Package 'ManyIVsNets'

June 23, 2025

Type Package

Title Environmental Phillips Curve Analysis with Multiple Instrumental Variables and Networks

Version 0.1.1

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Description Comprehensive toolkit for Environmental Phillips Curve analysis featuring multidimensional instrumental variable creation, transfer entropy causal discovery, network analysis, and state-of-the-art econometric methods. Implements geographic, technological, migration, geopolitical, financial, and natural risk instruments with robust diagnostics and visualization. Provides 24 different instrumental variable approaches with empirical validation. Methods based on Phillips (1958) <doi:10.1111/j.1468-0335.1958.tb00003.x>, transfer entropy by Schreiber (2000) <doi:10.1103/PhysRevLett.85.461>, and weak instrument tests by Stock and Yogo (2005) <doi:10.1017/CBO9780511614491.006>.

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URL https://github.com/avishekb9/ManyIVsNets, https://avishekb9.github.io/ManyIVsNets/

BugReports https://github.com/avishekb9/ManyIVsNets/issues

Encoding UTF-8

LazyData true

RoxygenNote 7.3.2

Depends R (>= 4.0.0)

Imports dplyr, readr, igraph, ggplot2, ggraph, AER, lmtest, sandwich, magrittr

Suggests testthat (>= 3.0.0), rmarkdown, pkgdown, knitr, RTransferEntropy, tidyr, viridis, countrycode, spelling

VignetteBuilder knitr

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Language en-US

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Repository CRAN

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Contents

`calculate_instrument_strength`

Calculate Instrument Strength

Description

Calculate Instrument Strength

Usage

```
calculate_instrument_strength(data)
```

Arguments

data	Enhanced EPC data

Value

Data frame with instrument strength results

---

conduct_transfer_entropy_analysis

Conduct Transfer Entropy Analysis for Causal Discovery

Description

Conduct Transfer Entropy Analysis for Causal Discovery

Usage

```
conduct_transfer_entropy_analysis(data)
```

Arguments

data	Enhanced EPC data with instruments

Value

List containing transfer entropy matrix, network, and metadata

Examples

```
# Transfer entropy analysis (computationally intensive)
data(sample_epc_data)
te_results <- conduct_transfer_entropy_analysis(sample_epc_data)
```

---

create_alternative_sota_instruments

Create Alternative State-of-the-Art Instruments

Description

Create Alternative State-of-the-Art Instruments

Usage

```
create_alternative_sota_instruments(data)
```

Arguments

data	Enhanced EPC data

Value

Data frame with alternative SOTA instruments

---

create_composite_instruments

Create Composite Instruments using Factor Analysis

Description

Create Composite Instruments using Factor Analysis

Usage

```
create_composite_instruments(instruments)
```

Arguments

instruments	Data frame with individual instruments

Value

Enhanced data frame with composite instruments

---

create_comprehensive_network_plots

Create Comprehensive Network Plots

Description

Create Comprehensive Network Plots

Usage

```
create_comprehensive_network_plots(
  te_results,
  te_iv_results,
  data,
  strength_results,
  output_dir = tempdir()
)
```

Arguments

`te_results`	Transfer entropy results
`te_iv_results`	Transfer entropy IV results
`data`	Enhanced EPC data
`strength_results`	Instrument strength results
`output_dir`	Directory to save plots (optional)

Value

List of plot objects

`create_comprehensive_results_table` *Create Comprehensive Results Table*

Description

Create Comprehensive Results Table

Create Comprehensive Results Table

Usage

```
create_comprehensive_results_table(models, diagnostics)
```


```
create_comprehensive_results_table(models, diagnostics)
```


Arguments

`models`	List of fitted models
`diagnostics`	List of diagnostic results

Value

Data frame with comprehensive results

Data frame with comprehensive results

`create_enhanced_test_data` *Create enhanced test data with all required variables*

Description

Create enhanced test data with all required variables

Usage

```
create_enhanced_test_data()
```

Value

Data frame with enhanced test data

`create_publication_summary` *Create Publication Summary*

Description

Create Publication Summary

Usage

```
create_publication_summary(results_table, strength_results, te_results)
```

Arguments

`results_table`	Main results table
`strength_results`	Instrument strength results
`te_results`	Transfer entropy results

Value

Character vector with summary text

create_real_instruments_from_data *Create Real Multidimensional Instruments from Economic Data*

Description

Create Real Multidimensional Instruments from Economic Data

Usage

```
create_real_instruments_from_data(epc_data)
```

Arguments

epc_data	Data frame containing EPC data with country and year columns

Value

Data frame with created instruments

Examples

```
# Create instruments using built-in sample data
data(sample_epc_data)
instruments <- create_real_instruments_from_data(sample_epc_data)
head(instruments)
```

create_test_epc_data *Create test EPC data for testing*

Description

Create test EPC data for testing

Usage

```
create_test_epc_data()
```

Value

Data frame with test EPC data

`create_test_instruments` *Create test instruments for testing*

Description

Create test instruments for testing

Usage

```
create_test_instruments()
```

Value

Data frame with test instruments

`create_te_based_instruments` *Create Transfer Entropy-Based Instruments*

Description

Create Transfer Entropy-Based Instruments

Usage

```
create_te_based_instruments(data, te_results)
```

Arguments

`data`	EPC data
`te_results`	Transfer entropy analysis results

Value

List with enhanced data and network centralities

`export_comprehensive_results` *Export Comprehensive Results to CSV*

Description

Export Comprehensive Results to CSV

Usage

```
export_comprehensive_results(
  models,
  diagnostics,
  strength_results,
  te_results,
  instruments,
  centralities,
  output_dir = tempdir()
)
```

Arguments

`models`	List of fitted models
`diagnostics`	List of diagnostic results
`strength_results`	Instrument strength results
`te_results`	Transfer entropy results
`instruments`	Created instruments data
`centralities`	Country network centralities
`output_dir`	Directory to save files

Value

No return value, called for side effects. Creates multiple CSV files and one text summary file in the specified output directory: Table_1_Complete_EPC_Results_From_Scratch.csv (main Environmental Phillips Curve analysis results), Table_2_Instrument_Strength_All_Types_From_Scratch.csv (instrument strength statistics), Table_3_Transfer_Entropy_Matrix.csv (transfer entropy matrix), Table_4_Created_Real_Instruments.csv (created instrumental variables), Table_5_Country_Network_Centralities.csv (network centrality measures), Table_6_IV_Diagnostics_Complete.csv (IV diagnostic tests), and Publication_Summary_Complete_From_Scratch.txt (comprehensive summary).

load_epc_data_corrected *Load and Clean EPC Data*

Description

Load and Clean EPC Data

Usage

```
load_epc_data_corrected(file_path = "epc_data_new_ar5_indicators.csv")
```

Arguments

file_path	Path to the EPC data CSV file

Value

Cleaned EPC data frame

Examples

```
# Load sample EPC data from package
sample_file <- system.file("extdata", "sample_epc_data.csv", package = "ManyIVsNets")
if (file.exists(sample_file)) {
  epc_data <- load_epc_data_corrected(sample_file)
  head(epc_data)
}


# Example with external file (only runs if file exists)
if (file.exists("your_epc_data.csv")) {
  epc_data <- load_epc_data_corrected("your_epc_data.csv")
}
```

merge_epc_with_created_instruments *Merge EPC Data with Created Instruments*

Description

Merge EPC Data with Created Instruments

Usage

```
merge_epc_with_created_instruments(epc_data, instruments)
```

Arguments

epc_data	EPC data frame
instruments	Instruments data frame

Value

Enhanced data frame with merged instruments

---

plot_country_income_network

Create Country Network Visualization by Income Classification

---

Description

Create Country Network Visualization by Income Classification

Usage

```
plot_country_income_network(country_network, output_dir = NULL)
```

Arguments

country_network	igraph network object
output_dir	Directory to save plots (optional)

Value

ggplot object

---

plot_cross_income_co2_nexus

Create Cross-Income CO2 Growth Nexus Visualization

Description

Create Cross-Income CO2 Growth Nexus Visualization

Usage

```
plot_cross_income_co2_nexus(data, output_dir = NULL)
```

Arguments

data	Enhanced EPC data
output_dir	Directory to save plots (optional)

Value

ggplot object

---

plot_instrument_causal_pathways

Create Instrument Causal Pathways Network

Description

Create Instrument Causal Pathways Network

Usage

```
plot_instrument_causal_pathways(data, output_dir = NULL)
```

Arguments

data	Enhanced EPC data
output_dir	Directory to save plots (optional)

Value

ggplot object

---

plot_instrument_strength_comparison

Create Instrument Strength Comparison Visualization

Description

Create Instrument Strength Comparison Visualization

Usage

```
plot_instrument_strength_comparison(strength_results, output_dir = NULL)
```

Arguments

strength_results	Data frame with instrument strength results
output_dir	Directory to save plots (optional)

Value

ggplot object

plot_migration_impact *Create Migration Impact Visualization*

Description

Create Migration Impact Visualization

Usage

```
plot_migration_impact(data, output_dir = NULL)
```

Arguments

data	Enhanced EPC data
output_dir	Directory to save plots (optional)

Value

ggplot object

plot_regional_network *Create Regional Network Visualization*

Description

Create Regional Network Visualization

Usage

```
plot_regional_network(data, output_dir = NULL)
```

Arguments

data	Enhanced EPC data
output_dir	Directory to save plots (optional)

Value

ggplot object

plot_transfer_entropy_network

Create Transfer Entropy Network Visualization

Description

Create Transfer Entropy Network Visualization

Usage

```
plot_transfer_entropy_network(te_results, output_dir = NULL)
```

Arguments

te_results	Transfer entropy analysis results
output_dir	Directory to save plots (optional)

Value

ggplot object

run_complete_epc_analysis

Run Complete EPC Analysis Pipeline

Description

Run Complete EPC Analysis Pipeline

Usage

```
run_complete_epc_analysis(data_file = NULL, output_dir = tempdir())
```

Arguments

data_file	Path to EPC data file (optional)
output_dir	Directory for outputs

Value

List with all analysis results

`run_comprehensive_epc_models` *Run Comprehensive EPC Models*

Description

Run Comprehensive EPC Models

Usage

```
run_comprehensive_epc_models(data)
```

Arguments

`data`	Enhanced EPC data with all instruments

Value

List of fitted models

`run_comprehensive_iv_diagnostics` *Run Comprehensive IV Diagnostics*

Description

Run Comprehensive IV Diagnostics

Run Comprehensive IV Diagnostics

Usage

```
run_comprehensive_iv_diagnostics(models)

run_comprehensive_iv_diagnostics(models)
```

Arguments

`models`	List of fitted models

Value

List of diagnostic results

List of diagnostic results

`sample_epc_data` *Sample Environmental Phillips Curve Data*

Description

A dataset containing Environmental Phillips Curve variables for 5 countries from 1991 to 2021, used for testing and demonstration purposes.

Usage

```
sample_epc_data
```

Format

A data frame with 155 rows and 9 variables:

country Country name

year Year (1991-2021)

CO2_per_capita CO2 emissions per capita

UR Total unemployment rate

URF Female unemployment rate

URM Male unemployment rate

PCGDP Per capita GDP

Trade Trade openness

RES Renewable energy share

Source

Generated for package testing and demonstration

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