Package ‘economiccomplexity’

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Type Package

Title Computational Methods for Economic Complexity

Version 2.1.0

Description A wrapper of different methods from Linear Algebra for the equations introduced in The Atlas of Economic Complexity and related literature. This package provides standard matrix and graph output that can be used seamlessly with other packages. See <doi:10.21105/joss.01866> for a summary of these methods and its evolution in literature.

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BugReports https://github.com/pachadotdev/economiccomplexity/issues/

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Carlo Bottai [ctb] (improved the eigenvalues calculation),
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`balassa_index` *Balassa Index*

Description

`balassa_index()` computes the Balassa Index for a bipartite relation between countries and products.

Usage

```
balassa_index(
  trade_data,
  discrete = TRUE,
  cutoff = 1,
  country = "country",
  product = "product",
  value = "value"
)
```

Arguments

`trade_data`	(Type: data.frame or matrix) a dataset such as `world_gdp_avg_1998_to_2000` containing countries, products and exported values.
`discrete`	(Type: logical) whether converting the Balassa Index to discrete (0/1) values. Anything below the specified cutoff is converted to 0 and 1 otherwise. By default this is set to `TRUE`.
`cutoff`	(Type: numeric) the cutoff to use for discretization. By default this is set to `1`.

`country`	(Type: character) the column with the countries. By default this is set to `"country"`. Used only if the input is a data.frame.
`product`	(Type: character) the column with the products. By default this is set to `"product"`. Used only if the input is a data.frame.
`value`	(Type: character) the column with the metric for country-product pairs. By default this is set to `"value"`. Used only if the input is a data.frame.

Details

The current implementation follows (Mariani et al. 2015) to obtain a metric for specialisation. In the context of international trade, if the Balassa Index for a country-product pair is more than 1, it means that country is specialized in that product. If the input for this function is a data.frame instead of a matrix, the function shall aggregate the data and convert the input to a matrix.

Value

A matrix with the Balassa Index.

References

For more information see:

Mariani M, Vidmer A, Medo M, Zhang Y (2015). "Measuring economic complexity of countries and products: which metric to use?" *The European Physical Journal B*, **88**(11), 293. doi:10.1140/epjb/e2015602987.

and the references therein.

Examples

```
bi <- balassa_index(world_trade_avg_1998_to_2000)

# partial view of index
n <- seq_len(5)
bi[n, n]
```

`complexity_measures` *Complexity Measures*

Description

`complexity_measures()` computes the Economic Complexity Index and the Product Complexity Index.

Usage

```
complexity_measures(
  balassa_index,
  method = "fitness",
  iterations = 20,
  extremality = 1
)
```

Arguments

`balassa_index`	(Type: matrix) the output from `balassa_index()`) or an equivalent arrangement.
`method`	(Type: character) one of these methods: fitness, reflections or eigenvalues. By default this is set to `"fitness"`.
`iterations`	(Type: numeric) the number of iterations to use. By default this is set to `20`.
`extremality`	(Type: numeric) the parameter to use in the fitness method. The other methods don't use this parameter. By default this is set to `1`.

Details

The current implementation follows (Mariani et al. 2015) to obtain different alternatives that account for diversification in bipartite relations.

Value

A list of two named numeric vectors.

References

For more information on this index see:

Mariani M, Vidmer A, Medo M, Zhang Y (2015). "Measuring economic complexity of countries and products: which metric to use?" *The European Physical Journal B*, **88**(11), 293. doi:10.1140/epjb/e2015602987.

and the references therein.

Examples

```
co <- complexity_measures(economiccomplexity_output$balassa_index)

# partial view of indexes
n <- seq_len(5)
co$complexity_index_country[n]
co$complexity_index_product[n]
```

complexity_outlook *Complexity Outlook*

Description

`complexity_outlook()` computes the Complexity Outlook Index and the Complexity Outlook Gain.

Usage

```
complexity_outlook(balassa_index, proximity_product, complexity_index_product)
```

Arguments

`balassa_index` (Type: matrix) the output from `balassa_index()`) or an equivalent arrangement.

`proximity_product` (Type: matrix) the output from `proximity()`) or an equivalent arrangement.

`complexity_index_product` (Type: numeric) the output from `complexity_measures()`) or an equivalent arrangement.

Details

The current implementation follows (Hausmann et al. 2014) to measure unexploited export oppportunities.

Value

A list of two named numeric vectors.

References

For more information on this index see:

Hausmann R, Hidalgo C, Bustos S, Coscia M, Simoes A, Yildirim M (2014). *The atlas of economic complexity: Mapping paths to prosperity*. MIT Press. doi:10.7551/mitpress/9647.001.0001.

and the references therein.

Examples

```
co <- complexity_outlook(
  economiccomplexity_output$balassa_index,
  economiccomplexity_output$proximity$proximity_product,
  economiccomplexity_output$complexity_measures$complexity_index_product
)

# partial view of complexity outlook
n <- seq_len(5)
```

```
co$complexity_outlook_index[n]
co$complexity_outlook_gain[n, n]
```

---

density *Density*

Description

`density()` computes the density matrix that accounts for the weighted proportions of the products connected to each good that the countries are exporting.

Usage

```
density(balassa_index, proximity_product)
```

Arguments

`balassa_index` (Type: matrix) the output from `balassa_index()`) or an equivalent arrangement.

`proximity_product` (Type: matrix) the output from `proximity()`) or an equivalent arrangement.

Details

The current implementation follows (Hausmann et al. 2014) to measure the oppotunities implied by a country's position.

Value

A matrix.

References

For more information on this index see:

Hausmann R, Hidalgo C, Bustos S, Coscia M, Simoes A, Yildirim M (2014). *The atlas of economic complexity: Mapping paths to prosperity*. MIT Press. doi:10.7551/mitpress/9647.001.0001.

and the references therein.

Examples

```
d <- density(
  economiccomplexity_output$balassa_index,
  economiccomplexity_output$proximity$proximity_product
)

# partial view of the density matrix
n <- seq_len(5)
d[n, n]
```

distance *Distance*

Description

`distance()` computes the distance matrix that accounts for the weighted proportions of the products connected to each good that the countries are not exporting.

Usage

```
distance(balassa_index, proximity_product)
```

Arguments

`balassa_index` (Type: matrix) the output from `balassa_index()`) or an equivalent arrangement.

`proximity_product` (Type: matrix) the output from `proximity()`) or an equivalent arrangement.

Details

The current implementation follows (Hausmann et al. 2014) to measure the oppotunities implied by a country's position.

Value

A matrix.

References

For more information on this index see:

Hausmann R, Hidalgo C, Bustos S, Coscia M, Simoes A, Yildirim M (2014). *The atlas of economic complexity: Mapping paths to prosperity*. MIT Press. doi:10.7551/mitpress/9647.001.0001.

and the references therein.

Examples

```
d <- distance(
  economiccomplexity_output$balassa_index,
  economiccomplexity_output$proximity$proximity_product
)

# partial view of the distance matrix
n <- seq_len(5)
d[n, n]
```

economiccomplexity_output

Example Outputs of the Functions within the Package

Description

List of different computations obtained by using the functions within the package.

Usage

```
data(economiccomplexity_output)
```

Format

Lists of vectors, matrices, and graphs.

Examples

```
data(economiccomplexity_output)
economiccomplexity_output$balassa_index
economiccomplexity_output$complexity_measures$complexity_index_country
```

productivity_levels

Productivity Levels

Description

`productivity_levels()` computes EXPY and PRODY measures.

Usage

```
productivity_levels(
  data_exp,
  data_gdp,
  country = "country",
  product = "product",
  value = "value"
)
```

Arguments

`data_exp`	(Type: data.frame, matrix or matrix) a dataset containing countries, products and exported values.
`data_gdp`	(Type: data.frame, matrix or matrix) a dataset containing countries and per-capita GDP values.
`country`	(Type: character) the column with the countries. By default this is set to `"country"`. Used only if the input is a data.frame.
`product`	(Type: character) the column with the products. By default this is set to `"product"`. Used only if the input is a data.frame.
`value`	(Type: character) the column with the metric for country-product pairs. By default this is set to `"value"`. Used only if the input is a data.frame.

Details

The current implementation follows (Hausmann et al. 2005) to obtain the productivity and income levels associated to exports.

Value

A list of two named numeric vectors.

References

For more information on prody and its applications see:

Hausmann R, Hwang J, Rodrik D (2005). "What You Export Matters." Working Paper 11905, National Bureau of Economic Research. doi:10.3386/w11905.

Examples

```
pl <- productivity_levels(
  world_trade_avg_1998_to_2000,
  world_gdp_avg_1998_to_2000
)

# partial view of productivity levels
n <- seq_len(5)
pl$productivity_level_country[n]
pl$productivity_level_product[n]
```

projections *Projections of a Country-Product Network*

Description

`projections()` computes two graphs that are particularly useful to visualize product-product and country-country similarity.

Usage

```
projections(
  proximity_country,
  proximity_product,
  avg_links = 5,
  tolerance = 0.05,
  compute = "both"
)
```

Arguments

`proximity_country`
: (Type: matrix) the output from `proximity()`) or an equivalent arrangement.

`proximity_product`
: (Type: matrix) the output from `proximity()`) or an equivalent arrangement.

`avg_links`
: average number of connections for the projections. By default this is set to `5`.

`tolerance`
: tolerance for proximity variation on each iteration until obtaining the desired average number of connections. By default this is set to `0.05`.

`compute`
: (Type: character) the proximity to compute. By default this is `"both"` (both projections) but it can also be `"country"` or `"product"`.

Details

The current implementation follows (Hausmann et al. 2014) to create simplified graphs that correspond to a simplification of the proximity matrices. The result is obtained by iterating and reducing links until the desired average number of links per node is obtained, or a spaning tree after the strongest links is returned when is not possible to return the desired network.

Value

A list of two graphs.

References

For more information see:

Hausmann R, Hidalgo C, Bustos S, Coscia M, Simoes A, Yildirim M (2014). *The atlas of economic complexity: Mapping paths to prosperity*. MIT Press. doi:10.7551/mitpress/9647.001.0001.

and the references therein.

Examples

```
net <- projections(
  economiccomplexity_output$proximity$proximity_country,
  economiccomplexity_output$proximity$proximity_product,
  avg_links = 10,
  tolerance = 0.1
)

# partial view of projections
n <- seq_len(5)
igraph::E(net$network_country)[n]
igraph::E(net$network_product)[n]
```

`proximity` *Proximity*

Description

`proximity()` computes two matrices that account for the similarity between pairs of countries and pairs of products.

Usage

```
proximity(balassa_index, compute = "both")
```

Arguments

`balassa_index`	(Type: matrix) the output from `balassa_index()`) or an equivalent arrangement.
`compute`	(Type: character) the proximity to compute. By default this is `"both"` (both proximity matrices) but it can also be `"country"` or `"product"`.

Details

The current implementation follows (Hausmann et al. 2014) to obtain the likelihood that two products "p1" and "p2" are exported by the same country and, conversely, that two countries "c1" and "c2" export the same product.

Value

A list of two matrices.

References

For more information see:

Hausmann R, Hidalgo C, Bustos S, Coscia M, Simoes A, Yildirim M (2014). *The atlas of economic complexity: Mapping paths to prosperity*. MIT Press. doi:10.7551/mitpress/9647.001.0001.

and the references therein.

Examples

```
pro <- proximity(economiccomplexity_output$balassa_index)

# partial view of proximity matrices
n <- seq_len(5)
pro$proximity_country[n, n]
pro$proximity_product[n, n]
```

---

rca — *Revealed Comparative Advantage*

Description

`balassa_index()` replaces this function

Usage

```
rca(...)
```

Arguments

`...`	old parameters

---

world_gdp_avg_1998_to_2000 — *World Trade Per-Capita GDP for the Period 1998-2000*

Description

A data frame that summarizes the per-capita GDP of different countries. The unit is year 2000 USD.

Usage

```
data(world_gdp_avg_1998_to_2000)
```

Format

A data frame with 240 rows and 2 columns.

Examples

```
data(world_gdp_avg_1998_to_2000)
head(world_gdp_avg_1998_to_2000)
```

world_trade_avg_1998_to_2000

World Trade Averages for the Period 1998-2000

Description

A data frame that summarizes all the products that different countries exported to the rest of the world. This data uses the SITC revision 2 classification with four digits product codes. The unit is year 2000 USD.

Usage

```
data(world_trade_avg_1998_to_2000)
```

Format

A data frame with 124,336 rows and 3 columns.

Examples

```
data(world_trade_avg_1998_to_2000)
head(world_trade_avg_1998_to_2000)
```

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