Internal migration and population redistribution: a cross-national comparison

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Introduction

This paper reports results from the IMAGE (Internal Migration Around the GlobE) project, a four year international collaborative research program designed to provide a robust framework for systematic comparisons of internal migration, the ultimate goal being to develop and apply a robust set of measures that can be used to advance understanding of the way in which internal migration varies across the world. The previous communications and papers from the project concentrated on the data issues (Bell *et al*., under revision), methodological issues (Bell *et al*. 2013a), the comparison of internal migration intensities (Bell *et al*. 2013b) and analysis for selected group of countries (Bell *et al*. 2012). The current paper focuses on the impact of internal migration on population redistribution.

The paper utilises data from the IMAGE project database, a global repository of internal migration data collections, coupled with the IMAGE Suite, a bespoke software system which computes key migration indicators based on flexible geographies, and aims to explore both the substantive and methodological dimensions of this problem. For the former, the key question concerns the role of internal migration in transforming settlement systems, particularly in terms of population concentration and de-concentration, and the way this varies over space and time. For the latter, the issues centre on selecting appropriate measures of migration, the way in which urban and rural are defined, and the spatial framework on which the analysis is based. The latter embodies the modifiable areal unit problem which plagues all geographical analysis but is especially pertinent to migration analysis because of the nature of the available data.

Methodology

We focus on a sample of countries representing all continents for which high resolution migration data are available. By way of background we first sketch the theoretical framework to understanding the role of migration in population redistribution within countries, and discuss the difficulties for cross-national comparison arising from differing data types, territorial geographies and definitions of urban and rural. For each of our sample countries, we then compute a series of standard indicators of migration impact at a range of geographic levels and patterns of spatial aggregation. We utilise migration events and fixed interval transition data to reveal contemporary trends and lifetime migration data to explore long-term effects. We show how differences in spatial resolution affect key measures of migration impact including the crude migration intensity (CMI), the migration efficiency index (MEI) and the aggregate net migration rate (ANMR), and explore how the relative contribution of these processes varies between countries. We then use population density as a proxy for level of urbanization and examine cross-national differences in the relationship between population density and regional net migration rates.

Aggregate indicators of migration impact

The quantification of the impact of internal migration on the spatial redistribution of population is a tricky problem, especially when international comparisons are attempted.
Bell *et al*. (2002) proposed a set of measures characterising various aspects of migration: its intensity, structure and impact. They show that the impact of migration is a function of overall intensity (CMI) and the spatial imbalance of flows (MEI) which combine to generate the aggregate net migration rate (ANMR).

$$\text{CMI} = 100\, M / P,$$

where M is the total number of internal migrants in a given time period and P is the population at risk of moving.

$$\text{MEI} = 100 \sum_i | D_i - O_i | / \sum_i (D_i + O_i),$$

where D_i is the total inflows to zone i and O_i is the total outflows from zone i.

$$\text{ANMR} = 100 \text{ x } 0.5 \sum_i | D_i - O_i | / \sum_i P_i,$$

where P_i is the population at risk in region i.

$$\text{ANMR} = \text{MEI x CMI} / 100.$$

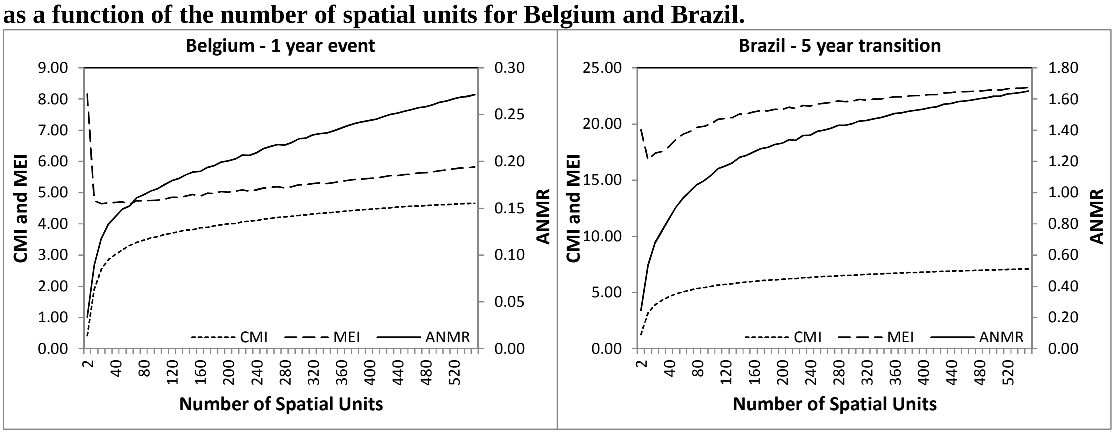
The same relative impact of migration on population redistribution, as measured through ANMR, may be achieved either through a higher migration efficiency combined with a lower migration intensity or with a lower migration efficiency combined with a higher intensity. Table 1 provides examples for selected countries and the full range of results is explored and analysed in the paper.

Differences in the number of spatial units in each country mean that these results are not comparable: indeed, the number of migrants and values of various migration indicators depend on the spatial system over which migration is measured. This problem, known as the modifiable areal unit problem, is addressed in the IMAGE Suite through a flexible spatial aggregation system which enables Basic Spatial Units (BSUs) to be aggregated into Aggregated Spatial Regions (ASRs) in a range of random spatial configurations at user defined spatial scales (Daras *et al*.2013). Multiple iterations at each spatial scale yield a stochastic distribution of the selected measures of migration. For the current paper we focus on migration efficiency. Selected results are illustrated in Figure 1 which shows an increase in the MEI as the number of zones increases, both in Belgium and in Brazil. Although the numbers for both countries are not directly comparable, the figure suggests that the efficiency of migration is much higher in Brazil than in Belgium.

Table 1. Migration impact indicators for selected countries

Country	Year	Data type	No. of regions	CMI	MEI	ANMR
Ghana	2000	5-year	10	3.5	15.7	0.6
	2000	5-year	110	6.0	22.7	1.4
	2000	Lifetime	10	17.7	45.2	8.0
Nepal	2001	5-year	74	3.3	44.2	1.4
	2001	Lifetime	74	14.1	56.6	8.0
Spain	2001	Lifetime	52	22.4	45.6	10.2
	2001	Lifetime	366	44.8	39.0	17.5
Brazil	2000	5-year	27	3.4	17.7	0.6
	2000	5-year	558	7.1	23.3	1.7
	2000	Lifetime	27	15.4	48.5	7.5
USA	2000	5-year	51	8.9	13.1	1.2
	2000	Lifetime	51	31.6	26.1	8.3
Australia	2011	5-year	88	15.5	7.2	1.1
	2011	5-year	333	21.2	8.6	1.8

Figure 1.Crude migration intensity, migration effectiveness index and aggregate net migration rate as a function of the number of spatial units for Belgium and Brazil.

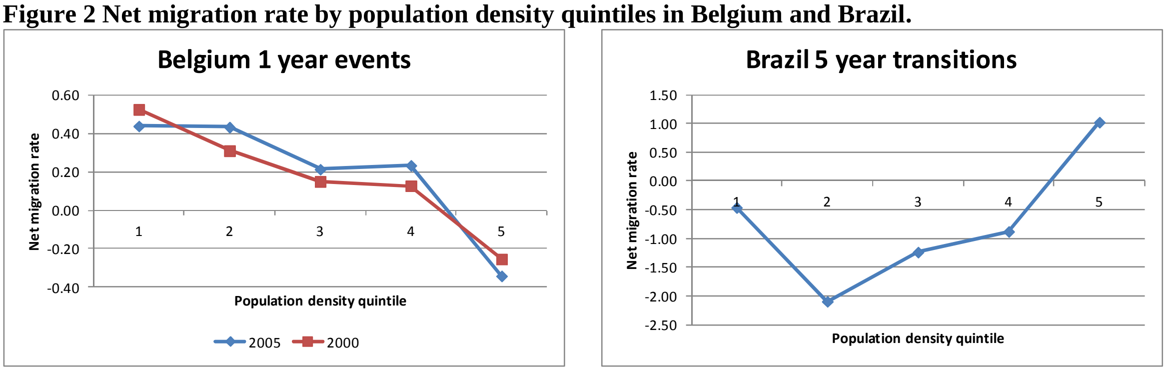


Concentration and de-concentration of population

The IMAGE inventory reveals that few countries measure urban-rural migration directly. Moreover, the comparison of available data is hindered by the differences in the way the "rural" and "urban" areas are defined: One of the possible solutions, applied previously for European countries by Rees and Kupiszewski (1999) is to use population density as a proxy variable for the degree of urbanization and to study cross-national differences by looking at regional net migration intensity as a function of population density. We adopt the same approach in the current paper. To facilitate cross-country comparison we group regions according to population density into five quintiles and calculate net migration rates for each quintile.

Figure 2 presents results for 5-year transitions in Brazil and for 1-year migration events in Belgium. The graph for Belgium illustrates contemporary processes in a developed country setting where counter-urbanisation processes hold sway: net migration in the quintile of regions with the highest density is negative. The graph for Brazil shows a sharply contrasting situation typical of a developing country in which population dynamics are still dominated by urbanization, with the most densely populated regions still gaining population through internal migration. The analysis also reveals that it is the regions with moderate population densities, rather than the lowest density regions that are the primary source of this urbanisation.

Figure 2 Net migration rate by population density quintiles in Belgium and Brazil.



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