Package 'EconCausal'

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Type Package

Title Causal Analysis for Macroeconomic Time Series (ECM-MARS, BSTS, Bayesian GLM-AR(1))

Version 1.0.2

Description
Implements three complementary pipelines for causal analysis on macroeconomic time series:
(1) Error-Correction Models with Multivariate Adaptive Regression Splines (ECM-MARS),
(2) Bayesian Structural Time Series (BSTS), and
(3) Bayesian GLM with AR(1) errors validated with Leave-Future-Out (LFO).
Heavy backends (Stan) are optional and never used in examples or tests.

VignetteBuilder knitr

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Encoding UTF-8

Depends R (>= 4.1)

Imports brms, readxl, dplyr, tidyr, tibble, purrr, bsts, BoomSpikeSlab, tseries, urca, vars, progressr, future.apply, rlang, magrittr, parallel, stats, utils

Suggests knitr, cmdstanr, rstan, future, RhpcBLASctl, rmarkdown, testthat (>= 3.0.0)

URL https://github.com/IsadoreNabi/EconCausal

BugReports https://github.com/IsadoreNabi/EconCausal/issues

Additional_repositories https://stan-dev.r-universe.dev

RoxygenNote 7.3.3

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`bglmar1` *Bayesian Generalized Linear Model with AR(1) Errors*

Description

Implements a Bayesian GLM with autoregressive errors of order 1 for causal inference between economic variables, with emphasis on temporal stability through Leave-Future-Out cross-validation.

Usage

```
bglmar1(
  data_path,
  circ_vars,
  prod_vars,
  max_lag = 3,
  initial_frac = 0.7,
  initial_min = 90,
  test_h = 12,
  step_h = 12,
  lfo_window = "sliding",
  chains = 4,
  parallel_chains = 4,
  iter = 1500,
  warmup = 750,
  adapt_delta = 0.95,
  trees = 12,
  seed = 2025,
  support_min = 0.6,
  folds_min = 5,
  sup_hi = 0.7,
  sup_lo = 0.6,
  backend = c("auto", "rstan", "cmdstanr")
)
```

Arguments

`data_path`	Path to Excel file containing the data
`circ_vars`	Character vector of circulation variable names
`prod_vars`	Character vector of production variable names

max_lag	Maximum number of lags for independent variables (default: 3)
initial_frac	Initial fraction of data for training (default: 0.7)
initial_min	Minimum number of observations for initial training (default: 90)
test_h	Test horizon in months (default: 12)
step_h	Step size between folds in months (default: 12)
lfo_window	Type of window for LFO ("sliding" or "expanding", default: "sliding")
chains	Number of MCMC chains (default: 4)
parallel_chains	Number of parallel chains (default: 4)
iter	Total iterations per chain (default: 1500)
warmup	Warmup iterations per chain (default: 750)
adapt_delta	Adapt delta parameter for NUTS (default: 0.95)
trees	Maximum tree depth for NUTS (default: 12)
seed	Random seed (default: 2025)
support_min	Minimum support threshold for stable relationships (default: 0.6)
folds_min	Minimum number of folds required (default: 5)
sup_hi	High support threshold (default: 0.7)
sup_lo	Low support threshold (default: 0.6)
backend	Backend for Stan compilation: "auto" (default), "rstan", or "cmdstanr". If "auto", the function uses 'rstan' when available, otherwise tries 'cmdstanr'.

Details

This function implements a Bayesian GLM with AR(1) errors for assessing causal relationships between economic variables. It uses Leave-Future-Out cross-validation with sliding windows to evaluate temporal stability of relationships. The function no longer requires 'cmdstanr' at install time; if 'backend = "cmdstanr"' is requested but 'cmdstanr' (and a working CmdStan) are not available, it gracefully falls back to 'rstan'. In any case, heavy computations are not run in package examples or tests.

Value

A list containing:

bench_bayes	Full results for all pairs
winners_070	Pairs with support >= 0.70
winners_060	Pairs with support >= 0.60
rank_out	Output from ranking function

Examples

```
## Not run:
# Example usage
result <- bglmar1(
  data_path = file.path(tempdir(), "data.xlsx"),
  circ_vars = c("TC_SPOT_CAN_US", "TC_SPOT_US_CAN", "TC_SPOT_US_REMB",
                "IPC", "TdI_LdelT", "TasaDescuento"),
  prod_vars = c("ValorExportaciones", "Real_Net_Profit",
                "RealSocialConsumptionPerWorker2017", "RealWage_PPP2017",
                "CapitalStock_PPP2017", "LaborProductivity_PPP2017",
                "InvestmentPerWorker_PPP2017"),
  backend = "auto"
)

## End(Not run)
```

---

bsts_model *Bayesian Structural Time Series Model*

Description

Implements Bayesian Structural Time Series models with Leave-Future-Out validation for assessing causal relationships between economic variables with temporal stability.

Usage

```
bsts_model(
  data_path,
  circ_vars,
  prod_vars,
  max_lag = 6,
  lfo_init_frac = 0.8,
  lfo_h = 6,
  lfo_step = 6,
  niter = 2000,
  burn = 500,
  seed = 123,
  seasonality = NULL,
  support_min = 0.6,
  folds_min = 5,
  sup_hi = 0.7,
  sup_lo = 0.6,
  out_dir = NULL
)
```

Arguments

data_path	Path to Excel file containing the data
circ_vars	Character vector of circulation variable names
prod_vars	Character vector of production variable names
max_lag	Maximum number of lags for independent variables (default: 6)
lfo_init_frac	Initial fraction for LFO (default: 0.8)
lfo_h	Horizon for LFO (default: 6)
lfo_step	Step size for LFO (default: 6)
niter	Number of MCMC iterations (default: 2000)
burn	Number of burn-in iterations (default: 500)
seed	Random seed (default: 123)
seasonality	Seasonality parameter (NULL for none, 12 for monthly)
support_min	Minimum support threshold (default: 0.6)
folds_min	Minimum number of folds required (default: 5)
sup_hi	High support threshold (default: 0.7)
sup_lo	Low support threshold (default: 0.6)
out_dir	Output directory for results (default: "output_bsts")

Details

This function implements Bayesian Structural Time Series models for assessing causal relationships between economic variables. It uses Leave-Future-Out cross-validation with tuning between Local Level and Local Linear Trend specifications. The methodology is described in detail in the methodological document "DETALLES METODOLOGICOS SPACESTATE MODEL.docx".

Value

A list containing:

rank_ss_all	Full results for all pairs
winners_ss_070	Pairs with support >= 0.70
winners_ss_060	Pairs with support >= 0.60
summaries_ss	Summary statistics

Examples

```
## Not run:
# Example usage
result <- bsts_model(
  data_path = file.path(tempdir(), "data.xlsx"),
  circ_vars = c("TC_SPOT_CAN_US", "TC_SPOT_US_CAN", "TC_SPOT_US_REMB",
                "IPC", "TdI_LdelT", "TasaDescuento"),
  prod_vars = c("ValorExportaciones", "Real_Net_Profit",
                "RealSocialConsumptionPerWorker2017", "RealWage_PPP2017",
```

```
                "CapitalStock_PPP2017", "LaborProductivity_PPP2017",
                "InvestmentPerWorker_PPP2017")
)

## End(Not run)
```

---

ecm_mars *Error Correction Model with Multivariate Adaptive Regression Splines*

Description

Implements a robust ECM benchmark with MARS enhancement for analyzing cointegration relationships between economic variables with temporal stability validation.

Usage

```
ecm_mars(
  data_path,
  circ_vars,
  prod_vars,
  cointeg_rule = "either",
  eg_p_cutoff = 0.05,
  ecm_p_cutoff = 0.05,
  lag_max_ecm = 4,
  min_tr = 20,
  min_te = 8,
  rolling_cv_enable = TRUE,
  rolling_cv_window = "sliding",
  rolling_cv_initial_frac = 0.8,
  rolling_cv_initial_min = 40,
  rolling_cv_test = 12,
  rolling_cv_step = 12,
  nested_tune = TRUE,
  nested_initial_f = 0.6,
  nested_test = 6,
  nested_step = 3,
  mars_grid = expand.grid(degree = c(1, 2), nk = c(15, 25, 35, 50, 65)),
  support_min = 0.75,
  folds_min_abs = 5,
  parallel_enable = TRUE,
  parallel_workers = max(1, parallel::detectCores() - 1)
)
```

Arguments

data_path	Path to Excel file containing the data
circ_vars	Character vector of circulation variable names
prod_vars	Character vector of production variable names
cointeg_rule	Cointegration rule ("either" for EG or Johansen, "both" for both)
eg_p_cutoff	Significance level for EG/Phillips-Ouliaris test (default: 0.05)
ecm_p_cutoff	Significance level for lambda<0 test in linear ECM (default: 0.05)
lag_max_ecm	Maximum lags in DeltaY and DeltaX for linear ECM (default: 4)
min_tr	Minimum training rows for MARS (default: 20)
min_te	Minimum test rows (default: 8)
rolling_cv_enable	Whether to enable rolling CV (default: TRUE)
rolling_cv_window	Type of window for rolling CV ("sliding" or "expanding", default: "sliding")
rolling_cv_initial_frac	Initial fraction for rolling CV (default: 0.8)
rolling_cv_initial_min	Minimum initial observations (default: 40)
rolling_cv_test	Test horizon for rolling CV (default: 12)
rolling_cv_step	Step size for rolling CV (default: 12)
nested_tune	Whether to enable nested tuning (default: TRUE)
nested_initial_f	Initial fraction for nested tuning (default: 0.6)
nested_test	Test horizon for nested tuning (default: 6)
nested_step	Step size for nested tuning (default: 3)
mars_grid	Data frame with MARS tuning parameters
support_min	Minimum proportion of valid folds (default: 0.75)
folds_min_abs	Minimum absolute number of valid folds (default: 5)
parallel_enable	Whether to enable parallel processing (default: TRUE)
parallel_workers	Number of parallel workers (default: detectCores() - 1)

Details

This function implements an Error Correction Model enhanced with Multivariate Adaptive Regression Splines for analyzing cointegration relationships between economic variables. It includes comprehensive temporal validation through rolling-origin cross-validation and nested tuning for MARS parameters. The methodology is described in detail in the methodological document "DETALLES METODOLOGICOS DE ECM-MARS2.docx".

Value

A data frame with evaluation results for all pairs

Examples

```
## Not run:
# Example usage
result <- ecm_mars(
  data_path = file.path(tempdir(), "data.xlsx"),
  circ_vars = c("ER.SPOT.CAN.US", "ER.SPOT.US.CAN", "ER.SPOT.US.REMB",
                "CPI", "TreasuryBonds10y", "FedDiscountRate"),
  prod_vars = c("Exports", "RealNetProfit", "RealSocialConsumptionPerWorker2017",
                "RealWagePPP2017", "CapitalStockPPP2017",
                "LaborProductivityPPP2017", "InvestmentPerWorkerPPP2017")
)

## End(Not run)
```

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