Model Migration Schedules

IIASA Research

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Model Migration Schedules Research

I. Measurement and Analysis

II. Model Migration Schedules

III. What the Age Composition of Migrants can Tell Us

IV. Simplified Model Migration Schedules

V. Future Research and Applications
I. Measurement and Analysis
RESEARCH OBJECTIVE:

There are age-specific gross migration flows regularities as in fertility and mortality.

Diagram:
- **Migration Rates or Proportion of Migrants at each age**
- Age axis labeled as AGE
I. MEASUREMENT AND ANALYSIS

References

Model Multiregional Life Tables and Stable Populations, Andrei Rogers and Luis J. Castro, RR-76-9 (Laxenburg, Austria, IIASA, first printing May 1976; second printing, February 1981), p. 82.


II. Model Migration Schedules (MMS)
II. MODEL MIGRATION SCHEDULES

RESEARCH OBJECTIVE:

The Migration regularities fit a mathematical function.

Recognizing that most human populations experience rates of age-specific fertility and mortality that exhibit remarkably persistent regularities, it was found possible to summarize and codify migration regularities by means of mathematical expressions called **Model Migration Schedules (MMS)**.
The **full model schedule** has 13 parameters: \( a_1, \alpha_1, a_2, \mu_2, \alpha_2, \lambda_2, a_3, \mu_3, \alpha_3, \lambda_3, \alpha_{14}, \alpha_4, \) and \( c. \)

The profile of the full model schedule is defined by 8 of the 13 parameters: \( \alpha_1, \mu_2, \alpha_2, \lambda_2, \mu_3, \alpha_3, \lambda_3, \alpha_4. \)

Its level is determined by the remaining 5 parameters: \( a_1, a_2, a_3, a_4, \) and \( c. \)

A change in the value of the area under a particular model schedule alters proportionally the values of the latter but does not affect the former.
II. MODEL MIGRATION SCHEDULES

References


II. MODEL MIGRATION SCHEDULES

References


III. What the Age Composition of Migrants can Tell Us
RESEARCH OBJECTIVE:

MMS based on parameters that interpret migration behavior (Family Migration)

Parameters:

- Age at which first migration occurs as independent (head of family)
- Mean age of head family migrants
- Mean age of dependents migrants (children moving with parents)
- Dependency Ratio
- Sex dependency (Women migrating with men)
III. WHAT THE AGE COMPOSITION OF MIGRANTS CAN TELL US

References


IV. Simplified MMS
IV. SIMPLIFIED MMS

RESEARCH OBJECTIVE:
MMS with few parameters representing demographic characteristics of the migrants

PARAMETERS:
- Adult mean age
- Children mean age
- Proportion of children migrants
IV. SIMPLIFIED MMS

References


V. Future Research and Applications
• More Focus on Users in Developing Countries
• Local Population Analysis
• Modeling Migration Dynamics Analysis
  – Gross to Net Migration
  – Net to Gross Migration
  – Urbanization
• International Migration Modeling

V. FUTURE RESEARCH
Age Population Composition of a High Population Growth City
Age Population Composition

PORCENTAJE DE 15 AÑOS Y MÁS

CANCÚN

NACIONAL

0 15 60

AGE
V. FUTURE RESEARCH
MIGRATION PHASES OF A CITY

PHASES OF MIGRATION

I  High Immigration City
II  City in Equilibrium
III High Outmigration City
AGE-SPECIFIC IN-MIGRATION DISTRIBUTION

\[ i(x) = W_i c_i(x) + (1-W_i)a_i(x) \]

where,

\[ i(x) = \frac{l(x)}{IT} \]

\( l(x) \) in-migrants at age \( x \)

\( IT \) Total of in-migrants

\( a_i(x) \) proportion of adult in-migrants at age \( x \)

\( c_i(x) \) proportion of children in-migrants at age \( x \)

\( W_i \) total proportion of children in-migrants.

In similar way the age-specific out-migration distribution:

AGE-SPECIFIC OUT-MIGRATION DISTRIBUTION

\[ e(x) = W_e c_e(x) + (1-W_e)a_e(x) \]

Where \( c_e(x) \), \( a_e(x) \), and \( W_e \) are defined as in the in-migration distribution
In turn, the adult and children functions are defined as follow:

\[ a(x) = \left[ \frac{1}{(ma-23)} \right] \exp - \left[ \frac{(x - 23)}{(ma - 23)} \right] - \exp[-0.2(x - 23)] \]

\[ c(x) = \left( \frac{1}{mc} \right) \exp(-x/mc) \]

Where \( ma \) and \( mc \) are the adult and children mean age of migrants respectively.

AGE-SPECIFIC NET MIGRATION PROFILES

\[ N(x)/K = [ \iota \ i(x) - \varepsilon \ e(x) ] \]

Where \( \iota \) and \( \varepsilon \) are the crude in- and out-migration rates respectively and \( K \) is total population. The crude rates are defined as: \( \iota = IT/K \) and \( \varepsilon = ET/K \)
HIGH IN-MIGRATION FLOW

SMMS PARAMETERS:

In-migration
ma= 30 yrs.
mc= 5 yrs.
W= 30% dependency ratio

Out-migration
ma=35 yrs.
mc=7 yrs.
W= 10%

Crude Rates
\( \iota = 0.15 \) (in-)
\( \epsilon = 0.05 \) (out-)
HIGH OUT-MIGRATION FLOW

SMMS PARAMETERS

**In-migration**
- ma = 35 yrs.
- mc = 7 yrs.
- W = 30% dependency ratio

**Out-migration**
- ma = 30 yrs.
- mc = 5 yrs.
- W = 10%

**Crude Rates**
- \( \mu = 0.05 \) (in-migration)
- \( \varepsilon = 0.15 \) (out-migration)
SIMILAR IN AND OUT MIGRATION FLOWS

SMMS PARAMETERS:

**In-migration**
- $ma = 30$ yrs.
- $mc = 7$ yrs.
- $W = 30\%$ dependency ratio

**Out-migration**
- $ma = 32$ yrs.
- $mc = 5$ yrs.
- $W = 30\%$

**Crude Rates**
- $\tau = 0.15$ (in-migration)
- $\epsilon = 0.15$ (out-migration)
LINEAR METHOD

\[
N(x)/K = [ \imath i(x) - \varepsilon e(x) ]
\]

Multiple Regression or Linear Programming

1. Net migration estimation by age \( N(x) \) by a residual or Cohort-Component method (Dependent Variable)

2. SMMS by age \( i(x) \) \( y \) \( e(x) \) (Independent variables)

Output:

Crude migration rates \( \imath \) \( y \) \( \varepsilon \) (Regression coefficients)
NON LINEAR METHOD

\[ \frac{N(x)}{K} = [1 \ i(x) - \varepsilon \ e(x)] \]

No-linear Parameter Estimation

1. Residual or Cohort-Component Method to obtain net migration by age \( N(x) \)

2. SMMS for \( i(x) \) and \( e(x) \).

Outputs:
- Crude migration rates \( i \) and \( \varepsilon \)

And for in- and out-migration flows:
- Adult mean age
- Children mean age
- Proportion of children migrants
Carnevale, S., 562, 597
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