

Package ‘GEGravity’

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Type Package

Title General Equilibrium Effect Estimator

Version 0.1.0

Description This package solves for general equilibrium effects of changes in trade policies using a one sector Armington-CES trade model. It uses a simple fixed point algorithm that allows for fast computation and is ideal for bootstrapping confidence intervals for general equilibrium simulations based on prior gravity estimates of FTAs or other similar variables. Note that this package is directly associated with the `ge_gravity` Stata package and has been commissioned with the appreciated support of the UK Department for Digital, Culture, Media & Sport.

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R topics documented:

ge_gravity	2
ge_gravity_rmd	4
TradeData0014	5
TradeData0014_Results	6
Index	7

ge_gravity

Solves a general equilibrium one sector Armington-CES trade model.

Description

ge_gravity solves for general equilibrium effects of changes in trade policies using a one sector Armington-CES trade model. It uses a simple fixed point algorithm that allows for fast computation that makes this program ideal for bootstrapping confidence intervals for general equilibrium simulations based on prior gravity estimates of FTAs or other similar variables.

Examples of references that conduct general equilibrium analysis based on FTA estimates in this way include Egger, Larch, Staub, & Winkelmann (2011), Anderson & Yotov (2016), and Baier, Yotov, & Zylkin (2019). Yotov, Piermartini, Monteiro, & Larch (2016) provide a detailed survey and introduction to the topic.

Usage

```
ge_gravity(exp_id, imp_id, flows, beta, theta = 1, mult = FALSE, data = list())
```

Arguments

exp_id	String representation of the exporter/origin country associated with each observation. This is arbitrary and for organization purposes only, i.e. AUS, Australia
imp_id	String representation of the importer/destination country associated with each observation. This is arbitrary and for organization purposes only, i.e. AUS, Australia
flows	Observed trade flows in the data for the year being used as the baseline for the counterfactual.
beta	An input reflecting the “partial” change in trade, typically obtained as a coefficient from a prior gravity estimation.
theta	Overall trade elasticity
mult	If true, assume that national expenditure is a fixed multiple of national output, as in Anderson & Yotov (2016). Otherwise (and by default), handle unbalances in the data by treating the trade balance as an additive component of national expenditure (see below).
data	A list to which we should add the new values. By default, this is an empty list. Note that this will be converted to a named dataframe on output.

Details

Please see `get_gravity_rmd("all")` for additional details.

Value

A dataframe element containing resulting estimations of impacts. Specifically, it returns results for general equilibrium changes in trade flows, welfare, and real wages as a result of the change in trade frictions. If ‘data’ is specified, the results will be added as columns.

This data will include the following:

- new_trade: The new level of trade for each pair of countries.

- welfare: The exporter's change in welfare (new/old level of welfare)
- real_wage: The exporter's change in real wage (new/old real wage).
Note: this is generally different from the change in welfare unless either trade is balanced or the "multiplicative" option is chosen.
- nom_wage: The exporter's change in nominal wage (new/old nom wage).
- price_index: The exporter's change in price index (new/old price index)

References

Please see `ge_gravity_rmd("all")` for information on references and sources.

See Also

`ge_gravity_rmd` allows you to access very explanatory RMD files to augment documentation.

Examples

```
# For a detailed explanation, check out the RMD files (see \code{ge_gravity_rmd})

# Foreign trade subset
f_trade <- TradeData0014[TradeData0014$exporter != TradeData0014$importer,]

# Normalize trade data to unit interval
f_trade$trade <- f_trade$trade / max(f_trade$trade)

# classify FEs for components to be absorbed (finding variable interactions)
f_trade$exp_year <- interaction(f_trade$expcode, f_trade$year)
f_trade$imp_year <- interaction(f_trade$impcode, f_trade$year)
f_trade$pair <- interaction(f_trade$impcode, f_trade$expcode)

# Fit generalized linear model based on specifications
partials <- alpaca::feglm(
  formula = trade ~ eu_enlargement + other_fta | exp_year + imp_year + pair,
  data = f_trade,
  family = poisson()
)$coefficient # We just need the coefficients for computation

# Sort trade matrix to make it easier to find imp/exp pairs
t_trade <- TradeData0014[order(
  TradeData0014$exporter,
  TradeData0014$importer,
  TradeData0014$year
),]

t_trade$eu_effect <- NA # This creates new column eu_effect

i <- 1
# Effect of EU entrance on country based on partial, if entry happened
invisible(by(t_trade, list(t_trade$expcode, t_trade$impcode), function(row) {

  # This is an effective boolean; was this a new EU pair created within time span?
  is_new_eu_pair <- tail(row$eu_enlargement, 1) - head(row$eu_enlargement, 1)

  # If it was, give it the computed partial eu_enlargement coefficient; if not, leave it unset
  t_trade[i, "eu_effect"] <- is_new_eu_pair * partials[1]
```

```

    i <- i + nrow(row)      # Increment index to start at the next imp/exp pair
  })
})

# Data to be finally fed to the function; only subset with eu_effect will be used
data <- t_trade[t_trade$year == 2000,]

## Running Actual Computations

w_mult = ge_gravity(
  exp_id = data$expcode,    # Origin country associated with each observation
  imp_id = data$impcode,    # Destination country associated with each observation
  flows  = data$trade,      # Observed trade flows for the baseline year
  beta   = data$eu_effect,  # "Partial" trade change; coefficient from gravity estimation
  theta  = 4,               # Trade elasticity
  mult   = TRUE,            # Assume national expenditure is fixed multiple of nat. output
  data   = data
)

w_o_mult = ge_gravity(
  data$expcode,    # Origin country associated with each observation
  data$impcode,    # Destination country associated with each observation
  data$trade,      # Observed trade flows for the baseline year
  data$eu_effect,  # "Partial" change in trade; coefficient from gravity estimation
  4,               # Trade elasticity
  FALSE,          # Assume trade balance is additive component of nat. expenditure
  data
)

```

ge_gravity_rmd

ge_gravity_rmd Opens Explanatory Rmd Files for GEGravity

Description

This is a streamlined way of getting the descriptive logic and testing files that were made to accompany this function. Specifically, this will copy the appropriate file into the user's working dir.

Usage

```
ge_gravity_rmd(file = "all", only_url = FALSE)
```

Arguments

file	The name of the Rmd file to open. The following are valid parameters: <ul style="list-style-type: none"> "all" : Opens "about.Rmd" A compact file with all of the Rmd components combined. "theory" : Opens "theory.Rmd" The background, theory, and further readings for how this works. "example" : Opens "example.Rmd" A standard use case of ge_gravity using TradeData0014.
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- "logic" : Opens "logic.Rmd"
A step-by-step of exactly how ge_gravity operates.
 - "compare" : Opens "compare.Rmd"
A comparison of the results of ge_gravity against its Stata counterpart.
- only_url Just get the URL of the location.

Details

The Rmd files are defaulty set up to export to html. Exporting in LaTeX will likely cause some issues. To manually knit, use `rmarkdown::render(filename,"html_document")`

This operation can also easily be done manually via `system.file`, i.e. `system.file("rmds", "<filename>.Rmd", pack = "GEGravity")` to get the directory address of an arbitrary Rmd file.

To open the RMD files programmatically, consider using `utils::file.edit()`.

Examples

```
# Copy about.Rmd file to working dir
ge_gravity_rmd("all")

# Copy, then programmatically render, theory.Rmd file to working dir
ge_gravity_rmd("theory")
rmarkdown::render("theory.Rmd")

# Export to html in working dir w/o copying RMD file
rmd_url <- ge_gravity_rmd("compare", only_url = TRUE)
rmarkdown::render(rmd_url, output_dir = ".")
```

TradeData0014

Trade Data 2000 - 2014

Description

The data set represents the aggregate trade between 44 countries observed over 2000-2014, using years 2000, 2005, 2010, and 2014.

Trade and domestic sales data has been aggregated from the WIOD database (see sources). For its use, consider "An Illustrated User Guide to the World Input-Output Database.

Information on Free Trade Agreements (FTAs) is taken from the NSF-Kellogg database maintained by Scott Baier and Jeff Bergstrand (see sources).

Usage

```
TradeData0014
```

Format

A list with 7744 rows and 9 variables:

exporter Country code of exporter country

importer Country code of importer country

expcode Label encoding of exporter country

imrcode Label encoding of importer country
 year Year of row data
 trade Aggregate trade flow between importer and exporter for that year
 eu_enlargement 0-1 Booleanic; whether this pair in the EU
 other_fta 0-1 Booleanic; other FTA pairwise satisfaction
 FTA 0-1 Booleanic; eu_enlargement or other_fta

Source

<http://www.wiod.org/database/wiots16>
<https://sites.nd.edu/jeffrey-bergstrand/database-on-economic-integration-agreements/>
http://www.tomzylkin.com/uploads/4/1/0/4/41048809/help_file.pdf

TradeData0014_Results *Trade Data 2000 - 2014 Results When Running Stata ge_gravity*

Description

Given the approach described in the example file of `ge_gravity`, running the function in conjunction with the `ppmlhdfc` function yields the following results when converted to a list. This is provided to test the R implementation against this, as this is package is commissioned to mimic the performance of the Stata counterpart.

Usage

TradeData0014_Results

Format

A list with 7744 rows and 15 variables:

exporter - FTA described by TradeData0014
 new_eu_pair 0-1 Booleanic: Did they shift from non-EU pair to EU pair in time period
 eu_effect Effect of EU entrance on country based on partial, if entry happened
 w_eu Estimated exporter welfare at equilibrium, with default (additive) assumption on national expenditure. Omitted for entries where year != 2000
 w_mult Estimated exporter welfare at equilibrium, with multiplicative assumption on national expenditure. Omitted for entries where year != 2000
 X_eu Estimated level of trade at equilibrium, with default (additive) assumption on national expenditure. Omitted for entries where year != 2000
 X_mult Estimated level of trade at equilibrium, with multiplicative assumption on national expenditure. Omitted for entries where year != 2000

Source

http://www.tomzylkin.com/uploads/4/1/0/4/41048809/help_file.pdf

Index

*Topic **datasets**

TradeData0014, [5](#)

TradeData0014_Results, [6](#)

ge_gravity, [2](#)

ge_gravity_rmd, [4](#)

TradeData0014, [5](#)

TradeData0014_Results, [6](#)