

# Package ‘migration.indices’

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**License** AGPL-3

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**Description** This package provides various indices, like Crude Migration Rate, different Gini indices or the Coefficient of Variation among others, to show the (un)equality of migration.

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## R topics documented:

migration.acv . . . . .	2
migration.acv.in . . . . .	3
migration.acv.out . . . . .	4
migration.cmr . . . . .	4
migration.connectivity . . . . .	5

migration.cv.in . . . . .	6
migration.cv.out . . . . .	7
migration.effectiveness . . . . .	8
migration.field.diagram . . . . .	9
migration.gini . . . . .	10
migration.gini.col . . . . .	11
migration.gini.col.standardized . . . . .	12
migration.gini.exchange . . . . .	13
migration.gini.exchange.standardized . . . . .	14
migration.gini.in . . . . .	15
migration.gini.out . . . . .	16
migration.gini.row . . . . .	17
migration.gini.row.standardized . . . . .	18
migration.gini.total . . . . .	19
migration.hyp . . . . .	20
migration.indices . . . . .	20
migration.inequality . . . . .	21
migration.weighted.gini.in . . . . .	22
migration.weighted.gini.mean . . . . .	23
migration.weighted.gini.out . . . . .	24
migration.world . . . . .	25

**Index** **26**

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migration.acv	<i>Aggregated System-wide Coefficient of Variation</i>
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**Description**

The Aggregated System-wide Coefficient of Variation is simply the sum of the Aggregated In-migration ([migration.acv.in](#)) and the Aggregated Out-migration Coefficient of Variation ([migration.acv.out](#)).

**Usage**

migration.acv(m)

**Arguments**

m	migration matrix
---	------------------

**Value**

A number where a higher ( $\neq 0$ ) shows more spatial focus.

**References**

- Andrei Rogers and Stuart Sweeney (1998) Measuring the Spatial Focus of Migration Patterns. *The Professional Geographer* **50**, 232–242

**See Also**

[migration.cv.in](#) [migration.cv.out](#) [migration.acv.in](#) [migration.acv.out](#)

**Examples**

```
data(migration.hyp)
migration.acv(migration.hyp) # 0.3333333
migration.acv(migration.hyp2) # 0.375
```

---

migration.acv.in	<i>Aggregated In-migration Coefficient of Variation</i>
------------------	---

---

**Description**

The Aggregated In-migration Coefficient of Variation is the weighted average of the In-migration Coefficient of Variation ([migration.cv.in](#)).

**Usage**

```
migration.acv.in(m)
```

**Arguments**

m	migration matrix
---	------------------

**Value**

A number where a higher ( $\neq 0$ ) shows more spatial focus.

**References**

- Andrei Rogers and Stuart Sweeney (1998) Measuring the Spatial Focus of Migration Patterns. *The Professional Geographer* **50**, 232–242

**See Also**

[migration.cv.in](#) [migration.cv.out](#) [migration.acv.out](#) [migration.acv](#)

**Examples**

```
data(migration.hyp)
migration.acv.in(migration.hyp) # 0.3333333
migration.acv.in(migration.hyp2) # 0.25
```

---

migration.acv.out      *Aggregated Out-migration Coefficient of Variation*

---

### Description

The Aggregated Out-migration Coefficient of Variation is the weighted average of the Out-migration Coefficient of Variation ([migration.cv.out](#)).

### Usage

```
migration.acv.out(m)
```

### Arguments

m                      migration matrix

### Value

A number where a higher ( $\neq 0$ ) shows more spatial focus.

### References

- Andrei Rogers and Stuart Sweeney (1998) Measuring the Spatial Focus of Migration Patterns. *The Professional Geographer* **50**, 232–242

### See Also

[migration.cv.in](#) [migration.cv.out](#) [migration.acv.in](#) [migration.acv](#)

### Examples

```
data(migration.hyp)
migration.acv.out(migration.hyp)    # 0
migration.acv.out(migration.hyp2)   # 0.125
```

---

migration.cmr              *Crude Migration Rate*

---

### Description

Crude Migration Rate

### Usage

```
migration.cmr(m, PAR, k = 100)
```

**Arguments**

m	migration matrix
PAR	population at risk (estimated average population size)
k	scaling constant (set to 100 by default to result in percentage)

**Value**

percentage (when k=100)

**References**

- Philip Rees, Martin Bell, Oliver Duke-Williams and Marcus Blake (2000) Problems and Solutions in the Measurement of Migration Intensities: Australia and Britain Compared. *Population Studies* **54**, 207–222

**Examples**

```
data(migration.world)
migration.cmr(migration.world, 6e+9)
```

---

```
migration.connectivity
```

*Migration Connectivity Index*

---

**Description**

The Migration Connectivity Index measures "the proportion of the total number of potential inter-regional flows which are not zero":

$$I_{MC} = \sum_i \sum_{j \neq i} \frac{MC_{ij}}{n(n-1)}$$

where  $MC_{ij}$  is 0 if the flow from  $i$  to  $j$  is zero and let it be 1 otherwise.

**Usage**

```
migration.connectivity(m)
```

**Arguments**

m	migration matrix
---	------------------

**Value**

A number between 0 and 1 where zero shows no connections between regions.

## References

- M. Bell, 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 (Statistics in Society)* **165**, 435–464

## Examples

```
data(migration.hyp)
migration.connectivity(migration.hyp)
data(migration.world)
migration.connectivity(migration.world)
```

---

migration.cv.in	<i>In-migration Coefficient of Variation</i>
-----------------	--

---

## Description

As "the coefficient of variation is defined as the standard deviation to mean ratio of a distribution", the In-migration Coefficient of Variation is computed by dividing the standard deviation (with the nominator being  $n$  instead of  $n - 1$ ) of the in-migration flows by the mean.

## Usage

```
migration.cv.in(m)
```

## Arguments

`m` migration matrix

## Value

A numeric vector of standardized values where a higher ( $\neq 0$ ) shows more spatial focus.

## References

- Andrei Rogers and Stuart Sweeney (1998) Measuring the Spatial Focus of Migration Patterns. *The Professional Geographer* **50**, 232–242

## See Also

[migration.cv.out](#) [migration.acv.in](#) [migration.acv.out](#) [migration.acv](#)

## Examples

```
## Not run:
data(migration.hyp)
migration.cv.in(migration.hyp) # 0.2000000 0.5000000 0.3333333
migration.cv.in(migration.hyp2) # 0.2000000 0.0000000 0.4285714

## End(Not run)
```

---

migration.cv.out	<i>Out-migration Coefficient of Variation</i>
------------------	---

---

### Description

As "the coefficient of variation is defined as the standard deviation to mean ratio of a distribution", the Out-migration Coefficient of Variation is computed by dividing the standard deviation (with the nominator being  $n$  instead of  $n - 1$ ) of the out-migration flows by the mean.

### Usage

```
migration.cv.out(m)
```

### Arguments

m	migration matrix
---	------------------

### Value

A numeric vector of standardized values where a higher ( $\neq 0$ ) shows more spatial focus.

### References

- Andrei Rogers and Stuart Sweeney (1998) Measuring the Spatial Focus of Migration Patterns. *The Professional Geographer* **50**, 232–242

### See Also

[migration.cv.in](#) [migration.acv.in](#) [migration.acv.out](#) [migration.acv](#)

### Examples

```
## Not run:  
data(migration.hyp)  
migration.cv.out(migration.hyp) # 0 0 0  
migration.cv.out(migration.hyp2) # 0.00 0.25 0.00  
  
## End(Not run)
```

---

migration.effectiveness

*Migration Effectiveness Index*

---

### Description

The Migration Effectiveness Index "measures the degree of (a)symmetry or (dis)equilibrium in the network of interregional migration flows":

$$MEI = 100 \frac{\sum_i |D_i - O_i|}{\sum_i |D_i + O_i|}$$

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

### Usage

migration.effectiveness(m)

### Arguments

m migration matrix

### Value

A number between 0 and 100 where the higher number shows an efficient mechanism of population redistribution.

### References

- Martin Bell and Salut Muhidin (2009) Cross-National Comparisons of Internal Migration. Research Paper. UNDP. [http://hdr.undp.org/en/reports/global/hdr2009/papers/HDRP\\_2009\\_30.pdf](http://hdr.undp.org/en/reports/global/hdr2009/papers/HDRP_2009_30.pdf)

### Examples

```
data(migration.hyp)
migration.effectiveness(migration.hyp)
data(migration.world)
migration.effectiveness(migration.world)
```



---

`migration.field.diagram`*Joint plot for in and out-migration fields*

---

### Description

This migration field diagram makes easy to visualize both direction of migration. E.g. points above the diagonal "are outward redistributors, while those below that line are inward redistributors."

### Usage

```
migration.field.diagram(m, method = c("gini", "acv"),
  title = "Migration field diagram",
  xlab = "Out-migration", ylab = "In-migration")
```

### Arguments

<code>m</code>	migration matrix
<code>method</code>	measurement of in and out-migration
<code>title</code>	plot title
<code>xlab</code>	label for x axis
<code>ylab</code>	label for y axis

### References

- Source code was adopted from Michael Ward and Kristian Skrede Gleditsch (2008) *Spatial Regression Models*. Thousand Oaks, CA: Sage. [http://privatwww.essex.ac.uk/~ksg/code/srm\\_enhanced\\_code\\_v5.R](http://privatwww.essex.ac.uk/~ksg/code/srm_enhanced_code_v5.R) with the permission of the authors.
- Case study and use case: Andrei Rogers and Stuart Sweeney (1998) Measuring the Spatial Focus of Migration Patterns. *The Professional Geographer* **50**, 232–242

### Examples

```
## Not run:
data(migration.world)
par(mfrow = c(2, 1))
migration.field.diagram(migration.world)
migration.field.diagram(migration.world, method = 'acv')

## End(Not run)
```

migration.gini

*Spatial Gini Indexes***Description**

This is a wrapper function computing all the following Gini indices:

- Total Flows Gini Index ([migration.gini.total](#))
- Rows Gini Index ([migration.gini.row](#))
- Standardized Rows Gini Index ([migration.gini.row.standardized](#))
- Columns Gini Index ([migration.gini.col](#))
- Standardized Columns Gini Index ([migration.gini.col.standardized](#))
- Exchange Gini Index ([migration.gini.exchange](#))
- Standardized Exchange Gini Index ([migration.gini.exchange.standardized](#))
- Out-migration Field Gini Index ([migration.gini.out](#))
- Migration-weighted Out-migration Gini Index ([migration.weighted.gini.out](#))
- In-migration Field Gini Index ([migration.gini.in](#))
- Migration-weighted In-migration Gini Index ([migration.weighted.gini.in](#))
- Migration-weighted Mean Gini Index ([migration.weighted.gini.mean](#))

**Usage**

```
migration.gini(m, corrected = TRUE)
```

**Arguments**

m	migration matrix
corrected	to use Bell et al. (2002) updated formulas instead of Plane and Mulligan (1997)

**Value**

List of all Gini indices.

**References**

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262
- M. Bell, 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 (Statistics in Society)* **165**, 435–464

**See Also**

[migration.gini.col](#) [migration.gini.row](#) [migration.gini.exchange](#) [migration.gini.in](#) [migration.gini.out](#)

**Examples**

```
data(migration.hyp)
migration.gini(migration.hyp)
migration.gini(migration.hyp2)
```

---

migration.gini.col      *Columns Gini Index*

---

**Description**

The Columns Gini index concentrates on the "relative extent to which the destination selections of in-migrations are spatially focused":

$$G_R^T = \frac{\sum_j \sum_{i \neq j} \sum_{g \neq i, j} |M_{ij} - M_{gj}|}{(2n(n-1) - 1) \sum_i \sum_{j \neq i} M_{ij}}$$

This implementation solves the above formula by computing the `dist` matrix for each columns.

**Usage**

```
migration.gini.col(m)
```

**Arguments**

`m`                      migration matrix

**Value**

A number between 0 and 1 where 0 means no spatial focusing and 1 shows maximum focusing.

**References**

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262

**See Also**

[migration.gini.row](#) [migration.gini.col.standardized](#)

**Examples**

```
data(migration.hyp)
migration.gini.col(migration.hyp) # 0.0555556
migration.gini.col(migration.hyp2) # 0.0416667
```

---

migration.gini.col.standardized  
*Standardized Columns Gini Index*

---

### Description

The standardized version of the Columns Gini Index ([migration.gini.col](#)) by dividing that with the Total Flows Gini Index ([migration.gini.total](#)):

$$G_C^{T*} = 100 \frac{G_C^T}{G^T}$$

As this index is standardized, it "facilitate comparisons from one period to the next" of the columns indices.

### Usage

```
migration.gini.col.standardized(m,
  gini.total = migration.gini.total(m, FALSE))
```

### Arguments

m	migration matrix
gini.total	optionally pass the pre-computed Total Flows Gini Index to save computational resources

### Value

A percentage range from 0% to 100% where 0% means that the migration flows are uniform, while a higher value indicates spatial focusing.

### References

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262

### See Also

[migration.gini.col](#) [migration.gini.row.standardized](#)

### Examples

```
data(migration.hyp)
migration.gini.col.standardized(migration.hyp) # 25
migration.gini.col.standardized(migration.hyp2) # 22.22222
```

---

 migration.gini.exchange

*Exchange Gini Index*


---

### Description

The Exchange Gini Index "indicates the contribution to spatial focusing represented by the  $n(n-q)$  net interchanges in the system":

$$G_{RC,CR}^T = \frac{\sum_i \sum_{j \neq i} |M_{ij} - M_{ji}|}{(2n(n-1) - 1) \sum_i \sum_{j \neq i} M_{ij}}$$

This implementation solves the above formula by simply subtracting the transposed matrix's values from the original one at one go.

### Usage

```
migration.gini.exchange(m)
```

### Arguments

m migration matrix

### Value

A number between 0 and 1 where 0 means no spatial focusing and 1 shows maximum focusing.

### References

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262

### See Also

[migration.gini](#) [migration.gini.exchange.standardized](#)

### Examples

```
data(migration.hyp)
migration.gini.exchange(migration.hyp) # 0.05555556
migration.gini.exchange(migration.hyp2) # 0.04166667
```

---

migration.gini.exchange.standardized  
*Standardized Exchange Gini Index*

---

### Description

The standardized version of the Exchange Gini Index ([migration.gini.exchange](#)) by dividing that with the Total Flows Gini Index ([migration.gini.total](#)):

$$G_{RC,CR}^{T*} = 100 \frac{G_{RC,CR}^T}{G^T}$$

As this index is standardized, it "facilitate comparisons from one period to the next" of the exchange indices.

### Usage

```
migration.gini.exchange.standardized(m,
  gini.total = migration.gini.total(m, FALSE))
```

### Arguments

m	migration matrix
gini.total	optionally pass the pre-computed Total Flows Gini Index to save resources

### Value

A percentage range from 0% to 100% where 0% means that the migration flows are uniform, while a higher value indicates spatial focusing.

### References

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262

### See Also

[migration.gini](#) [migration.gini.exchange](#)

### Examples

```
data(migration.hyp)
migration.gini.exchange.standardized(migration.hyp) # 25
migration.gini.exchange.standardized(migration.hyp2) # 22.22222
```

---

migration.gini.in      *In-migration Field Gini Index*

---

## Description

The In-migration Field Gini Index is a decomposed version of the Columns Gini Index ([migration.gini.col](#)) representing "the contribution of each region's columns to the total index" () ([migration.gini.total](#)):

$$G_j^I = \frac{\sum_{i \neq j} \sum_{k \neq j, i} |M_{ij} - M_{kj}|}{2(n-2) \sum_{i \neq j} M_{ij}}$$

These Gini indices facilitates the direct comparison of different territories without further standardization.

## Usage

```
migration.gini.in(m, corrected = TRUE)
```

## Arguments

m	migration matrix
corrected	Bell et al. (2002) updated the formula of Plane and Mulligan (1997) to be $2(n-2)$ instead of $2(n-1)$ because "the number of comparisons should exclude the diagonal cell in each row and column, and the comparison of each cell with itself".

## Value

A numeric vector with the range of 0 to 1 where 0 means no spatial focusing and 1 shows maximum focusing.

## References

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262
- M. Bell, 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 (Statistics in Society)* **165**, 435–464

## See Also

[migration.gini](#) [migration.gini.out](#) [migration.weighted.gini.in](#)

## Examples

```
data(migration.hyp)
migration.gini.in(migration.hyp)      # 0.2000000 0.5000000 0.3333333
migration.gini.in(migration.hyp2)    # 0.2000000 0.0000000 0.4285714
migration.gini.in(migration.hyp, FALSE) # 0.1000000 0.2500000 0.1666667
migration.gini.in(migration.hyp2, FALSE) # 0.1000000 0.0000000 0.2142857
```

---

migration.gini.out      *Out-migration Field Gini Index*

---

## Description

The Out-migration Field Gini Index is a decomposed version of the Rows Gini Index (`migration.gini.row`) representing "the contribution of each region's row to the total index" () (`migration.gini.total`):

$$G_i^O = \frac{\sum_{j \neq i} \sum_{l \neq i, j} |M_{ij} - M_{il}|}{2(n-2) \sum_{j \neq k} M_{ij}}$$

These Gini indices facilitates the direct comparison of different territories without further standardization.

## Usage

```
migration.gini.out(m, corrected = TRUE)
```

## Arguments

m	migration matrix
corrected	Bell et al. (2002) updated the formula of Plane and Mulligan (1997) to be $2(n-2)$ instead of $2(n-1)$ because "the number of comparisons should exclude the diagonal cell in each row and column, and the comparison of each cell with itself".

## Value

A numeric vector with the range of 0 to 1 where 0 means no spatial focusing and 1 shows maximum focusing.

## References

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262
- M. Bell, 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 (Statistics in Society)* **165**, 435–464



**See Also**

[migration.gini](#) [migration.gini.in](#) [migration.weighted.gini.out](#)

**Examples**

```
data(migration.hyp)
migration.gini.out(migration.hyp)      # 0 0 0
migration.gini.out(migration.hyp2)    # 0.000 0.25 0.000
migration.gini.out(migration.hyp, FALSE) # 0 0 0
migration.gini.out(migration.hyp2, FALSE) # 0.000 0.125 0.000
```

---

migration.gini.row      *Rows Gini Index*

---

**Description**

The Rows Gini index concentrates on the "relative extent to which the destination selections of out-migrations are spatially focused":

$$G_R^T = \frac{\sum_i \sum_{j \neq i} \sum_{h \neq i, j} |M_{ij} - M_{ih}|}{(2n(n-1) - 1) \sum_i \sum_{j \neq i} M_{ij}}$$

This implementation solves the above formula by computing the dist matrix for each row.

**Usage**

```
migration.gini.row(m)
```

**Arguments**

m                      migration matrix

**Value**

A number between 0 and 1 where 0 means no spatial focusing and 1 shows maximum focusing.

**References**

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262

**See Also**

[migration.gini.col](#) [migration.gini.row.standardized](#)

**Examples**

```
data(migration.hyp)
migration.gini.row(migration.hyp) # 0
migration.gini.row(migration.hyp2) # 0.02083333
```

---

migration.gini.row.standardized  
*Standardized Rows Gini Index*

---

### Description

The standardized version of the Rows Gini Index ([migration.gini.row](#)) by dividing that with the Total Flows Gini Index ([migration.gini.total](#)):

$$G_R^{T*} = 100 \frac{G_R^T}{G^T}$$

As this index is standardized, it "facilitate comparisons from one period to the next of the rows" indices.

### Usage

```
migration.gini.row.standardized(m,
  gini.total = migration.gini.total(m, FALSE))
```

### Arguments

m	migration matrix
gini.total	optionally pass the pre-computed Total Flows Gini Index to save computational resources

### Value

A percentage range from 0% to 100% where 0% means that the migration flows are uniform, while a higher value indicates spatial focusing.

### References

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262

### See Also

[migration.gini.row](#) [migration.gini.col.standardized](#)

### Examples

```
data(migration.hyp)
migration.gini.row.standardized(migration.hyp) # 0
migration.gini.row.standardized(migration.hyp2) # 11.11111
```

---

migration.gini.total *Total Flows Gini Index*

---

## Description

The Total Gini Index shows the overall concentration of migration with a simple number computed by comparing each cell of the migration matrix with every other cell except for the diagonal:

$$G^T = \frac{\sum_i \sum_{j \neq i} \sum_k \sum_{l \neq k} |M_{ij} - M_{kl}|}{(2n(n-1) - 1) \sum_i \sum_{j \neq i} M_{ij}}$$

This implementation solves the above formula by a simple loop for performance issues to compare all values to the others at one go, although smaller migration matrices could also be addressed by a much faster `dist` method. Please see the sources for more details.

## Usage

```
migration.gini.total(m, corrected = TRUE)
```

## Arguments

<code>m</code>	migration matrix
<code>corrected</code>	Bell et al. (2002) updated the formula of Plane and Mulligan (1997) to have $2n(n-1) - 1$ instead of $2n(n-1)$ in the denominator to "ensure that the index can assume the upper limit of 1".

## Value

A number between 0 and 1 where 0 means no spatial focusing and 1 shows that all migrants are found in one single flow.

## References

- David A. Plane and Gordon F. Mulligan (1997) Measuring Spatial Focusing in a Migration System. *Demography* **34**, 251–262
- M. Bell, 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 (Statistics in Society)* **165**, 435–464

## See Also

[migration.gini.col](#) [migration.gini.row](#) [migration.gini.exchange](#) [migration.gini.in](#) [migration.gini.out](#)

**Examples**

```

data(migration.hyp)
migration.gini.total(migration.hyp)      # 0.2666667
migration.gini.total(migration.hyp2)    # 0.225
migration.gini.total(migration.hyp, FALSE) # 0.2222222
migration.gini.total(migration.hyp2, FALSE) # 0.1875

```

---

migration.hyp	<i>Hypotetical Migration Matrix</i>
---------------	-------------------------------------

---

**Description**

A small (3x3) hypotetical migration matrix.

**Format**

migration matrix

**References**

- David A. Plane and Gordon F. Mulligan (1997): Measuring Spatial Focusing in a Migration System. *Demography* **34**, pp. 253
- Andrei Rogers and Stuart Sweeney (1998) Measuring the Spatial Focus of Migration Patterns. *The Professional Geographer* **50**, 232–242

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migration.indices	Migration indices
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**Description**

This package provides various indices, like Crude Migration Rate, different Gini indices or the Coefficient of Variation among others, to show the (un)equality of migration.

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migration.inequality *Migration Inequality Index*

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## Description

Measures the distance from an expected distribution:

$$IMI = \frac{\sum_i \sum_{j \neq i} |M_{ij} - M'_{ij}|}{2}$$

## Usage

```
migration.inequality(m,  
  expected = c("equal", "weighted"))
```

## Arguments

m	migration matrix
expected	type of expected distribution

## Value

A number between 0 and 1 where 1 shows greater inequality.

## References

- M. Bell, 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 (Statistics in Society)* **165**, 435–464

## Examples

```
data(migration.hyp)  
migration.inequality(migration.hyp)  
migration.inequality(migration.hyp, expected = 'weighted')  
data(migration.world)  
migration.inequality(migration.world)
```

---

 migration.weighted.gini.in

*Migration-weighted In-migration Gini Index*


---

### Description

The Migration-weighted In-migration Gini Index is a weighted version of the In-migration Field Gini Index ([migration.gini.in](#)) "according to the zone of destination's share of total migration and the mean of the weighted values is computed as":

$$MWGI = \frac{\sum_j G_j^I \frac{\sum_j M_{ij}}{\sum_{ij} M_{ij}}}{n}$$

### Usage

```
migration.weighted.gini.in(m, mgi = migration.gini.in(m))
```

### Arguments

m	migration matrix
mgi	optionally passed (precomputed) Migration In-migration Gini Index

### References

- M. Bell, 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 (Statistics in Society)* **165**, 435–464

### See Also

[migration.gini](#) [migration.gini.in](#) [migration.weighted.gini.out](#) [migration.weighted.gini.mean](#)

### Examples

```
data(migration.hyp)
migration.weighted.gini.in(migration.hyp) # 0.1222222
migration.weighted.gini.in(migration.hyp2) # 0.05238095
```

---

`migration.weighted.gini.mean`*Migration-weighted Mean Gini Index*

---

### Description

The Migration-weighted Mean Gini Index is simply the average of the Migration-weighted In-migration ([migration.weighted.gini.in](#)) and the Migration-weighted Out-migration ([migration.weighted.gini.out](#)) Gini Indices:

$$MWG^A = \frac{MWG^O + MWG^I}{2}$$

### Usage

```
migration.weighted.gini.mean(m, mwgi, mwgo)
```

### Arguments

<code>m</code>	migration matrix
<code>mwgi</code>	optionally passed (precomputed) Migration-weighted In-migration Gini Index
<code>mwgo</code>	optionally passed (precomputed) Migration-weighted Out-migration Gini Index

### Value

This combined index results in a number between 0 and 1 where 0 means no spatial focusing and 1 shows maximum focusing.

### References

- M. Bell, 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 (Statistics in Society)* **165**, 435–464

### See Also

[migration.weighted.gini.in](#) [migration.weighted.gini.out](#)

### Examples

```
data(migration.hyp)
migration.weighted.gini.mean(migration.hyp) # 0.06111111
migration.weighted.gini.mean(migration.hyp2) # 0.03660714
```

---

 migration.weighted.gini.out

*Migration-weighted Out-migration Gini Index*


---

## Description

The Migration-weighted Out-migration Gini Index is a weighted version of the Out-migration Field Gini Index ([migration.gini.out](#)) "according to the zone of destination's share of total migration and the mean of the weighted values is computed as":

$$MWG^O = \frac{\sum_i G_i^O \frac{\sum_j M_{ij}}{\sum_{ij} M_{ij}}}{n}$$

## Usage

```
migration.weighted.gini.out(m,
  mgo = migration.gini.out(m))
```

## Arguments

m	migration matrix
mgo	optionally passed (precomputed) Migration In-migration Gini Index

## References

- M. Bell, 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 (Statistics in Society)* **165**, 435–464

## See Also

[migration.weighted.gini.in](#) [migration.weighted.gini.mean](#)

[migration.gini](#) [migration.gini.out](#) [migration.weighted.gini.in](#) [migration.weighted.gini.mean](#)

## Examples

```
data(migration.hyp)
migration.weighted.gini.out(migration.hyp) # 0
migration.weighted.gini.out(migration.hyp2) # 0.02083333
```



---

migration.world

*Global Bilateral Migration Database (2000)*

---

**Description**

Global (country-to-country) matrix of bilateral migrant stocks in 2000 with 226 economies involved.

**Format**

migration matrix

**References**

- World Bank (2010): Global Bilateral Migration Database. <http://data.worldbank.org/data-catalog/global-bilateral-migration-database>

# Index

## \*Topic **datasets**

migration.hyp, 20  
migration.world, 25

## \*Topic **data**

migration.hyp, 20  
migration.world, 25

migration.acv, 2, 3, 4, 6, 7  
migration.acv.in, 2, 3, 3, 4, 6, 7  
migration.acv.out, 2, 3, 4, 6, 7  
migration.cmr, 4  
migration.connectivity, 5  
migration.cv.in, 3, 4, 6, 7  
migration.cv.out, 3, 4, 6, 7  
migration.effectiveness, 8  
migration.field.diagram, 9  
migration.gini, 10, 13–15, 17, 22, 24  
migration.gini.col, 10, 11, 12, 15, 17, 19  
migration.gini.col.standardized, 10, 11,  
12, 18  
migration.gini.exchange, 10, 13, 14, 19  
migration.gini.exchange.standardized,  
10, 13, 14  
migration.gini.in, 10, 15, 17, 19, 22  
migration.gini.out, 10, 15, 16, 19, 24  
migration.gini.row, 10, 11, 16, 17, 18, 19  
migration.gini.row.standardized, 10, 12,  
17, 18  
migration.gini.total, 10, 12, 14–16, 18,  
19  
migration.hyp, 20  
migration.hyp2 (migration.hyp), 20  
migration.indices, 20  
migration.indices-package  
(migration.indices), 20  
migration.inequality, 21  
migration.weighted.gini.in, 10, 15, 22,  
23, 24  
migration.weighted.gini.mean, 10, 22, 23,  
24

migration.weighted.gini.out, 10, 17, 22,  
23, 24  
migration.world, 25