table 6 contains these

²⁷ In the database we also distinguish between ‘other’ and ‘other zeros’. In the case of ‘other’ we allocate data to all of the countries in the region. In ‘other zeros’ the data are only allocated to those countries in the region with zeros. For example data for ‘Other SAF’ would be allocated across Botswana, Lesotho, Namibia, South Africa and Swaziland, while data for ‘other zero SAF’ would be allocated only to these 5 countries if data were initially zero, i.e. unavailable elsewhere.

propensity shares and how many immigrants were distributed based on these numbers for each country. This was assumed the most pragmatic method for distributing the remainder categories though three weaknesses are evident. Firstly migrants are not distributed as integers and thus rounding is required. Secondly the propensity to send migrants abroad is based on the sum of the relevant row (the total number of migrants abroad from any particular country) if it so happens that a specific country sends many people to a country for which no data were collected that share will be under-estimated. Lastly GemPack™ is only accurate to 7 significant figures and thus very small errors are inevitable with any imputations.

Table 6. Propensity shares for ‘Other Oceania’ split for Portugal.

<i>Country</i>	<i>Propensity Share</i>	<i>Share*No. Migrants to be assigned (rounded)</i>
Australia	0.259	2
New Zealand	0.362	2
American Samoa	0.028	0
Cook Islands	0.016	0
Fiji	0.100	1
French Polynesia	0.001	0
Guam	0.058	0
Kiribati	0.002	0
Marshall Islands	0.006	0
Federated States of Micronesia	0.013	0
Nauru	0.001	0
New Caledonia	0.001	0
Norfolk Island	0.000	0

Northern Marianas	0.005	0
Niue	0.005	0
Palau	0.004	0
Papua New Guinea	0.022	0
Samoa	0.075	1
Solomon Islands	0.002	0
Tokelau	0.002	0
Tonga	0.036	0
Tuvalu	0.001	0
Vanuatu	0.002	0
Wallis and Fortuna	0.002	0
Total	1	6

The second category, ‘All other’, was undertaken after all of the ‘other regions’ had been allocated. This specific ordering ensured that the smaller, regional remainder categories (‘other regions’ e.g. ‘Other Caribbean’) were disaggregated prior to the larger category (‘All Other’). This ensured that we had the maximum data available upon which to calculate the shares and allocate the ‘All other’ category.

This category was then allocated using a similar method to that described above, however regional shares were used rather than global shares.

$$(3) P_{r,REG} = \frac{M_{r,REG}}{\sum_{s \in other} M_{s,REG}}$$

Where: $P_{r,REG}$ = Country r 's propensity to send residents to region REG.

$M_{r,REG}$ = The number of migrants abroad from country r located in region REG.

$M_{s,REG}$ = The number of migrants abroad from countries in s located in region REG.

The benefit of using regional shares, over global shares, is that countries have different propensities to send people to specific regions. For example, the share of people from Kenya in Nigeria is likely to be much higher (as a share of Nigeria's foreigners) than the

share of Kenyan's in Malaysia (as a share of Malaysia's foreigners). If we used the 'global share' the share of Kenyan's allocated to Nigeria and Malaysia would be the same. By using regional shares however we recognise the fact that Kenyan's are more likely to go to Africa than they are to S. E. Asia²⁸.

Version 5c

The only countries with no bilateral information were those countries where only a total supplied by the UN was found. As the main aim of the project was to produce a full bilateral matrix it was important to calculate these coefficients. These were calculated on the same basis as the 'All Other' category, i.e. based on (3), the propensity for countries to send people abroad. Again regional shares were used; so that when we determined the shares of Malaysians and Nigerians in China we used the average propensity of Malaysia and Nigeria to send people to East Asia. We believe that taking into account the fact that migration is regional has significantly improved the allocations. One example is that this method significantly reduced the number of Mexican's living abroad. If global shares had been used the large number of Mexicans in the USA would have also led to high shares of Mexican's in the rest of the world. By using regional shares we recognise that while Mexican's do move to the USA, they do not move to other countries, such as Europe. Moreover, there are now more African migrants reflecting the fact that Africans tend to move to other African nations. The 62 countries until now lacking bilateral data had all their coefficients estimated in this way.

Lastly, once the foreign born matrix was filled, all of the older data, that prior to 2000, was scaled to the UN (2003) midyear-totals for 2000 so that a complete bilateral matrix for the foreign born for the years 2000-02 resulted (Note data for 2001 and 2002 was not

²⁸ Of course this procedure is only as good as the initial data which is why this was undertaken after allocating 'other regions' and combining the nationality and foreign born matrices. For example, if data for the other African countries in the region (REG in equation (3)) are also poor and hence do not pick up this tendency then it will not show up in the data for Nigeria. In cases where there were no regional data global shares were used.

scaled to the UN totals). This allowed the inclusion of many countries that have neither collected the relevant migration statistics nor released them. The drawback in these circumstances is that the migration history between the date the older source was conducted and 2000/01 will be lost as the relative shares are maintained over time. Table 7 provides details as to the data contained in each version together with the number of immigrants included.

Table 7. Versions of the database.

Version	Information contained
1	<ul style="list-style-type: none"> • Raw data collected including older primary sources where later information unavailable. • Meaningless 'unknown' totals omitted. • Those countries where totals reported prior to break-up redistributed according to bilateral migration stocks post break-up. • Aggregated in dependences. • Entered zeros where applicable.
2	<ul style="list-style-type: none"> • Extrapolated bilateral data for Russia.
3	<ul style="list-style-type: none"> • Separated jointly reported nations, and those prior to break-up where no post break-up migration data available, according to population shares.
4	<ul style="list-style-type: none"> • Removed ethnic nationalities with little or no correlation to states or regions. • Added additional DFID figures on the number of Indians residing in Middle Eastern Economies. • Removed 'unknown' or 'ignored' categories as these most likely accounts for domestic population and not migrants. • Removed those recorded with dual nationality.
5a	<ul style="list-style-type: none"> • Entered UN data for country of birth totals where data missing. • Used Entropy measure to compare nationality and country of birth shares. • Having confirmed that the series were highly correlated

	used the additional information content in the nationality matrix to supplement the foreign born matrix with additional coefficients of interest.
5b	<ul style="list-style-type: none"> Disaggregated remainder categories based on countries' propensity to send migrants abroad.
5c	<ul style="list-style-type: none"> Used shares based on countries' propensity to send migrants abroad to fill all remaining bilateral coefficients. Scaled data to UN (2003)

Data Summary

The final version of the database contains 176.6 million international migrants. This figure appears realistic as the UN figure for 2000 was 175 million and here the data refers to 2000-02, allowing for some growth in the stock of migrants for those countries with more recent data. Table 8 shows the proportion of all world migrants recorded bilaterally across these sub-continental regions and table 9 lists the top 15 receiving and sending nations. Table 10 outlines the percentages of immigrants that other sub-continental regions are host to, and similarly table 11 shows the percentages of emigrants sent from these states.

Table 8. Percentage of world migrants recorded as a bilateral movement between pairs of sub-continental regions (give at least 2 d.p.s.—this is accurate to the nearest 1.75 million at present)

To From	Oceania	E. Asia	SE. Asia	S. Asia	N. Am.	S. Am.	C. Am.	Car.	EU & EFTA	Rest Eur.	Ex-USSR	ME & N. Af.	S. Af.	SS Af.	Total
Oceania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
E. Asia	0	2	1	0	2	0	0	0	0	0	0	0	0	0	6
SE. Asia	0	0	1	0	2	0	0	0	1	0	0	1	0	0	6
S. Asia	0	0	0	6	1	0	0	0	1	0	0	5	0	0	13
N. Am.	0	0	0	0	6	0	0	0	1	0	0	0	0	0	8
S. Am.	0	0	0	0	1	1	0	0	1	0	0	0	0	0	4
C. Am.	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
Car.	0	0	0	0	3	0	0	0	0	0	0	0	0	0	4
EU & EFTA	1	0	0	0	3	1	0	0	6	0	0	1	0	0	12
Rest Eur.	0	0	0	0	1	0	0	0	3	1	1	1	0	0	6
Ex-USSR	0	0	0	0	1	0	0	0	1	1	15	1	0	0	18
ME & N. Af.	0	0	0	0	1	0	0	0	4	0	0	4	0	0	10
S. Af.	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2
SS Af.	0	0	0	0	0	0	0	0	1	0	0	0	1	5	7
Total	3	3	3	7	23	2	0	1	19	3	16	12	3	6	100

North America – which here includes Mexico, is the sub-continental region with the greatest number of migrants (23%), closely followed by the EU and EFTA (19%), and the USSR (16%). The USSR is also the largest sending region (18%), though South Asians and Western Europeans and the Middle East and North Africa also send significant numbers.

Table 9. Top 15 receiving and sending nations

	Emigrants	% World Migrant Population		Immigrants	% World Migrant Population
Russia	12,229,010	6.92	United States	34,634,791	19.61
Mexico	10,060,947	5.70	Russia	12,881,923	7.29
India	9,133,994	5.17	Germany	9,143,249	5.18
Ukraine	6,621,331	3.75	Ukraine	6,947,118	3.93
Bangladesh	6,478,780	3.67	France	6,277,188	3.55
China	5,680,193	3.22	India	6,270,667	3.55
UK	4,144,848	2.35	Canada	5,717,003	3.24
Germany	4,087,546	2.31	Saudi Arabia	5,254,812	2.98
Kazakhstan	3,828,136	2.17	UK	4,865,546	2.75
Pakistan	3,653,381	2.07	Pakistan	4,242,689	2.40
Philippines	3,398,768	1.92	Australia	4,073,213	2.31
Italy	3,282,893	1.86	Kazakhstan	3,027,952	1.71
Turkey	3,023,010	1.71	Hong Kong	2,703,486	1.53
Afghanistan	2,741,079	1.55	Cote d'Ivoire	2,336,366	1.32
Morocco	2,685,329	1.52	Iran	2,321,445	1.31
Total	81,049,245	45.89	Total	110,697,448	62.67

Table 10. Percentage of immigrants recorded by region of origin

From \ To	Oceania	E. Asia	SE. Asia	S. Asia	N. Am.	S. Am.	C. Am.	Car.	EU & EFTA	Rest Eur.	Ex-USSR	ME & N. Af.	S. Af.	SS Af.
Oceania	14	1	1	0	1	0	0	0	1	0	0	0	0	0
E. Asia	8	68	19	1	9	3	3	1	2	1	0	0	1	1
SE. Asia	12	13	52	2	9	0	0	1	4	1	0	4	0	1
S. Asia	4	4	9	81	5	1	1	1	6	1	0	38	2	1
N. Am.	3	2	3	2	27	3	11	32	3	1	0	1	1	1
S. Am.	1	6	1	1	5	58	9	7	5	1	0	0	0	1
C. Am.	0	0	0	0	5	1	68	1	0	0	0	0	0	0
Car.	0	0	1	1	12	2	3	39	2	0	0	0	0	1
EU & EFTA	40	1	5	3	14	27	3	12	29	12	1	4	7	3
Rest Eur.	8	0	1	1	4	2	0	1	14	39	3	6	2	1
Ex-USSR	1	2	2	4	2	1	1	2	4	36	93	7	5	2
ME & N. Af.	4	2	4	2	4	1	1	1	22	6	1	35	2	4
S. Af.	3	0	1	0	1	0	0	0	3	1	0	0	45	5
SS Af.	1	0	0	1	2	0	0	0	5	1	0	3	34	80
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100

It proves informative to read tables 9 and 10 in unison. Table 9 shows for example that 14% of all migrants in Oceania are from other parts of Oceania, but table 10 shows that these migrants constitute 46% of all Oceania migrants. Conversely Europe and EFTA send 9% of all their migrants to Oceania but these make up 40% of the migrant population in Oceania. The diagonals in tables 7, 9 and 10 all confirm that most migration takes place at the sub-continental level.

Table 11. Percentage of emigrants recorded by region of destination

From \ To	Oceania	E. Asia	SE. Asia	S. Asia	N. Am.	S. Am.	C. Am.	Car.	EU & EFTA	Rest Eur.	Ex-USSR	ME & N. Af.	S. Af.	SS Af.	Total
Oceania	46	2	4	2	22	0	0	0	18	1	1	2	1	1	100
E. Asia	4	35	9	2	38	1	0	0	8	0	1	1	0	1	100
SE. Asia	6	7	25	3	36	0	0	0	12	0	1	10	0	1	100
S. Asia	1	1	2	43	8	0	0	0	8	0	0	35	0	1	100
N. Am.	1	1	1	2	81	1	0	3	7	0	1	2	0	1	100
S. Am.	1	4	1	1	32	32	1	1	23	1	1	1	0	1	100
C. Am.	0	0	0	1	77	1	13	0	4	0	1	1	0	1	100
Car.	0	0	0	1	77	1	0	7	10	0	1	1	0	1	100
EU & EFTA	9	0	1	2	26	5	0	1	45	2	2	4	2	1	100
Rest Eur.	3	0	0	2	16	1	0	0	42	15	8	11	1	1	100
Ex-USSR	0	0	0	1	3	0	0	0	4	5	80	5	1	1	100
ME & N. Af.	1	0	1	2	8	0	0	0	41	1	1	41	1	2	100
S. Af.	4	0	1	1	5	0	0	0	25	1	0	1	51	12	100
SS Af.	0	0	0	1	5	0	0	0	13	0	0	5	12	62	100

To even undertake an exercise such as was attempted in this paper could be considered foolhardy by experts from many disciplines outside economics. Indeed such an exercise epitomises the silent debate that rages between economists and other social scientists concerning the very methods of economics itself; between the simplification of the real world, and a pragmatic stance in an attempt to quantify it on the one hand, and the accuracy and the need for qualitative evidence on the other.

In spite of the inherent errors due to a lack of bilateral data for some countries, the assumptions made and the methodologies used, the database should provide a realistic overview of current migration trends in terms of the overall magnitude of migrant stocks and regional migration patterns. Under current data dissemination and considering the heterogeneity that exists between the available sources any undertaking on the subject will inevitably be incomplete. Having highlighted the problems encountered researchers should be able to build upon the data as they see fit and thus the database should provide a solid platform for future work. One key area of concern is the distribution of migrants based on their propensity to send migrants abroad. A gravity-type equation would be superior for this disaggregation but ideally requires additional data on visa requirements and policy, which were unavailable at the time of writing. Despite these shortcomings the data provided here, though not entirely accurate should prove valuable in a wide range of applications throughout the social sciences. International migration increasingly represents an important issue on the agendas of both developed and developing nations alike, and the information supplied here should facilitate both the superior modelling of global migration trends and a more informed policy debate.

Annex 1

Table 12 –Sources and Years for Raw data collated

Country	Data type	Nationality or Birth	Source	Year
Australia	B	B	C	2001
New Zealand	B	B	C	2001
American Samoa	B	B	C	2000
Cook Islands	B	N	C	2001
Fiji	B	B	C	1986
French Polynesia	B/B	B/N	C/C	2002/2002
Guam	B	B	C	2000
Kiribati	B	E	C	2000
Marshall Islands	B	N	C	1999
Micronesia, Federated States of	B	B	C	2000
Nauru	UN	N	U	2000
New Caledonia	B	N	C	1996
Norfolk Island	B/B	B/N	C/C	2001/2001
Northern Mariana Islands	B	B	C	2000
Niue	B	N	C	2001
Palau	B	B	C	2000
Papua New Guinea	B	B	C	1971
Samoa	B	B	C	2001
Solomon Islands	T	N	C	1999
Tokelau	B	E	C	1996
Tonga	B	E	C	1996
Tuvalu	T	N	C	2002
Vanuatu	B	N	C	1986
Wallis and Futuna	T	B	C	1996

China	UN	E	U	2000
Hong Kong	B/B	B/N	C/C	2001/2001
Japan	B	N	C	2000
Korea, Republic of	B	N	C	2000
Taiwan	B	N	S	2000
Macau	B/B	B/O	C/S	1991/2001
Mongolia	UN	N	U	2000
Korea, Democratic People's Republic of	UN	E	U	2000
Indonesia	UN	N	U	2000
Malaysia	B	B	C	1991
Philippines	B	N	C	2000
Singapore	B	B	C	2000
Thailand	B	N	S	2000
Viet Nam	T	N	C	1999
Brunei Darussalam	B	B	C	1981
Cambodia	B	N	C	1998
Lao People's Democratic Republic	B	N	C	1995
Myanmar	B	N	S	2000
Timor Leste	UN	E	U	2000
Bangladesh	B	B	C	1974
India	B	B	C	1991
Sri Lanka	B	N	C	1981
Afghanistan	UN	E	U	2000
Bhutan	UN	N	U	2000
Country	Data type	Nationality or Birth	Source	Year
Maldives	UN	N	U	2000
Nepal	B/B	B/N	C/C	2001/2001

Pakistan	T	B	C	1998
Canada	B	B	C	2001
United States of America	B	B	C	2000
Mexico	B	B	C	2000
Bermuda	B	B	C	2000
Greenland	UN	B	U	2000
Saint Pierre and Miquelon	B	B	C	1962
Colombia	B	B	C	1993
Peru	B	B	C	1993
Venezuela	B	B	C	1990
Bolivia	B	B	C	2001
Ecuador	B	B	C	1990
Argentina	B	B	C	2001
Brazil	B/T	B/N	C/C	1991/2000
Chile	B	B	C	2002
Uruguay	B	B	C	1996
Falkland Islands (Malvinas)	B/B	B/N	C/C	2001/2001
French Guiana	B	N	C	1990
Guyana	B	B	C	1960
Paraguay	B	B	C	2002
Suriname	UN	N	U	2000
Belize	B	B	C	2000
Costa Rica	B/B	B/N	C/C	2002/2002
El Salvador	B	B	C	1990
Guatemala	B	B	C	1994
Honduras	B	B	C	2001
Nicaragua	B	B	C	1995

Panama	B	O	C	2000
Antigua & Barbuda	UN	B	U	2000
Bahamas	UN	B	U	2000
Barbados	B	B	C	1980-81
Dominica	B	B	C	1981
Dominican Republic	B	B	C	2002
Grenada	UN	B	U	2000
Haiti	B	B	C	1971
Jamaica	B	B	C	1960
Puerto Rico	T	B	C	2000
Saint Kitts and Nevis	UN	B	U	2000
Saint Lucia	B	B	C	1980
Saint Vincent and the Grenadines	B	B	C	1991
Trinidad and Tobago	B	B	C	2000
Virgin Islands, U.S.	B	B	C	2000
Anguilla	B	N	C	2001
Aruba	B	N	C	2000
Cayman Islands	T	N	S	1997
Cuba	B	B	C	1970
Guadeloupe	B	N	C	1990
Martinique	B	N	C	1990
Montserrat	UN	B	U	2000
Netherlands Antilles	B/B	B/N	C/C	2001/2001
Turks and Caicos	B	B	C	1990
Country	Data type	Nationality or Birth	Source	Year
Virgin Islands, British	B	B	C	1980-81
Austria	B/B	B/N	C/C	2001/2001
Belgium	B/B	B/N	O/S	2001/2000

Denmark	B/B	B/N	P/S	2001/2001
Finland	B/B	B/N	P/P	2001/2002
France	B/B	B/N	C/C	1999/1999
Germany	B/B	B/N	C/S	2001/2001
United Kingdom	B	B	C	2001
Greece	B/B	B/N	C/C	2001/2001
Ireland	B/B	B/N	C/C	2002/2002
Italy	B	N	S	2000
Luxembourg	B/B	B/N	C/C	2001/2001
Netherlands	B/B	B/N	P/P	2001/2001
Portugal	B/B	B/N	C/C	2001/2001
Spain	B/B	B/N	C/C	2001/2001
Sweden	B/B	B/N	P/P	2001/2001
Switzerland	B/B	B/N	C/P	2000/2000
Iceland	B/B	B/N	P/P	2001/2001
Liechtenstein	B	B	S	2000
Norway	B/B	B/N	P/P	2001/2001
Andorra	B	N	S	2002
Bosnia and Herzegovina	B	E	C	1991
Faeroe Islands	UN	B	U	2000
Gibraltar	B/B	B/N	C/C	2001/2001
Macedonia, the former Yugoslav Republic of	B	N	C	1994
Monaco	UN	B	U	2000
San Marino	UN	B	U	2000
Serbia and Montenegro	UN	B	U	2000
Albania	T	B	C	2001

Bulgaria	B	N	C	2001
Croatia	B/B	B/E	C/S	2001/2001
Cyprus	B	B	C	2002
Czech Republic	B/B	B/N	C/R	2001/2000
Hungary	B/B	B/N	C/S	2001/2001
Malta	B/B	B/N	C/C	1995/1995
Poland	B	B	C	2001
Romania	B	E	C	2002
Slovakia	B/B	B/E	C/S	2001/2001
Slovenia	B	N	C	2001
Estonia	B/B	B/N	C/C	2001/2001
Latvia	B	N	S	2001
Lithuania	B/B	B/N	C/C	2001/2001
Russian Federation	B	B	C	1989
Armenia	B/T	B/N	C/S	2001/2001
Azerbaijan	B	N	S	2001
Belarus	B	E	S	1999
Georgia	B	B	C	2002
Kazakhstan	B	E	S	1999
Kyrgyzstan	B	E	S	1999
Moldova, Republic of	B	E	S	2001
Tajikistan	B	E	S	1989
Turkmenistan	B	E	C	1995
Ukraine	B/B	B/E	C/C	2001/2001
Country	Data type	Nationality or Birth	Source	Year
Uzbekistan	B	E	S	1989
Turkey	B/B	B/N	C/S	2001/1998
Bahrain	B	N	C	2001
Iran, Islamic Republic	B	N	C	1996

of				
Iraq	UN	N	U	2000
Israel	B	B	S	2001
Jordan	T	N	C	1994
Kuwait	T	N	S	2001
Lebanon	UN	B	U	2000
Palestinian Territory, Occupied	B/B	B/N	C/C	1997/1997
Oman	T	N	S	1998
Qatar	UN	N	U	2000
Saudi Arabia	B	N	S	1995
Syrian Arab Republic	B	N	C	1981
United Arab Emirates	T	N	S	1993
Yemen	UN	N	U	2000
Morocco	UN	N	C	2000
Tunisia	B	N	C	1966
Algeria	UN	N	U	2000
Egypt	UN	B	U	2000
Libyan Arab Jamahiriya	B	O	C	1964
Botswana	B	N	C	2001
South Africa	B/B	B/N	C/C	2001/2001
Lesotho	B	N	C	1996
Namibia	B	N	C	1991
Swaziland	B	N	C	1997
Malawi	B	N	C	1998
Mozambique	B	N	C	1997
Tanzania, United Republic of	UN	B	U	2000
Zambia	T	N	C	2000

Zimbabwe	UN	B	U	2000
Angola	UN	B	U	2000
Congo, the Democratic Republic of the	UN	B	U	2000
Mauritius	B	N	C	2000
Seychelles	B	N	C	1997
Madagascar	UN	N	U	2000
Uganda	B	N	C	2002
Benin	B	N	C	1992
Burkina Faso	B	N	S	1996
Burundi	UN	B	U	2000
Cameroon	UN	B	U	2000
Cape Verde	B	B	C	1990
Central African Republic	UN	N	U	2000
Chad	UN	E	U	2000
Comoros	B	N	C	1980
Congo	UN	B	U	2000
Cote d'Ivoire	UN	N	U	2000
Djibouti	UN	E	U	2000
Equatorial Guinea	B	N	C	1994
Eritrea	UN	E	U	2000
Ethiopia	B	N	C	1994
Country	Data type	Nationality or Birth	Source	Year
Gabon	B	N	C	1993
Gambia	UN	B	U	2000
Ghana	B	N	C	2000
Guinea	UN	N	U	2000

Guinea-Bissau	B	N	C	1991
Kenya	UN	B	U	2000
Liberia	UN	B	U	2000
Mali	UN	N	U	2000
Mauritania	B	N	C	1988
Mayotte	--	-	-	-
Niger	UN	B	U	2000
Nigeria	B	N	C	1991
Reunion	B	N	C	1999
Rwanda	B	N	C	2002
Saint Helena	UN	B	U	2000
Sao Tome and Principe	B	B	C	1981
Senegal	UN	B	U	2000
Sierra Leone	B	N	C	1985
Somalia	UN	E	U	2000
Sudan	B	B	C	1953
Togo	UN	B	U	2000

Where two letters are recorded and separated by a forward slash the first letter refers to data collected by country of birth and the second to information regarding nationality.

T = Total or very limited bilateral entries only

B = Bilateral (May not be for all 226 countries but at least bilateral for main partners).

B/B = Bilateral/Bilateral

B/T = Bilateral/Total

UN = UN total only

N = Nationality

B = Birth

E = Ethnicity

B/N = Birth and nationality

O = Other but equivalent

C= Census

PR = Population register

S = Source unclear or not stated but obtained from National Statistics Bureau, either directly or from published yearly handbooks.

U = Unknown need check with UN

R = register of foreigners

O = Other i.e. survey/permit data

Annex 2

The entropy measure used to compare the shares of the foreign born and nationality matrices are based on the entropy measure (3) that devised by Walmsley and McDougall (2004):

$$(3) E_{r,s} = 0.5[S_{r,s}^{*A}(\text{Log}_e(S_{r,s}^{*A}/S_{r,s}^{*B}))] + 0.5[S_{r,s}^{*B}(\text{Log}_e(S_{r,s}^{*B}/S_{r,s}^{*A}))]$$

Where: $E_{r,s}$ = the entropy measure of the difference between $S_{r,s}^{*A}$ and $S_{r,s}^{*B}$

$S_{r,s}^{*A}$ = the adjusted share of migrants from country r in country s to use in foreign born matrix.

$S_{r,s}^{*B}$ = the adjusted share of migrants from country r in country s to use in nationality matrix.

The adjustment to the shares being:

$$S_{r,s}^{*A} = (S_{r,s}^A(1-TINY)) + (S_{r,s}^B(TINY))$$

$$S_{r,s}^{*B} = (S_{r,s}^B(1-TINY)) + (S_{r,s}^A(TINY))$$

Where: $S_{r,s}^A$ = The proportion of migrants from country r to the total in country s in the foreign born matrix.

$S_{r,s}^B$ = The proportion of migrants from country r to the total in country s in the nationality matrix.

$TINY$ = Small number

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