

Package ‘tradeIndices’

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Type Package

Title International Trade Intensity, Openness and Diversification Measures

Version 0.1.0

Description Calculates commonly used indicators for empirical international trade analysis from user-supplied data. Measures include trade openness, bilateral export and import intensity, the Herfindahl-Hirschman concentration index, normalized and entropy-based diversification, structural diversification relative to a benchmark, export similarity, trade complementarity, revealed comparative advantage, and intra-industry trade. Functions are vectorized where appropriate, validate economically meaningful inputs, and require no external data service. The definition of trade openness follows the World Bank indicator metadata <<https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS>>. Methodological background for several trade indicators is provided by the World Bank's World Integrated Trade Solution <https://wits.worldbank.org/wits/wits/witshelp/Content/Utilities/e1.trade_indicators.htm> and the World Trade Organization (2012, ISBN:9789287038128).

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tradeIndices-package	<i>tradeIndices: International Trade Indicators</i>
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Description

Dependency-light functions for trade intensity, openness, concentration, diversification, similarity, complementarity, revealed comparative advantage, and intra-industry trade.

Details

The package accepts user-supplied trade values and performs no automatic data download. See `vignette("trade-indicators", package = "tradeIndices")` for a worked agricultural-trade example.

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See Also

[trade_openness](#), [trade_intensity](#), [trade_diversification](#)

grubel_lloyd	<i>Grubel-Lloyd Intra-Industry Trade Index</i>
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Description

Calculates the Grubel-Lloyd index for individual products or an aggregate weighted across products.

Usage

```
grubel_lloyd(
  exports,
  imports,
  aggregate = FALSE,
  scale = 100,
  na.rm = FALSE
)
```

Arguments

exports	Numeric vector of exports by product.
imports	Numeric vector of imports by product.
aggregate	Logical. If TRUE, return the aggregate index; otherwise return one index per product.
scale	Positive numeric scaling factor. The default gives values from zero to 100.
na.rm	Logical. Should paired missing observations be removed for the aggregate index?

Details

The product-level index is

$$scale[1 - |X_k - M_k|/(X_k + M_k)].$$

The aggregate form is

$$scale[1 - \sum_k |X_k - M_k| / \sum_k (X_k + M_k)].$$

Value

A numeric vector for product-level calculations or one numeric value for the aggregate index. Categories with zero exports and imports return NA_real_ at product level.

References

Grubel, H. G., and Lloyd, P. J. (1975). *Intra-Industry Trade: The Theory and Measurement of International Trade in Differentiated Products*. Macmillan. ISBN 978-0-333-17210-0.

Examples

```
exports <- c(rice = 40, wheat = 25, tea = 30)
imports <- c(rice = 10, wheat = 20, tea = 28)
grubel_lloyd(exports, imports)
grubel_lloyd(exports, imports, aggregate = TRUE)
```

rca_balassa

Balassa Revealed Comparative Advantage

Description

Calculates revealed comparative advantage as the reporter's product export share divided by the corresponding world product export share.

Usage

```
rca_balassa(
  country_product_exports,
  country_total_exports,
  world_product_exports,
  world_total_exports
)
```

Arguments

country_product_exports
Exports of each product by the country.

country_total_exports
Total exports of the country.

world_product_exports
World exports of each product.

world_total_exports
Total world exports.

Details

The Balassa index is

$$(X_{ik}/X_i)/(X_{wk}/X_w).$$

When world exports of a product are zero, the corresponding result is missing.

Value

A numeric vector. Values greater than one indicate revealed comparative advantage.

References

Balassa, B. (1965). Trade liberalisation and revealed comparative advantage. *The Manchester School*, 33(2), 99–123. doi:10.1111/j.14679957.1965.tb00050.x.

Examples

```
rca_balassa(  
  country_product_exports = c(40, 20, 10),  
  country_total_exports = 100,  
  world_product_exports = c(300, 500, 200),  
  world_total_exports = 5000  
)
```

trade_concentration	<i>Trade Concentration and Diversification</i>
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Description

Calculates concentration or diversification from trade values distributed across products or trading partners.

Usage

```
trade_concentration(  
  x,  
  method = c("hhi", "normalized_hhi"),  
  scale = 1,  
  na.rm = FALSE  
)  
  
trade_diversification(  
  x,  
  method = c(  
    "one_minus_hhi",  
    "normalized_hhi",  
    "shannon",  
    "effective_number"  
  ),  
  na.rm = FALSE  
)
```

Arguments

x	Numeric vector of non-negative trade values across products or trading partners.
method	The concentration or diversification method. See Details.
scale	Positive numeric scaling factor. Use 10000 to express HHI on the conventional 0–10,000 scale.
na.rm	Logical. Should missing categories be removed?

Details

Let p_k denote the trade share of category k and n the number of included categories. The HHI is $\sum p_k^2$. Normalized HHI is

$$(HHI - 1/n)/(1 - 1/n).$$

The diversification alternatives are one minus HHI, one minus normalized HHI, normalized Shannon entropy, and the effective number of categories $\exp(-\sum p_k \log p_k)$. The first three diversification measures lie between zero and one. Effective number lies between one and n .

For comparisons across observations, use a consistent product or partner universe because the normalized measures depend on n .

Value

One numeric value. NA_real_ is returned when total trade is zero or when missing values are present and na.rm = FALSE.

References

World Bank (2010). Trade Indicators. https://wits.worldbank.org/wits/wits/witshelp/Content/Utilities/e1.trade_indicators.htm.

Examples

```
x <- c(rice = 45, wheat = 25, tea = 20, spices = 10)
trade_concentration(x)
trade_concentration(x, scale = 10000)
trade_diversification(x)
trade_diversification(x, method = "shannon")
trade_diversification(x, method = "effective_number")
```

trade_diversification_index
Structural Trade Indices

Description

Compares two product or partner compositions using shares calculated from non-negative trade values.

Usage

```
trade_diversification_index(
  country_exports,
  benchmark_exports,
  na.rm = FALSE
)
```

```

export_similarity(exports_a, exports_b, scale = 100, na.rm = FALSE)

trade_complementarity(
  country_exports,
  partner_imports,
  scale = 100,
  na.rm = FALSE
)

```

Arguments

country_exports	Numeric vector of a country's exports by category.
benchmark_exports	Numeric vector of benchmark exports using the same categories.
exports_a	Numeric vector of exports for the first economy.
exports_b	Numeric vector of exports for the second economy.
partner_imports	Numeric vector of the partner's imports by category.
scale	Positive numeric scaling factor for similarity and complementarity. The default is 100.
na.rm	Logical. Should paired missing categories be removed?

Details

The structural trade-diversification index is

$$0.5 \sum_k |p_{ik} - p_{bk}|.$$

Zero indicates identical structures and one indicates no overlap. It is a dissimilarity-from-benchmark measure and should not be interpreted as an evenness measure.

Export similarity and trade complementarity use the complementary form

$$scale(1 - 0.5 \sum_k |p_{1k} - p_{2k}|).$$

If both inputs are named, categories are aligned by name. If one input is named, both must be named.

Value

One numeric value, or NA_real_ when a composition has zero total trade or contains missing values and na.rm = FALSE.

References

World Bank (2010). Trade Indicators. https://wits.worldbank.org/wits/wits/witshelp/Content/Utilities/e1.trade_indicators.htm.

Examples

```
country <- c(rice = 45, wheat = 25, tea = 20, spices = 10)
world <- c(spices = 30, tea = 15, wheat = 35, rice = 20)

trade_diversification_index(country, world)
export_similarity(country, world)
trade_complementarity(country, world)
```

trade_intensity	<i>Bilateral Trade Intensity</i>
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Description

Calculates bilateral export or import intensity relative to a partner's share in world trade.

Usage

```
trade_intensity(
  bilateral_exports,
  reporter_exports,
  world_exports_to_partner,
  world_exports,
  adjustment = c("none", "exclude_reporter")
)

import_intensity(
  bilateral_imports,
  reporter_imports,
  world_imports_from_partner,
  world_imports,
  adjustment = c("none", "exclude_reporter")
)
```

Arguments

bilateral_exports	Exports from the reporter to the partner.
reporter_exports	Total exports of the reporter.
world_exports_to_partner	Total exports from the world to the partner.
world_exports	Total world exports.
adjustment	Either "none" for the conventional index or "exclude_reporter" to exclude reporter-partner trade from the reference market.
bilateral_imports	Imports of the reporter from the partner.

reporter_imports
 Total imports of the reporter.

world_imports_from_partner
 Total imports by the world from the partner.

world_imports Total world imports.

Details

The conventional export-intensity index is

$$(X_{ij}/X_i)/(M_j/M_w).$$

The import-intensity index is

$$(M_{ij}/M_i)/(X_j/X_w).$$

With adjustment = "exclude_reporter", the bilateral flow and reporter total are excluded from the reference partner and world totals, respectively.

Partner-reported imports may be used as mirror data for world exports to the partner, but differences in valuation, timing, and reporting can cause the two series to differ.

Value

A numeric vector. A value greater than one indicates trade that is more intensive than the partner's reference share in world trade.

References

World Bank (2010). Trade Indicators. https://wits.worldbank.org/wits/wits/witshelp/Content/Utilities/e1.trade_indicators.htm.

World Trade Organization (2012). *A Practical Guide to Trade Policy Analysis*. ISBN 978-92-870-3812-8.

Examples

```
trade_intensity(
  bilateral_exports = 25,
  reporter_exports = 200,
  world_exports_to_partner = 400,
  world_exports = 5000
)

import_intensity(
  bilateral_imports = 18,
  reporter_imports = 160,
  world_imports_from_partner = 300,
  world_imports = 4800
)
```

trade_openness	<i>Trade Openness</i>
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Description

Calculates exports plus imports as a share of gross domestic product.

Usage

```
trade_openness(exports, imports, gdp, scale = 100)
```

Arguments

exports	Numeric vector of exports.
imports	Numeric vector of imports.
gdp	Numeric vector of gross domestic product in the same monetary unit as trade.
scale	Positive numeric scaling factor. The default expresses the result as a percentage of GDP.

Details

The calculation is $scale(X + M)/GDP$. Missing inputs produce missing outputs. Values are vectorized, and scalar inputs are recycled to the common input length.

Value

A numeric vector of trade-openness values.

References

World Bank (2026). Trade (percentage of GDP). <https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS>.

Examples

```
trade_openness(
  exports = c(120, 135, 150),
  imports = c(100, 115, 125),
  gdp = c(500, 540, 590)
)
```

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