Package 'debtkit'

November 1, 2026

Title Debt Sustainability Analysis and Fiscal Risk Assessment

Version 0.1.4

Description Analyses government debt sustainability using the standard debt dynamics framework from Blanchard (1990) <doi:10.1787/435618162862> and the IMF Debt Sustainability Analysis methodology (IMF, 2013) and the Sovereign Risk and Debt Sustainability Framework (IMF, 2022). Projects debt-to-GDP paths, decomposes historical debt changes into interest, growth, and primary balance contributions, and estimates fiscal reaction functions following Bohn (1998) <doi:10.1162/003355398555793>. Produces stochastic fan charts via Monte Carlo simulation, standardised stress tests, and IMF-style heat map risk assessments. Computes S1/S2 sustainability gap indicators used by the European Commission. All methods are pure computation with no external dependencies beyond base R; works with fiscal data from any source.

Depends R (>= 4.1.0)

License MIT + file LICENSE

Encoding UTF-8

Language en-US

Imports cli (>= 3.6.0), grDevices, graphics, stats

Suggests testthat (>= 3.0.0)

Config/testthat/edition 3

URL https://charlescoverdale.github.io/debtkit/, https://github.com/charlescoverdale/debtkit

BugReports https://github.com/charlescoverdale/debtkit/issues

Config/roxygen2/version 8.1.0

NeedsCompilation no

Author Charles Coverdale [aut, cre]

Maintainer Charles Coverdale <charlesfcoverdale@gmail.com>

Repository CRAN

Date/Publication 2026-11-01 15:20:21 UTC

Contents

dk_bohn_test 2
dk_compare 4
dk_decompose 5
dk_estimate_shocks 6
dk_fan_chart 7
dk_gfn 9
dk_heat_map 10
dk_project 12
dk_rg 13
dk_sample_data 15
dk_stress_test 16
dk_sustainability_gap 18

Index **20**

`dk_bohn_test` *Bohn's Fiscal Reaction Function Test*

Description

Estimates the fiscal reaction function following Bohn (1998): `pb(t) = rho * d(t-1) + alpha * Z(t) + epsilon(t)`, where `pb` is the primary balance-to-GDP ratio, `d` is lagged debt-to-GDP, and `Z` is a matrix of control variables.

Usage

```
dk_bohn_test(
  primary_balance,
  debt,
  controls = NULL,
  method = c("ols", "rolling", "quadratic"),
  window = NULL,
  robust_se = FALSE
)
```

Arguments

`primary_balance`	Numeric vector of primary balance-to-GDP ratios.
`debt`	Numeric vector of lagged debt-to-GDP ratios (same length as `primary_balance`).
`controls`	Optional data.frame of control variables (same number of rows as `primary_balance`). Each column enters the regression as a separate regressor.
`method`	Character; `"ols"` (default) for a single OLS regression over the full sample, `"rolling"` for rolling-window regressions, or `"quadratic"` for a non-linear specification that includes a squared debt term to detect fiscal fatigue (Ghosh et al. 2013).

window	Integer; rolling window size. Required when method = "rolling", ignored otherwise.
robust_se	Logical; if TRUE, compute Newey-West HAC standard errors using a Bartlett kernel with automatic bandwidth floor(4*(n/100)^(2/9)). This corrects for serial correlation in fiscal data. Default FALSE.

Details

A positive and statistically significant rho indicates that the government systematically raises the primary surplus in response to rising debt, satisfying a sufficient condition for debt sustainability.

Value

An S3 object of class dk_bohn with components:

rho Estimated fiscal response coefficient (full sample or last rolling window).

rho_se Standard error of rho.

rho_pvalue p-value for the test H0: rho = 0.

sustainable Logical; TRUE if rho > 0 and rho_pvalue < 0.05.

model The lm object from the full-sample (OLS/quadratic) or last-window (rolling) regression.

method The method used ("ols", "rolling", or "quadratic").

rho_ts A data.frame with columns index, rho, rho_lower, rho_upper if method = "rolling"; NULL otherwise.

robust_se Logical; whether HAC standard errors were used.

rho2 Coefficient on debt squared (only for method = "quadratic").

rho2_se Standard error of rho2 (quadratic only).

rho2_pvalue p-value for rho2 (quadratic only).

turning_point Debt level where fiscal response peaks, -rho/(2*rho2) (quadratic only).

References

Bohn, H. (1998). "The Behavior of U.S. Public Debt and Deficits." *Quarterly Journal of Economics*, 113(3), 949–963. doi:10.1162/003355398555793

Ghosh, A.R., Kim, J.I., Mendoza, E.G., Ostry, J.D. and Qureshi, M.S. (2013). "Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies." *The Economic Journal*, 123(566), F4–F30.

Examples

```
# Simulate data with positive fiscal response
set.seed(42)
n <- 50
debt <- cumsum(rnorm(n, 0.01, 0.02)) + 0.6
pb <- 0.04 * debt + rnorm(n, 0, 0.005)
result <- dk_bohn_test(pb, debt)
print(result)
```

dk_compare *Compare Debt Projections*

Description

Produces a side-by-side comparison of multiple debt-to-GDP projections, aligning them by year and computing terminal values.

Usage

```
dk_compare(..., metric = "debt")
```

Arguments

`...`	Named `dk_projection` objects to compare. Names are used as scenario labels.
`metric`	Character. The metric to compare. Currently only `"debt"` is supported. Default `"debt"`.

Value

An S3 object of class `dk_comparison` containing:

paths A `data.frame` with a `year` column and one column per scenario, giving the debt-to-GDP path.

terminal Named numeric vector of terminal debt-to-GDP ratios.

Examples

```
d <- dk_sample_data()
base <- dk_project(tail(d$debt, 1), 0.03, 0.04, 0.01, horizon = 5)
austerity <- dk_project(tail(d$debt, 1), 0.03, 0.04, 0.03, horizon = 5)
stimulus <- dk_project(tail(d$debt, 1), 0.03, 0.05, -0.01, horizon = 5)

comp <- dk_compare(
  Baseline = base,
  Austerity = austerity,
  Stimulus = stimulus
)
comp
plot(comp)
```

`dk_decompose` *Decompose Historical Debt Changes*

Description

Breaks down observed year-on-year changes in the debt-to-GDP ratio into four components:

Usage

```
dk_decompose(debt, interest_rate, gdp_growth, primary_balance, years = NULL)
```

Arguments

`debt`	Numeric vector of historical debt-to-GDP ratios.
`interest_rate`	Numeric vector of effective interest rates on government debt. Must be the same length as `debt`.
`gdp_growth`	Numeric vector of nominal GDP growth rates. Must be the same length as `debt`.
`primary_balance`	Numeric vector of primary balance-to-GDP ratios (positive = surplus). Must be the same length as `debt`.
`years`	Optional integer vector of year labels. Must be the same length as `debt`. If `NULL` (default), years are numbered sequentially.

Details

1. **Interest effect**: $r_t/(1+g_t) \cdot d_{t-1}$
2. **Growth effect**: $-g_t/(1+g_t) \cdot d_{t-1}$
3. **Primary balance effect**: $-pb_t$
4. **Stock-flow adjustment (residual)**: actual change minus the sum of the three identified components.

This is the standard decomposition used by the IMF (2013) and European Commission. The SFA residual captures privatisation receipts, exchange-rate valuation changes, below-the-line operations, and any measurement error.

Value

An S3 object of class `dk_decomposition` containing:

data A `data.frame` with columns `year`, `debt`, `change`, `interest_effect`, `growth_effect`, `snowball_effect`, `primary_balance_effect`, and `sfa`.

years The year labels used.

References

Blanchard, O.J. (1990). Suggestions for a New Set of Fiscal Indicators. *OECD Economics Department Working Papers*, No. 79. doi:10.1787/435618162862

International Monetary Fund (2013). *Staff Guidance Note for Public Debt Sustainability Analysis in Market-Access Countries*. IMF Policy Paper.

Examples

```
d <- dk_sample_data()
dec <- dk_decompose(
  debt = d$debt,
  interest_rate = d$interest_rate,
  gdp_growth = d$gdp_growth,
  primary_balance = d$primary_balance,
  years = d$years
)
dec
plot(dec)
```

---

dk_estimate_shocks *Estimate Joint Distribution of Macro Shocks*

Description

Estimates the joint distribution of GDP growth, interest rate, and primary balance shocks for use in stochastic debt sustainability analysis. Three estimation methods are supported: a VAR(1) model (default), residual bootstrap, and a simple multivariate normal fit.

Usage

```
dk_estimate_shocks(
  gdp_growth,
  interest_rate,
  primary_balance,
  method = c("var", "bootstrap", "normal"),
  years = NULL
)
```

Arguments

`gdp_growth`	Numeric vector of historical real GDP growth rates.
`interest_rate`	Numeric vector of historical nominal (or real) interest rates.
`primary_balance`	Numeric vector of historical primary balance-to-GDP ratios.
`method`	Character; one of `"var"` (default), `"bootstrap"`, or `"normal"`.
`years`	Optional numeric vector of year labels (same length as data).

Details

For `method = "var"`, a VAR(1) is estimated equation-by-equation via OLS on the lagged system. The residual variance-covariance matrix captures the joint shock distribution. For `method = "bootstrap"`, the same VAR(1) is estimated and residuals are stored for block resampling. For `method = "normal"`, the sample means and covariance of the raw series are used directly.

Value

An S3 object of class `dk_shocks` with components:

vcov 3x3 variance-covariance matrix with rows/columns named `growth`, `interest_rate`, `primary_balance`.

means Named numeric vector of variable means.

method The estimation method used.

residuals Matrix of residuals (for `"var"` and `"bootstrap"`) or `NULL` (for `"normal"`).

var_coefficients VAR(1) coefficient matrix (for `"var"`) or `NULL`.

n_obs Number of observations used.

Examples

```
set.seed(1)
n <- 30
g <- rnorm(n, 0.02, 0.015)
r <- rnorm(n, 0.03, 0.01)
pb <- rnorm(n, -0.02, 0.01)
shocks <- dk_estimate_shocks(g, r, pb)
print(shocks)
```

`dk_fan_chart` *Stochastic Debt Fan Chart*

Description

Projects debt-to-GDP paths via Monte Carlo simulation using the standard debt dynamics equation. At each step, correlated shocks to growth, the interest rate, and the primary balance are drawn from a multivariate normal distribution and added to the baseline paths. The result is a fan chart showing the distribution of projected debt paths.

Usage

```
dk_fan_chart(
  debt,
  interest_rate,
  gdp_growth,
  primary_balance,
  shocks = NULL,
```

```
  shock_vcov = NULL,
  n_sim = 1000L,
  horizon = 5L,
  confidence = c(0.1, 0.25, 0.5, 0.75, 0.9),
  seed = NULL
)
```

Arguments

debt	Numeric scalar; initial debt-to-GDP ratio.
interest_rate	Numeric scalar or vector of length horizon; baseline interest rate path.
gdp_growth	Numeric scalar or vector of length horizon; baseline GDP growth path.
primary_balance	Numeric scalar or vector of length horizon; baseline primary balance-to-GDP path.
shocks	A dk_shocks object (from dk_estimate_shocks()) providing the shock distribution, or NULL.
shock_vcov	Optional 3x3 variance-covariance matrix (alternative to shocks). Rows/columns ordered: growth, interest_rate, primary_balance. Ignored if shocks is provided.
n_sim	Integer; number of Monte Carlo simulations (default 1000).
horizon	Integer; projection horizon in years (default 5).
confidence	Numeric vector of quantile levels for fan bands (default c(0.10, 0.25, 0.50, 0.75, 0.90)).
seed	Optional integer seed for reproducibility.

Value

An S3 object of class dk_fan with components:

simulations Matrix of dimension n_sim x (horizon + 1) containing all simulated debt paths.

quantiles Matrix of quantiles at each time step, with rows corresponding to the confidence levels.

baseline Numeric vector of length horizon + 1; the deterministic baseline debt path.

confidence The quantile levels used.

horizon The projection horizon.

prob_above Named list with the probability of debt exceeding 60 percent, 90 percent, and 120 percent of GDP at the terminal year.

Random number generation

Passing seed calls set.seed() and does not restore the previous state, so the caller's random stream is left reseeded after the call. This is deliberate: a save-and-restore implementation was removed at CRAN's request in 0.1.2 because it manipulated .GlobalEnv. If you need to continue a reproducible stream afterwards, call set.seed() again yourself, or omit seed and seed the surrounding script instead.

Examples

```
set.seed(1)
n <- 30
g <- rnorm(n, 0.02, 0.015)
r <- rnorm(n, 0.03, 0.01)
pb <- rnorm(n, -0.02, 0.01)
shocks <- dk_estimate_shocks(g, r, pb)

fan <- dk_fan_chart(
  debt = 0.90,
  interest_rate = 0.03,
  gdp_growth = 0.02,
  primary_balance = -0.02,
  shocks = shocks,
  n_sim = 500,
  horizon = 10,
  seed = 42
)
print(fan)
```

---

dk_gfn *Gross Financing Needs*

Description

Computes gross financing needs (GFN) as a share of GDP over a projection horizon. GFN represents the total amount of new borrowing a government requires each year to cover its primary deficit, interest payments, and maturing debt:

Usage

```
dk_gfn(debt, interest_rate, maturity_profile, primary_balance, horizon = 5)
```

Arguments

`debt`	Numeric scalar. Initial debt-to-GDP ratio.
`interest_rate`	Numeric scalar or vector of length `horizon`. Effective nominal interest rate on government debt.
`maturity_profile`	Numeric vector or scalar. If a vector, gives the share of GDP maturing in each year of the horizon. If a scalar, interpreted as the average maturity in years; debt is assumed to mature uniformly at `debt / maturity_profile` per year.
`primary_balance`	Numeric scalar or vector of length `horizon`. Primary balance as a share of GDP (positive = surplus).
`horizon`	Integer scalar. Projection horizon in years. Default `5`.

Details

$$GFN_t = -pb_t + r_t \cdot d_t + m_t$$

where pb is the primary balance (positive = surplus), r is the effective interest rate, d is debt-to-GDP, and m is maturing debt as a share of GDP.

Value

A `data.frame` with columns:

year Year index (1 to `horizon`).

primary_deficit Primary deficit (negative of primary balance).

interest_payments Interest payments as a share of GDP.

maturing_debt Maturing debt as a share of GDP.

gfn Total gross financing needs as a share of GDP.

References

International Monetary Fund (2013). *Staff Guidance Note for Public Debt Sustainability Analysis in Market-Access Countries*. IMF Policy Paper.

Examples

```
# Scalar average maturity of 7 years
dk_gfn(debt = 0.90, interest_rate = 0.03,
       maturity_profile = 7, primary_balance = -0.02)

# Explicit maturity profile
dk_gfn(debt = 0.90, interest_rate = 0.03,
       maturity_profile = c(0.15, 0.12, 0.10, 0.08, 0.05),
       primary_balance = -0.02)
```

---

dk_heat_map *IMF-Style Risk Heat Map*

Description

Classifies sovereign debt risk as low, medium, or high based on IMF (2013) thresholds for debt-to-GDP, gross financing needs, and optional debt-profile indicators. Advanced economies and emerging markets use different thresholds.

Usage

```
dk_heat_map(
  debt,
  gross_financing_needs,
  debt_profile = NULL,
  country_type = c("ae", "em")
)
```

Arguments

`debt`	Numeric scalar. Debt-to-GDP ratio.
`gross_financing_needs`	Numeric scalar. Gross financing needs as a share of GDP.
`debt_profile`	Optional named list of debt-profile indicators (all as ratios):
	share_st_debt Share of short-term debt in total debt.
	fx_share Share of foreign-currency-denominated debt.
	nonresident_share Share of debt held by non-residents.
	bank_share Share of debt held by domestic banks.
	change_st_debt Year-on-year change in the share of short-term debt (in percentage points of GDP).
`country_type`	Character. Either `"ae"` (advanced economy, default) or `"em"` (emerging market).

Value

An S3 object of class `dk_heatmap` containing:

ratings Named list of risk ratings (`"low"`, `"medium"`, or `"high"`) for each indicator.

overall Character. Overall risk level: `"high"` if any indicator is high, `"medium"` if any is medium, otherwise `"low"`.

values Named list of input values.

thresholds The thresholds used for classification.

country_type The country type used.

References

International Monetary Fund (2013). *Staff Guidance Note for Public Debt Sustainability Analysis in Market-Access Countries*. IMF Policy Paper.

International Monetary Fund (2022). *Staff Guidance Note on the Sovereign Risk and Debt Sustainability Framework for Market Access Countries*. IMF Policy Paper.

Examples

```
hm <- dk_heat_map(
  debt = 0.90,
  gross_financing_needs = 0.18,
  debt_profile = list(fx_share = 0.30, share_st_debt = 0.15),
```

```
  country_type = "ae"
)
hm
```

---

dk_project *Project Debt-to-GDP Path*

Description

Projects a debt-to-GDP ratio forward using the standard debt dynamics equation:

Usage

```
dk_project(
  debt,
  interest_rate,
  gdp_growth,
  primary_balance,
  sfa = 0,
  horizon = 10,
  date = NULL
)
```

Arguments

debt	Numeric scalar. Initial debt-to-GDP ratio (e.g., 0.90 for 90 per cent of GDP).
interest_rate	Numeric scalar or vector of length horizon. Nominal effective interest rate on government debt.
gdp_growth	Numeric scalar or vector of length horizon. Nominal GDP growth rate.
primary_balance	Numeric scalar or vector of length horizon. Primary balance as a share of GDP. Positive values denote a surplus; negative values a deficit.
sfa	Numeric scalar or vector of length horizon. Stock-flow adjustment as a share of GDP. Default 0.
horizon	Integer scalar. Number of years to project forward. Default 10.
date	Optional Date. If supplied, the projection is anchored to this date (stored in the output for labelling purposes).

Details

$$d_{t+1} = \frac{1 + r_t}{1 + g_t} d_t - pb_t + sfa_t$$

where d is the debt-to-GDP ratio, r is the effective nominal interest rate on government debt, g is nominal GDP growth, pb is the primary balance as a share of GDP (positive = surplus), and sfa captures stock-flow adjustments (e.g. privatisation receipts, exchange-rate valuation changes, below-the-line operations).

Value

An S3 object of class `dk_projection` containing:

debt_path Numeric vector of length `horizon + 1`, giving the debt-to-GDP ratio from the initial period through the terminal period.

decomposition A `data.frame` with columns `year`, `debt`, `interest_effect`, `growth_effect`, `snowball_effect`, `primary_balance_effect`, `sfa_effect`, and `change`.

horizon The projection horizon.

inputs A list storing all input parameters.

References

Blanchard, O.J. (1990). Suggestions for a New Set of Fiscal Indicators. *OECD Economics Department Working Papers*, No. 79. doi:10.1787/435618162862

International Monetary Fund (2013). *Staff Guidance Note for Public Debt Sustainability Analysis in Market-Access Countries*. IMF Policy Paper.

Examples

```
d <- dk_sample_data()
proj <- dk_project(
  debt = tail(d$debt, 1),
  interest_rate = 0.03,
  gdp_growth = 0.04,
  primary_balance = 0.01
)
proj
plot(proj)
```

---

dk_rg *Interest Rate-Growth Differential and Debt-Stabilising Primary Balance*

Description

Computes the interest rate-growth differential ($r - g$), a key indicator of debt sustainability. When $r > g$, debt grows faster than the economy (the "snowball effect" is adverse) and a primary surplus is needed to stabilise the debt ratio. When $r < g$, the government can run a primary deficit and still see the debt ratio fall.

Usage

```
dk_rg(interest_rate, gdp_growth, inflation = NULL, debt = NULL)
```

Arguments

`interest_rate`	Numeric. Effective nominal interest rate on government debt. Scalar or vector.
`gdp_growth`	Numeric. Nominal GDP growth rate. Scalar or vector (same length as `interest_rate`).
`inflation`	Numeric or `NULL`. If supplied, the inflation rate used to compute the real $r - g$. Scalar or same length as `interest_rate`. Default `NULL`.
`debt`	Numeric or `NULL`. If supplied, the debt-to-GDP ratio used to compute the debt-stabilising primary balance. Scalar or same length as `interest_rate`. Default `NULL`.

Details

If `debt` is supplied, the function also computes the **debt-stabilising primary balance**: the primary surplus (as a share of GDP) required to hold the debt-to-GDP ratio constant at its current level. This is given by:

$$pb^* = \frac{r - g}{1 + g} \cdot d$$

If `inflation` is supplied, the function computes the **real** $r - g$ differential by deflating both the interest rate and GDP growth: $r_{real} = (1 + r)/(1 + \pi) - 1$ and $g_{real} = (1 + g)/(1 + \pi) - 1$.

Value

A named list with:

rg_differential Numeric vector. The nominal $r - g$ differential.

real_rg Numeric vector. The real $r - g$ differential. Only present if `inflation` was supplied.

debt_stabilising_pb Numeric vector. The debt-stabilising primary balance as a share of GDP. Only present if `debt` was supplied.

References

Blanchard, O.J. (1990). Suggestions for a New Set of Fiscal Indicators. *OECD Economics Department Working Papers*, No. 79. doi:10.1787/435618162862

Barrett, P. (2018). Interest-Growth Differentials and Debt Limits in Advanced Economies. *IMF Working Paper*, WP/18/82.

Examples

```
# Simple scalar case
dk_rg(interest_rate = 0.04, gdp_growth = 0.03)

# With debt: compute stabilising primary balance
dk_rg(interest_rate = 0.04, gdp_growth = 0.03, debt = 0.90)

# With inflation: compute real r-g
dk_rg(interest_rate = 0.04, gdp_growth = 0.05, inflation = 0.02)
```

```
# Vector case using sample data
d <- dk_sample_data()
dk_rg(
  interest_rate = d$interest_rate,
  gdp_growth = d$gdp_growth,
  debt = d$debt
)
```

`dk_sample_data` *Sample Fiscal Data*

Description

Provides built-in sample datasets for running examples and tests without requiring external data.

Usage

```
dk_sample_data(country = c("sample", "high_debt"))
```

Arguments

`country`	Character. Which sample dataset to return. Options: `"sample"` (default) provides a synthetic 20-year history for a mid-income country; `"high_debt"` provides a high-debt scenario.

Value

A list with components:

years Integer vector of years.

debt Numeric vector of debt-to-GDP ratios.

interest_rate Numeric vector of effective interest rates on government debt.

gdp_growth Numeric vector of nominal GDP growth rates.

primary_balance Numeric vector of primary balance-to-GDP ratios (positive = surplus).

Examples

```
d <- dk_sample_data()
d$debt
d$years
```

dk_stress_test *IMF Standardised Stress Tests*

Description

Applies six standardised IMF stress-test scenarios to a baseline debt projection using the debt dynamics equation:

Usage

```
dk_stress_test(
  debt,
  interest_rate,
  gdp_growth,
  primary_balance,
  horizon = 5,
  growth_shock = -0.01,
  interest_shock = 0.02,
  exchange_shock = 0.15,
  fx_share = 0,
  pb_shock = -0.01,
  contingent_shock = 0.1,
  calibrate = NULL
)
```

Arguments

debt	Numeric scalar. Initial debt-to-GDP ratio.
interest_rate	Numeric scalar or vector of length horizon. Baseline nominal effective interest rate.
gdp_growth	Numeric scalar or vector of length horizon. Baseline nominal GDP growth rate.
primary_balance	Numeric scalar or vector of length horizon. Baseline primary balance as a share of GDP (positive = surplus).
horizon	Integer scalar. Projection horizon in years. Default 5.
growth_shock	Numeric scalar. Percentage-point reduction in GDP growth applied in the first two years. Default -0.01 (1 pp lower growth).
interest_shock	Numeric scalar. Percentage-point increase in the interest rate. Default 0.02 (200 basis points).
exchange_shock	Numeric scalar. Depreciation fraction applied to foreign-currency debt. Default 0.15 (15 per cent depreciation).
fx_share	Numeric scalar. Share of debt denominated in foreign currency. Default 0.
pb_shock	Numeric scalar. Percentage-point deterioration in primary balance in the first two years. Default -0.01.

`contingent_shock`
: Numeric scalar. One-off increase in debt-to-GDP from contingent liabilities materialising. Default `0.10`.

`calibrate`
: Optional named list for data-driven shock calibration. Should contain numeric vectors `gdp_growth_hist`, `interest_rate_hist`, and `primary_balance_hist`. When provided, shock sizes are computed as one standard deviation of each historical series, replacing the fixed defaults. When `NULL` (default), the fixed defaults are used.

Details

$$d_{t+1} = \frac{1 + r_t}{1 + g_t} d_t - pb_t + sfa_t$$

The six scenarios are:

1. **Growth shock**: GDP growth reduced by `growth_shock` for the first two years.
2. **Interest rate shock**: interest rate increased by `interest_shock` for the full horizon.
3. **Exchange rate shock**: debt increases by `debt * fx_share * exchange_shock` in year 1 (one-off stock-flow adjustment from currency depreciation).
4. **Primary balance shock**: primary balance reduced by `pb_shock` for the first two years.
5. **Combined shock**: simultaneous growth shock of `growth_shock / 2` and interest rate shock of `interest_shock / 2`.
6. **Contingent liabilities**: one-off debt increase of `contingent_shock` in year 1.

Value

An S3 object of class `dk_stress` containing:

scenarios A `data.frame` with columns `year`, `baseline`, `growth`, `interest_rate`, `exchange_rate`, `primary_balance`, `combined`, and `contingent`.

terminal Named numeric vector of terminal debt-to-GDP under each scenario.

inputs A list storing all input parameters.

References

International Monetary Fund (2013). *Staff Guidance Note for Public Debt Sustainability Analysis in Market-Access Countries*. IMF Policy Paper.

International Monetary Fund (2022). *Staff Guidance Note on the Sovereign Risk and Debt Sustainability Framework for Market Access Countries*. IMF Policy Paper.

Examples

```
st <- dk_stress_test(
  debt = 0.90,
  interest_rate = 0.03,
  gdp_growth = 0.04,
  primary_balance = 0.01,
```

```
  fx_share = 0.20
)
st
plot(st)
```

`dk_sustainability_gap` *S1 and S2 Sustainability Gap Indicators*

Description

Computes the S1 and S2 fiscal sustainability gap indicators used by the European Commission to assess the size of the permanent budgetary adjustment required to ensure debt sustainability.

Usage

```
dk_sustainability_gap(
  debt,
  structural_balance,
  gdp_growth,
  interest_rate,
  ageing_costs = 0,
  target_debt = 0.6,
  target_year = 20,
  indicator = c("both", "S1", "S2")
)
```

Arguments

`debt`	Numeric scalar. Current debt-to-GDP ratio.
`structural_balance`	Numeric scalar. Current structural primary balance as a share of GDP (positive = surplus).
`gdp_growth`	Numeric scalar. Real GDP growth rate.
`interest_rate`	Numeric scalar. Real interest rate.
`ageing_costs`	Numeric scalar. Projected increase in age-related expenditure as percentage points of GDP. Default `0`.
`target_debt`	Numeric scalar. Target debt-to-GDP ratio for S1. Default `0.60`.
`target_year`	Integer scalar. Number of years to reach the target debt ratio. Default `20`.
`indicator`	Character. Which indicator to compute: `"S1"`, `"S2"`, or `"both"` (default).

Details

S1 measures the permanent adjustment in the structural primary balance needed to bring the debt-to-GDP ratio to `target_debt` in `target_year` years, taking into account projected increases in age-related expenditure.

S2 measures the permanent adjustment needed to stabilise the debt-to-GDP ratio over an infinite horizon, including the cost of future increases in age-related spending. That cost enters as the annuity value of their net present value, which for the permanent step increase assumed here equals `ageing_costs`.

Value

An S3 object of class `dk_sgap` containing:

S1 The S1 sustainability gap (or `NA` if not requested).

S2 The S2 sustainability gap (or `NA` if not requested).

risk_S1 Risk classification for S1: `"low"`, `"medium"`, or `"high"`.

risk_S2 Risk classification for S2: `"low"`, `"medium"`, or `"high"`.

required_pb The required structural primary balance implied by S1.

current_pb The current structural primary balance.

inputs A list storing all input parameters.

References

European Commission (2012). *Fiscal Sustainability Report 2012*. European Economy 8/2012, Directorate-General for Economic and Financial Affairs.

Examples

```
dk_sustainability_gap(
  debt = 0.90,
  structural_balance = -0.01,
  gdp_growth = 0.015,
  interest_rate = 0.025,
  ageing_costs = 0.02
)
```

Index

dk_bohn_test, 2
dk_compare, 4
dk_decompose, 5
dk_estimate_shocks, 6
dk_estimate_shocks(), *8*
dk_fan_chart, 7
dk_gfn, 9
dk_heat_map, 10
dk_project, 12
dk_rg, 13
dk_sample_data, 15
dk_stress_test, 16
dk_sustainability_gap, 18

set.seed(), *8*