KNOMAD

Global Knowledge Partnership on Migration and Development

KNOMAD WORKING PAPER 3

Measuring Internal Migration around the Globe: A Comparative Analysis

Martin Bell

Elin Charles-Edwards

November 2014

Measuring Internal Migration around the Globe: A Comparative Analysis*

Martin Bell and Elin Charles-Edwards
The Queensland Centre for Population Research, University of Queensland

Abstract

Compared with other demographic processes, remarkably little attention has been given to the way internal migration varies between countries around the world. We set out the rationale for such comparisons and identify the impediments which have constrained prior work, including a global review of the types of migration data collected. We then draw upon an extensive repository of data assembled through the IMAGE (Internal Migration Around the Globe) project to compare countries with respect to the overall intensity of migration over one- and five-year intervals, the age profile of migration, and the spatial patterns of population movement. We identify marked variations both between and within world regions on each of these dimensions, and document a general decline in mobility over the period 1990-2000. Analysis reveals close links between migration and some aspects of national development but also underlines the significance of history, culture, and social context in shaping mobility behavior. We stress the need for greater harmonization of national practice in collection of internal migration data in order to enhance cross-national comparisons.

Keywords: Internal migration, Data, Migration intensity, Comparative analysis.

*Paper produced for KNOMAD's Thematic Working Group on Internal Migration and Urbanization. It draws on results from and forms part of the IMAGE project, an international research collaboration supported by the Australian Research Council through ARC Discovery Project DP110101363. The paper draws data from several sources including the IPUMS database maintained by the Minnesota Population Center and CELADE (The Centro Latinoamericano y Caribeno de Demografia) as well as from individual national statistical offices. The authors appreciate helpful comments from an anonymous external referee and from participants in the KNOMAD conference on internal migration and urbanization held on April 30-May 1, 2014, in Dhaka, Bangladesh. Other outputs from the Project are listed on the IMAGE project website at http://www.gpem.uq.edu.au/image. The authors may be contacted at martin.bell@uq.edu.au and e.charles-edwards@uq.edu.au.

Table of Contents

Measuring Internal Migration around the Globe: A Comparative Analysis

1. Introduction

Population mobility is integral to development, for both individuals and nations (United Nations 2009), for it enables individuals, families, and households to meet their goals and aspirations. It is also essential to the efficient and effective functioning of cities and regions, labor markets, and communities (World Bank 2009). Population movements take a wide variety of forms, from local diurnal mobility, such as commuting, to permanent relocations that cross international borders. Intermediate along this continuum are the changes of residence that occur within a country, which fall under the general rubric of internal migration. Such moves are rarely "permanent": in some countries people change their place of residence ten or more times during their lives, whereas elsewhere mobility is less common (Rees et al. 2000). Reasons for internal migration also differ widely. Despite this, there is growing evidence of commonalities between countries in the causes, dynamics, and consequences of internal migration, that invite cross-national comparisons.

This paper draws on results from the IMAGE project,[1] together with a range of other research, to explore key dimensions of internal migration in countries around the world. We begin by reviewing the rationale for making comparisons between countries and summarise relevant prior work. Data availability and the way migration is measured emerge as fundamental constraints to comparative research, and we examine contemporary practice in data collection and the issues that arise from the differences we observe. We then utilise data for 82 countries assembled in the IMAGE data repository to explore the way in which internal migration varies between countries. We focus principally on the overall intensity, or level, of migration within each country in order to provide a single summary index and seek to explain cross-national variations through associations with a range of widely used development indicators, including the Human Development Index. Migration is age-selective and there is mounting evidence that differences between countries are echoed in their migration age profiles. We draw on data for selected countries to explore these differences and examine the linkages to cross-national differences in the timing of life course events. Human mobility is ultimately a spatial activity, so we also consider the patterns of migration found in selected countries at different stages of human development and levels of urbanisation. We conclude by outlining avenues for further work.

[1] Details of the IMAGE project are available at http://www.gpem.uq.edu.au/image.

2. Why compare countries?

In other fields of demography there is a long-established tradition of clearly defined statistical indicators by which countries can be compared. Examples include the total fertility rate, life expectancy at birth, and level of urbanisation. League tables ranking countries on these, and a variety of other measures, are routinely available in international statistical collections, such as those maintained by the United Nations and the Population Reference Bureau. In recent years, estimates of the international migration rate have also become available for most countries and increasing efforts have been made to enhance the comparability of international migration statistics (Abel and Sander 2014). To date, however, statistical indicators on other forms of population mobility, including internal migration, have been conspicuous by their absence.

Cross-national comparisons provide valuable insights into various aspects of demographic behaviour, and internal migration is no exception. As argued elsewhere, such comparisons serve to identify commonalities between countries, but also to highlight distinctive or unusual trends and patterns that remain unremarkable when viewed in isolation. Findings assembled across a range of spatial and temporal settings in this way can aid understanding and contribute to building more nuanced, evidence-based theory. This, in turn, is fundamental to the development of policies to facilitate, shape, control and respond to population movement. In a field of demography where data, methods of classification, analytical techniques, and statistical indicators lag well behind their counterparts in the study of fertility and mortality, persuasive arguments can also be made that comparative analysis serves an essential role in adding rigour to research in individual country settings (Bell et al. 2002). Without greater rigour, effective comparisons between countries are seriously compromised by differences in data and methods that are all but unimaginable in other fields. By the same token, it can readily be argued that the absence of international standards for data collection and measurement is itself a major impediment to comparative research.

3. Issues in comparing internal migration between countries

At least three broad groups of issues stand in the way of effective cross-national comparisons. Foremost among these is the complexity of migration itself. While fertility and mortality are singular events tied to specific locations, migration is a repetitive process with a variable temporal and spatial signature. As a result it is possible to recognise four discrete dimensions of migration, all of which are relevant to understanding the dynamics of contemporary societies (Bell et al. 2002). First, migration can be seen as a mechanism linked to individual aspirations and constraints. From this perspective, it is the overall level or incidence of migration and the way this varies among particular groups that are of interest. Following van Imhoff and Keilman (1991) we describe this as the *intensity* of migration. Second, migration is a central mechanism driving change in the pattern of human settlement

at a range of scales, so spatial redistribution is also pertinent. Linked to this, a third dimension concerns the distances over which people move. The rationale for local mobility differs from that which drives long distance moves, so distance itself is a significant parameter. Migration also serves to connect cities and regions, in the same way they are linked by trade and commodity flows. In a globalised world connectivity is a critical consideration and this is a fourth dimension on which migration is of interest. Our primary focus in this paper is on the first two of these four dimensions: the overall intensity of migration, including the way this varies by age, and the spatial patterns of internal migration, particularly their impact on spatial redistribution.

Selecting the most relevant dimension of migration is one task for the analyst: a second is finding an appropriate way to measure it. Clearly-specified statistics are crucial to robust comparisons, whether between countries, or for a single country over time. In other areas of the social sciences there are standard, widely-accepted measures, the definition and computation of which are universally accepted by the international statistical community. Fertility, for example, is commonly measured using the total fertility rate and net reproduction rate, while mortality is categorised according to the International Classification for Diseases (ICD), now in its 10th revision. In the field of migration, however, the development of such classifications and measures is still in its infancy. Bell et al. (2002) proposed a battery of 15 measures covering the four dimensions of mobility described above, including five measures concerned with capturing migration intensities and two focused on spatial impact. For the analysis presented here, we focus mainly on the simplest and most straightforward of these measures, the *crude migration intensity* (CMI), and the *migration effectiveness index* (MEI), computation of which are described below.

The third broad group of problems which stand in the way of cross-national comparison is the collection of a consistent set of migration data. Bell et al. (2014) report that fully 179 of the 193 UN member states collect information on internal migration, but the form of the data varies widely, with differences on three dimensions generally being recognised:

- *Types of data.* While many countries measure migration as a change of address, or transition between two discrete points in time, others collect information on all migration events, and a third group of countries simply record duration of residence in the current location;

- *Migration interval.* For countries which measure migration as a transition, the interval over which it is computed also varies, with some electing to measure it over a one or five year interval, others migration since birth, and some the interval since the last move; and

- *Spatial framework.* Countries differ widely in the way the geography of migration is recorded, not only in the way the country is divided into zones, but also in the precision with which current residence is recorded.

While some of these differences are a product of particular forms of data collection or administrative geographies, others appear to be driven by historical inertia. The legacies of colonial influence, for example, are readily apparent in contemporary data collection systems across Africa. The problem for comparative analysis is that harmonisation on any of these dimensions is often unattainable (Bell and Rees 2006; Rees et al. 2000) and this, in turn, prejudices computation of robust measures by which to make cross-national comparisons. In the following section we examine the types of internal migration data available around the world and review the extent of these variations.

4. Internal migration data: who collects what?[2]

Data on internal migration are derived from three main sources: censuses, population registers and administrative data, and national surveys. Of these, censuses represent the primary or most common data source, with 158 countries using this mechanism to collect some form of internal migration data (Bell et al. 2014). A further 50 countries draw on population registers or administrative data (such as national health registers, or electoral rolls) and these are particularly common in Europe and parts of East Asia (Table 1). Surveys are also widely used and take a variety of forms. Some, such as the American Community Survey, represent unique systems but others are more generic instruments which collect similar data across a number of countries. Examples include USAID's Demographic and Health Surveys, the World Bank's Living Standards Measurement Study and the European Union Labour Force Surveys. Bell et al. (2014) identified 110 countries which utilized national surveys to collect internal migration data, and while small sample sizes limit insights into spatial patterns of internal migration, surveys generally do provide some measure of migration intensity. They also provide coverage of many countries in parts of the world, particularly Africa, for which other forms of internal migration data are less readily available.

Together, censuses, population registers, and national surveys provide sources of information on internal migration for 179 of the 193 UN member states.[3] As shown below, however, the types of information collected vary widely, both in terms of the time interval over which migration is measured, and the geographic framework to which it refers. Turning first to the time dimension, Table 2 sets out the types of migration data collected by each of the main data sources. Migration event data are associated exclusively with population registers and administrative sources. These capture all registered changes of address, and are generally released for single-year intervals. Censuses, on the other hand, commonly measure migration as a transition, derived by comparing place of residence at two points in time, and use a variety of time intervals. One- and five-year intervals are widely used but the

[2] This section draws heavily on the IMAGE inventory paper published as Bell et al. (2014): Internal Migration Data around the World: Assessing Contemporary Practice, Population, Space and Place, DOI: 10.1002/psp.1848.

[3] Of the remaining 14 countries, four do not appear to collect statistics on internal migration, while information is lacking for the remaining 10.

most common approach adopted in censuses is to measure lifetime migration by comparing place of birth with place of current residence, effectively capturing the net change of location since birth. Another strategy is to collect data on the place of residence prior to the latest (most recent) move and to couple this with information on duration of residence in the current location. These same data collection strategies feature in national surveys but the latter are biased towards latest move and duration of residence, rather than fixed-interval data.

Table 1: Countries collecting internal migration data since 1995, by continent and source

Region	Census	Register	Survey	Total countries collecting data	Total no. of countries
Africa	43	0	38	50	54
Asia	37	15	24	41	47
Europe	31	32	32	41	43
Latin America and the Caribbean	32	0	12	32	33
Northern America	2	2	2	2	2
Oceania	13	1	2	13	14
Total	158	50	110	179	193

Source: IMAGE Inventory of Internal Migration data collections; modified after Bell et al. (2014)

Table 2: Types of migration data collected, by source type

Type of Migration Data	Census (2000)	Survey	Register
Event	0	0	50
One year interval	29	30	0
Five year interval	52	9	0
Other fixed interval	32	7	0
Lifetime	122	34	0
Latest move	55	75	0
Duration of residence	71	94	0
Total Countries	142	110	50

Source: IMAGE Inventory of Internal Migration data collections; modified after Bell et al. (2014)

All of these data sources potentially provide useful insights into specific aspects of migration within individual country settings but, as noted above, differences in types of data and in the time frames over which they measure migration seriously hinder direct comparisons between countries. Lifetime migration data appear to offer the greatest international coverage but comparability is undermined because of differences between countries in the age structure of their populations (which determine the cumulative duration of exposure to migration). Moreover, lifetime data inherit all the effects of historical trends and events and

are a poor surrogate for contemporary migration behaviour. Duration of residence data coupled with information on the latest move offer a more up-to-date picture but comparability is again undermined by differences between countries in the duration intervals for which the information is either collected or reported. The net result of all these issues is that cross-national comparisons of internal migration are best achieved focusing on data for one- and five-year intervals (considered separately). However, by judicious use of event and duration data for countries where these are reliable, it is possible to increase the number of countries for which estimates can be made. As set out below, we have assembled estimates of one-year migration intensities for 41 countries and five-year intensities for 36 countries.

While this approach harmonises the data as far as possible for differences in the time intervals over which migration is measured, comparability also calls for attention to differences between countries in their spatial frameworks; that is, in the number of regions used to capture population movements. Since countries differ widely in size, statistical geography and patterns of settlement, simple cross-national comparisons of migration intensities referenced to each nation's own statistical geographies are not viable (Long 1991). For example, internal migration in the United States 2000 census was measured between more than 3,000 counties, and in the UK between more than 10,000 wards. In Mongolia on the other hand, the data trace movements between just 21 *aimags* (provinces), and in Nepal between 74 districts. Table 3 provides an indication of the wide range of regional frameworks for which migration data are available for countries around the world and it is readily apparent that there is widespread variation.

Table 3: Smallest spatial units recorded in countries, by migration data type*

Number of zones	One year	Five years	Undefined interval	Other defined interval	Duration	Birth place	Any migration data
2-24	3	8	8	2	5	25	13
25-99	7	6	17	4	9	27	20
100-249	1	5	2	3	2	10	11
250-999	3	11	5	3	5	17	17
1000+	9	12	5	8	16	17	34
Not specified	6	11	17	12	35	27	47
Total	29	53	54	32	72	123	142

Source: IMAGE Inventory of Internal Migration data collections. * 2000 Census round.

One solution to this problem of differing spatial frameworks is to compare countries with respect to all changes of address, including local residential mobility—those moves that occur within and between regions, or even localities. Although it is common in the literature to make a conceptual distinction between these two forms of mobility, in practice there is no way of making a clear analytical distinction. We refer to this measure of all changes of address as the overall or *aggregate crude migration intensity* (ACMI). Only 15 percent of

countries collect information on all changes of address directly through censuses, registers, or surveys. For others, however, it is possible to estimate the ACMI using the approach proposed by Courgeau et al. (2012), as described below.

5. Estimating aggregate migration intensities

The approach developed by Courgeau (1973; Courgeau et al. 2012) generates an estimate of the aggregate crude migration intensity for each country by fitting a regression line to intensities for that country measured at a range of geographic scales, as recorded in the country-specific data. The underpinning logic is that, as the number of zones into which a territory is divided increases, so the number of inter-zonal migrants rises. Courgeau et al. (2012) deduce a linear relationship between the crude migration intensity (CMI_n) observed at a given level of disaggregation, *n*, (where *n* = the number of zones) and the logarithm of the average number of households per zone, *H/n*, at that spatial level, where *H* represents the total number of households across all zones. In equation 1, the parameter *k* scales this relationship and *w* is a constant. For countries which provide migration data at more than one level of spatial scale (e.g., states, provinces, counties, etc.) it is therefore possible to estimate equation 1. Substituting *H/n* = 1 corresponds to a hypothetical level of spatial resolution at which there is just one household per zone and therefore captures all migrations. Since ln(1) = 0, the corresponding ACMI can be read directly from the *y* intercept on a graph or computed from equation 1 as the constant *w*.

$CMI_n = w + k \ln (H/n)$ [Equation 1]

We compute the ACMI using the spatial aggregation sub-system of the IMAGE studio (Stillwell et al. 2014) to estimate migration intensities at a series of spatial scales for each country. Multiple iterations of the IMAGE Studio ensure the result reflects movement across a representative spatial framework. We then calculate the ACMI by fitting a regression line through the mean observation at each spatial level and record the y intercept. For countries lacking detailed inter-regional flow matrices, we calculate the ACMI in the same way, but fit the regression line to just the data points derived from the available data—that is the record of migrants or migrations at various levels of the administrative hierarchy employed in each national statistical system (Law 1999)—e.g., regions, provinces, districts, and counties. Appendix A provides a simple worked example of the estimation procedure.

6. Comparing internal migration around the world

To compare internal migration intensities, we draw on the repository of internal migration data assembled as part of the IMAGE project from international data collections and from the holdings of individual national statistics agencies. A key resource for the IMAGE repository was the Integrated Public Use Microdata Series-International (IPUMS-International) which houses census sample files for more than 70 countries (Minnesota Population Center 2014). A second important source was the online database maintained by

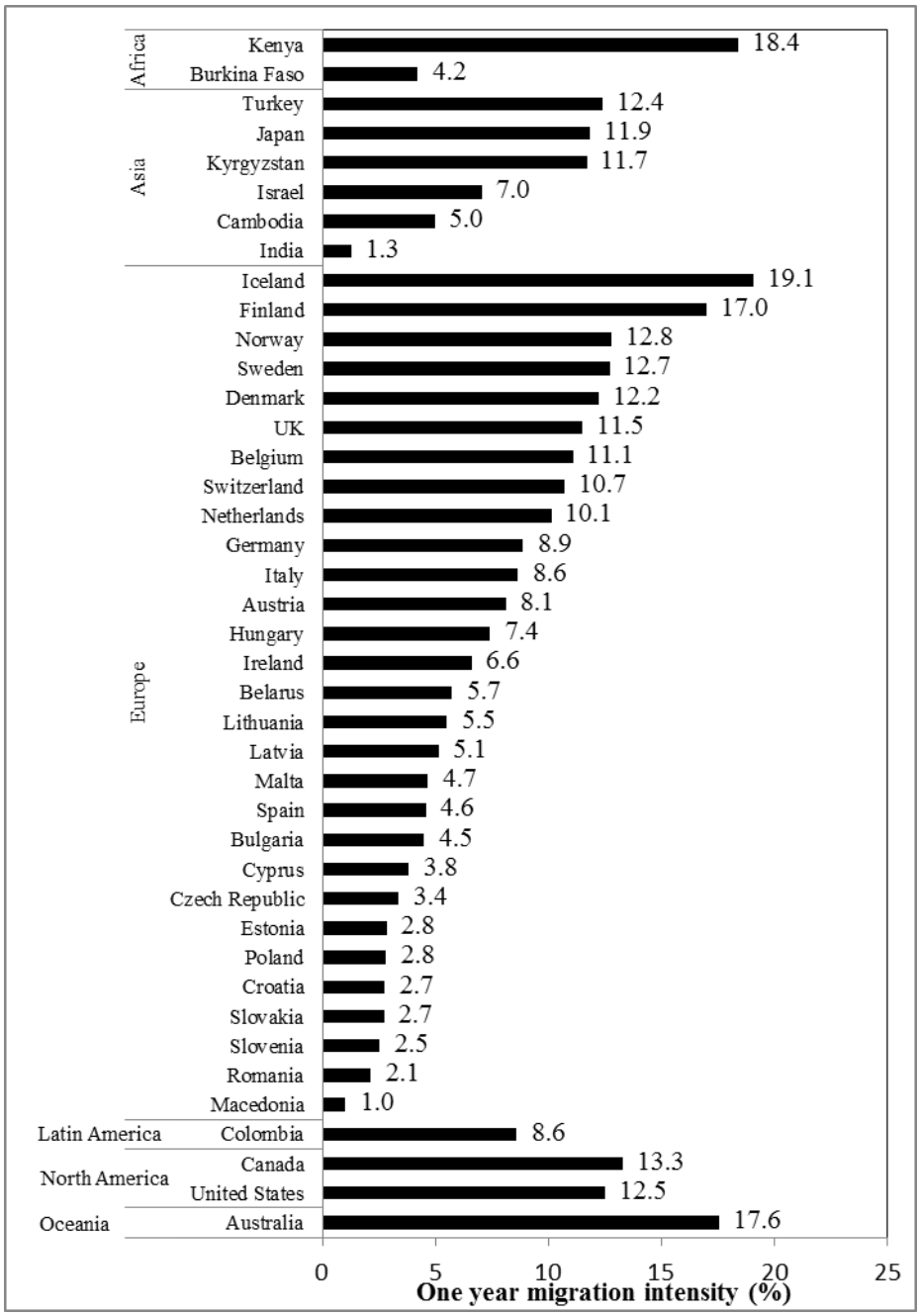
CELADE, The Centro Latinoamericano y Caribeno de Demografia of the United Nations, which maintains complete census counts for countries in Latin America and the Caribbean. For this paper we analyse data for 82 countries, and for 70 of these we have estimates of migration intensities. For countries that collect data on all changes of address, we report these figures directly. For the remainder we estimate the ACMI using the methodology described above.

Figure 1 sets out one-year ACMIs for 41 countries. Geographic coverage varies by continent, with 28 countries covered in Europe, seven in Asia, two each in Africa and North America, and a single each in the Latin America and Caribbean region, and Oceania. These variations in coverage largely reflect regional differences in data collection practices. European countries tend to collect one-year data, but this is a much rarer practice in other parts of the world.

One-year intensities range from 19.1 percent in Iceland to just 1 percent in Macedonia. The highest intensities are found in the Nordic countries (Iceland, Finland, Norway, Sweden, and Denmark) along with Kenya, and the "new world" countries of Australia, Canada and the United States. Within Europe, a marked north-south gradient is apparent, with the high intensities of the Nordic countries moderating southwards through Belgium, the Netherlands, Germany, and Switzerland, and dropping below 5 percent in southern and eastern Europe. Outside Europe, regional patterns are difficult to discern because of poor coverage, but the available data suggest that intensities in Asia are more moderate, ranging from around 12 percent in Japan to just over 1 percent in India.

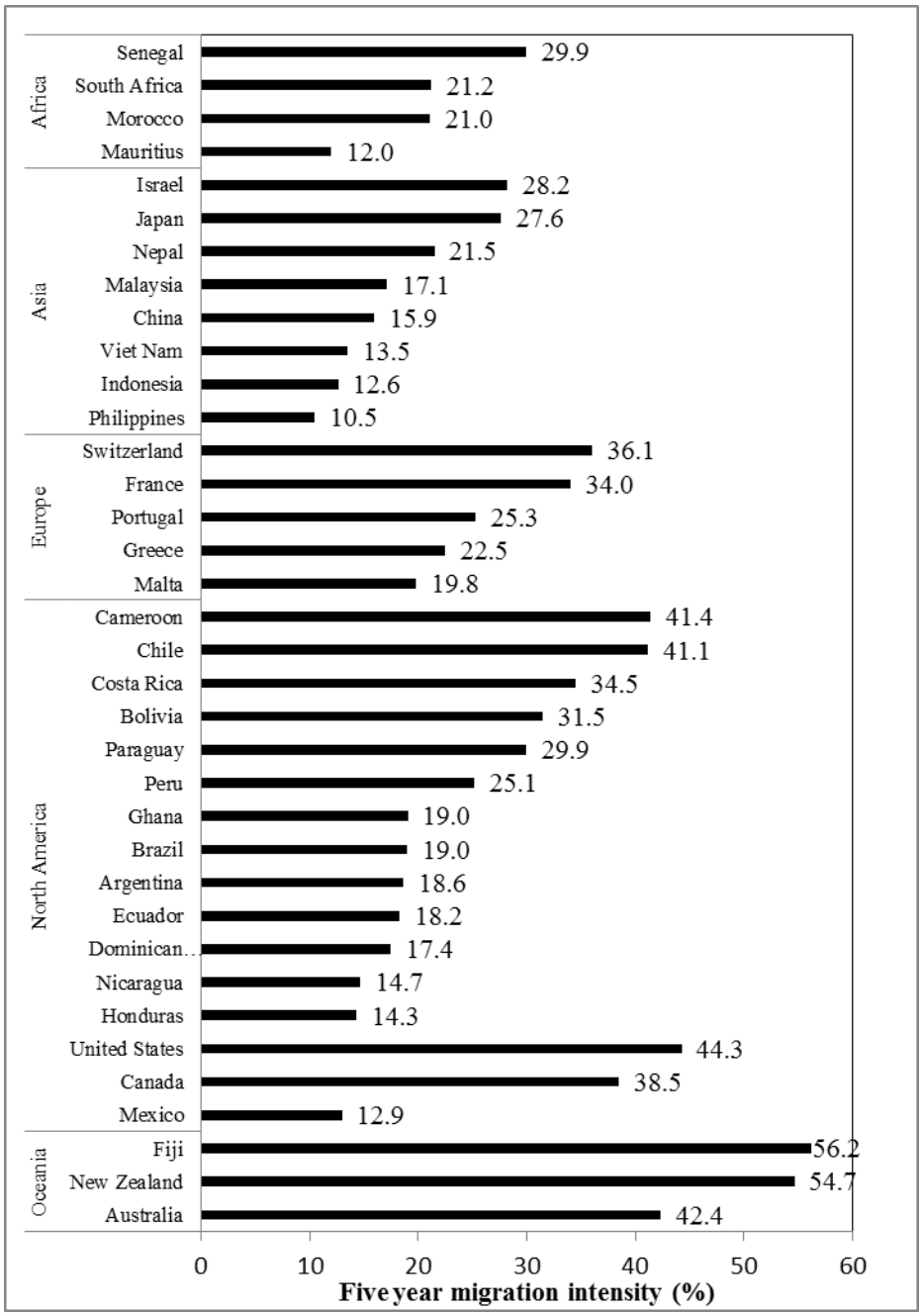
Figure 2 sets out five-year ACMIs for 36 countries. Coverage is most complete in Latin America, with data for 11 countries, followed by Asia (eight), Africa (six), Europe (five), North America (three), and Oceania (three). Migration intensities range from over 50 percent (Fiji) to Philippines (10 percent). "New world" countries again show some of the highest levels of mobility (New Zealand, United States, Canada) while the lowest intensities are found in Southeast Asia and Central America. Countries in Africa display more moderate intensities and Latin America demonstrates a patchwork of high (Chile) and more moderate (Brazil, Argentina) mobility. Data for Europe again suggest a north-south gradient.

Figure 1: Aggregate one-year migration intensities for selected countries, circa 2000



Source: Authors' calculations from the IMAGE data repository

Figure 2: Aggregate five-year migration intensities for selected countries, circa 2000



Source: Authors' calculations from data in the IMAGE data repository

There is no reliable way of translating between one- and five-year intensities (Kitsul and Philipov 1981) but relativities in the ranking of countries across the two measures do suggest a broad regionalization of migration intensities across the globe. Migration intensities are lowest in Asia and highest in the "new world" immigrant societies of Australia, Canada, New Zealand, and the USA. Countries in north-west Europe also exhibit high migration intensities, equivalent to those seen in parts of the new world. Overall intensities decline, however as we shift south and east across the continent. Latin America presents a more varied picture

with pockets of high mobility in Chile and the Andean countries but low levels of intensity in parts of Central America. Evidence for Africa is somewhat lacking but also suggests considerable heterogeneity in migration intensities across the continent.

7. Trends in the intensity of internal migration

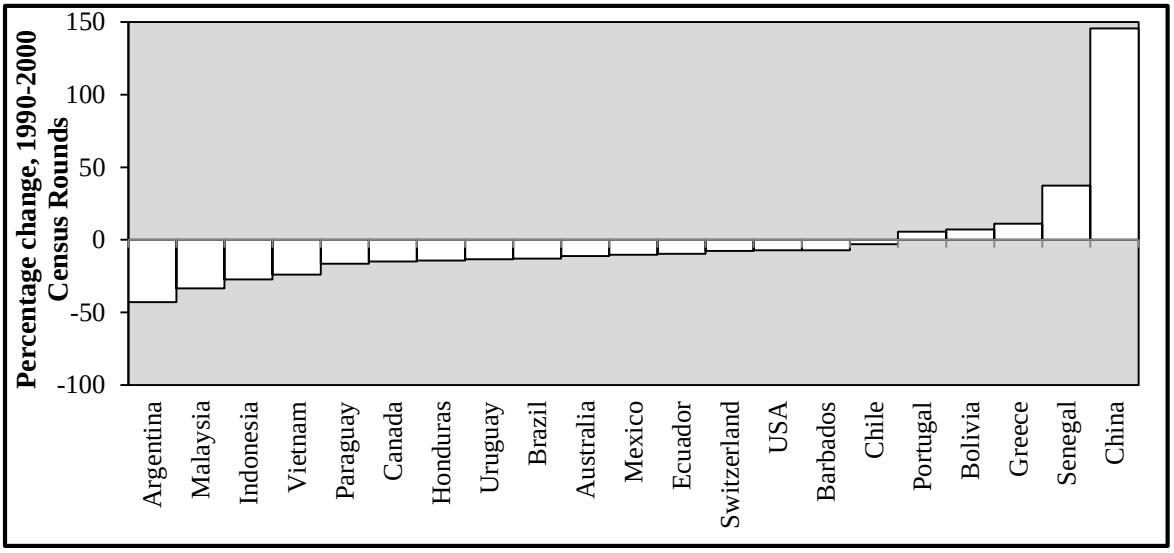
The conventional narrative holds that in an era of globalization, population mobility is on an upward trajectory and that all forms of migration are accelerating rapidly (Castles and Miller 2009). However, there is mounting evidence that international migration rates have been remarkably stable over recent decades (Abel and Sander 2014), and that internal migration has actually been falling in some developed countries, including the United States, Britain, and Australia (Cooke 2011; Champion and Shuttleworth 2013).

Figure 3 shows the percentage change in five-year migration intensities between the UN's 1990 and 2000 rounds of censuses for 21 countries. Here, five-year migration intensities are measured for movements between major administrative regions, rather than as ACMIs, because the latter are not readily available for the earlier period. This geography varies between countries but it does provide a stable framework against which to assess changes over time within individual countries. The results show that, within this ten-year period, migration intensities fell in fully three-quarters of countries in the sample, with the largest declines in Argentina (43.5 percent), Malaysia (33.3 percent), Indonesia (27.3 percent), and Vietnam (24.0 percent).

These declines can readily be traced to major national or regional events. In the case of Argentina, for example, declining migration is coincident with the Argentine Great Depression (1998-2002). Similarly, in Southeast Asia, falling mobility can be traced to the 1997 Asian financial crisis, which had its onset in Thailand, but spread rapidly to other countries in the region. Muhidin (2014) describes how this resonated through the political, economic, and social spheres of Indonesian life with varying regional impacts in a way that reshaped internal migration. He also documents a reversal in the downward trend according to data from the subsequent 2010 Census. In Indonesia, however, as in other countries, there are long-term secular forces acting to reduce mobility. Population ageing is one significant factor, particularly in developed countries. Mobility is highest among young adults, and as populations age a larger share of the population move into the older, lower-mobility age groups. Another contributing factor is the progressive equilibration of national space-economies, reducing the needs and opportunities for inter-regional labor migration. We discuss this argument further below when we examine spatial patterns, but Long (1991) and Bogue et al. (2009) saw this as a key factor in declining interstate migration in the United States over an extended period. China presents a noteworthy exception to the general pattern of decline, with inter-provincial migration intensities increasing by almost 150 percent between the 1990 and 2000 census rounds. In this case, explanation probably lies in the partial relaxation of restrictions on movement to the nation's major coastal cities (Bell

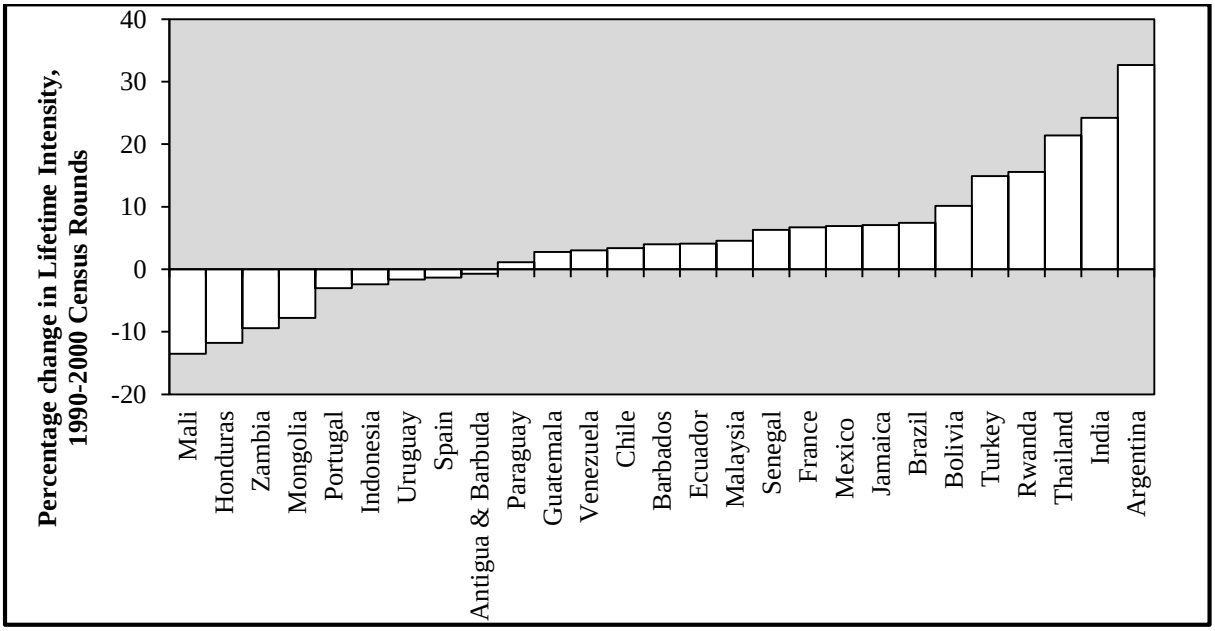
and Muhidin 2009). Senegal also registered a marked increase in migration intensities over the same period (37.3 percent), but the causes of rising mobility in this case are less clear.

Figure 3: Changes in five-year migration intensities between major regions for selected countries*



Source: Authors' calculations from the IMAGE data repository. * % changes between 1990 & 2000 UN censuses

Figure 4: Changes in lifetime internal migration intensities between major regions for selected countries*



Source: Authors' calculations from the IMAGE data repository. * % changes between 1990 & 2000 censuses

Changes in lifetime migration intensities between the 1990 and 2000 census rounds provide further insight into internal migration trends (Figure 4). Lifetime intensities capture the cumulative migration history of a nation's population and as such have considerably more

inertia—are less strongly influenced by recent trends, and provide a poor picture of contemporary migration. They do, however, serve well to reveal the long-term trajectory. Not all countries collect lifetime data, and the countries identified here do not exactly match those considered earlier, but they nevertheless present a revealing picture. As shown in Figure 4, lifetime inter-regional intensities actually rose in two-thirds of countries in our sample, including several countries for which Figure 3 revealed a five-year fall: Argentina, Malaysia, Brazil, Mexico, Ecuador, Barbados, and Chile. These differences almost certainly reflect the cumulative increase in lifetime exposure to the risk of moving among these populations, which has more than offset the decline due to more recent, period effects. In other countries, such as Indonesia, Honduras, and Uruguay, both recent and lifetime intensities have fallen, suggesting that the cumulative effect of collective lifetime migration histories is no longer sufficient to counter declining mobility at younger ages. Declining lifetime migration intensities —which are characteristic of fully one-third of countries in our sample— may also reflect a rising incidence of return migration to regions of birth, either following retirement or in response to other events.

8. Explaining cross-national differences

There are many possible approaches to explaining differences in migration intensity between countries and regions around the world. In his seminal paper in the early 1990s, Long (1991) sought explanation for high mobility in the four New World countries (USA, Canada, Australia, and New Zealand) by reference to peripatetic traditions inherited from immigrant forbears. Also relevant were the associated institutional frameworks and the relative openness of housing and employment markets. At a broader, conceptual level, Zelinsky (1971) also sought to link the overall intensity of migration to progress through the demographic transition, arguing that there were “definite patterned regularities in the growth of personal mobility through space-time”. On this basis, a close link might be expected between the level of mobility in individual countries and their degree of modernization. As elaborated below, Zelinsky anticipated different trajectories for particular forms of movement (e.g., rural-urban, urban-urban), so it is difficult to tie the transition thesis directly to aggregate mobility. Moreover the mobility transition hypothesis has been criticized as Eurocentric and time-bound (Woods et al. 1993; Skeldon 1990), so is not an ideal framework for exploring global differences.

An alternative approach to explaining cross-national differences is through associations between migration intensities and major socio-economic forces. If mobility is a product of national development, then we should expect discernible relationships between the intensity of internal migration and key indicators of development. In Table 4, we set out correlation coefficients between one-year and five-year aggregate migration intensities (from Figures 1 and 2) and 13 selected national indicators (sourced from the United Nations and The World Bank) under three broad headings: economic, social, and demographic.

Table 4: Associations (Pearson's r) between ACMI* and selected development indicators

	Variables	1-year ACMI	5-year AMCI
Economic	GDP per capita (2005 PPP$)	0.67	0.62
	Gini coefficient (income inequality 2000, 2005)	-0.03	-0.18
	Foreign direct investment as a proportion of GDP (2000)	0.02	-0.13
	Female labor force participation (2000)	0.26	0.10
	Labor force participation (2000)	0.18	0.25
Social	Human Development Index (2000)	0.49	0.60
	Mobile phone subscribers (2000)	0.65	0.62
	Literacy (2000)	0.09	-0.03
Demographic	Life expectancy at birth (E_0) (2000-2005)	0.50	0.41
	Total fertility rate (2000-2005)	-0.02	-0.29
	Growth rate (2000-2005)	0.16	-0.28
	Median age	0.21	0.49
	Urbanization (2000)	0.60	0.53
	Net international migration rate (2000-2005)	0.26	0.58
	Remittances as % of GDP (2000)	-0.32	-0.44

Note: correlations are computed across 39 of the 41 countries in Figure 1 and 24 of the 26 in Figure 2. Extreme outliers have been removed from the analysis (Kenya and Kyrgyzstan in the case of the one-year intensities and Fiji and Cameroon in the case of the five-year intensities). *ACMI = Aggregate Crude Migration Intensity.

Correlation coefficients for the selected variables peak at 0.67 for the one-year interval and at 0.62 for the five-year interval and, with few exceptions, are remarkably consistent across the two intervals. This is perhaps surprising because, of the 70 countries for which the analysis was conducted, only seven feature in both the one-year and five-year lists: the spatial coverage of the two observation periods is quite different, the one-year data dominated by Europe, the five-year data drawn more widely from across the globe. The similarity in correlation coefficients with migration intensity data for the two intervals, therefore, lends considerable support to the reliability of the results, and the consistency with which the selected variables mediate migration.

Across the countries in our sample, the strongest correlation is with GDP per capita (2005 PPP$), delivering a coefficient (Pearson's r) of 0.67 with the one-year migration intensities and 0.62 with the five-year intensities. These results confirm the close functional link between mobility and economic development. Mobility itself is integral to the development process and this result suggests that the link is globally significant and applicable across a wide range of stages of economic development. At the same time, high per-capita income itself facilitates mobility within countries. Correlations with the other economic variables in Table 4 are much weaker. Measures of regional inequality, thought to be a key driver of inter-regional migration, are not readily available, but overall income inequality displays no appreciable association with aggregate migration intensity. Labor force participation, both

total and among women, displays a low positive association with migration, possibly reflecting the significance of labor migration in economic development. On the other hand there is no apparent linkage between migration and FDI, probably because the latter tends to be capital- rather than labor-intensive and is concentrated in a relatively small number of countries.

Turning to the social indicators in Table 4, there is a moderate positive association between the Human Development Index (HDI) and migration intensity measured over both the five-year (0.60) and one-year (0.49) intervals. The HDI is a composite index encompassing GDP per capita, education, and life expectancy, and reinforces the suggestion of a close link between mobility and development measured across a broad spectrum. Basic literacy seems unconnected to internal migration, but there is a surprisingly strong, positive association with the proportion of the population with a mobile phone subscription, and this again holds across both country samples. One interpretation is that greater connectivity is facilitating, rather than substituting for, internal migration as originally anticipated by Zelinsky (1971).

There are moderate associations between migration intensities and a number of the demographic indicators. Life expectancy at birth, one component of the HDI, registers a strong positive correlation. Increased life expectancy itself implies lower morbidity and raises the opportunity for mobility, but the propensity to migrate falls as age increases (Rogers and Castro 1981), so the association here is more likely linked to socio-economic development. In a similar way, the modest association with median age probably reflects the indirect effects of economic development, rather than the effects of an older population *per se*. Also notable from Table 4 is the poor association with fertility, or with overall population growth, confirming that migration levels are not merely a product of rapid growth, nor are they directly linked to the process of demographic transition. On the other hand, there is a strong, positive association between migration intensity and the level of urbanization within a country: the more highly urbanized, the greater the intensity of migration. For countries in the midst of urban transition, this can be explained as a direct consequence of the rise in rural-urban migration that is a key driver of urbanization. As the level of urbanization increases, however, rural-urban migration declines (Dyson 2010; Lerch 2014), and high migration intensities are more likely associated with inter- and intra-urban migration.

As other commentators have pointed out, migration within countries does not occur in isolation: it is closely linked to other forms of mobility, particularly international migration. Table 4 provides intriguing evidence as to the nature of these connections. Net international migration rates are positively associated with both five-year and one-year migration intensities. For countries experiencing net gains from international migration, this suggests some support for notions of displacement, or substitution effects (see, for example, Frey 1979). This is particularly characteristic of developed countries, which are most strongly represented in the one-year migration data although, with a correlation coefficient of just 0.26, the relationship is rather weak. A much stronger correlation is found across the

broader sample of countries represented in the five-year data, many of which registered net international migration losses. In this instance, international outflows may well be substituting for, and thereby reducing, internal mobility. Lerch (2014) provides a lucid account of this process in the case of Albania. Remittances are grouped with the other demographic variables because they are closely tied to international migration, and the data in Table 4 again provide some clues as to the variability in internal migration intensities. The coefficients are negative for both one- and five-year periods, indicating that as international remittances climb, the intensity of internal migration is reduced. International labor migration is one important element in the kitbag of livelihood survival strategies for poor people in developing countries, and the negative association reported here suggests that work abroad, which serves to supplement household budgets at home, may well limit the need for migration within the country, and hence reduce internal migration intensities.

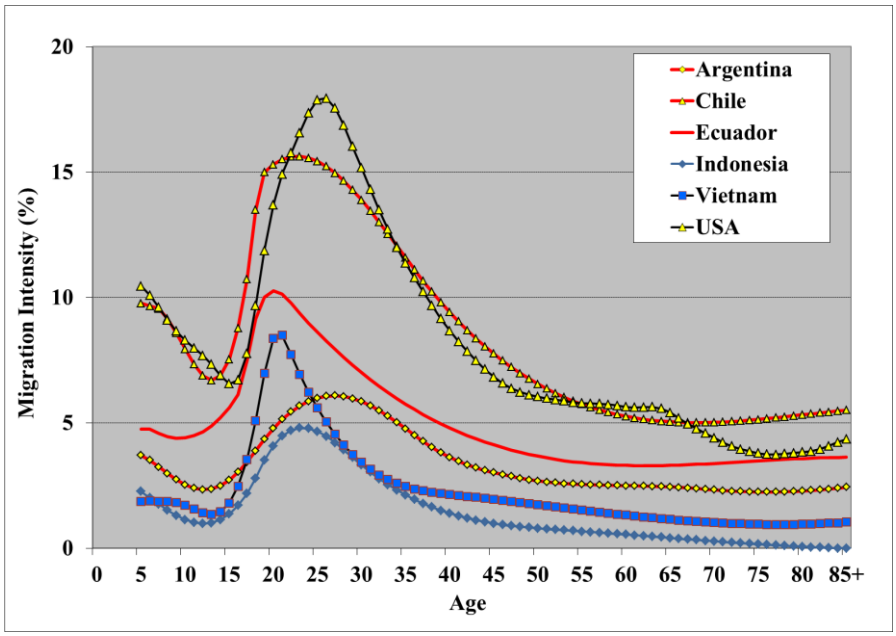
9. The significance of age

Rogers and Castro (1981) found that despite widespread variations in migration intensity, the age profile of migration followed a shape that was remarkably similar from one country to another around the world. They also found that profile shape was largely scale-independent: within individual countries the age profile for moves between say, provinces, closely matched that for moves between municipalities. Building on Rogers and colleagues work, it is now well-established that migration probabilities are highest among young adults and fall steadily with increasing age, reaching a low around retirement before rising again among the very old. Migration is low in the teenage years but higher among the very young, as children move with their parents, while a secondary peak is also found in some countries on retirement. These regularities have been steadily systematized and incorporated into the lexicon and toolbox of migration studies under the rubric of model migration schedules (see, for example, Rogers and Castro 1981; Wilson 2010).

Notwithstanding the widespread occurrence of this general pattern, there is mounting evidence of significant variations between countries in key aspects of the migration age profile, particularly in the nature of the migration peak among young adults. Bell and Muhidin (2009) examined the age profile of internal migration in 18 countries drawn from all regions of the world. The results revealed marked variations between countries in three distinct features: the age at which migration peaks, the intensity at the peak, and the shape of the peak itself. The age at peak, for example, varied from lows of around 20-21 years in Ecuador and China to highs of 27-28 years in Argentina and Portugal. At the same time, migration in some countries was concentrated into more narrow age ranges than in others. Thus, Malaysia and Vietnam displayed sharp migration peaks whereas in the USA and Canada, the peak was broader, and spread more widely across the age range (Bell and Muhidin 2009). For the most part, these variations were maintained both for movements between major regions (e.g., provinces) and between minor regions (e.g., counties), thereby confirming the findings of Rogers and Castro (1981) that age profile shapes are largely scale-

independent. Figure 5 illustrates these variations across selected countries. Comparing migration profiles shows that in countries such as Vietnam and Ecuador there is an early, sharp migration peak, while Indonesia and Argentina show more moderate levels of migration at later ages. For Chile and the USA, intensities are higher, but with quite different age distributions.

Figure 5: Age profiles of internal migration between major regions, five-year observation intervals for selected countries



Source: Modified after Bell and Muhidin (2009)

In subsequent work undertaken as part of the IMAGE project, Bernard et al. (2014a) examined six discrete indicators that capture particular facets of the migration age profile, moving beyond the conventional approach based on model migration schedules and overcoming their several limitations for comparative work of this type. Applying correlation and factor analysis to these six facets measured across 25 countries, they showed that the complexity of the migration profile could be reduced to just two key indicators: the age at peak migration and the intensity at the peak. As well as identifying these two key features, the two metrics are closely linked to other key features of the profiles. The intensity of the peak shapes the upwards and downwards slopes of the curve which progressively steepen as intensity rises (e.g., Vietnam compared with Indonesia in Figure 5). At the same time the age at the peak governs the symmetry of the profile, with curves that peak at older ages generally being more symmetrical, that is to say less skewed (e.g., Argentina and USA in Figure 5, compared with Ecuador and Chile). Thus, it appears that in countries where the migration peak is high, most movement tends to be concentrated in a relatively narrow age band. Moreover, in countries where the peak occurs at relatively older ages, migration events tend to be distributed more symmetrically around the peak.

Bernard et al. (2014a) showed that, together, these two dimensions of the age profile—the age and intensity at the peak—accounted for fully two-thirds of the variance between the 25 sample countries. They also demonstrated (2014a, Figure 5) that when plotted against each other, the two measures revealed substantial regional variation among countries of the world, with distinctive age patterns in:

- South and East Asia, characterized by young profiles with high migration peaks;
- Developed countries which display older profiles with generally lower peaks;
- Latin American countries, characterized by two discrete clusters, both with moderate intensities but a mix of younger and older peaks, the former concentrated in the northern Andes, the latter in the south of the continent and in Central America; and
- African examples, which were limited but revealed a similar mix to that observed in Latin America with moderate intensities split between younger (West Africa) and older peaks (South Africa).

In a further contribution to this line of inquiry, Bernard et al. (2014b) demonstrate that the timing of migration closely parallels the age structure of key life course transitions among young adults. This is a demographically dense period of the life course (Rindfuss 1991) involving a suite of major life course transitions—completion of education, labor force entry, union formation and first childbearing. The way in which these transitions serve to trigger migration is well recognized in the literature (see, for example, Mulder and Wagner 1998), but Bernard et al. (2014b) provide the first clear evidence that differences between countries in the timing and prevalence of these events are systematically linked to migration, not only in regard to the ages at which these events peak, but also in the degree to which transitions and migrations are spread across age groups. Thus, countries in which life course transitions typically occur early and within a narrow age range, as is the case with union and family formation in China and Nepal, also tend to display age profiles that are young and highly age-concentrated. Conversely, protracted life course transitions that peak in the mid to late twenties, as in many developed countries, are associated with broad, deferred migration peaks. Bernard et al. (2014b) note that the link between migration and life course events is generally stronger among women than among men, a result they attribute to the more structured nature of women's lives.

The prevalence of individual life-course transitions varies widely between countries, particularly for events such as tertiary education, and not all such events necessarily trigger migration. In Britain, for example, entry to university commonly involves a long distance migration, whereas in Australia such movements are much less common. Moreover, migration is not confined solely to young adults, and is often the product of causes other than conventional life-course transitions. Consideration of the age profile of migration does, however, serve to underline the importance of cultural norms and contextual factors in

explaining cross-national differences in aggregate migration intensities. Equally important to an appreciation of cross-national variations, are differences in the spatial patterning of population movements.

10. Spatial patterns of migration

Just as the intensity of internal migration differs between countries, so too are the spatial patterns of population movement posited to vary over space and time, contingent on key aspects of national development. Indeed, with the progressive reduction of spatial differentials in fertility and mortality, internal migration together with migration from abroad now play a central role in driving spatial redistribution of populations and shaping national settlement systems. Zelinsky (1971) sought to formalize the link between development and the spatial patterning of migration flows in his hypothesis of the mobility transition. According to this model, early transitional societies are marked by high levels of rural-to-urban migration and by flows to settlement frontiers. As the demographic transition proceeds and rural populations begin to fall, rural-to-urban and frontier flows are expected to weaken, to be replaced with rising inter-urban and intra-urban exchanges. Urban-to-rural migration may also occur at the same time as counter-urbanization emerges in response to urban diseconomies of scale and a rising tide of lifestyle-based movements (see, for example, Champion 1989).

Building on observations by Kuznets (1955) of the relationship between economic development and income inequality, economic theory also foreshadows a shift in the balance of inter-regional migration flows as regional inequalities first rise and then fall with the development process. Cheng and Wu (2014) show that in China, urbanization has been a key mechanism in this process, and in the United States, Bogue et al. (2009) point to regional economic convergence as one reason for falling levels of interstate migration. As development and urbanization proceed, we might therefore expect to see a Kuznets-style inverted U-shaped relationship between development and the balance of migration flows, tending initially towards less balanced flows, with greater population redistribution and more directional tendencies as particular regions, usually cities, become increasingly attractive to migrants. As wealth and innovations diffuse, and regional economic differentials diminish, inter-regional migration flows might then be expected to come more closely into balance; the net effect being to reduce the extent of population redistribution arising from migration. Table 5 provides a concise summary of the way each of these key forms of movement is hypothesized to play out as development proceeds.

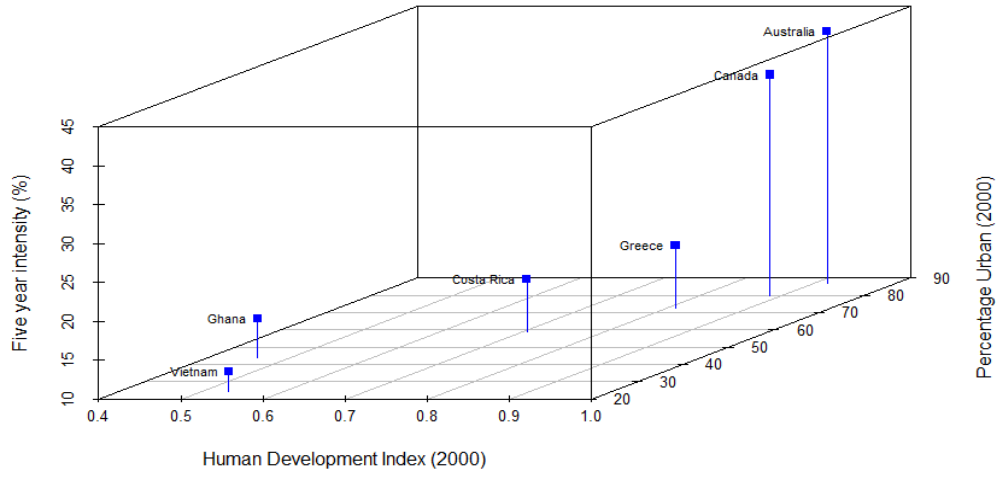
Table 5: Hypothesized trends in migration patterns with development

Form of Migration	Trend with development
Rural to rural	High then falls as rural populations diminish

Rural to urban	Rises then falls with rural exodus
Urban to urban	Rises as urban populations increase and
Urban to rural	May rise in post-industrial societies
Balance of flows	Falls then rises, becoming more balanced
Population redistribution	Rises then falls as flows and counter-flows approach equilibrium

Exploration of these processes in a cross-national context is inhibited by differences in spatial frameworks and a dearth of time series data. Some indication of the links between development and migration flows can be derived, however, by examining countries at different levels of urbanization. Figure 6 plots five-year migration intensities against the HDI and the percentage of the population living in urban areas for selected countries representing world regions. As anticipated, there is a broad positive association between HDI, urbanization, and migration intensity. Ghana and Vietnam both are at early stages of urbanization and development and exhibit relatively low migration intensities. By contrast, Canada and Australia display high intensities, are highly urbanized, and have high levels of human development. Costa Rica and Greece present a more varied picture. Costa Rica displays the high level of urbanization characteristic of many Latin American countries but, coupled with a low score on the HDI, experiences moderate migration intensity. Greece, on the other hand, is both highly urbanized and developed, but exhibits only moderate migration intensity.

Figure 6: Five-year migration intensities, selected countries by HDI & urbanization level



Figures 7-12 show the regional pattern of net migration gains and losses for these countries. While there are some differences in the structure of net migration gains and losses across countries, there are also many commonalities, pointing to a relatively weak association between development and urbanization and the spatial structure of migration flows. For

example, Ghana, Costa Rica, Greece, and Australia all display net migration losses from their metropolitan cores coupled with large net gains on the metropolitan peripheries, consistent with processes of suburbanization, urban overspill and counter-urbanization. By contrast, major metropolitan regions in Canada and Vietnam both register net migration gains, despite being at very different stages of development. Net migration losses from rural areas are observed in all countries in the sample, but are by no means uniform. Both Canada and Australia, for example, record net losses from parts of their agricultural and pastoral zones as well as more remote regions. This is accompanied by net migration gains in rural regions with large natural resource endowments, as well as in regions with high amenity values, such as Australia's east coast and the Greek islands. A similar mosaic of rural gains and losses can be observed in other countries in the sample. Ghana registered widespread net losses from northern agricultural regions but gains in the south and west that are richly endowed with natural and mining resources. In Costa Rica, gains in rural regions of the north are offset by losses from the eastern provinces.

The heterogeneity in regional migration patterns observed across this selection of countries attests to the importance of territorial inequalities in driving migration, but weakens the case for any standard, universal path through the mobility transition, at least with respect to the spatial patterning of flows. Assessing the precise role of migration in regard to urbanization is also made difficult by differences between countries in defining "urban", and by the fact that few countries classify migration data by urban and rural origins (see Bell et al. 2014). Disentangling the role of internal migration compared with international movements, natural increase, and reclassification is therefore a serious challenge (Keyfitz 1980; Lerch 2014). One aspect of spatial patterning that is more readily addressed in a cross-national context, however, is the overall extent of population redistribution arising from internal migration.

Underlying the patchwork of net migration gains and losses in Figures 7-12 is a much larger set of migration flows and counter-flows. Table 6 sets out the corresponding data for each country, together with three system-wide indices: the *crude migration intensity* (CMI), the *migration effectiveness index* (MEI), and the *aggregate net migration rate* (ANMR). Also identified is the *population at risk* (PAR). Computation of these measures is described in detail elsewhere and need not be repeated here (see, for example, Bell et al. 2002; Plane and Rogerson 1994). What is most notable from Table 6 is the marked difference between gross inter-regional flows in each country and the resulting net redistribution. This is captured as a percentage in the MEI, which effectively measures the efficiency with which migration redistributes population between regions. Low values, as in Australia, indicate that flows are closely balanced across the system as a whole with migration flows between regions largely offset by counter-flows, indicating a system close to equilibrium and in which there is little resultant redistribution of population. In Vietnam, on the other hand, the MEI of 58.2 depicts a markedly different migration regime, characterized by sharp disequilibrium and substantial redistribution: migration is highly effective in shifting population between

regions. Indeed, the MEI can be interpreted to indicate that for every 100 people migrating between regions, there was a net shift of 58 people. This compares with a figure of just seven for every 100 cross-border flows in the case of Australia.

Figure 7: Net internal migration rate (%), Ghana, 1995-2000

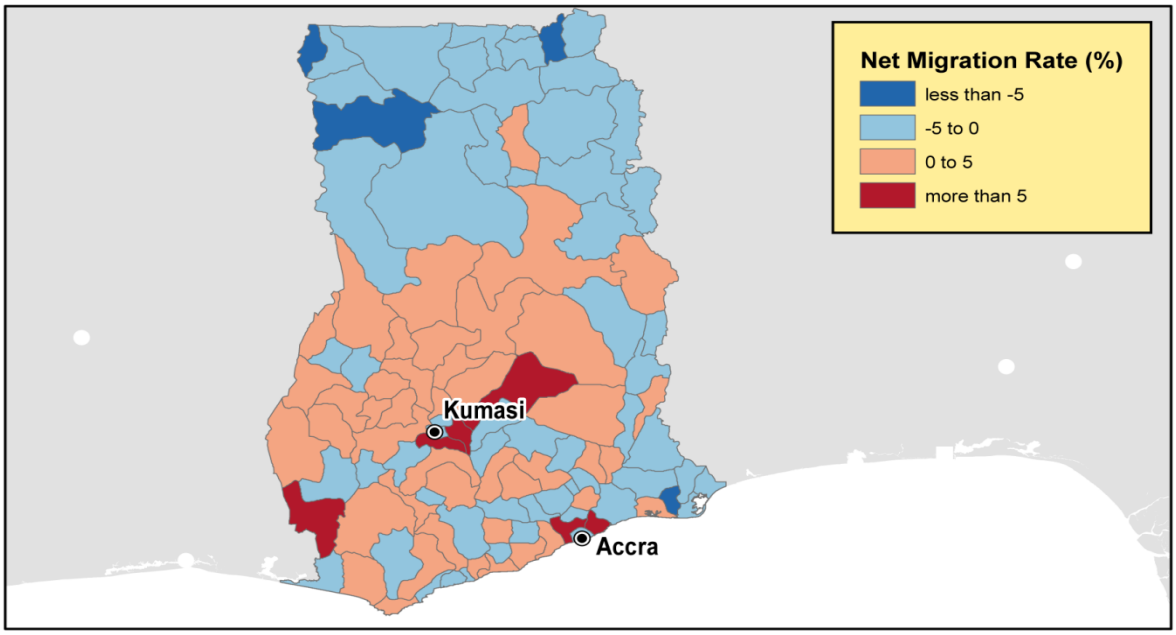


Figure 8: Net internal migration rate (%), Vietnam, 2004-2009

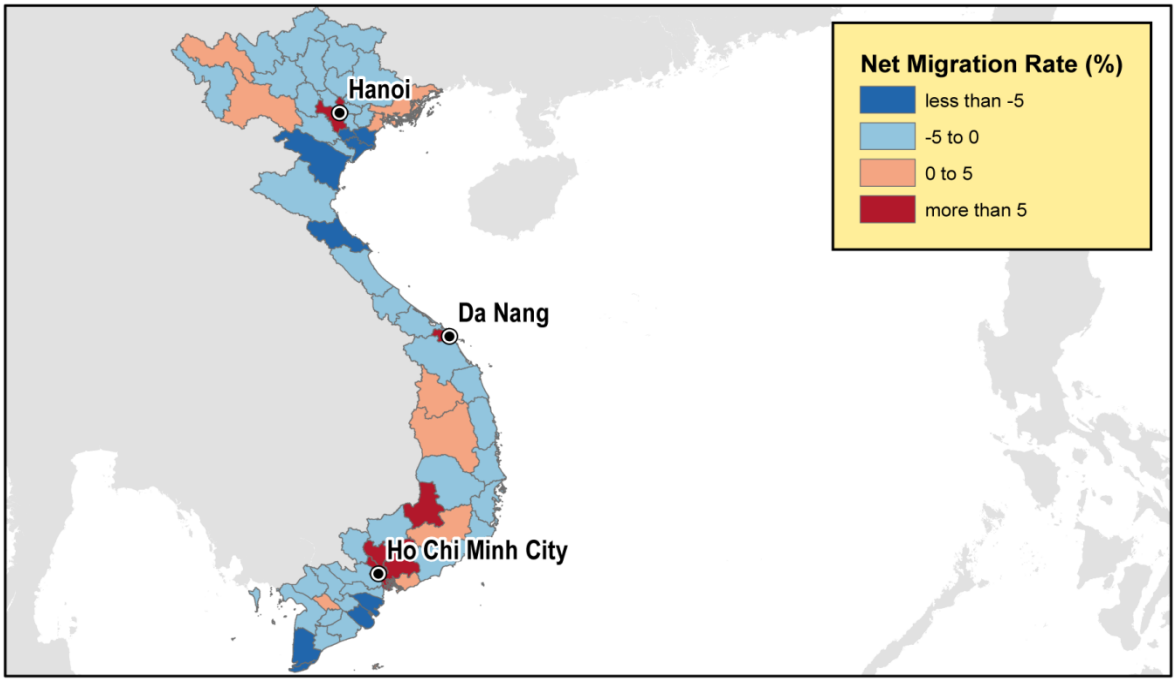


Figure 9: Net internal migration rate (%), Greece, 1996-2001

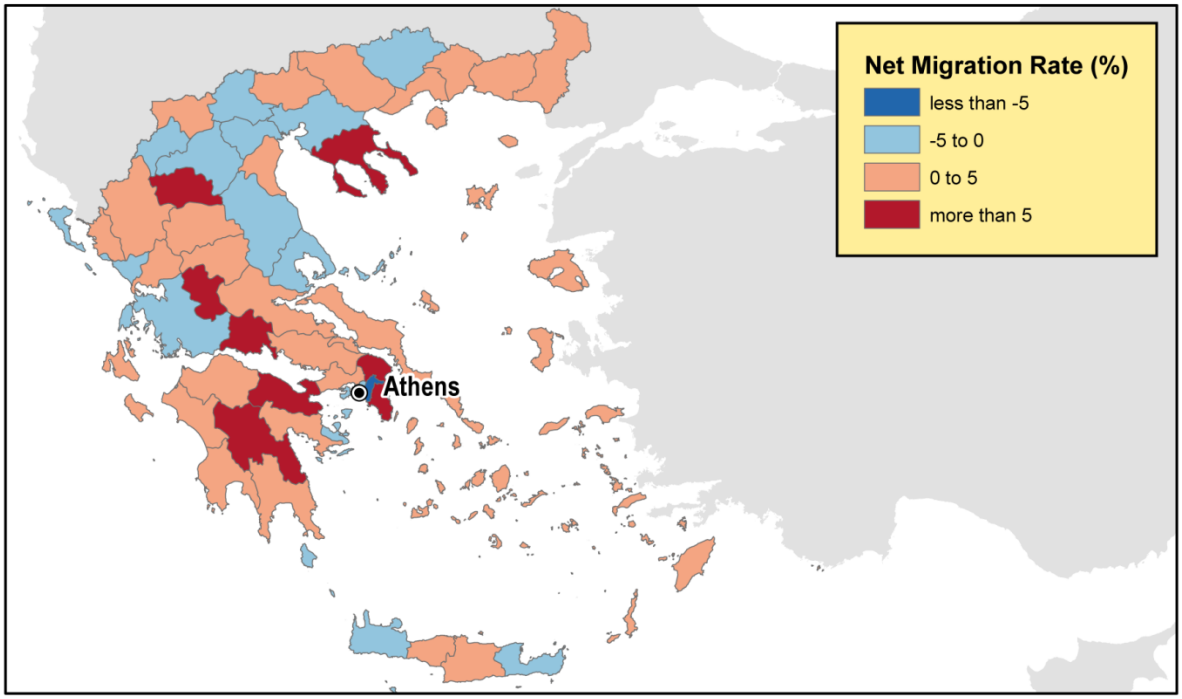


Figure 10: Net internal migration rate (%), Costa Rica, 2005-2010

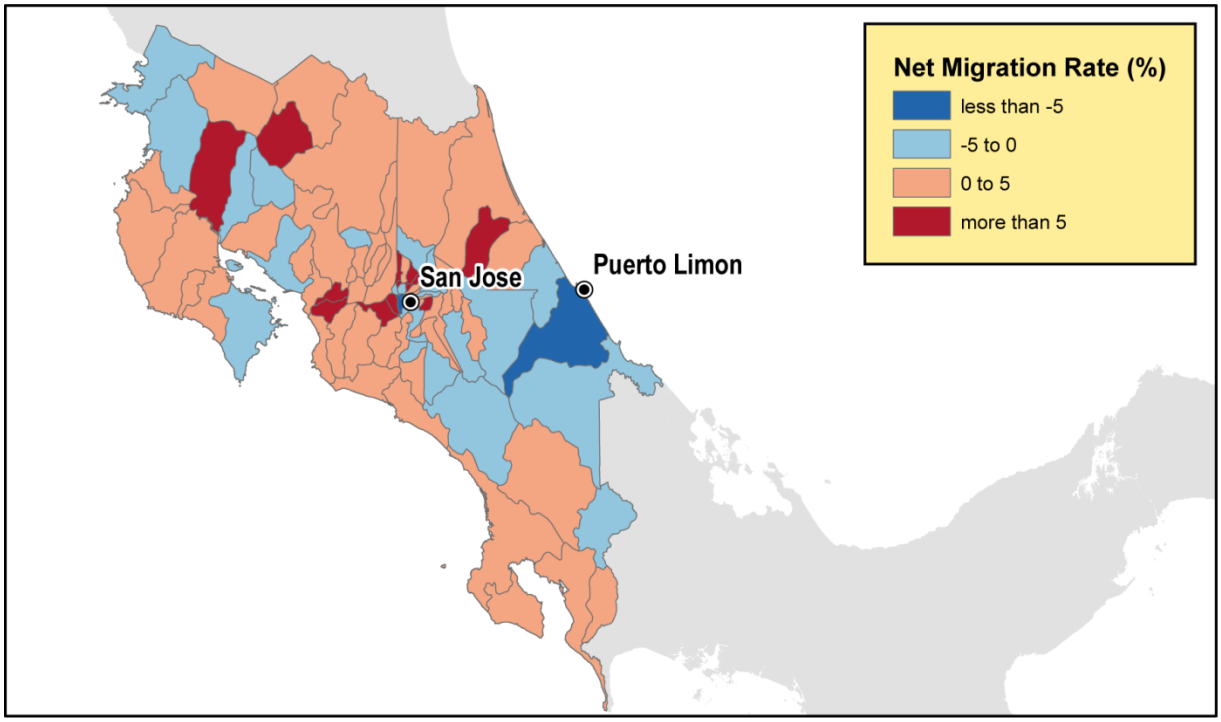


Figure 11: Net internal migration rate (%), Canada, 2001-2006

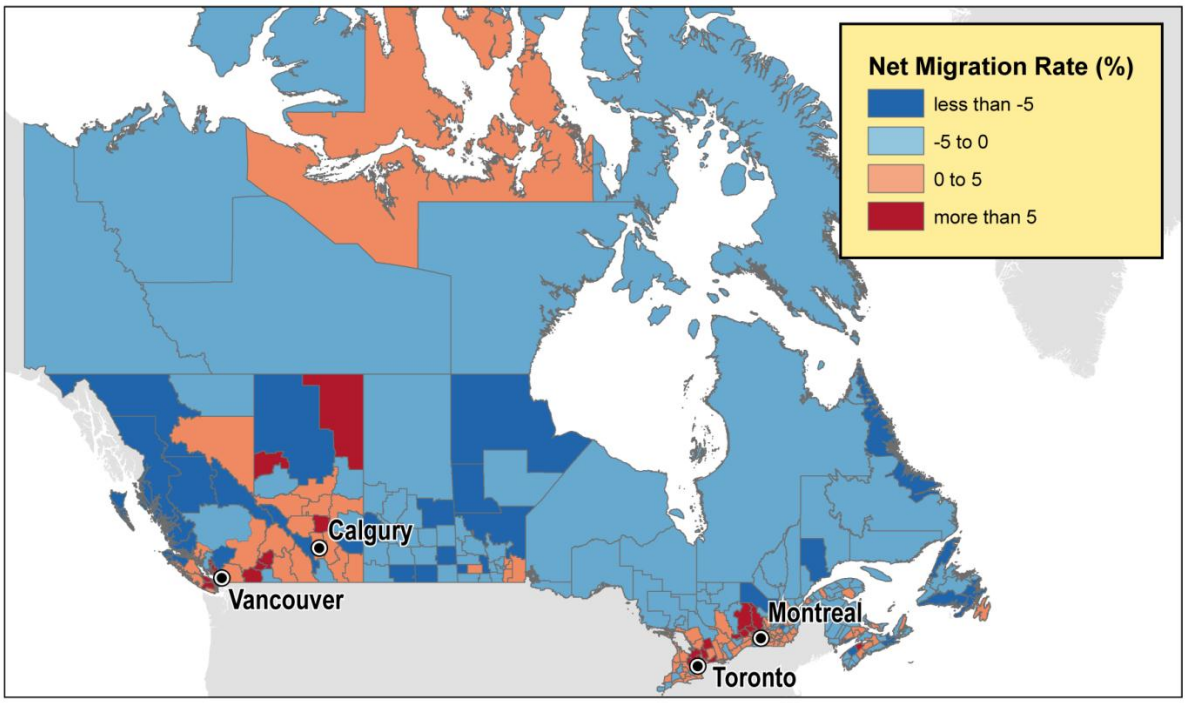
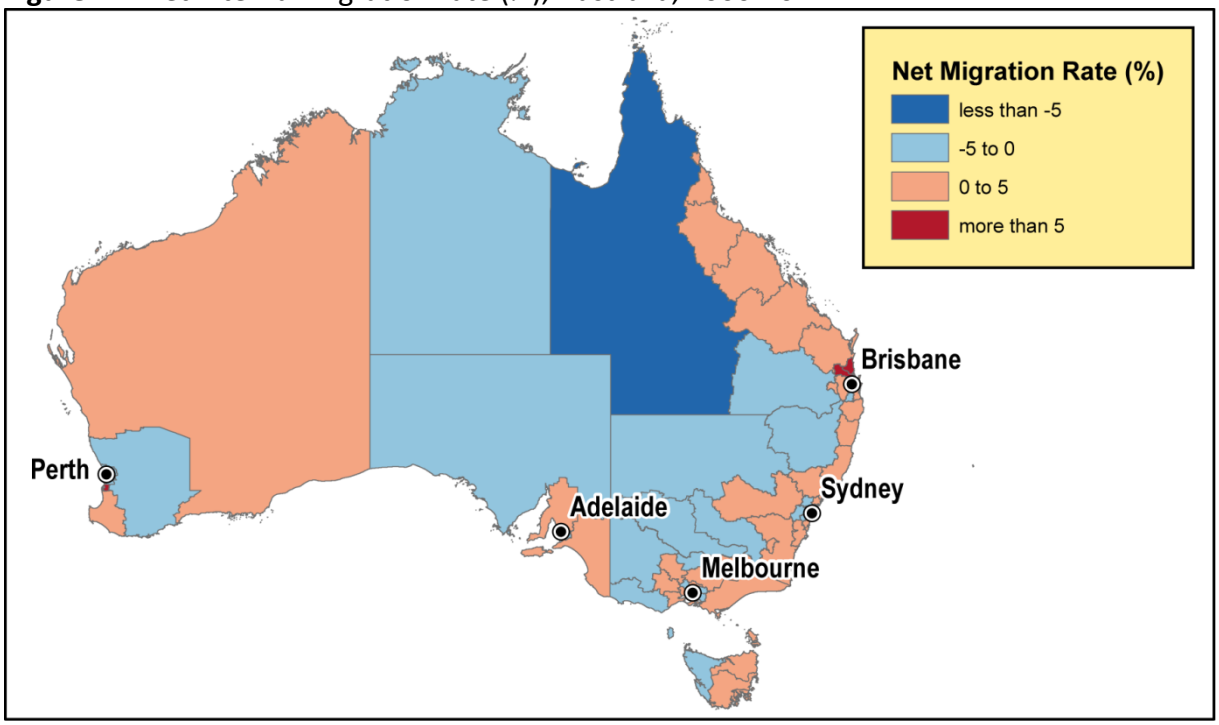


Figure 12: Net internal migration rate (%), Australia, 2006-2011



Migration effectiveness is a key aspect of inter-regional population dynamics, but it is the way effectiveness combines with migration intensity that fundamentally determines the impact of migration on the settlement system. Table 6 sets out CMIs, denoting the intensity

of movement between regions for each of the six sample countries; it is the combination of this measure with the MEI that generates the ANMR via the formula ANMR = (CMI*MEI)/100. The ANMR, which can also be calculated simply as net redistribution divided by the population at risk (and expressed as a percentage), in turn indicates the overall impact of migration in altering the spatial distribution of population across the settlement system. Thus, in the case of Ghana, the ANMR indicates that internal migration redistributed 1.4 percent of the national population between regions over the five-year period. What is apparent from Table 6, is that the very high MEI in Vietnam was substantially offset by a comparatively modest intensity—that is, among those who moved between regions, there was a strong directional focus, although the overall propensity to make such moves was quite low. By contrast, the intensity of inter-regional migration in Australia was the highest of all six sample countries, but this was largely offset by its migration effectiveness, which was by far the lowest. The net effect of these forces was that Vietnam registered the most significant impact on its settlement pattern as a result of migration, but this was a product of high effectiveness rather than high overall mobility. In Australia, on the other hand, high mobility was largely absorbed in reciprocal, self-compensating flows.

Table 6: Five-year migration flows, rates and population redistribution, selected countries

Country	Ghana	Vietnam	Greece	Costa Rica	Canada	Australia
Year(s)	2000	2009	2001	2011	2006	2011
No. of Regions	110	63	54	81	288	88
Total flows	961,270	3,395,783	572,390	404,109	3,350,105	2,703,190
Net redistribution	218,490	1,974,654	132,490	57,941	503,810	195,200
PAR*	16,121,740	78,471,824	9,470,900	3,874,413	28,373,615	17,420,371
CMI*	6.0	4.3	6.0	10.4	11.8	15.5
MEI*	22.7	58.2	23.1	14.3	15.0	7.2
ANMR*	1.4	2.5	1.4	1.5	1.8	1.1

Source: Authors' calculations from the IMAGE repository. * PAR, CMI, MEI, and ANMR are described in text.

As demonstrated earlier, migration intensities vary according to spatial scale, and the differences apparent in Table 6 may be traced, at least in part, to the regional frameworks for which national migration data are available. However, work currently in progress in the IMAGE project demonstrates that migration effectiveness is remarkably stable across spatial scales within individual countries, such that the differences reported in Table 6 are likely to hold irrespective of the level of spatial disaggregation employed. The data in Table 6 also deliver a strong negative association between MEIs on the one hand and the HDI ($r = -0.63$) and level of urbanization on the other ($r = -0.86$). While the number of sample countries is small, this provides qualified support for the hypothesis that inter-regional migration flows come more closely into balance as development proceeds.

Conclusions

This paper has drawn on the data repository assembled as part of the IMAGE project to explore the way in which migration within countries varies around the world. Recognizing that internal migration is a complex, multifaceted phenomenon, we chose to examine three related dimensions: its overall intensity, age composition, and spatial patterning, and to establish the way in which it varied among countries at differing levels or stages of development. The relationship between migration and development has attracted considerable attention from a range of leading scholars (see, for example, Skeldon 1997). What the current paper has sought to add is a systematic analysis of cross-national differences based on rigorously defined measures of key dimensions of internal migration.

We argued that such comparisons highlight commonalities and differences among countries, enhance analytical rigor, aid theorization, and facilitate the development of policy. However, drawing together data for cross-national comparisons presents a number of challenges, both methodological and practical. Among the former, we identified as most critical differences in the types of data that are collected, in the time interval over which migration is measured and in the spatial frameworks that are employed. From a practical perspective, the central obstacle lies in accessing and assembling data a comprehensive sample of data. Elsewhere, with colleagues (Bell et al. 2014), we have advanced a number of recommendations for consideration by the international statistical community designed specifically to facilitate cross-national comparisons. Key among these recommendations are that:

1. Internal migration should be measured over a fixed interval, ideally over one or five years, with a lower priority accorded to place of birth within a country;

2. Data on place of residence should be coded to the smallest geographical zones feasible;

3. Priority should be given to collecting data on all changes of usual address to facilitate comparisons of overall migration intensity;

4. Data on duration of residence, if collected, should be recorded as length of residence rather than year of arrival, and indicate explicitly the spatial unit to which it refers; and

5. Statistical agencies should disseminate a range of standard outputs on internal migration including detailed origin-destination flow matrices.

Implementation of these recommendations would contribute significantly to progress in internal migration research.

Notwithstanding the deficit of readily available information, we were able to assemble internal migration data for a total of 82 countries. We then coupled techniques recently proposed by Courgeau et al. (2012) with the analytical software developed in the IMAGE suite (Stillwell et al. 2014) to generate estimates of aggregate crude migration intensities, representing all changes of address within a country (which we argue is the only reliable

basis on which to make such comparisons). Our results, computed separately for countries measuring migration over five year intervals (36) and one year (41) intervals, reveal substantial variation in the level of mobility in countries around the globe. One year intensities range from 19.1 percent in Iceland to just 1 percent in Macedonia and five year intensities from over 50 percent (Fiji) to just 10 percent in the Philippines.

Distinct regional patterns in migration intensity are also apparent, with evidence of high mobility in the "new world" immigrant societies of Australia, Canada, New Zealand and the USA, and relatively low migration intensities across much of Asia. North-west Europe also exhibits high migration intensities but these decline shifting south and east across the continent. Latin America presents a mosaic of high mobility in the Andean countries but lower intensities in Central America, while evidence for Africa, although less complete, also suggests considerable heterogeneity.

What most countries share in common is a tendency for migration intensities to have declined over recent decades. This is most readily apparent in data measured over one- and five-year intervals and is masked by inertia in lifetime migration data. There are important exceptions, most notably China, where policy shifts have eased restrictions on population movement since the 1980s. Unlike the other key dimensions of demography, fertility and mortality, there is no evidence of any global convergence among countries in the level of internal migration (compare Wilson 2011).

We sought explanation for these differences in migration intensities between countries by reference to a suite of economic, social and demographic variables. The results revealed moderate to strong correlations with several key indicators, particularly GDP per capita, life expectancy, the HDI and level of urbanization. Equally notable was a strong association with the incidence of mobile phone subscriptions, and more moderate links to median age and labor force participation. Individually and collectively these results suggest strong links between the intensity of internal migration and the level of national development. Equally notable were moderate to strong associations with two indicators of international migration: the net international migration rate and international remittances, underlining the interconnections between different forms of population movement. The fact that these relationships were broadly consistent across both the one and five year data, representing two somewhat different groups of countries, lends considerable strength to their significance.

The battery of variables tested here might be extended to explore a variety of other factors likely to influence migration. Education, unemployment, housing costs, personal freedom and civil unrest may all play a role. For this paper, however, we sought to explore two other dimensions of cross-national variation: the age structure of migration and its spatial pattern. Evidence from a sample of six regionally representative countries demonstrates that cross-national variations are not confined solely to migration intensity but are also to be found in these aspects of mobility. Drawing on other research from the IMAGE project, we showed

that the height and age at peak migration among young adults vary systematically and appear to be driven largely by the timing of certain life course events. These in turn have a strong regional dimension that is closely related to certain aspects of national development. In a similar way sample data for a range of countries showed that, underlying the complex patchwork of spatial patterns, there is evidence of systematic regularities in the balance of inter-regional migration flows which again are related to levels of national development. As anticipated by theory, migration flows appear to come more closely into equilibrium among countries at later stages of development, independent of the overall level of migration intensity.

Collectively, these findings are suggestive rather than conclusive. The results presented here represent the most extensive international comparison of internal migration rates compiled to date. However, further work is needed to extend our league tables to deliver comprehensive global coverage. Internal migration data are patchy in several parts of the world, particularly Africa, Western Asia and the former USSR. If greater breadth is to be achieved, international cooperation will be needed to harmonize data collection. In a similar way, analysis of migration age profiles and spatial patterns needs to be extended to a broader range of countries, and some of this work is already underway as part of the IMAGE project. Equally challenging is the task of establishing the extent and nature of the links between migration and development. As demonstrated here, migration intensity, age and pattern each appear to be associated with particular aspects of national development, but the connections between these dimensions of migration and their functional linkages to the development process are yet to be clearly articulated. Explanation will need to move beyond the simple associations with national indicators presented here. Equally, it is important to recognize that demographic behavior, especially in a spatial context, is strongly influenced by local contingency, culture, history and geography. Simple, global explanations are out of reach in work such as this. Placing key aspects of migration behavior, rigorously measured, within a cross-national framework does, however, serve to focus attention on commonalities and differences in a form conducive to sharpening both global and local understanding.

References

Abel, G. and N. Sander. 2014. “Quantifying Global International Migration Flows.” *Science*, 343(6178): 1520-1522.

Bell, M., M. Blake, P. Boyle, O. Duke-Williams, P. Rees, J. Stillwell, and G. Hugo. 2002. “Cross-National Comparison of Internal Migration: Issues and Measures.” *Journal of the Royal Statistical Society: Series A,* 165(3): 435-464.

Bell, M., E. Charles-Edwards, D. Kupiszewska, M. Kupiszewski, J. Stillwell, and Y. Zhu. 2014. “Internal Migration Data around the World: Assessing Contemporary Practice.” *Population, Space and Place.* Wiley Online Library, DOI 10.1002/psp1848.

Bell, M. and S. Muhidin. 2009. “Cross-National Comparisons of Internal Migration.” *Human Development Research Paper 2009/30.* United Nations, New York. http://hdr.undp.org/en/reports/global/hdr2009/papers/HDRP_2009_30.pdf

Bell, M. and P. Rees. 2006. "Comparing Migration in Britain and Australia: Harmonisation Through Use of Age-Time Plans." *Environment and Planning A,* 38(50): 959-988.

Bernard, A., M. Bell, and E. Charles-Edwards. 2014a. “Improved Measures for the Cross-National Comparison of Age Profiles of Internal Migration.” *Population Studies*. http://dx.doi.org/10.1080/00324728.2014.890243

Bernard, A., M. Bell, and E. Charles-Edwards. 2014b. “Life-Course Transitions and the Age Profile of Internal Migration.” *Population and Development Review*, 40(2): 213-239.

Bogue, D., G. Liegel, and M. Kozloski. 2009. “Immigration, Internal Migration, and Local Mobility in the United States.” Cheltenham, UK and Northampton, Ma, USA: Edward Elgar.

Castles, S. and M. Miller. 2009. “The Age of Migration: International Population Movements in the Modern World.” Palgrave Macmillan, Basingstoke.

Champion, A. 1989. “Counterurbanisation: The Changing Pace and Nature of Population Deconcentration.” Edward Arnold, London.

Champion, A. and I. Shuttleworth. 2013. “Are We Becoming More Migratory?” Paper presented to the ONS-LS Beta Test Meeting, University College, London, November 5, 2013. http://www.ons.gov.uk/ons/guide.../are-we-becoming-more-migratory.pdf

Cheng, W. and Y. Yu. 2014. “Understanding the Kuznets Process: An Empirical Investigation of Income Inequality in China 1978-2011.” *Department of Economics Discussion Paper 12/14.* Monash University, Melbourne. http://www.buseco.monash.edu.au/eco/research/papers/2014/1214kuznetschengwucema.pdf

Cooke, T. 2011. “It is Not Just the Economy: Declining Migration and the Rise of Secular Rootedness.” *Population, Space and Place,* 17(3): 193-2003.

Courgeau, D. 1973. “Migrants and Migrations.” *Population*, 28: 95-128.

Courgeau, D., S. Muhidin, and M. Bell. 2012. “Estimating Changes of Residence for Cross-National Comparison.” *Population* (English edition), 67(4): 631-651.

Dyson, T. 2010. “Population and Development: the Demographic Transition.” Palgrave Macmillan, New York.

Frey, W.H. 1979. “Central City White Flight: Racial and Nonracial Causes.” *American Sociological Review*, 44(3): 425-448.

Keyfitz, N. 1980. “Do Cities Grow by Natural Increase or by Migration?” *Geographical Analysis,* 12: 142-156.

Kitsul, P. and D. Philipov. 1981. “The One Year/Five Year Migration Problem.” In *Advances in Multiregional Demography* (ed. A. Rogers): 1–34. International Institute for Applied Systems Analysis, Laxenburg.

Kuznets, S. 1955. “Economic Growth and Income Inequality.” *American Economic Review*, 45(1): 1-28.

Law, G. 1999. “Administrative Subdivisions of Countries: A Comprehensive World Reference, 1900 through 1998.” Jefferson, North Carolina, McFarland and Company.

Lerch, M. 2014. “The Role of Migration in the Urban Transition: a Demonstration from Albania.” *Demography*, 51:1527-1550.

Long, L. 1991. “Residential Mobility Differences among Developed Countries.” *International Regional Science Review*, 14(2): 133-147.

Minnesota Population Center. 2014. Integrated Public Use Microdata Series, International: Version 6.3 [Machine-readable database]. Minneapolis: University of Minnesota, 2014. https://international.ipums.org/international/

Muhidin, S. 2014. “Internal Migration and Development in Indonesia: Trends, Patterns and Current Issues.” Paper presented to International Conference on Internal Migration and Urbanization, organised by the Global Knowledge Partnership on Migration and Development (KNOMAD), Dhaka, Bangladesh, April 30-May 1, 2014.

Mulder, C. and M. Wagner. 1998. “First-time Home-Ownership in the Family Life Course: A West German-Dutch Comparison.” *Urban Studies,* 35 (4): 687-713.

Plane, D. and P. Rogerson. 1994. *The Geographical Analysis of Population,* Wiley.

Rees, P., M. Bell, O. Duke-Williams, and M. Blake. 2000. “Problems and Solutions in the Measurement of Migration Intensities: Australia and Britain Compared.” *Population Studies*, 54(2): 207-222.

Rindfuss, R. 1991. 'The Young Adult Years: Diversity, Structural Change, and Fertility.” *Demography,* 28 (4): 493-512.

Rogers, A. and L. Castro. 1981. *Model Migration Schedules*. International Institute for Applied Systems Analysis, Laxenburg.

Skeldon, R. 1990. *Population Mobility in Developing Countries: a Reinterpretation.* Belhaven, London.

_____ 1997. *Migration and Development: A Global Perspective.* Harlow, Longman.

Stillwell, J., K. Daras, M. Bell, and N. Lomax. 2014. “The IMAGE Studio: A Tool for Internal Migration Analysis and Modelling.” *Applied Spatial Analysis and Policy,* 10.1007/s12061-014-9104-4.

United Nations. 2009. *Human Development Report 2009:* “Overcoming Barriers: Human Mobility and Development*.”* United Nations Development Program, New York.

Van Imhoff, E. and N. Keilman. 1991. *LIPRO 2.0: An Application of a Dynamic Demographic Projection Model to Household Structure in the Netherlands*. Swets and Zeitlinger, Amsterdam.

Wilson, C. 2011. “Understanding Global Demographic Convergence since 1950.” *Population and Development Review,* 37(2): 375-388.

Wilson, T. 2010. “Model Migration Schedules Incorporating Student Migration Peaks.” *Demographic Research*, 23 – 8: 191-222.

Woods, R., M. Cadwallader, and W. Zelinsky. 1993. “Classics in Human Geography Revisited.” *Progress in Human Geography*, 17: 213-219.

World Bank. 2009. *World Development Report 2009:* “Reshaping Economic Geography.” The World Bank, Washington DC.

Zelinsky, W. 1971. “The Hypothesis of the Mobility Transition.” *Geographical Review,* 61(2): 219-249.

Appendix: Estimating Aggregate Crude Migration Intensities

The most reliable basis on which to compare the level or intensity of migration within countries is to focus on all changes of address, since this circumvents problems created by differences between countries in the spatial frameworks on which migration statistics are collected. However, comparatively few countries collect information on all changes of residence. We therefore utilize the method proposed by Courgeau et al. (2012) to estimate this *aggregate crude migration intensity* (ACMI), using equation 1.

$$CMI_n = w + k \ln (H/n) \quad [1]$$

where

H = total households

n= number of zones

k = constant

The diagrams and tables below provide a simple worked example of the estimation procedure using data for Germany.

1. Data on crude migration intensities are assembled for each of the spatial scales available from administrative or statistical geographies. At each level we calculate the corresponding average number of households per zone and express this as a natural logarithm. These data are shown for the 16 states, 412 kreise and 12,227 communes in Germany in 2009 (Table A1) and plotted in Figure A1.
2. Observed data are usually limited to a small number of observations—commonly 2, 3, or 4 levels—corresponding to national administrative geographies, such as regions, provinces, counties, or municipalities. While the Courgeau method can be implemented using this limited number of observations, additional estimates significantly enhance the reliability of the resulting estimate of the ACMI. We derive this additional rigor, and simultaneously address the problems arising from the modifiable areal unit problem, by creating additional geographies using the random aggregation procedures embedded in the IMAGE studio (Stillwell et al. 2014). Table A1 reports the additional estimates at a selected set of spatial aggregations and Figure A2 displays the resulting additions graphically.
3. The Courgeau method hypothesizes a linear relationship between the observed CMI and the average number of households per zone (under certain simplifying assumptions). The results in Figures A1 and A2 indicate that this association clearly

holds in the case of Germany with a coefficient of determination (r^2) of 0.989 across the 12 observations.

4. We derive the estimated ACMI by fitting a linear regression equation to the observed data, as shown in Figure A3. The intercept on the y axis corresponds to the point at which there is an average of just one household per zone, thus $H/n = 1$ and ln (H/n) = 0. Substituting in equation 1, $CMI_n = w + 0$. The constant w then represents the ACMI and corresponds to the y intercept in Figure A3.

Table A1: Data for estimation of ACMI using the Courgeau method, Germany, 2009

	Number of zones	Average number of households per zone	Ln(Average number of households per zone)	Crude migration intensity
Observed data	1	40188000		
	16	2511750	14.7	1.3
	412	97544	11.5	3.1
	12227	3287	8.1	5.3
Estimated data (IMAGE Studio)	10	4018800	15.2	1.3
	50	803760	13.6	2.0
	100	401880	12.9	2.4
	150	267920	12.5	2.6
	200	200940	12.2	2.7
	250	160752	12.0	2.8
	300	133960	11.8	2.9
	350	114823	11.7	3.0
	400	100470	11.5	3.1

Figure A1: Plot of CMI vs. average households per zone, observed data, Germany, 2009

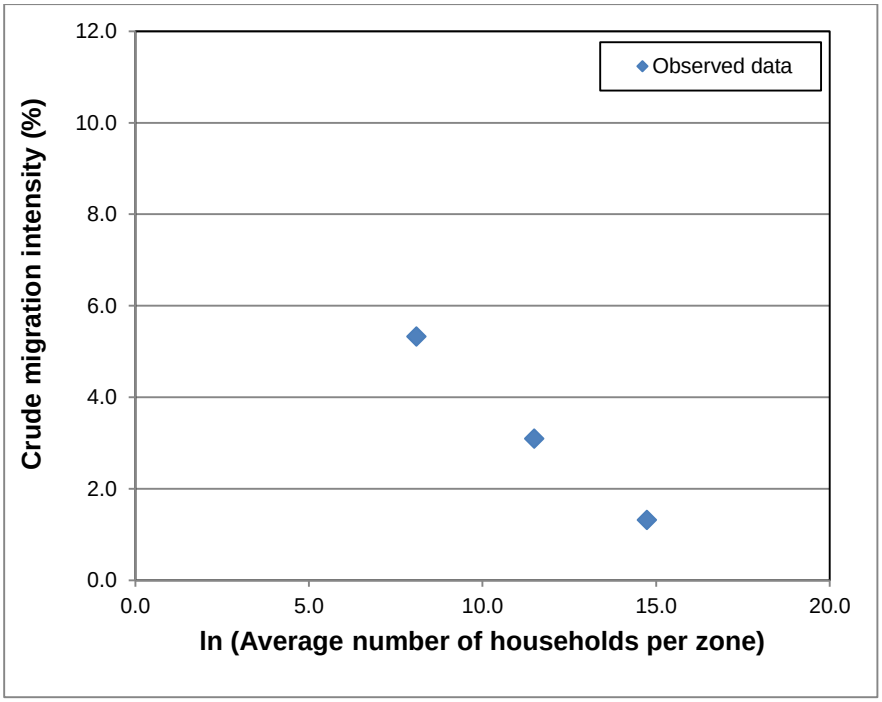


Figure A2: Plot of CMI vs. average households per zone, adding IMAGE Studio estimates, Germany, 2009

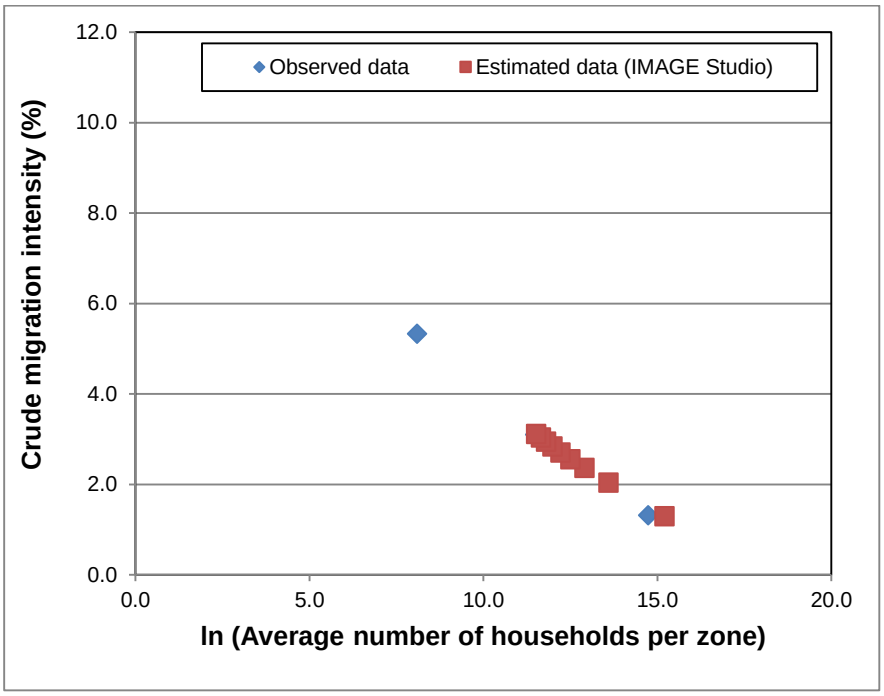


Figure A3: Estimating the ACMI through linear regression, Germany, 2009