

# Package ‘CGE’

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**Type** Package

**Title** Computing General Equilibrium

**Version** 0.3.3

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**Description** Developing general equilibrium models, computing general equilibrium and simulating economic dynamics with structural dynamic models in LI (2019, ISBN: 9787521804225) ``General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press''. When developing complex general equilibrium models, GE package should be used in addition to this package.

**License** GPL-2 | GPL-3

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CD\_A

*Cobb-Douglas Demand Structure Matrix***Description**

This function computes the Cobb-Douglas demand structure matrix.

**Usage**

```
CD_A(alpha, Beta, p)
```

**Arguments**

alpha            a nonnegative numeric m-vector or m-by-1 matrix.  
 Beta            a nonnegative numeric n-by-m matrix whose each column sum equals 1.  
 p                a nonnegative numeric n-vector or n-by-1 matrix.

**Value**

A demand coefficient n-by-m matrix is computed which indicates the demands of agents (firms or consumers) for obtaining unit product or utility with Cobb-Douglas production functions or utility functions under the price vector p.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
CD_A(1, c(0.5, 0.5), c(1, 2))

#####
alpha <- c(5, 3, 1)
Beta <- matrix(c(
  0.6, 0.4, 0.2,
  0.1, 0.4, 0.7,
  0.3, 0.2, 0.1
), 3, 3, TRUE)
p <- 1:3
CD_A(alpha, Beta, p)
```

---

CD\_mA

*Cobb-Douglas Monetary Demand Structure Matrix*

---

**Description**

This function computes a Cobb-Douglas monetary demand structure matrix in a monetary economy.

**Usage**

```
CD_mA(alpha, Beta, p)
```

**Arguments**

alpha a nonnegative numeric m-vector or m-by-1 matrix.  
 Beta nonnegative numeric n-by-m matrix whose each column sum equals 1.  
 p a nonnegative numeric n-vector or n-by-1 matrix.

**Details**

Some elements of Beta corresponding to money equal -1.

**Value**

A n-by-m matrix is computed which indicates the (monetary) demand structure of agents (firms or consumers) with Cobb-Douglas production functions or utility functions under the price vector p.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
alpha <- c(1, 1, 1)
Beta <- matrix(c(
  0.5, 0.5, 0.5,
  0.5, 0.5, 0.5,
  -1, -1, -1
), 3, 3, TRUE)
p <- c(1, 2, 0.1)
CD_mA(alpha, Beta, p)
```

---

 CES\_A

---

*CES Demand Coefficient Matrix*


---

**Description**

This function computes the CES demand coefficient matrix.

**Usage**

```
CES_A(sigma, alpha, Beta, p, Theta = NULL)
```

**Arguments**

sigma	a numeric m-vector or m-by-1 matrix.
alpha	a nonnegative numeric m-vector or m-by-1 matrix.
Beta	a nonnegative numeric n-by-m matrix.
p	a nonnegative numeric n-vector or n-by-1 matrix.
Theta	null or a positive numeric n-by-m matrix.

**Value**

A demand coefficient n-by-m matrix is computed which indicates the demands of agents (firms or consumers) for obtaining unit product or utility with CES production functions or utility functions (e.g.  $\alpha * (\beta_1 * x_1^\sigma + \beta_2 * x_2^\sigma)^{1/\sigma}$  or  $\alpha * (\beta_1 * (x_1/\theta_1)^\sigma + \beta_2 * (x_2/\theta_2)^\sigma)^{1/\sigma}$ ) under the price vector p.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```

CES_A(-1, 2, c(0.2, 0.1), c(1, 2))

#####
sigma <- c(-1, -1, -1)
alpha <- c(1, 1, 1)
Beta <- matrix(c(
  0, 1, 1,
  1, 0, 0,
  1, 0, 0
), 3, 3, TRUE)
p <- 1:3
CES_A(sigma, alpha, Beta, p)

#####
sigma <- -1e-10
alpha <- 1
Beta <- c(0.8, 0.2)
Theta <- c(2, 1)
p <- c(1, 1)
CES_A(sigma, alpha, Beta, p, Theta)
CD_A(alpha * prod(Theta^(-Beta)), Beta, p)

CES_A(sigma, alpha, Beta, p, Beta)
CD_A(alpha * prod(Beta^(-Beta)), Beta, p)

```

```
CES_A(-1e5, alpha, Beta, p, Theta)
```

---

CES\_mA

*CES Monetary Demand Coefficient Matrix*

---

### Description

This function computes a CES monetary demand coefficient matrix in a monetary economy.

### Usage

```
CES_mA(sigma, alpha, Beta, p, Theta = NULL)
```

### Arguments

sigma	a numeric m-vector or m-by-1 matrix.
alpha	a nonnegative numeric m-vector or m-by-1 matrix.
Beta	a nonnegative numeric n-by-m matrix whose each column sum equals 1.
p	a nonnegative numeric n-vector or n-by-1 matrix.
Theta	null or a positive numeric n-by-m matrix.

### Details

Some elements of Beta corresponding to money equal -1.

### Value

A n-by-m matrix is computed which indicates the (monetary) demand structure of agents (firms or consumers) with CES production functions or utility functions under the price vector p.

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
alpha <- matrix(1, 6, 1)
Beta <- matrix(c(
  0, 1, 1, 0, 1, 1,
  0.5, 0, 0, 0, 0, 0,
  -1, -1, -1, 0, 0, 0,
  0.5, 0, 0, 0.5, 0, 0,
  0, 0, 0, 0.5, 0, 0,
  0, 0, 0, -1, -1, -1
), 6, 6, TRUE)
p <- c(1, 2, 0.1, 4, 5, 0.1)
CES_mA(rep(-1, 6), alpha, Beta, p)
```

ChinaCGE2012

*A CGE Model of China based on the Input-Output Table of 2012 (Unit: Ten Thousand RMB)*

**Description**

This data set gives parameters of a CGE model of China based on the input-output table of 2012.

**Usage**

ChinaCGE2012

**Format**

A list containing the following components:

A(state)	function	a function which returns a demand structure 41-by-38 matrix under a given price 41-vector.
B	numeric	a supply structure 41-by-38 matrix.
S0Exg	numeric	an exogenous supply 41-by-38 matrix.
z0	numeric	an initial exchange levels (i.e. activity levels, production levels or utility levels) 38-vector.
subject.names	character	names of 41 subjects (or commodities).
sector.names	character	names of 38 sectors.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**



```
ChinaCGE2012$A(list(p = rep(1, 41)))

#####
cge <- function(GRExg = 0) {
  sdm(
    A = ChinaCGE2012$A,
    B = ChinaCGE2012$B,
    S0Exg = ChinaCGE2012$S0Exg,
    GRExg = GRExg,
    z0 = ChinaCGE2012$z0,
    priceAdjustmentVelocity = 0.03
  )
}

#####
ge0 <- cge()
names(ge0$p) <- ChinaCGE2012$subject.names
ge0$p

names(ge0$z) <- ChinaCGE2012$sector.names
ge0$z

#####
ge6 <- cge(GRExg = 0.06)
names(ge6$p) <- ChinaCGE2012$subject.names
ge6$p

names(ge6$z) <- ChinaCGE2012$sector.names
ge6$z
```

---

dg

*A Modified diag Function*

---

## Description

This function works in the way analogous to the `diag` function of Matlab.

## Usage

```
dg(x)
```

## Arguments

`x` a number, vector or square matrix.

## Value

If `x` is a number, `dg` returns itself. If `x` is a vector, a one-row matrix or a one-column matrix, `dg` returns a matrix with `x` as the main diagonal. Otherwise `dg` returns `diag(x)`.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**Examples**

```
diag(matrix(2, 3))
dg(matrix(2, 3))
```

---

Example.MWG.15.B.1      *Example 15.B.1 in MWG (1995)*

---

**Description**

This is Example 15.B.1 in MWG (1995, P519), which is a pure exchange Cobb-Douglas 2-by-2 economy.

**Usage**

```
Example.MWG.15.B.1(
  a = 0.1,
  S0Exg = matrix(c(
    1, 2,
    2, 1
  )), 2, 2, TRUE)
)
```

**Arguments**

**a**                      Each consumer has the Cobb-Douglas utility function  $x_1^a x_2^{1-a}$ .

**S0Exg**                 exogenous supply matrix which will be passed to the function `sdm`.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

Mas-Colell, Andreu and Whinston, Michael Dennis and Green, Jerry R. (1995, ISBN: 0195073401) Microeconomic Theory. Oxford University Press (New York).

**Examples**

```

Example.MWG.15.B.1()

#####
Example.MWG.15.B.1(a = 0.2)

#####
S <- matrix(c(
  18, 72,
  40, 20
), 2, 2, TRUE)
ge <- Example.MWG.15.B.1(a = 0.2, S0Exg = S)
ge$p / ge$p[1]

```

---

Example.MWG.15.B.2      *Example 15.B.2 in MWG (1995)*

---

**Description**

This is Example 15.B.2 in MWG (1995, P521), which is a pure exchange 2-by-2 economy with quasilinear utility functions.

**Usage**

```
Example.MWG.15.B.2(p0 = c(1, 0.3))
```

**Arguments**

`p0`                      an initial price 2-vector, which will be passed to the function `sdm`.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

Mas-Colell, Andreu and Whinston, Michael Dennis and Green, Jerry R. (1995, ISBN: 0195073401) Microeconomic Theory. Oxford University Press (New York).

**Examples**

```

ge <- Example.MWG.15.B.2()
ge$p

#####

```

```
ge <- Example.MWG.15.B.2(p0 = c(0.3, 1))
ge$p

#####
ge <- Example.MWG.15.B.2(p0 = c(1, 1))
ge$p
```

---

Example.MWG.Exercise.15.B.6  
*Exercise 15.B.6 in MWG (1995)*

---

### Description

This is Exercise 15.B.6 in MWG (1995, P541), which is a pure exchange CES 2-by-2 economy.

### Usage

```
Example.MWG.Exercise.15.B.6(p0 = c(1, 2))
```

### Arguments

`p0` an initial price 2-vector, which will be passed to the function `sdm`.

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

Mas-Colell, Andreu and Whinston, Michael Dennis and Green, Jerry R. (1995, ISBN: 0195073401) Microeconomic Theory. Oxford University Press (New York).

### Examples

```
ge <- Example.MWG.Exercise.15.B.6()
ge$p / ge$p[2] # (3/4)^3

#####
ge <- Example.MWG.Exercise.15.B.6(p0 = c(2, 1))
ge$p / ge$p[2] # (4/3)^3

#####
ge <- Example.MWG.Exercise.15.B.6(p0 = c(1, 1))
ge$p
```

---

Example.MWG.Exercise.15.B.9

*Exercise 15.B.9 in MWG (1995)*

---

### Description

This is Exercise 15.B.9 in MWG (1995, P541), which is a pure exchange 2-by-2 economy.

### Usage

```
Example.MWG.Exercise.15.B.9(  
  S0Exg = matrix(c(  
    30, 0,  
    0, 20  
  ), 2, 2, TRUE)  
)
```

### Arguments

S0Exg            an exogenous supply matrix, which will be passed to the function sdm.

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

Mas-Colell, Andreu and Whinston, Michael Dennis and Green, Jerry R. (1995, ISBN: 0195073401) Microeconomic Theory. Oxford University Press (New York).

### Examples

```
Example.MWG.Exercise.15.B.9()  
  
#####  
S <- matrix(c(  
  5, 0,  
  0, 20  
) , 2, 2, TRUE)  
Example.MWG.Exercise.15.B.9(S0Exg = S)
```

---

Example.Section.3.1.2.corn

*Example in Section.3.1.2 of Li (2019)*

---

### Description

This is the example in Section.3.1.2 of Li (2019), which is a Leontief-type two-sector corn economy.

### Usage

Example.Section.3.1.2.corn()

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example.Varian.Exercise.18.2

*Exercise 18.2 in Varian (1992)*

---

### Description

This is Exercise 18.2 in Varian (1992, P357), which is a Cobb-Douglas 3-by-4 economy.

### Usage

Example.Varian.Exercise.18.2()

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

Varian, Hal R. (1992, ISBN: 0393957357) Microeconomic Analysis. W. W. Norton & Company.

### Examples

```
ge <- Example.Varian.Exercise.18.2()
ge$A %*% diag(ge$z) #input matrix
```

---

Example.Varian.P352      *Example on Page 352 in Varian (1992)*

---

**Description**

This is the example on page 352 in Varian (1992) (see also Example 15.C.2. in MWG, 1995, P542), which is a decreasing-returns-to-scale Cobb-Douglas 3-by-2 economy and can be transformed into a constant-returns-to-scale 3-by-3 (or 3-by-2) economy.

**Usage**

Example.Varian.P352(agent.number = 3)

**Arguments**

agent.number      agent.number can be set to 3 or 2.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

Mas-Colell, Andreu and Whinston, Michael Dennis and Green, Jerry R. (1995, ISBN: 0195073401) Microeconomic Theory. Oxford University Press (New York).

Varian, Hal R. (1992, ISBN: 0393957357) Microeconomic Analysis. W. W. Norton & Company.

**Examples**

Example.Varian.P352()

#####

Example.Varian.P352(agent.number = 2)

---

Example2.2      *Example 2.2 in Li (2019)*

---

**Description**

This is Example 2.2 in Li (2019), which is a Cobb-Douglas pure production economy.

**Usage**

Example2.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example2.3

*Example2.3 in Li (2019)*

---

**Description**

This is Example 2.3 in Li (2019), which is a von Neumann economy.

**Usage**

Example2.3()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example3.1

*Example 3.1 in Li (2019)*

---

**Description**

This is Example 3.1 in Li (2019), which is a two-sector corn economy with a non-homothetic utility function.

**Usage**

Example3.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)



---

Example3.10

*Example 3.10 in Li (2019)*

---

**Description**

This is Example 3.10 in Li (2019), which is a Leontief corn economy with three primary factors.

**Usage**

Example3.10()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example3.12

*Example 3.12 in Li (2019)*

---

**Description**

This is Example 3.12 in Li (2019), which is an economy with decreasing returns to scale.

**Usage**

Example3.12()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example3.14

*Example 3.14 in Li (2019)*

---

**Description**

This is Example 3.14 in Li (2019), which illustrates the relationship between a regular economy and a pure exchange economy.

**Usage**

Example3.14()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example3.2

*Example 3.2 in Li (2019)*

---

**Description**

This is Example 3.2 in Li (2019), which is a Cobb-Douglas two-sector corn economy.

**Usage**

Example3.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example3.4

*Example 3.4 in Li (2019)*

---

**Description**

This is Example 3.2 in Li (2019), which is a Lontief three-sector economy with one primary factor.

**Usage**

Example3.4()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example3.8

*Example 3.8 in Li (2019)*

---

**Description**

This is Example 3.8 in Li (2019), which is a Cobb-Douglas three-sector economy with one primary factor.

**Usage**

Example3.8()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example3.9

*Example 3.9 in Li (2019)*

---

**Description**

This is Example 3.9 in Li (2019), which is a Cobb-Douglas three-sector economy with two primary factors.

**Usage**

Example3.9()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.10

*Example 4.10 in Li (2019)*

---

**Description**

This is Example 4.10 in Li (2019), which illustrates the tax.

**Usage**

Example4.10()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.11.1

*First Part of Example 4.11 in Li (2019)*

---

**Description**

This is the first part of Example 4.11 in Li (2019), which illustrates the tax.

**Usage**

Example4.11.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.11.2

*Second Part of Example 4.11 in Li (2019)*

---

**Description**

This is the second part of Example 4.11 in Li (2019), which illustrates the tax.

**Usage**

Example4.11.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.12

*Example 4.12 in Li (2019)*

---

**Description**

This is Example 4.12 in Li (2019), which illustrates the tax.

**Usage**

Example4.12()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.13

*Example 4.13 in Li (2019)*

---

**Description**

This is Example 4.13 in Li (2019), which illustrates the dividend.

**Usage**

Example4.13()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.15

*Example 4.15 in Li (2019)*

---

**Description**

This is Example 4.15 in Li (2019), which illustrates over-investment.

**Usage**

Example4.15()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.16

*Example 4.16 in Li (2019)*

---

**Description**

This is Example 4.16 in Li (2019), which illustrates technology monopoly.

**Usage**

Example4.16()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.2

*Example 4.2 in Li (2019)*

---

**Description**

This is Example 4.2 in Li (2019), which illustrates the non-sufficient supply of the primary factor.

**Usage**

Example4.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example4.8

*Example 4.8 in Li (2019)*

---

**Description**

This is Example 4.8 in Li (2019), which illustrates the increasing returns to scale.

**Usage**

Example4.8()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)



---

Example4.9

*Example 4.9 in Li (2019)*

---

**Description**

This is Example 4.9 in Li (2019), which illustrates the price signal.

**Usage**

Example4.9()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.1

*Example 5.1 in Li (2019)*

---

**Description**

This is Example 5.1 in Li (2019), which illustrates fixed assets.

**Usage**

Example5.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.10

*Example 5.10 in Li (2019)*

---

**Description**

This is Example 5.10 in Li (2019), which illustrates pollution.

**Usage**

Example5.10()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.11.1

*First Part of Example 5.11 in Li (2019)*

---

**Description**

This is the first part of Example 5.11 in Li (2019), which illustrates pollution.

**Usage**

Example5.11.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.11.2

*Second Part of Example 5.11 in Li (2019)*

---

**Description**

This is the second part of Example 5.11 in Li (2019), which illustrates pollution.

**Usage**

Example5.11.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.2

*Example 5.2 in Li (2019)*

---

**Description**

This is Example 5.2 in Li (2019), which illustrates fixed assets.

**Usage**

Example5.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.3.1

*First Part of Example 5.3 in Li (2019)*

---

**Description**

This is the first part of Example 5.3 in Li (2019), which illustrates fixed assets.

**Usage**

Example5.3.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.3.2

*Second Part of Example 5.3 in Li (2019)*

---

**Description**

This is the second part of Example 5.3 in Li (2019), which illustrates fixed assets.

**Usage**

Example5.3.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.4

*Example 5.4 in Li (2019)*

---

**Description**

This is Example 5.4 in Li (2019), which illustrates fixed assets.

**Usage**

Example5.4()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.5

*Example 5.5 in Li (2019)*

---

**Description**

This is Example 5.5 in Li (2019), which illustrates fixed assets.

**Usage**

Example5.5()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example5.6

*Example 5.6 in Li (2019)*

---

**Description**

This is Example 5.6 in Li (2019), which illustrates fixed assets.

**Usage**

Example5.6()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.10

*Example 6.10 in Li (2019)*

---

**Description**

This is Example 6.10 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.10()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.11

*Example 6.11 in Li (2019)*

---

**Description**

This is Example 6.11 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.11()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.13

*Example 6.13 in Li (2019)*

---

**Description**

This is Example 6.13 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.13()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge <- Example6.13()
matplot(ge$ts.p, type = "l")
matplot(ge$ts.z, type = "l")
```

---

Example6.2.1

*First Part of Example 6.2 in Li (2019)*

---

**Description**

This is the first part of Example 6.2 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.2.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.2.2

*Second Part of Example 6.2 in Li (2019)*

---

**Description**

This is the second part of Example 6.2 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.2.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)



---

Example6.3

*Example 6.3 in Li (2019)*

---

**Description**

This is Example 6.3 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.3()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.4

*Example 6.4 in Li (2019)*

---

**Description**

This is Example 6.4 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.4()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.5

*Example 6.5 in Li (2019)*

---

**Description**

This is Example 6.5 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.5()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.6.1

*First Part of Example 6.6 in Li (2019)*

---

**Description**

This is the first part of Example 6.6 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.6.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.6.2

*Second Part of Example 6.6 in Li (2019)*

---

**Description**

This is the second part of Example 6.6 in Li (2019), which illustrates the first country of a two-country economy.

**Usage**

Example6.6.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.6.3

*Third Part of Example 6.6 in Li (2019)*

---

**Description**

This is the third part of Example 6.6 in Li (2019), which illustrates the second country of a two-country economy.

**Usage**

Example6.6.3()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.7

*Example 6.7 in Li (2019)*

---

**Description**

This is Example 6.7 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.7()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example6.9

*Example 6.9 in Li (2019)*

---

**Description**

This is Example 6.9 in Li (2019), which illustrates a two-country economy.

**Usage**

Example6.9()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.1

*Example 7.1 in Li (2019)*

---

**Description**

This is Example 7.1 in Li (2019), which illustrates a monetary pure exchange economy.

**Usage**

Example7.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.10

*Example 7.10 in Li (2019)*

---

**Description**

This is Example 7.10 in Li (2019), which illustrates fiat money and representative money.

**Usage**

Example7.10()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.10.2

*Extra Part of Example 7.10 in Li (2019)*

---

**Description**

This is an extra part of Example 7.10 in Li (2019), which illustrates fiat money and representative money.

**Usage**

Example7.10.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.11

*Example 7.11 in Li (2019)*

---

**Description**

This is Example 7.11 in Li (2019), which illustrates bond.

**Usage**

Example7.11()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.12

*Example 7.12 in Li (2019)*

---

**Description**

This is Example 7.12 in Li (2019), which illustrates the foreign exchange rate and international credit.

**Usage**

Example7.12()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.13

*Example 7.13 in Li (2019)*

---

**Description**

This is Example 7.13 in Li (2019), which illustrates indirect financing based on commercial banks.

**Usage**

Example7.13()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.14

*Example 7.14 in Li (2019)*

---

**Description**

This is Example 7.14 in Li (2019), which illustrates shadow prices.

**Usage**

Example7.14()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.15

*Example 7.15 in Li (2019)*

---

**Description**

This is Example 7.15 in Li (2019), which illustrates shadow prices and international trade.

**Usage**

Example7.15()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)



---

 Example7.2

*Example 7.2 in Li (2019)*


---

**Description**

This is Example 7.2 in Li (2019), which illustrates a monetary Cobb-Douglas zero-growth corn economy.

**Usage**

```
Example7.2()
```

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
## Another way to compute this equilibrium, i.e. treating money as tax receipt.
r <- 0.25
ge <- sdm(
  A = function(state) {
    alpha <- rbind(1, 1, 1)
    Beta <- matrix(c(
      0.5, 0.5, 0.5,
      0.5, 0.5, 0.5
    ), 2, 3, TRUE)
    tmp.A <- CD_A(alpha, Beta, state$p[1:2])
    tmp <- apply(tmp.A, 2, function(x) sum(x * state$p[1:2]))

    rbind(tmp.A, r * tmp / state$p[3])
  },
  B = diag(3),
  S0Exg = {
    tmp <- matrix(NA, 3, 3)
    tmp[2, 2] <- 100
    tmp[3, 3] <- 100
    tmp
  }
)

ge$p / ge$p[3] * r

p <- ge$p
p[3] <- p[3] / r
```

p / p[3]

---

Example7.3

*Example 7.3 in Li (2019)*

---

**Description**

This is Example 7.3 in Li (2019), which illustrates a monetary Leontief corn economy.

**Usage**

Example7.3()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.4

*Example 7.4 in Li (2019)*

---

**Description**

This is Example 7.4 in Li (2019), which illustrates a monetary Cobb-Douglas positive-growth corn economy.

**Usage**

Example7.4()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.5.1

*First Part of Example 7.5 in Li (2019)*

---

**Description**

This is the first part of Example 7.5 in Li (2019), which illustrates a monetary Cobb-Douglas corn economy including dividend.

**Usage**

Example7.5.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.5.2

*Second Part of Example 7.5 in Li (2019)*

---

**Description**

This is the second part of Example 7.5 in Li (2019), which illustrates a monetary Cobb-Douglas corn economy including dividend.

**Usage**

Example7.5.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.6

*Example 7.6 in Li (2019)*

---

**Description**

This is Example 7.6 in Li (2019), which illustrates foreign exchange rates.

**Usage**

Example7.6()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.7

*Example 7.7 in Li (2019)*

---

**Description**

This is Example 7.7 in Li (2019), which illustrates foreign exchange rates.

**Usage**

Example7.7()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.8

*Example 7.8 in Li (2019)*

---

**Description**

This is Example 7.8 in Li (2019), which illustrates commodity money.

**Usage**

Example7.8()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example7.9X

*Example 7.9 in Li (2019)*

---

**Description**

This is Example 7.9 in Li (2019), which illustrates commodity money and representative money.

**Usage**

Example7.9X()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example8.1

*Example 8.1 in Li (2019)*

---

**Description**

This is Example 8.1 in Li (2019), which expounds the equilibrium coffee problem.

**Usage**

Example8.1()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example8.2

*Example 8.2 in Li (2019)*

---

**Description**

This is Example 8.2 in Li (2019), which expounds a Cobb-Douglas market-clearing exchange process.

**Usage**

Example8.2()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

---

Example8.7

*Example 8.7 in Li (2019)*

---

**Description**

This is Example 8.7 in Li (2019), which discusses price changes in the coffee economy.

**Usage**

Example8.7()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge <- Example8.7()
matplot(ge$ts.p, type = "l")
matplot(ge$ts.z, type = "l")
```

---

Example8.8

*Example 8.8 in Li (2019)*

---

**Description**

This is Example 8.8 in Li (2019), which illustrates a dynamic exchange model with one type of money.

**Usage**

Example8.8()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge <- Example8.8()
matplot(ge$ts.p, type = "l")
matplot(ge$ts.z, type = "l")
```

---

 Example8.9

*Example 8.9 in Li (2019)*


---

**Description**

This is Example 8.9 in Li (2019), which illustrates a dynamic exchange model with multiple types of money.

**Usage**

```
Example8.9()
```

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge <- Example8.9()
matplot(ge$ts.p, type = "l")
matplot(ge$ts.z, type = "l")
```

---

 Example9.10

*Example 9.10-9.14 in Li (2019)*


---

**Description**

This is Example 9.10-14 in Li (2019), which illustrates economic cycles in a monetary economy and economic policies ironing economic cycles.

**Usage**

```
Example9.10(
  policy = NULL,
  pExg = rbind(NA, NA, 0.25),
  p0 = rbind(0.625, 0.375, 0.25),
  priceAdjustmentVelocity = 0.3,
  ts = TRUE
)
```



**Arguments**

	Those arguments will be passed to the function <code>sdm</code> . See <a href="#">sdm</a> .
<code>policy</code>	a policy function
<code>pExg</code>	an n-vector indicating the exogenous prices (if any).
<code>p0</code>	an initial price n-vector.
<code>priceAdjustmentVelocity</code>	the price adjustment velocity.
<code>ts</code>	if TRUE, the time series of the last iteration are returned.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**See Also**

[sdm](#); [Example9.10.policy.interest.rate](#); [Example9.10.policy.money.supply](#); [Example9.10.policy.deflation](#); [Example9.10.policy.quantitative.easing](#); [Example9.10.policy.tax](#); [Example9.10.policy.deficit.fiscal](#)

**Examples**

```
##### no policy
ge <- Example9.10()
matplot(ge$ts.p, type = "l")
matplot(ge$ts.z, type = "l")

##### interest rate policy (Fig. 9.12)
Example9.10(policy = Example9.10.policy.interest.rate)

##### monetary supply policy (Fig. 9.13)
Example9.10(policy = Example9.10.policy.money.supply)

##### deflation policy (Fig. 9.14)
ge <- Example9.10(
  policy = Example9.10.policy.deflation,
  pExg = rbind(NA, NA, 0),
  p0 = rbind(0.625, 0.375, 0), ts = TRUE
)
plot(ge$ts.S[3, 3, ], type = "l")
plot(ge$ts.q[, 3], type = "l")

##### quantitative easing policy (Fig. 9.15)
ge <- Example9.10(
  policy = Example9.10.policy.quantitative.easing,
  pExg = rbind(NA, NA, 0),
```

```

    p0 = rbind(0.625, 0.375, 0),
    ts = TRUE
  )
plot(log(ge$ts.S[3, 3, ]), type = "l")
plot(ge$ts.q[, 3], type = "l")
plot(log(ge$ts.p[, 1]), type = "l")
lines(log(ge$ts.p[, 2]), col = "blue")

##### deficit fiscal policy (Fig. 9.17; Fig. 9.18)
ge <- Example9.10(
  policy = Example9.10.policy.deficit.fiscal,
  priceAdjustmentVelocity = 0.5, ts = TRUE
)
plot(ge$ts.S[3, 3, ], type = "l")
plot(ge$ts.q[, 1], type = "l")

deficit.Example9.10 <- ge$policy.data
plot(deficit.Example9.10, type = "l")
plot(deficit.Example9.10[, 1], cumsum(deficit.Example9.10[, 2]), type = "l")
plot(deficit.Example9.10[, 1],
      cumsum(deficit.Example9.10[, 2]) /
      (tail(ge$ts.z[, 1] * ge$ts.p[, 1], -399)),
      type = "l"
)

##### tax policy (Fig. 9.16)
ge <- Example9.10(policy = Example9.10.policy.tax)
plot(ge$policy.data, type = "l")

```

---

Example9.10.policy.deficit.fiscal

*Deficit Fiscal Policy for Example 9.10 in Li (2019)*

---

### Description

This is the deficit fiscal policy for the economy of Example 9.10 in Li (2019), which is discussed in Example 9.14.

### Usage

```
Example9.10.policy.deficit.fiscal(time, state, state.history)
```

### Arguments

time	the current time.
state	a list indicating the current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.
state.history	the history of economic states.

**Value**

Example9.10.policy.deficit.fiscal returns a list indicating the modified current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels), supplies and current policy data.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**See Also**

[Example9.10](#); [Example9.10.policy.interest.rate](#); [Example9.10.policy.money.supply](#); [Example9.10.policy.deficit.fiscal](#); [Example9.10.policy.quantitative.easing](#); [Example9.10.policy.tax](#)

---

Example9.10.policy.deflation

*Deflation Policy for Example9.10 in Li (2019)*

---

**Description**

This is the deflation policy for the economy of Example 9.10 in Li (2019), which is discussed in Example 9.12.

**Usage**

```
Example9.10.policy.deflation(time, state, state.history)
```

**Arguments**

time	the current time.
state	a list indicating the current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.
state.history	the history of economic states.

**Value**

Example9.10.policy.deflation returns a list indicating the modified current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**See Also**

[Example9.10](#); [Example9.10.policy.interest.rate](#); [Example9.10.policy.money.supply](#); [Example9.10.policy.quantity](#); [Example9.10.policy.tax](#); [Example9.10.policy.deficit.fiscal](#)

---

Example9.10.policy.interest.rate

*Interest Rate Policy for Example9.10 in Li (2019)*

---

**Description**

This is the interest rate policy for the economy of Example 9.10 in Li (2019), which is discussed in Example 9.11.

**Usage**

Example9.10.policy.interest.rate(time, state, state.history)

**Arguments**

time	the current time.
state	a list indicating the current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.
state.history	the history of economic states.

**Value**

Example9.10.policy.interest.rate returns a list indicating the modified current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**See Also**

[Example9.10](#); [Example9.10.policy.money.supply](#); [Example9.10.policy.deflation](#); [Example9.10.policy.quantity](#); [Example9.10.policy.tax](#); [Example9.10.policy.deficit.fiscal](#)

---

`Example9.10.policy.money.supply`*Money Supply Policy for Example9.10 in Li (2019)*

---

**Description**

This is the money supply policy for the economy of Example 9.10 in Li (2019), which is discussed in Example 9.12.

**Usage**

```
Example9.10.policy.money.supply(time, state, state.history)
```

**Arguments**

<code>time</code>	the current time.
<code>state</code>	a list indicating the current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.
<code>state.history</code>	the history of economic states.

**Value**

`Example9.10.policy.money.supply` returns a list indicating the modified current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**See Also**

[Example9.10](#); [Example9.10.policy.interest.rate](#); [Example9.10.policy.deflation](#); [Example9.10.policy.quantitative easing](#); [Example9.10.policy.tax](#); [Example9.10.policy.deficit.fiscal](#)

---

Example9.10.policy.quantitative.easing

*Quantitative Easing Policy for Example 9.10 in Li (2019)*

---

### Description

This is the deflation policy for the economy of Example 9.10 in Li (2019), which is discussed in Example 9.12.

### Usage

```
Example9.10.policy.quantitative.easing(time, state, state.history)
```

### Arguments

time	the current time.
state	a list indicating the current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.
state.history	the history of economic states.

### Value

Example9.10.policy.quantitative.easing returns a list indicating the modified current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

### See Also

[Example9.10](#); [Example9.10.policy.interest.rate](#); [Example9.10.policy.money.supply](#); [Example9.10.policy.def](#)  
[Example9.10.policy.tax](#); [Example9.10.policy.deficit.fiscal](#)

---

Example9.10.policy.tax

*Tax Policy for Example9.10 in Li (2019)*

---

### Description

This is the tax policy for the economy of Example 9.10 in Li (2019), which is discussed in Example 9.13.

### Usage

```
Example9.10.policy.tax(time, state, state.history)
```

### Arguments

time	the current time.
state	a list indicating the current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels) and supplies.
state.history	the history of economic states.

### Value

Example9.10.policy.tax returns a list indicating the modified current economic state including prices, exchange levels (i.e. activity levels, production levels or utility levels), supplies and current policy data.

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

### See Also

[Example9.10](#); [Example9.10.policy.interest.rate](#); [Example9.10.policy.money.supply](#); [Example9.10.policy.deficit.fiscal](#); [Example9.10.policy.quantitative.easing](#); [Example9.10.policy.deficit.fiscal](#)

---

Example9.3

*Example 9.3 in Li (2019)*

---

**Description**

This is Example 9.3 in Li (2019), which illustrates economic cycles in a pure production economy.

**Usage**

Example9.3()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge<-Example9.3()
matplot(ge$ts.p, type="l")
matplot(ge$ts.z, type="l")
```

---

Example9.4

*Example 9.4 in Li (2019)*

---

**Description**

This is Example 9.4 in Li (2019), which illustrates economic cycles in a corn economy.

**Usage**

Example9.4()

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)



**Examples**

```
ge<-Example9.4()
matplot(ge$ts.p, type="l")
matplot(ge$ts.z, type="l")
```

---

Example9.5

*Example 9.5 in Li (2019)*

---

**Description**

This is Example 9.5 in Li (2019), which illustrates the price-control equilibrium.

**Usage**

```
Example9.5()
```

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge<-Example9.5()
matplot(ge$ts.p, type="l")
matplot(ge$ts.z, type="l")
```

---

Example9.6

*Example 9.6 in Li (2019)*

---

**Description**

This is Example 9.6 in Li (2019), which illustrates the technological progress and capital accumulation in the corn economy.

**Usage**

```
Example9.6()
```

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge<-Example9.6()  
matplot(ge$ts.p, type="l")  
matplot(ge$ts.z, type="l")
```

---

Example9.7

*Example 9.7 in Li (2019)*

---

**Description**

This is Example 9.7 in Li (2019), which illustrates fixed assets and economic cycles.

**Usage**

```
Example9.7()
```

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
ge<-Example9.7()  
matplot(ge$ts.p, type="l")  
matplot(ge$ts.z, type="l")
```

---

F\_Z                      *Exchange Function*

---

**Description**

Given a price vector, a demand coefficient matrix and a supply matrix, this function computes the (disequilibrium) exchange results of an exchange process. There are  $n$  commodities and  $m$  agents in the exchange process.

**Usage**

```
F_Z(A, p, S)
```

**Arguments**

A                      a n-by-m demand coefficient matrix.  
p                      a price n-vector.  
S                      a n-by-m supply matrix.

**Value**

F\_Z returns a list containing the following components:

z                      an exchange amount m-vector.  
q                      a sales rate n-vector.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
A <- matrix(c(
  0.05, 0.05, 0.1,
  0.1, 0, 0.1,
  0, 0.15, 0.05
), 3, 3, TRUE)
S <- diag(3)

# a market-clearing price vector
p <- c(0.6, 0.9, 1)
result <- F_Z(A, p, S)
# Each sales rate is equal to 1
```

```

result$q
# the purchase matrix
A %*% diag(result$z)

# a non-market-clearing price vector
p <- c(1, 1, 1)
result <- F_Z(A, p, S)
# Some sales rates don't equal 1
result$q
# the purchase matrix
A %*% diag(result$z)

```

---

iep                                    *Compute Instantaneous Equilibrium Path (alias Market Clearing Path)*

---

### Description

This function computes the instantaneous equilibrium path (alias market clearing path).

### Usage

```

iep(A.iiep = NULL, A = NULL, B.iiep = NULL, B = NULL,
    SExg.iiep, InitialEndowments, nPeriods.iiep, ...)

```

### Arguments

A.iiep	A.iiep(state.iiep) is a function which returns a demand coefficient matrix or a function A(state). state.iiep is a list consisting of time (the iiep time), p (the price vector at the iiep time), z (output and utility vector at the iiep time).
A	a demand coefficient matrix or a function A(state) which returns a demand coefficient matrix. If A.iiep is not NULL, A will be ignored.
B.iiep	B.iiep(state.iiep) is a function which returns a supply coefficient matrix or a function B(state) at the iiep time.
B	a supply coefficient matrix or a function B(state) which returns a supply coefficient matrix. If B.iiep is not NULL, B will be ignored.
SExg.iiep	an exogenous supply matrix or a function SExg.iiep(state.iiep) which returns an exogenous supply matrix at the iiep time.
InitialEndowments	a matrix indicating the initial endowments.
nPeriods.iiep	number of periods of the instantaneous equilibrium path.
...	parameters of the function sdm.

### Details

This function computes the instantaneous equilibrium path (alias market clearing path) of a dynamic economy with the structural dynamic model (the sdm function).

**Value**

a list of general equilibria.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

Acemoglu, D. (2009, ISBN: 9780691132921) Introduction to Modern Economic Growth. Princeton University Press.

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

LI Wu (2010) A Structural Growth Model and its Applications to Sraffa's System. <http://www.iioa.org/conferences/18th/paper>

Torres, Jose L. (2016, ISBN: 9781622730452). Introduction to Dynamic Macroeconomic General Equilibrium Models (Second Edition). Vernon Press.

**See Also**

[sdm](#); [Example7.2](#)

**Examples**

```
## example 6.4 of Acemoglu (2009, page 206)
discount.factor <- 0.97
return.rate <- 1 / discount.factor - 1

A <- function(state) {
  a1 <- CD_A(
    1, rbind(0.35, 0.65, 0),
    c(state$p[1] * (1 + return.rate), state$p[2:3])
  )
  a2 <- c(1, 0, 0)
  a1[3] <- state$p[1] * a1[1] * return.rate / state$p[3]
  cbind(a1, a2)
}

B <- matrix(c(
  1, 0,
  0, 1,
  0, 1
), 3, 2, TRUE)

SExg.iiep <- {
  tmp <- matrix(NA, 3, 2)
  tmp[2, 2] <- tmp[3, 2] <- 1
  tmp
}
```

```

InitialEndowments <- {
  tmp <- matrix(0, 3, 2)
  tmp[1, 1] <- 0.01
  tmp[2, 2] <- tmp[3, 2] <- 1
  tmp
}

ge.list <- iep(
  A = A, B = B, SExg.iiep = SExg.iiep,
  InitialEndowments = InitialEndowments,
  nPeriods.iiep = 50
)

z <- t(sapply(ge.list, function(x) x$z))
matplot(z, type = "l")

z[1:49, 1] * (1 - 0.97 * 0.35) # the same as z[-1,2] (i.e. consumption)

# stochastic (instantaneous) equilibrium path (SEP) in the economy above.
nPeriods.iiep <- 150
set.seed(1)
alpha.SEP <- rep(1, 50)
for (t in 51:nPeriods.iiep) {
  alpha.SEP[t] <- exp(0.95 * log(alpha.SEP[t - 1]) +
    rnorm(1, sd = 0.01))
}

A.iiep <- function(state.iiep) {
  A <- function(state) {
    a1 <- CD_A(
      alpha.SEP[state.iiep$time],
      rbind(0.35, 0.65, 0),
      c(state$p[1] * (1 + return.rate), state$p[2:3])
    )
    a2 <- c(1, 0, 0)
    a1[3] <- state$p[1] * a1[1] * return.rate / state$p[3]
    cbind(a1, a2)
  }

  return(A)
}

ge.list <- iep(
  A.iiep = A.iiep, B = B, SExg.iiep = SExg.iiep,
  InitialEndowments = InitialEndowments,
  nPeriods.iiep = nPeriods.iiep
)

z <- t(sapply(ge.list, function(x) x$z))
matplot(z, type = "l")

## an example with two firms

```

```

sigma <- 0 # 0 implies Cobb-Douglas production functions
gamma1 <- 0.01
gamma2 <- 0.01
gamma3 <- 0.01
beta1 <- 0.35
beta2 <- 0.4

A.iep <- function(state.iep) {
  A <- function(state) {
    a1 <- CES_A(sigma, exp(gamma1 * (state.iep$time - 1)), rbind(beta1, 0, 1 - beta1), state$p)
    a2 <- CES_A(sigma, exp(gamma2 * (state.iep$time - 1)), rbind(beta2, 0, 1 - beta2), state$p)
    a3 <- c(0, 1, 0)
    cbind(a1, a2, a3)
  }

  return(A)
}

B <- diag(3)

SExg.iep <- function(state.iep) {
  tmp <- matrix(NA, 3, 3)
  tmp[3, 3] <- exp(gamma3 * (state.iep$time - 1))
  tmp
}

InitialEndowments <- {
  tmp <- matrix(0, 3, 3)
  tmp[1, 1] <- 0.01
  tmp[2, 2] <- 0.02
  tmp[3, 3] <- 1
  tmp
}

ge.list <- iep(
  A.iep = A.iep, B = B, SExg.iep = SExg.iep,
  InitialEndowments = InitialEndowments,
  nPeriods.iep = 100, trace = FALSE
)

z <- t(sapply(ge.list, function(x) x$z)) # outputs and utility
matplot(z, type = "l")

diff(log(z)) # logarithmic growth rate

## an example with heterogeneous firms
A <- function(state) {
  a1 <- CD_A(1, rbind(0.35, 0.65), state$p)
  a2 <- CD_A(1.3, rbind(0.9, 0.1), state$p)
  a3 <- c(1, 0)
  cbind(a1, a2, a3)
}

```

```

B <- matrix(c(
  1, 1, 0,
  0, 0, 1
), 2, 3, TRUE)

SExg.iiep <- {
  tmp <- matrix(NA, 2, 3)
  tmp[2, 3] <- 1
  tmp
}

InitialEndowments <- {
  tmp <- matrix(0, 2, 3)
  tmp[1, 1] <- tmp[1, 2] <- 0.01
  tmp[2, 3] <- 1
  tmp
}

ge.list <- iep(
  A = A, B = B, SExg.iiep = SExg.iiep,
  InitialEndowments = InitialEndowments,
  nPeriods.iiep = 200, trace = FALSE
)

z <- t(sapply(ge.list, function(x) x$z))
matplot(z, type = "l")

## an iep of the example (see Table 2.1 and 2.2) of the canonical dynamic
## macroeconomic general equilibrium model in Torres (2016).
discount.factor <- 0.97
return.rate <- 1 / discount.factor - 1
depreciation.rate <- 0.06

A <- function(state) {
  a1 <- CD_A(1, rbind(0, 0.65, 0.35, 0), state$p)
  a2 <- CD_A(1, rbind(0.4, 1 - 0.4, 0, 0), state$p)
  a3 <- c(1, 0, 0, state$p[1] * return.rate / state$p[4])
  cbind(a1, a2, a3)
}

B <- matrix(c(
  1, 0, 1 - depreciation.rate,
  0, 1, 0,
  0, 0, 1,
  0, 1, 0
), 4, 3, TRUE)

SExg.iiep <- {
  tmp <- matrix(NA, 4, 3)
  tmp[2, 2] <- tmp[4, 2] <- 1
  tmp
}

```



```

InitialEndowments <- {
  tmp <- matrix(0, 4, 3)
  tmp[1, 1] <- 0.01
  tmp[2, 2] <- tmp[4, 2] <- 1
  tmp[3, 3] <- 0.01
  tmp
}

ge.list <- iep(
  A = A, B = B, SExg.iiep = SExg.iiep,
  InitialEndowments = InitialEndowments,
  nPeriods.iiep = 200, trace = FALSE
)

z <- t(sapply(ge.list, function(x) x$z))
matplot(z, type = "l")

## another iep of the economy above
discount.factor <- 0.97
return.rate <- 1 / discount.factor - 1
depreciation.rate <- 0.06

A <- function(state) {
  a1 <- CD_A(
    1, rbind(0.35, 0.65, 0),
    c(state$p[1] * (return.rate + depreciation.rate), state$p[2:3])
  )
  a2 <- CD_A(1, rbind(0.4, 1 - 0.4, 0), state$p)
  a1[3] <- state$p[1] * a1[1] * return.rate / state$p[3]
  cbind(a1, a2)
}

B <- function(state) {
  tmp <- matrix(c(
    1, 0,
    0, 1,
    0, 1
  ), 3, 2, TRUE)

  tmp[1] <- tmp[1] + A(state)[1, 1] * (1 - depreciation.rate)
  tmp
}

SExg.iiep <- {
  tmp <- matrix(NA, 3, 2)
  tmp[2, 2] <- tmp[3, 2] <- 1
  tmp
}

InitialEndowments <- {
  tmp <- matrix(0, 3, 2)
  tmp[1, 1] <- 0.01
  tmp[2, 2] <- tmp[3, 2] <- 1
}

```

```

    tmp
  }

ge.list <- iep(
  A = A, B = B, SExg.iiep = SExg.iiep,
  InitialEndowments = InitialEndowments,
  nPeriods.iiep = 100, n = 3, m = 2, trace = FALSE
)

z <- t(sapply(ge.list, function(x) x$z))
matplot(z, type = "l")

## TFP shock in the economy above (see Torres, 2016, section 2.8).
nPeriods.iiep <- 200

discount.factor <- 0.97
return.rate <- 1 / discount.factor - 1
depreciation.rate <- 0.06

set.seed(1)
alpha.shock <- rep(1, 100)
alpha.shock[101] <- exp(0.01)
for (t in 102:nPeriods.iiep) {
  alpha.shock[t] <- exp(0.95 * log(alpha.shock[t - 1]))
}

A.iiep <- function(state.iiep) {
  A <- function(state) {
    a1 <- CD_A(
      alpha.shock[state.iiep$time],
      rbind(0.35, 0.65, 0),
      c(state$p[1] * (return.rate + depreciation.rate), state$p[2:3])
    )
    a2 <- CD_A(1, rbind(0.4, 1 - 0.4, 0), state$p)
    a1[3] <- state$p[1] * a1[1] * return.rate / state$p[3]
    cbind(a1, a2)
  }

  return(A)
}

B.iiep <- function(state.iiep) {
  B <- function(state) {
    tmp <- matrix(c(
      1, 0,
      0, 1,
      0, 1
    ), 3, 2, TRUE)

    a1 <- CD_A(
      alpha.shock[state.iiep$time],
      rbind(0.35, 0.65, 0),
      c(state$p[1] * (return.rate + depreciation.rate), state$p[2:3])
    )
  }
}

```

```

    )

    tmp[1] <- tmp[1] + a1[1] * (1 - depreciation.rate)
    tmp
  }

  return(B)
}

SEXg.iiep <- {
  tmp <- matrix(NA, 3, 2)
  tmp[2, 2] <- tmp[3, 2] <- 1
  tmp
}

InitialEndowments <- {
  tmp <- matrix(0, 3, 2)
  tmp[1, 1] <- tmp[2, 2] <- tmp[3, 2] <- 1
  tmp
}

ge.list <- iep(
  A.iiep = A.iiep, B.iiep = B.iiep, SEXg.iiep = SEXg.iiep,
  InitialEndowments = InitialEndowments,
  nPeriods.iiep = nPeriods.iiep, n = 3, m = 2, trace = FALSE
)

z <- t(sapply(ge.list, function(x) x$z))
c <- sapply(ge.list, function(x) x$A[1,2]*x$z[2]) #consumption

par(mfrow = c(2, 2))
matplot(z, type = "l")
x <- 100:140
plot(x, z[x, 1] / z[x[1], 1], type = "b", pch = 20)
plot(x, z[x, 2] / z[x[1], 2], type = "b", pch = 20)
plot(x, c[x] / c[x[1]], type = "b", pch = 20)

## an iiep of example 7.2 (a monetary economy) in Li (2019).
A <- function(state) {
  alpha <- rbind(1, 1, 1)
  Beta <- matrix(c(
    0.5, 0.5, 0.5,
    0.5, 0.5, 0.5,
    -1, -1, -1
  ), 3, 3, TRUE)
  CD_mA(alpha, Beta, state$p)
}

B <- diag(3)

SEXg.iiep <- {
  tmp <- matrix(NA, 3, 3)
  tmp[2, 2] <- 100

```

```

tmp[3, 3] <- 100
tmp
}

InitialEndowments <- {
  tmp <- matrix(0, 3, 3)
  tmp[1, 1] <- 10
  tmp[2, 2] <- tmp[3, 3] <- 100
  tmp
}

ge.list <- iep(
  A = A, B = B, SExg.iiep = SExg.iiep,
  InitialEndowments = InitialEndowments,
  nPeriods.iiep = 20,
  moneyIndex = 3,
  moneyOwnerIndex = 3,
  pExg = rbind(NA, NA, 0.25)
)

par(mfrow = c(1, 2))
z <- t(sapply(ge.list, function(x) x$z))
matplot(z, type = "b", pch = 20)
p <- t(sapply(ge.list, function(x) x$p))
matplot(p, type = "b", pch = 20)

## an example of structural transition policy
A.iiep <- function(state.iiep) {
  a <- 15
  b <- 25
  A <- function(state) {
    alpha1 <- 5
    alpha2 <- 15

    if (state.iiep$time == 1 || state.iiep$z[1] <= a) {
      alpha <- alpha1
    } else if (state.iiep$z[1] > b) {
      alpha <- alpha2
    } else {
      alpha <- (b - state.iiep$z[1]) / (b - a) * alpha1 +
        (state.iiep$z[1] - a) / (b - a) * alpha2
    }

    return(cbind(
      CD_A(alpha, c(0.5, 0.5), state$p),
      c(1, 0)
    ))
  }
}

return(A)
}

B <- matrix(c(

```

```

    1, 0,
    0, 1
  ), 2, 2, TRUE)

SExg.iep <- function(state.iep) {
  if (state.iep$time >= 15 && state.iep$z[1] < 30) {
    result <- matrix(c(
      NA, NA,
      0.6, 0.4
    ), 2, 2, TRUE)
  } else {
    result <- matrix(c(
      NA, NA,
      0, 1
    ), 2, 2, TRUE)
  }

  return(result)
}

InitialEndowments <- {
  tmp <- matrix(0, 2, 2)
  tmp[1, 1] <- 1
  tmp[2, 2] <- 1
  tmp
}

ge.list <- iep(
  A.iep = A.iep, B = B, SExg.iep = SExg.iep,
  InitialEndowments = InitialEndowments,
  nPeriods.iep = 30, trace = FALSE
)

z <- t(sapply(ge.list, function(x) x$z))
matplot(z, type = "b", pch = 20)

```

---

Leontief\_mA

*Leontief Monetary Demand Coefficient Matrix*


---

### Description

This function computes a Leontief monetary demand coefficient matrix in a monetary economy.

### Usage

```
Leontief_mA(A.pre, p)
```

**Arguments**

A.pre            a numeric n-by-m matrix.  
 p                a nonnegative numeric n-vector or n-by-1 matrix.

**Details**

Some elements of A corresponding to money equal -1.

**Value**

A n-by-m matrix is computed which indicates the (monetary) demand structure of agents (firms or consumers) with Leontief production functions or utility functions under the price vector p.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

**Examples**

```
A.pre <- matrix(c(
  0.5, 1, 1,
  0.1, 0, 0,
  -1, -1, -1
), 3, 3, TRUE)
p <- c(1, 2, 0.1)
Leontief_mA(A.pre, p)
```

---

 PF\_eig

---

*P-F (i.e. Perron-Frobenius) Eigenvalue and Eigenvector*


---

**Description**

This function computes the P-F (i.e. Perron-Frobenius) eigenvalue and eigenvector of an indecomposable nonnegative square matrix.

**Usage**

```
PF_eig(M)
```

**Arguments**

M                an indecomposable nonnegative square matrix.

**Value**

PF\_eig returns a list containing the following components:

val                the P-F eigenvalue of M.  
vec                the normalized P-F eigenvector of M.

**Author(s)**

LI Wu <liwu@staff.shu.edu.cn>

**References**

Horn, R. A., Johnson, C. R. (2012, ISBN: 0521548233) Matrix Analysis. Cambridge University Press.

**Examples**

```
M<-matrix(c(0.5,1,
            1, 0),2,2,TRUE)
PF_eig(M)
```

---

sdm

*Structural Dynamic Model (alias Structural Growth Model)*


---

**Description**

This function computes the general equilibrium and simulates the economic dynamics. The key part of this function is an exchange function (see [F\\_Z](#)), which is expounded in Li (2010, 2019).

**Usage**

```
sdm(
  A,
  B = diag(nrow(A)),
  n = nrow(B),
  m = ncol(B),
  S0Exg = matrix(NA, n, m),
  p0 = matrix(1, nrow = n, ncol = 1),
  z0 = matrix(100, nrow = m, ncol = 1),
  GRExg = NA,
  moneyOwnerIndex = NULL,
  moneyIndex = NULL,
  pExg = NULL,
  tolCond = 1e-5,
  maxIteration = 200,
  numberOfPeriods = 300,
  depreciationCoef = 0.8,
```

```

thresholdForPriceAdjustment = 0.99,
priceAdjustmentMethod = "variable",
priceAdjustmentVelocity = 0.15,
trace = TRUE,
ts = FALSE,
policy = NULL,
exchangeFunction = F_Z
)

```

### Arguments

A	a demand coefficient n-by-m matrix (alias demand structure matrix) or a function A(state) which returns an n-by-m matrix.
B	a supply coefficient n-by-m matrix (alias supply structure matrix) or a function which returns an n-by-m matrix. If (i,j)-th element of S0Exg is not NA, the value of the (i,j)-th element of B will be useless and ignored.
n	the number of commodities.
m	the number of economic agents (or sectors).
S0Exg	an initial exogenous supply n-by-m matrix. This matrix may contain NA, but not zero.
p0	an initial price n-vector.
z0	an m-vector consisting of the initial exchange levels (i.e. activity levels, production levels or utility levels).
GRExg	an exogenous growth rate of the exogenous supplies in S0Exg. If GRExg is NA and some commodities have exogenous supply, then GRExg will be set to 0.
moneyOwnerIndex	a vector consisting of the indices of agents supplying money.
moneyIndex	a vector consisting of the commodity indices of all types of money.
pExg	an n-vector indicating the exogenous prices (if any).
tolCond	the tolerance condition.
maxIteration	the maximum iteration count. If the main purpose of running this function is to do simulation instead of calculating equilibrium, then maxIteration should be set to 1.
numberOfPeriods	the period number in each iteration.
depreciationCoef	the depreciation coefficient (i.e. 1 minus the depreciation rate) of the unsold products.
thresholdForPriceAdjustment	the threshold for the fixed percentage price adjustment method.
priceAdjustmentMethod	the price adjustment method. Normally it should be set to "variable". If it is set to "fixed", a fixed percentage price adjustment method will be used.
priceAdjustmentVelocity	the price adjustment velocity.



trace	if TRUE, information is printed during the running of sdm.
ts	if TRUE, the time series of the last iteration are returned.
policy	a policy function.
exchangeFunction	the exchange function.

### Details

The parameters A may be a function  $A(\text{state})$  wherein state is a list consisting of p (the price vector), z (the output and utility vector), w (the wealth vector), t (the time) and e (the foreign exchange rate vector if any). state indicates the states at time t.

The parameters B also may be a function  $B(\text{state})$  wherein state is a list consisting of p (the price vector), z (the output and utility vector) and t (the time).

### Value

sdm returns a list containing the following components:

tolerance	the tolerance of the results.
p	equilibrium prices.
z	equilibrium exchange levels (i.e. activity levels, output levels or utility levels).
S	the equilibrium supply matrix at the initial period.
e	equilibrium foreign exchange rates in a multi-money economy.
growthRate	the endogenous equilibrium growth rate in a pure production economy.
A	the equilibrium demand coefficient matrix.
B	If B is a function, the equilibrium supply coefficient matrix is returned.
ts.p	the time series of prices in the last iteration.
ts.z	the time series of exchange levels (i.e. activity levels, production levels or utility levels) in the last iteration.
ts.S	the time series of supply matrix in the last iteration.
ts.q	the time series of sales rates in the last iteration.
ts.e	the time series of foreign exchange rates in the last iteration.
policy.data	the policy data.

### Author(s)

LI Wu <liwu@staff.shu.edu.cn>

### References

LI Wu (2019, ISBN: 9787521804225) General Equilibrium and Structural Dynamics: Perspectives of New Structural Economics. Beijing: Economic Science Press. (In Chinese)

LI Wu (2010) A Structural Growth Model and its Applications to Sraffa's System. <http://www.iioa.org/conferences/18th/paper>

Torres, Jose L. (2016, ISBN: 9781622730452) Introduction to Dynamic Macroeconomic General Equilibrium Models (Second Edition). Vernon Press.

Varian, Hal R. (1992, ISBN: 0393957357) Microeconomic Analysis. W. W. Norton & Company.

**See Also**

[iep](#); [Example2.2](#); [Example2.3](#); [Example.Section.3.1.2.corn](#); [Example3.1](#); [Example3.2](#); [Example3.4](#); [Example3.8](#); [Example3.9](#); [Example3.10](#); [Example3.12](#); [Example3.14](#); [Example4.2](#); [Example4.8](#); [Example4.9](#); [Example4.10](#); [Example4.11.1](#); [Example4.11.2](#); [Example4.12](#); [Example4.13](#); [Example4.15](#); [Example4.16](#); [Example5.1](#); [Example5.2](#); [Example5.3.2](#); [Example5.4](#); [Example5.5](#); [Example5.6](#); [Example5.10](#); [Example5.11.1](#); [Example5.11.2](#); [Example6.2.1](#); [Example6.2.2](#); [Example6.3](#); [Example6.4](#); [Example6.5](#); [Example6.6.1](#); [Example6.6.2](#); [Example6.6.3](#); [Example6.7](#); [Example6.9](#); [Example6.10](#); [Example6.11](#); [Example7.1](#); [Example7.2](#); [Example7.3](#); [Example7.4](#); [Example7.5.1](#); [Example7.5.2](#); [Example7.6](#); [Example7.7](#); [Example7.8](#); [Example7.9X](#); [Example7.10](#); [Example7.10.2](#); [Example7.11](#); [Example7.12](#); [Example7.13](#); [Example7.14](#); [Example7.15](#); [Example8.1](#); [Example8.2](#); [Example8.7](#); [Example8.8](#); [Example8.9](#); [Example9.3](#); [Example9.4](#); [Example9.5](#); [Example9.6](#); [Example9.7](#); [Example9.10](#);

**Examples**

```

## the example on page 352 in Varian (1992)
ge <- sdm(
  A = function(state) {
    a <- 0.5

    alpha <- rep(1, 3)
    Beta <- matrix(c(0, a, a,
                    0.5, 0, 0,
                    0.5, 1 - a, 1 - a), 3, 3, TRUE)

    #the demand coefficient matrix.
    CD_A(alpha, Beta, state$p)
  },
  B = diag(3),
  S0Exg = matrix(c(NA, NA, NA,
                  NA, 1, NA,
                  NA, NA, 1), 3, 3, TRUE),
  GRExg = 0,
  tolCond = 1e-10
)

ge$p/ge$p[1]

## the example (see Table 2.1 and 2.2) of the canonical dynamic
## macroeconomic general equilibrium model in Torres (2016).
discount.factor <- 0.97
return.rate <- 1 / discount.factor - 1
depreciation.rate <- 0.06

ge <- sdm(
  n = 4, m = 3,
  A = function(state) {
    a1 <- CD_A(1, rbind(0, 0.65, 0.35, 0), state$p)
    a2 <- CD_A(1, rbind(0.4, 1 - 0.4, 0, 0), state$p)
    a3 <- c(1, 0, 0, state$p[1] * return.rate / state$p[4])
  }
)

```

```
      cbind(a1, a2, a3)
    },
    B = matrix(c(
      1, 0, 1 - depreciation.rate,
      0, 1, 0,
      0, 0, 1,
      0, 1, 0
    ), 4, 3, TRUE),
    S0Exg = {
      tmp <- matrix(NA, 4, 3)
      tmp[2, 2] <- 1
      tmp[4, 2] <- 1
      tmp
    },
    priceAdjustmentVelocity = 0.03,
    maxIteration = 1,
    numberOfPeriods = 5000,
    ts = TRUE
  )

ge$A %*% diag(ge$z) # the demand matrix
ge$p / ge$p[1]

plot(ge$ts.z[, 1], type = "l")
```

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