

# Package ‘CIM’

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**Title** Compositional Impact of Migration

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**Description** Produces statistical indicators of the impact of migration on the socio-demographic composition of an area. Three measures can be used: ratios, percentages and the Duncan index of dissimilarity. The input data files are assumed to be in an origin-destination matrix format, with each cell representing a flow count between an origin and a destination area. Columns are expected to represent origins, and rows are expected to represent destinations. The first row and column are assumed to contain labels for each area. See Rodriguez-Vignoli and Rowe (2018) <doi:10.1080/00324728.2017.1416155> for technical details.

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**Repository** CRAN

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CIM	<i>Compositional Impact of Migration</i>
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### Description

produce statistical indicators of the impact of migration on the socio-demographic composition of an area. Three measures can be used: ratios, percentages and the Duncan index of dissimilarity. The input data files are assumed to be in an origin-destination matrix format, with each cell representing a flow count between an origin and a destination area. Columns are expected to represent origins, and rows are expected to represent destinations. The first row and column are assumed to contain labels for each area. See Rodríguez-Vignoli and Rowe (2018) for technical details.

### Usage

```
CIM(..., calculation, numerator, denominator, DuncanAll = TRUE,
      rest = TRUE)
```

### Arguments

...	2 or more data frames, each containing an origin-destination migration matrix by population attribute (i.e. age, sex, education, ethnicity, etc.). Columns are expected to represent origins, and rows are expected to represent destinations. The first row and column are assumed to contain labels for each area.
calculation	a character, indicating the migration impact indicator selected to measure the socio-demographic composition of an area. Users can type one of three options: "ratio", "percentage" or "duncan".
numerator	a number, indicating the index number of the data frame to be used as the numerator for the calculation. Type 1 to use the first data frame included in the function. Type 2 to use the second data frame included in the function, and so on.
denominator	a number, indicating the index number of the data frame to be used as the denominator for the calculation. Type 1 to use the first data frame included in the function. Type 2 to use the second data frame included in the function, and so on. Note the numerator data frame must differ from the denominator data frame.
DuncanAll,	a logical argument. If calculation = "Duncan", this logical argument must be specified. The Duncan index measures the dissimilarity in the spatial distribution of a chosen group (first data frame in the function) against a reference category as specified by the "DuncanAll" argument. If TRUE, the reference category is the sum of all data frames, except for the first data frame included in the function (i.e. chosen group). If FALSE, a specific data frame must be specified to be the reference group. See Duncan and Duncan (1955) for details on

the Duncan index, and Rodríguez-Vignoli and Rowe (2017a, b) for an empirical application of the CIM using the Duncan index.

`rest`, a logical argument. If `calculation = "Duncan"`, this argument must be specified. It enables a special calculation of the CIM, for a particular area (e.g. the Greater London Metropolitan Area), and the rest of spatial units comprising a country. To correctly compute the CMI, these spatial units need to be amalgamated and included as a single column/row in the matrix - labelled "Rest of the country" (e.g. Rest of the UK). If `TRUE`, the column/row of the "Rest of the country" is considered for the calculation and is excluded from the denominator of the duncan index. If `FALSE`, the "Rest of the country" column/row is included in the denominator, producing the wrong results.

### Value

an object containing:

for the "ratio" and "percentage" calculation options:

`num_results`: a data frame containing nine area-level indicators: the Factual Value (FV), Counterfactual Value (CFV), Compositional Impact of Migration (CIM), Compositional Impact of Migration Percentage Change (CIM\_PC), Diagonal Cell Indicator (DIAG), Compositional Impact of Migration for Inflows (CIM\_I), Compositional Impact of Migration for Outflows (CIM\_O), CIM\_I as a percentage of CMI (CIM\_I\_PC), and CIM\_O as a percentage of CMI (CIM\_O\_PC)

for the "duncan" calculation option:

`duncan_results`: a data frame, containing the Factual Value of the Area-Specific Share (ASFVShare\_cg), and the Counterfactual Value of the Area-Specific Share (ASCFVShare\_cg) for the chosen group; the Factual Value of the Area-Specific Share (ASFVShare\_ref) and the Counterfactual Value of the Area-Specific Share (ASCFVShare\_ref) for the reference group; the Area-Specific Share Factual Value Difference between the ASFVShare\_cg and ASFVShare\_ref (ASShareFV\_diff); and the Area-Specific Share Counterfactual Value Difference between the ASCFVShare\_cg and ASCFVShare\_ref (ASShareCFV\_diff). The chosen group corresponds to the first data frame in the function. See above the argument "DuncanAll" to specify the reference category.

`duncan_index`: a numeric value, indicating the Duncan Index of dissimilarity for the chosen group.

### References

- Duncan, O.D. and Duncan, B., 1955. A methodological analysis of segregation indexes. *American sociological review*, 20(2), pp.210-217.
- Rodríguez-Vignoli, J.R. and Rowe, F., 2017a. ¿Contribuye la migración interna a reducir la segregación residencial?: el caso de Santiago de Chile 1977-2002. *Revista Latinoamericana de Población*, (21), pp.7-46.
- Rodríguez-Vignoli, J.R. and Rowe, F., 2017b. The Changing Impacts of Internal Migration on Residential Socio-Economic Segregation in the Greater Santiago. 28th International Population Conference of the International Union for the Scientific Study of Population (IUSSP), Cape Town, South Africa.
- Rodríguez-Vignoli, J. and Rowe, F., 2018. How is internal migration reshaping metropolitan populations in Latin America? A new method and new evidence. *Population studies*, 72(2), pp.253-273. doi.org/10.1080/00324728.2017.1416155

**Examples**

```

## Read in the two data.frames included in the package
m <- male
f <- female

## Run the function using "ratio" calculation
CIM.ratio <- CIM(m, f, calculation = "ratio", numerator = 1, denominator = 2)
## Print the resulted data.frame
CIM.ratio

## Run the function using "percentage" calculation
CIM.percentage <- CIM(m, f, calculation = "percentage", numerator = 1, denominator = 2)
## See the resulted data.frame
CIM.percentage

## For the Duncan index, we compute impact of internal migration on the spatial pattern of
## residential age segregation of people age 65 and over in the
## local authority districts of Greater London using 2011 census data.
## Chosen group: people aged 65 and over.
## Reference category: the rest of age groups.
## For this example, this group is people aged pop1-14, 15-29, 30-14 and 45-64).
CIM.duncan <- CIM(pop65over, pop1_14, pop15_29, pop30_44, pop45_64,
  calculation = "duncan", numerator = 1, DuncanAll= TRUE)
CIM.duncan$duncan_results
CIM.duncan$duncan_index

```

---

female

*OD matrix, female, 2008-2013.*


---

**Description**

4x4 origin-destination migration data matrix, female, 2008-2013, Chile.

**Usage**

```
female
```

**Format**

A data frame of 4 rows by 4 columns containing a 3x3 origin-destination migration data matrix for females, including counts for the non-migrant population in the diagonal. The first row and column correspond to the area names. Rows correspond to destinations and columns represent origins.

**Greater.Santiago** Population, female

**Rest.of.the.Metropolitan.region** Population, female

**Rest.of.the.country** Population, female

**Source**

<https://www.tandfonline.com/doi/suppl/10.1080/00324728.2017.1416155?scroll=top>

---

male

*OD matrix, male, 2008-2013.*

---

**Description**

4x4 origin-destination migration data matrix, male, 2008-2013, Chile.

**Usage**

male

**Format**

A data frame of 4 rows by 4 columns containing a 3x3 origin-destination migration data matrix for males, including counts for the non-migrant population in the diagonal. The first row and column correspond to the area names. Rows correspond to destinations and columns represent origins.

**Greater.Santiago** Population, male

**Rest.of.the.Metropolitan.region** Population, male

**Rest.of.the.country** Population, male

**Source**

<https://www.tandfonline.com/doi/suppl/10.1080/00324728.2017.1416155?scroll=top>

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pop15\_29

*OD matrix, people aged 15-29, 2010-2011.*

---

**Description**

34x34 origin-destination migration data matrix, population aged 15-29, 2010-2011, UK.

**Usage**

pop15\_29

**Format**

A data frame of 34 rows by 34 columns containing a 33x33 origin-destination migration data matrix for people aged 15-29, including counts for the non-migrant population in the diagonal. The first row and column correspond to the area names. Rows correspond to destinations and columns represent origins.

**Barking and Dagenham** Population, aged 15 to 29  
**Barnet** Population, aged 15 to 29  
**Bexley** Population, aged 15 to 29  
**Brent** Population, aged 15 to 29  
**Bromley** Population, aged 15 to 29  
**Camden** Population, aged 15 to 29  
**Croydon** Population, aged 15 to 29  
**Ealing** Population, aged 15 to 29  
**Enfield** Population, aged 15 to 29  
**Greenwich** Population, aged 15 to 29  
**Hackney** Population, aged 15 to 29  
**Hammersmith and Fulham** Population, aged 15 to 29  
**Haringey** Population, aged 15 to 29  
**Harrow** Population, aged 15 to 29  
**Havering** Population, aged 15 to 29  
**Hillingdon** Population, aged 15 to 29  
**Hounslow** Population, aged 15 to 29  
**Islington** Population, aged 15 to 29  
**Kensington and Chelsea** Population, aged 15 to 29  
**Kingston upon Thames** Population, aged 15 to 29  
**Lambeth** Population, aged 15 to 29  
**Lewisham** Population, aged 15 to 29  
**Merton** Population, aged 15 to 29  
**Newham** Population, aged 15 to 29  
**Redbridge** Population, aged 15 to 29  
**Richmond upon Thames** Population, aged 15 to 29  
**Southwark** Population, aged 15 to 29  
**Sutton** Population, aged 15 to 29  
**Tower Hamlets** Population, aged 15 to 29  
**Waltham Forest** Population, aged 15 to 29  
**Wandsworth** Population, aged 15 to 29  
**City of London-Westminster** Population, aged 15 to 29  
**Rest of the UK** Population, aged 15 to 29

**Source**

2011 Census for England and Wales

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pop1\_14

*OD matrix, people aged 1-14, 2010-2011.*

---

### Description

34x34 origin-destination migration data matrix, population aged 1-14, 2010-2011, UK.

### Usage

pop1\_14

### Format

A data frame of 34 rows by 34 columns containing a 33x33 origin-destination migration data matrix for people aged 1-14, including counts for the non-migrant population in the diagonal. The first row and column correspond to the area names. Rows correspond to destinations and columns represent origins.

**Barking and Dagenham** Population, aged 1 to 14  
**Barnet** Population, aged 1 to 14  
**Bexley** Population, aged 1 to 14  
**Brent** Population, aged 1 to 14  
**Bromley** Population, aged 1 to 14  
**Camden** Population, aged 1 to 14  
**Croydon** Population, aged 1 to 14  
**Ealing** Population, aged 1 to 14  
**Enfield** Population, aged 1 to 14  
**Greenwich** Population, aged 1 to 14  
**Hackney** Population, aged 1 to 14  
**Hammersmith and Fulham** Population, aged 1 to 14  
**Haringey** Population, aged 1 to 14  
**Harrow** Population, aged 1 to 14  
**Havering** Population, aged 1 to 14  
**Hillingdon** Population, aged 1 to 14  
**Hounslow** Population, aged 1 to 14  
**Islington** Population, aged 1 to 14  
**Kensington and Chelsea** Population, aged 1 to 14  
**Kingston upon Thames** Population, aged 1 to 14  
**Lambeth** Population, aged 1 to 14  
**Lewisham** Population, aged 1 to 14

**Merton** Population, aged 1 to 14  
**Newham** Population, aged 1 to 14  
**Redbridge** Population, aged 1 to 14  
**Richmond upon Thames** Population, aged 1 to 14  
**Southwark** Population, aged 1 to 14  
**Sutton** Population, aged 1 to 14  
**Tower Hamlets** Population, aged 1 to 14  
**Waltham Forest** Population, aged 1 to 14  
**Wandsworth** Population, aged 1 to 14  
**City of London-Westminster** Population, aged 1 to 14  
**Rest of the UK** Population, aged 1 to 14

### Source

2011 Census for England and Wales

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pop30\_44

*OD matrix, people aged 30-34, 2010-2011.*

---

### Description

34x34 origin-destination migration data matrix, population aged 30-34, 2010-2011, UK.

### Usage

pop30\_44

### Format

A data frame of 34 rows by 34 columns containing a 33x33 origin-destination migration data matrix for people aged 30-34, including counts for the non-migrant population in the diagonal. The first row and column correspond to the area names. Rows correspond to destinations and columns represent origins.

**Barking and Dagenham** Population, aged 30 to 44  
**Barnet** Population, aged 30 to 44  
**Bexley** Population, aged 30 to 44  
**Brent** Population, aged 30 to 44  
**Bromley** Population, aged 30 to 44  
**Camden** Population, aged 30 to 44  
**Croydon** Population, aged 30 to 44  
**Ealing** Population, aged 30 to 44



**Enfield** Population, aged 30 to 44  
**Greenwich** Population, aged 30 to 44  
**Hackney** Population, aged 30 to 44  
**Hammersmith and Fulham** Population, aged 30 to 44  
**Haringey** Population, aged 30 to 44  
**Harrow** Population, aged 30 to 44  
**Havering** Population, aged 30 to 44  
**Hillingdon** Population, aged 30 to 44  
**Hounslow** Population, aged 30 to 44  
**Islington** Population, aged 30 to 44  
**Kensington and Chelsea** Population, aged 30 to 44  
**Kingston upon Thames** Population, aged 30 to 44  
**Lambeth** Population, aged 30 to 44  
**Lewisham** Population, aged 30 to 44  
**Merton** Population, aged 30 to 44  
**Newham** Population, aged 30 to 44  
**Redbridge** Population, aged 30 to 44  
**Richmond upon Thames** Population, aged 30 to 44  
**Southwark** Population, aged 30 to 44  
**Sutton** Population, aged 30 to 44  
**Tower Hamlets** Population, aged 30 to 44  
**Waltham Forest** Population, aged 30 to 44  
**Wandsworth** Population, aged 30 to 44  
**City of London-Westminster** Population, aged 30 to 44  
**Rest of the UK** Population, aged 30 to 44

**Source**

2011 Census for England and Wales

---

pop45\_64

*OD matrix, people aged 45-64, 2010-2011.*

---

### Description

34x34 origin-destination migration data matrix, population aged 45-64, 2010-2011, UK.

### Usage

pop45\_64

### Format

A data frame of 34 rows by 34 columns containing a 33x33 origin-destination migration data matrix for people aged 45-64, including counts for the non-migrant population in the diagonal. The first row and column correspond to the area names. Rows correspond to destinations and columns represent origins.

**Barking and Dagenham** Population, aged 45 to 64

**Barnet** Population, aged 45 to 64

**Bexley** Population, aged 45 to 64

**Brent** Population, aged 45 to 64

**Bromley** Population, aged 45 to 64

**Camden** Population, aged 45 to 64

**Croydon** Population, aged 45 to 64

**Ealing** Population, aged 45 to 64

**Enfield** Population, aged 45 to 64

**Greenwich** Population, aged 45 to 64

**Hackney** Population, aged 45 to 64

**Hammersmith and Fulham** Population, aged 45 to 64

**Haringey** Population, aged 45 to 64

**Harrow** Population, aged 45 to 64

**Havering** Population, aged 45 to 64

**Hillingdon** Population, aged 45 to 64

**Hounslow** Population, aged 45 to 64

**Islington** Population, aged 45 to 64

**Kensington and Chelsea** Population, aged 45 to 64

**Kingston upon Thames** Population, aged 45 to 64

**Lambeth** Population, aged 45 to 64

**Lewisham** Population, aged 45 to 64

**Merton** Population, aged 45 to 64  
**Newham** Population, aged 45 to 64  
**Redbridge** Population, aged 45 to 64  
**Richmond upon Thames** Population, aged 45 to 64  
**Southwark** Population, aged 45 to 64  
**Sutton** Population, aged 45 to 64  
**Tower Hamlets** Population, aged 45 to 64  
**Waltham Forest** Population, aged 45 to 64  
**Wandsworth** Population, aged 45 to 64  
**City of London-Westminster** Population, aged 45 to 64  
**Rest of the UK** Population, aged 45 to 64

### Source

2011 Census for England and Wales

---

pop65over

*OD matrix, people aged 65+, 2010-2011.*

---

### Description

34x34 origin-destination migration data matrix, population aged 65+, 2010-2011, UK..

### Usage

pop65over

### Format

A data frame of 34 rows by 34 columns containing a 33x33 origin-destination migration data matrix for people aged 65+, including counts for the non-migrant population in the diagonal. The first row and column correspond to the area names. Rows correspond to destinations and columns represent origins.

**Barking and Dagenham** Population, aged 65 plus  
**Barnet** Population, aged 65 plus  
**Bexley** Population, aged 65 plus  
**Brent** Population, aged 65 plus  
**Bromley** Population, aged 65 plus  
**Camden** Population, aged 65 plus  
**Croydon** Population, aged 65 plus  
**Ealing** Population, aged 65 plus

**Enfield** Population, aged 65 plus  
**Greenwich** Population, aged 65 plus  
**Hackney** Population, aged 65 plus  
**Hammersmith and Fulham** Population, aged 65 plus  
**Haringey** Population, aged 65 plus  
**Harrow** Population, aged 65 plus  
**Havering** Population, aged 65 plus  
**Hillingdon** Population, aged 65 plus  
**Hounslow** Population, aged 65 plus  
**Islington** Population, aged 65 plus  
**Kensington and Chelsea** Population, aged 65 plus  
**Kingston upon Thames** Population, aged 65 plus  
**Lambeth** Population, aged 65 plus  
**Lewisham** Population, aged 65 plus  
**Merton** Population, aged 65 plus  
**Newham** Population, aged 65 plus  
**Redbridge** Population, aged 65 plus  
**Richmond upon Thames** Population, aged 65 plus  
**Southwark** Population, aged 65 plus  
**Sutton** Population, aged 65 plus  
**Tower Hamlets** Population, aged 65 plus  
**Waltham Forest** Population, aged 65 plus  
**Wandsworth** Population, aged 65 plus  
**City of London-Westminster** Population, aged 65 plus  
**Rest of the UK** Population, aged 65 plus

**Source**

2011 Census, England and Wales

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