

# Simulation Analysis of the Japanese Economy with a Stock-Flow Consistent Model

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# 1. Research Content

## ○ Objective

To clarify the issues of the Japanese economy, which has been in a long deflationary situation, and to explore measures to place the economy on a sustainable growth trajectory.

## ○ Method Approach based on a macro model rooted in accounting (Stock-Flow Consistent Model)

⇒ Verified with actual Japanese SNA data (first attempt in Japan)

## ○ Key Points

- Currently, Japan is exploring achieving economic growth through wage increases.
- Meanwhile, the timing of interest rate hikes is being considered to address inflation and yen depreciation.
- While the economic effects of wage increases are generally recognized, the effects of interest rate hikes are divided (⇒ 2.)
- This study focuses on examining the effects of wage increases and interest rate hikes on the growth of the Japanese economy.

## 2. Effects of Interest Rate Hikes

### ○ Perspectives from Previous Research

- Keynesian and Neoclassical (Conventional)

Interest rates  $\uparrow$   $\Rightarrow$  Investment  $\downarrow$   $\Rightarrow$  GDP  $\downarrow$   $\Rightarrow$  Inflation rate  $\downarrow$

- Post-Keynesian

Interest rates  $\uparrow$   $\Rightarrow$  Investment  $\downarrow$   $\Rightarrow$  Production capacity  $\downarrow$   $\Rightarrow$  Excess demand  $\Rightarrow$  Inflation rate  $\uparrow$

- MMT

Interest rates  $\uparrow$   $\Rightarrow$  Asset income  $\uparrow$   $\Rightarrow$  Consumption  $\uparrow$   $\Rightarrow$  GDP  $\uparrow$   $\Rightarrow$  Inflation rate  $\uparrow$

### ○ Results obtained from this research (Effects of interest rate hikes in Japan)

- OLS estimations : The correlation between corporate investment and interest rates is weak, or rising interest rates increase investment ( $\Rightarrow$  7.)
- Simulation result : Interest rate hikes stimulate economic growth through income effects ( $\Rightarrow$  9. 10.)

$\Rightarrow$  It is considered that the income increase effect outweighs the investment decrease effect  
(consistent with MMT)

### 3. Problem Awareness

○ Stagnation of wages, prices, and the economy over 30 years



○ Concerns over the accumulation of government debt

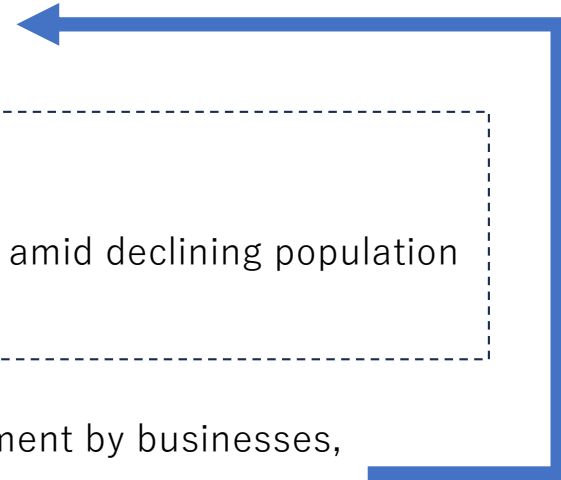
○ Concerns about the sustainability of social security finances amid declining population and aging society



○ Low domestic consumption by households, domestic investment by businesses, and growth expenditure by the government



○ Unable to escape the deflationary spiral (the “Lost 30 years”)



## 4. Previous Research on SFC Models Referenced

### ○ Basic Texts on SFC Models

Godley, Wynne, and Mark Lavoie (2012). *Monetary Economics*. Palgrave Macmillan.

### ○ Empirical Studies

- Byrialsen, M.R., and Hamid Raza (2020). “An Empirical Stock-Flow Consistent Macroeconomic Model for Denmark.” Levy Economics Institute of Bard College Working Paper, 942.
- Burgess, S., Oliver Burrows, Antoine Godin, Stephen Kinsella, and Stephen Millard (2016). “A Dynamic Model of Financial Balances for the United Kingdom.” Bank of England.

### ○ Research in Japan

- Ono, T., and Nishi, H. (2011). “Reconstructing Kaleckian model: Stock-Flow Consistent model.”

This paper introduced the SFC model for the first time in Japan, focusing on theoretical analysis without connecting to real data.

## 5. What is an SFC Model?

- A macroeconomic dynamic model that divides economic agents into households, firms, government, financial institutions, and the foreign sector, and models transactions within and between these sectors based on the principles of accounting entries.



- It utilizes a framework known as the Transaction Flow Matrix.

|                  |                           | Households        | Firms         |                   | Government    | Banks   |              | Rest of the world | $\Sigma$      |
|------------------|---------------------------|-------------------|---------------|-------------------|---------------|---------|--------------|-------------------|---------------|
|                  |                           |                   | current       | capital           |               | current | capital      |                   |               |
| <b>Flow</b>      | Consumption               | -C                | +C            |                   |               |         |              |                   | 0             |
|                  | Investment                |                   | +I            | -I                |               |         |              |                   | 0             |
|                  | Export                    |                   | +EX           |                   |               |         |              | -EX               | 0             |
|                  | Import                    |                   | -IM           |                   |               |         |              | +IM               | 0             |
|                  | Government Expenditure    |                   | +G            |                   | -G            |         |              |                   | 0             |
|                  | Wage                      | +WBh              | -WB           |                   |               |         |              | +WBo              | 0             |
|                  | Entrepreneurial profits   | +FDf              | -Ff           | +FUf              |               |         |              |                   | 0             |
|                  | Bank profit               | +FDb              |               |                   |               | -Fb     | +FUb         |                   | 0             |
|                  | Loan interest             | -rl.Lh-1          | -rl.Lf-1      |                   |               | +rl.L-1 |              | -rl.Lo-1          | 0             |
|                  | Deposit interest          | +rm.Mh-1          | +rm.Mf-1      |                   |               | -rm.M-1 |              | +rm.Mo-1          | 0             |
|                  | Government bonds interest |                   |               |                   |               | -rb.B-1 | +rb.B-1      |                   | 0             |
|                  | Tax                       | -Th               | -Tf           |                   | +T            | -Tb     |              |                   | 0             |
|                  | <b>Stock</b>              | Loan              | + $\Delta$ Lh |                   | + $\Delta$ Lf |         |              | - $\Delta$ L      | + $\Delta$ Lo |
| Deposit          |                           | - $\Delta$ Mh     |               | - $\Delta$ Mf     |               |         | + $\Delta$ M | - $\Delta$ Mo     | 0             |
| Government bonds |                           |                   |               |                   | + $\Delta$ B  |         | - $\Delta$ B |                   | 0             |
| Equity           |                           | - $\Delta$ ef.pef |               | + $\Delta$ ef.pef |               |         |              |                   | 0             |
| $\Sigma$         |                           | 0                 | 0             | 0                 | 0             | 0       | 0            | 0                 | 0             |

- Horizontal and vertical totals sum to zero (Principle of accounting balance)
  - Horizontal: Transactions between sectors
  - Vertical: Sectoral internal balances

- Equations are set up within the constraints of these accounting relationships.



- Simulation results are output as being equivalent to the results of accounting entries.

## 6. Transaction Flow Matrix of the Japanese Economy <GDP and NDP>

< 2019 National Accounts >

(\*1)

| Fiscal Year (Billion Yen)  | Households |           | Non_financial firms |           | Government |          | Financial firms |          | Non_profit inst. |          | Rest of the world | Σ   |
|--|------------|-----------|---------------------|-----------|------------|----------|-----------------|----------|------------------|----------|-------------------|-----|
|  | current    | capital   | current             | capital   | current    | capital  | current         | capital  | current          | capital  |                   |     |
| 1. Private final consumption expenditure                                 | -296,451.0 |           | 303,858.8           |           |            |          |                 |          | -7,407.8         |          |                   | 0.0 |
| 2. Government final consumption expenditure<br>(including)               |            |           | 111,826.9           |           | -111,826.9 |          |                 |          |                  |          |                   | 0.0 |
| (1) Individual consumption expenditure                                   |            |           | 68,703.1            |           |            |          |                 |          |                  |          |                   |     |
| (2) Collective consumption expenditure                                   |            |           | 43,123.9            |           |            |          |                 |          |                  |          |                   |     |
| 3. Private fixed capital formation<br>(including) Changes in inventories |            | -21,121.3 | 121,131.2           | -94,960.4 |            |          |                 | -2,533.9 |                  | -2,515.6 |                   | 0.0 |
| 4. Government fixed capital formation                                    |            |           | 22,078.9            |           | -22,078.9  |          |                 |          |                  |          |                   | 0.0 |
| 5. Net exports of goods and services                                     |            |           | -2,059.5            |           |            |          |                 |          |                  |          | 2,059.5           | 0.0 |
| <b>&lt;Gross Domestic Product&gt;</b>                                    |            |           | 556,836.3           |           |            |          |                 |          |                  |          |                   |     |
| 1. Private consumption of fixed capital                                  |            | 23,820.1  | -115,733.5          | 86,840.9  |            |          |                 | 2,542.3  |                  | 2,530.2  |                   | 0.0 |
| 2. Government consumption of fixed capital                               |            |           | -19,029.0           |           |            | 19,029.0 |                 |          |                  |          |                   | 0.0 |
| <b>&lt;Net Domestic Product&gt;</b>                                      |            |           | 422,073.8           |           |            |          |                 |          |                  |          |                   |     |

○To use data prior to the COVID-19 pandemic as the initial values for the simulation, data from the 2019 National Accounts have been used.

(\*1) The horizontal totals represent transactions between sectors and sum to zero (though there may be discrepancies due to rounding).

## 6. Transaction Flow Matrix of the Japanese Economy < Primary Income Balance >

< 2019 National Accounts >

(\*1)

| Fiscal Year (Billion Yen)                             | Households |         | Non_financial firms |           | Government |         | Financial firms |         | Non_profit inst. |         | Rest of the world | Σ   |
|---|------------|---------|---------------------|-----------|------------|---------|-----------------|---------|------------------|---------|-------------------|-----|
|   | current    | capital | current             | capital   | current    | capital | current         | capital | current          | capital |                   |     |
| <b>&lt;Net Domestic Product&gt;</b>                   |            |         | 422,073.8           |           |            |         |                 |         |                  |         |                   |     |
| 1. Taxes on production and imports less Subsidies     |            |         | -43,305.9           |           | 43,305.9   |         |                 |         |                  |         |                   | 0.0 |
| 2. Operating surplus and mixed income                 | 32,394.3   |         | 50,425.6            | -92,292.3 |            |         | 9,472.4         |         |                  |         |                   | 0.0 |
| 3. Compensation of employees                          | 287,994.7  |         | -287,887.9          |           |            |         |                 |         |                  |         | -106.8            | 0.0 |
| (including)   |            |         |                     |           |            |         |                 |         |                  |         |                   |     |
| (1) Wages and salaries                                | 244,185.4  |         |                     |           |            |         |                 |         |                  |         |                   |     |
| (2) Employers' social contributions                   | 43,809.3   |         |                     |           |            |         |                 |         |                  |         |                   |     |
| a. Employers' actual social contributions             | 42,091.8   |         |                     |           |            |         |                 |         |                  |         |                   |     |
| b. Employers' imputed social contributions            | 1,717.5    |         |                     |           |            |         |                 |         |                  |         |                   |     |
| 4. Property income                                    | 21,215.1   |         | -3,117.0            |           | 37.7       |         | 3,391.1         |         | 274.2            |         | -21,800.8         | 0.3 |
| (1) Interest  |            |         |                     |           |            |         |                 |         |                  |         |                   |     |
| (Receivable)  | 7,162.3    |         | 6,470.4             |           | 5,688.6    |         | 28,578.1        |         | 136.4            |         | 4,055.3           | 0.0 |
| (Payable)   | -1,801.1   |         | -3,049.6            |           | -8,175.8   |         | -24,593.5       |         | -33.7            |         | -14,437.4         |     |
| (2) Dividends   |            |         |                     |           |            |         |                 |         |                  |         |                   |     |
| (Receivable)  | 6,383.5    |         | 19,004.5            |           | 2,524.5    |         | 16,520.3        |         | 170.0            |         | 8,308.2           | 0.2 |
| (Payable)   | 0.0        |         | -25,596.0           |           | 0.0        |         | -7,587.9        |         | 0.0              |         | -19,726.9         |     |
| (3) Other investment income                           |            |         |                     |           |            |         |                 |         |                  |         |                   |     |
| (Receivable)  | 9,470.4    |         | 53.7                |           | 0.4        |         | 4.4             |         | 1.5              |         |                   | 0.1 |
| (Payable)   | 0.0        |         | 0.0                 |           | 0.0        |         | -9,530.3        |         | 0.0              |         |                   |     |
| (including) Investment income on pension entitlements |            |         |                     |           |            |         |                 |         |                  |         |                   |     |
| (Receivable)  | 1,257.4    |         |                     |           |            |         |                 |         |                  |         |                   | 0.0 |
| (Payable)   |            |         |                     |           |            |         | -1,257.4        |         |                  |         |                   |     |
| 5. Rent   | 2,902.6    |         | -2,524.5            |           | -348.2     |         | -124.4          |         | 33.2             |         | 61.3              | 0.0 |
| (Receivable)  | 3,149.4    |         | 1,642.8             |           | 19.5       |         |                 |         | 54.8             |         | 78.7              | 0.0 |
| (Payable)   | -246.8     |         | -4,167.3            |           | -367.7     |         | -124.4          |         | -21.6            |         | -17.4             |     |
| <b>&lt;Balance of primary incomes, net&gt;</b>        | 344,506.7  |         | 43,371.8            |           | 42,995.4   |         | 12,739.1        |         | 307.4            |         | -19,786.8         |     |



## 6. Transaction Flow Matrix of the Japanese Economy < Disposable Income >

< 2019 National Accounts >

(\*1)

| Fiscal Year (Billion Yen)   | Households               |         | Non_financial firms |         | Government       |         | Financial firms          |         | Non_profit inst. |         | Rest of the world | Σ           |
|---|--------------------------|---------|---------------------|---------|------------------|---------|--------------------------|---------|------------------|---------|-------------------|-------------|
|   | current                  | capital | current             | capital | current          | capital | current                  | capital | current          | capital |                   |             |
| <b>&lt;Balance of primary incomes, net&gt;</b>  | 344,506.7                |         | 43,371.8            |         | 42,995.4         |         | 12,739.1                 |         | 307.4            |         | <b>-19,786.8</b>  |             |
| 1. Current taxes on income, wealth, etc.  | <b>-30,356.4</b>         |         | <b>-21,308.3</b>    |         | 56,424.7         |         | <b>-4,760.0</b>          |         |                  |         |                   | 0.0         |
| 2. Net social contributions   | <b>-83,912.5</b>         |         | 947.9               |         | 74,398.5         |         | 8,416.3                  |         | 149.8            |         | 0.0               | 0.0         |
| (1) Employers' actual social contributions  | <b>-42,091.8</b>         |         |                     |         | 33,478.9         |         | 8,612.9                  |         |                  |         |                   | 0.0         |
| (2) Employers' imputed social contributions   | <b>-1,717.5</b>          |         | 947.9               |         | 2,352.7          |         | <b>-1,732.9</b>          |         | 149.8            |         |                   | 0.0         |
| (3) Households' actual social contributions   | <b>-39,138.6</b>         |         |                     |         | 38,566.9         |         | 571.7                    |         |                  |         |                   | 0.0         |
| (4) Households' contributions supplements<br>(less) Service charges on pension scheme | <b>-1,257.4</b><br>292.8 |         |                     |         |                  |         | 1,257.4<br><b>-292.8</b> |         |                  |         |                   | 0.0         |
| 3. Social benefits other than social transfers in kind                                | 79,518.1                 |         | <b>-947.9</b>       |         | <b>-68,842.6</b> |         | <b>-9,213.1</b>          |         | <b>-514.6</b>    |         | 0.0               | <b>-0.1</b> |
| (1) Social security benefits in cash  | 59,054.3                 |         |                     |         | <b>-59,054.3</b> |         |                          |         |                  |         |                   | 0.0         |
| (2) Other social insurance pension benefits   | 9,166.0                  |         |                     |         |                  |         | <b>-9,166.0</b>          |         |                  |         |                   | 0.0         |
| (3) Other social insurance non-pension benefits                                       | 3,497.4                  |         | <b>-947.9</b>       |         | <b>-2,352.7</b>  |         | <b>-47.1</b>             |         | <b>-149.8</b>    |         |                   | <b>-0.1</b> |
| (4) Social assistance benefits  | 7,800.4                  |         |                     |         | <b>-7,435.6</b>  |         |                          |         | <b>-364.8</b>    |         |                   | 0.0         |
| 4. Other current transfers  | <b>-1,474.6</b>          |         | <b>-2,170.8</b>     |         | <b>-6,531.2</b>  |         | <b>-88.9</b>             |         | 9,107.2          |         | 1,158.5           | 0.2         |
| (1) Net non-life insurance premiums   |                          |         |                     |         |                  |         | 5,261.2                  |         |                  |         |                   | 0.0         |
| (Receivable)  |                          |         |                     |         |                  |         |                          |         |                  |         |                   |             |
| (Payable)   | <b>-3,102.5</b>          |         | <b>-1,930.4</b>     |         | <b>-18.3</b>     |         | <b>-135.9</b>            |         | <b>-74.1</b>     |         |                   |             |
| (2) Non-life insurance claims   | 3,030.4                  |         | 1,862.3             |         | 14.4             |         | 289.5                    |         | 64.7             |         |                   | 0.1         |
| (Receivable)  |                          |         |                     |         |                  |         |                          |         |                  |         |                   |             |
| (Payable)   |                          |         |                     |         |                  |         | <b>-5,261.2</b>          |         |                  |         |                   |             |
| (3) Current transfers within general government                                       |                          |         |                     |         | 66,777.6         |         |                          |         |                  |         |                   | 0.0         |
| (Receivable)  |                          |         |                     |         |                  |         |                          |         |                  |         |                   |             |
| (Payable)   |                          |         |                     |         | <b>-66,777.6</b> |         |                          |         |                  |         |                   |             |
| (4) Current international cooperation   |                          |         |                     |         | 0.5              |         |                          |         |                  |         |                   |             |
| (Receivable)  |                          |         |                     |         |                  |         |                          |         |                  |         |                   |             |
| (Payable)   |                          |         |                     |         | <b>-362.6</b>    |         |                          |         |                  |         |                   |             |
| (5) Miscellaneous current transfers   | 12,589.7                 |         | 3,075.6             |         | 2,202.6          |         | 551.6                    |         | 9,116.6          |         |                   |             |
| (Receivable)  |                          |         |                     |         |                  |         |                          |         |                  |         |                   |             |
| (Payable)   | <b>-13,992.2</b>         |         | <b>-5,178.3</b>     |         | <b>-8,367.8</b>  |         | <b>-794.1</b>            |         |                  |         |                   | 0.1         |
| (6) Other current transfers (Rest of the world)                                       |                          |         |                     |         |                  |         |                          |         |                  |         | 686.9             |             |
| To/From Government sector   |                          |         |                     |         |                  |         |                          |         |                  |         | <b>-485.1</b>     |             |
| (7) Other current transfers (Rest of the world)                                       |                          |         |                     |         |                  |         |                          |         |                  |         | 5,002.7           |             |
| To/From Government other sectors  |                          |         |                     |         |                  |         |                          |         |                  |         | <b>-4,046.0</b>   |             |
| (Payable)   |                          |         |                     |         |                  |         |                          |         |                  |         |                   |             |
| <b>&lt;Disposable income, net&gt;</b>   | 308,281.3                |         | 19,892.7            |         | 98,444.8         |         | 7,093.4                  |         | 9,049.8          |         | <b>-18,628.3</b>  |             |

## 6. Transaction Flow Matrix of the Japanese Economy < Net Lending / Net Borrowing >

< 2019 National Accounts >

| Fiscal Year (Billion Yen)   | Households |             | Non financial firms |             | Government |             | Financial firms |             | Non profit inst. |             | Rest of the world |             | Σ   |
|---|------------|-------------|---------------------|-------------|------------|-------------|-----------------|-------------|------------------|-------------|-------------------|-------------|-----|
|   | current    | capital     | current             | capital     | current    | capital     | current         | capital     | current          | capital     |                   |             |     |
| <Disposable income, net>  | 308,281.3  |             | 19,892.7            |             | 98,444.8   |             | 7,093.4         |             | 9,049.8          |             | -18,628.3         |             |     |
| Adjustment for the change in pension entitlements   | -796.7     |             |                     |             |            |             | 796.7           |             |                  |             |                   |             | 0.0 |
| <Saving, net><br>(Disposable income, net - Consumption ± Adjustment for the change in pension entitlements) | 11,033.6   |             | 19,892.7            |             | -13,382.1  |             | 7,890.1         |             | 1,642.0          |             | -18,628.3         |             |     |
| <b>Savings investment balance</b><br>(Saving, net - fixed capital formation + consumption of fixed capital) | 13,732.4   |             | 11,773.2            |             | -16,432.0  |             | 7,898.5         |             | 1,656.6          |             | -18,628.3         |             | 0.4 |
| Capital transfers, etc.   | 2,136.6    |             | -396.8              |             | -907.6     |             | -1,155.3        |             | -137.3           |             | 460.4             |             | 0.0 |
| (1) Capital transfers, net  | -2,030.4   |             | 2,581.9             |             | 159.9      |             | -1,191.9        |             | 20.1             |             | 460.4             |             | 0.0 |
| (2) Changes in inventories  | 12.5       |             | 902.0               | -878.3      | -36.2      |             |                 |             |                  |             |                   |             | 0.0 |
| (3) Purchases of land, net  | -4,179.5   |             | 2,955.0             |             | 1,103.7    |             | -36.6           |             | 157.4            |             |                   |             | 0.0 |
| (*2) ① <Net lending(+)/net borrowing(-)>  | 15,869.0   |             | 11,376.4            |             | -17,339.6  |             | 6,743.2         |             | 1,519.3          |             | -18,167.9         |             | 0.4 |
| <Changes in financial assets and liabilities >  | Assets     | Liabilities | Assets              | Liabilities | Assets     | Liabilities | Assets          | Liabilities | Assets           | Liabilities | Assets            | Liabilities |     |
| Monetary gold and SDRs  | 0.0        | 0.0         | 0.0                 | 0.0         | 61.3       | 0.0         | 0.0             | 0.0         | 0.0              | 0.0         | 0.0               | 61.3        | 0.0 |
| Currency and deposits   | 21,004.1   | 0.0         | 8,366.5             | 0.0         | -2,808.0   | 0.0         | 251.6           | 27,155.2    | 649.9            | 0.0         | -628.2            | -319.3      | 0.0 |
| Loans   | 26.5       | 7,854.5     | 1,258.1             | 13,236.5    | -4,630.8   | -2,199.7    | 121,070.9       | 98,420.4    | 24.5             | 221.9       | 28,712.0          | 28,927.6    | 0.0 |
| Debt securities   | 1,683.8    | 0.0         | 1,200.1             | 10,079.0    | -4,027.6   | 13,782.0    | 25,939.8        | 4,492.7     | -1,037.4         | 0.0         | 4,595.0           | 0.0         | 0.0 |
| Equity and investment fund shares   | -2,822.4   | 0.0         | -107.9              | 278.9       | 590.6      | -1.4        | 12,529.2        | 11,536.9    | 152.4            | 0.0         | 1,472.5           | 0.0         | 0.0 |
| Insurance, pension and standardized guarantee schemes   | 1,020.7    | 0.0         | 89.2                | -1,374.2    | 0.0        | 0.0         | -1,664.1        | 820.0       | 0.0              | 0.0         | 0.0               | 0.0         | 0.0 |
| Financial derivatives and employee stock options  | 16.0       | 0.0         | 0.0                 | 16.0        | 0.0        | 0.0         | 0.0             | 0.0         | 0.0              | 0.0         | 0.0               | 0.0         | 0.0 |
| Other financial assets  | 774.4      | -1,076.4    | 2,145.1             | -20,833.2   | 10,965.2   | 1,836.8     | 18,693.0        | 29,641.3    | -220.7           | -861.4      | 25,339.5          | 48,989.4    | 0.0 |
| (*2) ② <Net lending(+)/net borrowing(-) (financial surplus or deficit)>                                     |            | 14,925.0    |                     | 11,548.1    |            | -13,267.0   |                 | 4,753.9     |                  | 208.2       |                   | -18,168.2   | 0.0 |
| ① - ② (statistical error)   |            | 944.0       |                     | -171.7      |            | -4,072.6    |                 | 1,989.3     |                  | 1,311.1     |                   | 0.3         | 0.4 |

(\*2) Although ① and ② are supposed to match, statistical errors arise because ① is an aggregate from the capital account and ② is an aggregate from the financial account.

## 7. Features of the Model

### ○ Interest Rates

- SNA's asset and liability items are classified into six types: interest-bearing assets and liabilities, equity assets and liabilities, and investment assets and liabilities.

⇒ Return rates are set for each sector and each type (6 sectors × 6 types = 36 rates).

| <b>Firms</b>       | ① Asset   | ② Composition ratio<br>(① ÷ ⑤) | ③ Return rate<br>(④ ÷ ①) | ④ Asset income<br>(receivable) | ① Liability | ② Composition ratio<br>(① ÷ ⑤) | ③ Return rate<br>(④ ÷ ①) | ④ Asset income<br>(payable) |
|--------------------|-----------|--------------------------------|--------------------------|--------------------------------|-------------|--------------------------------|--------------------------|-----------------------------|
| A Interest bearing | 664,378   | 0.58                           | 0.97%                    | 6,470                          | 843,158     | 0.50                           | 0.36%                    | 3,050                       |
| B Equity           | 470,511   | 0.41                           | 4.04%                    | 19,005                         | 819,751     | 0.48                           | 3.12%                    | 25,596                      |
| C Investment       | 3,263     | 0.00                           | 1.65%                    | 54                             | 27,578      | 0.02                           | 0.00%                    | 0                           |
| ⑤ Total            | 1,138,152 |                                |                          |                                | 1,690,487   |                                |                          |                             |

A Interesting bearing : Currency and deposits, Loans, Debt securities, Financial derivatives and employee stock options, Other financial assets

B Equity : Equity and investment fund shares

C Investment : Insurance, pension and standardized guarantee schemes

## 7. Features of the Model

### ○ Wages

- Wages are assumed to grow at a fixed rate of increase, while decreasing by the rate of population decline (1%).

$$\text{Domestic wage } WB_d = (1 + grwb) \cdot WB_d(-1) \cdot (1 + grpp)$$

grwb : Wage increase rate, grpp : Population growth rate

### ○ Consumption

- Consumption is modeled as a function of expected disposable income and net financial assets.
- Expected disposable income is assumed to grow at the same rate as wages.

$$\text{Households consumption } C_h = \alpha 1 \cdot Yde + \alpha 2 \cdot V_h(-1)$$

$\alpha 1$  : Propensity to consume out of disposal income,  $\alpha 2$  : Propensity to consume out of net financial asset,  $V_h$  : Households net financial asset

$$\text{Expected disposable income } Yde = (1 + grwb) \cdot YD(-1)$$

## 7. Features of the Model

### ○ Corporate Investment

- A function of the constant term (C), capacity utilization (GDP/FixCapital), interest rates (ShortRate), and GDP

$$\text{Firms Investment } I_{nf} = -100673.4 - 40773.64 \cdot \text{GDP/Fixed Capital} + 367034.6 \cdot \text{Shortloan Rate} + 0.405041 \cdot \text{GDP}$$

| 1994~2019                                | Coefficient        |                   |                  |                   | AIC             | Adj R^2         |
|--|--------------------|-------------------|------------------|-------------------|-----------------|-----------------|
|  | C                  | GDP               | GDP/FixCapital   | ShortRate         |                 |                 |
| GDP/FixCapital, ShortRate                |                    |                   | 113884.3**       | -495452.8**       | 20.30279        | 0.166312        |
| C, GDP/FixCapital, ShortRate             | 7471.049           |                   | 104023.4*        | -455864.6         | 20.37743        | 0.132046        |
| GDP                                      |                    | 0.162123**        |                  |                   | 19.55629        | 0.590286        |
| C, GDP                                   | -98413.53**        | 0.348079**        |                  |                   | 18.77463        | 0.819144        |
| ShortRate                                |                    |                   |                  | 4700210**         | 24.00752        | -34.125634      |
| C, ShortRate                             | 85730.11**         |                   |                  | -7802.736         | 20.52543        | -0.041588       |
| GDP/FixCapital                           |                    |                   | 104799**         |                   | 20.50824        | -0.061466       |
| C, GDP/FixCapital                        | 48569.70           |                   | 45412.63         |                   | 20.43555        | 0.047944        |
| <b>C, GDP/FixCapital, ShortRate, GDP</b> | <b>-100673.4**</b> | <b>0.405041**</b> | <b>-40773.64</b> | <b>367034.6**</b> | <b>18.55232</b> | <b>0.864556</b> |

- The coefficient for interest rates is positive: An increase in interest rates boosts GDP through income effects, which in turn drives investment.
- The coefficient for capacity utilization is negative: Due to uncertainty about the future, domestic investment does not increase as much as GDP growth.

## 7. Features of the Model

### ○ Government Expenditure

- Public investment grows at a constant rate.

$$\text{Government investment } I_g = (1 + \text{grg}) \cdot G(-1)$$

grg : Growth rate of government investment

- Government collective consumption and government individual consumption (in-kind benefits) are expressed as a ratio to GDP

$$\text{Government individual consumption } C_{g\_ind} = \mu_{ind} \cdot Y$$

$\mu_{ind}$  : Government individual consumption/GDP

$$\text{Government collective consumption } C_{g\_col} = \mu_{col} \cdot Y$$

$\mu_{col}$  : Government collective consumption/GDP

## 7. Features of the Model

### ○ Cash transfers and social contributions

- Cash transfers and social contributions are expressed as a ratio to GDP and allocated to each sector based on current ratios.

Households social benefit(Receivable)  $SBEN_h = \omega_{bh} \cdot Y$

$\omega_{bh}$  : Households social benefit/GDP

(Payable)  $\Rightarrow$  Firms : 0.012, Government : 0.864, Financial firms : 0.116,  
Non\_profit inst. : 0.008

Households social contributions(Payable)  $SCON_h = \omega_{ch} \cdot Y$

$\omega_{ch}$  : Households social contributions/GDP

(Receivable)  $\Rightarrow$  Firms : 0.011, Government : 0.887, Financial firms : 0.100,  
Non\_profit inst. : 0.002

## 7. Features of the Model

### ○ Net Exports

- Expressed as a ratio to GDP.

$$\text{Net exports NEX} = \varepsilon \cdot Y$$

$\varepsilon$  : Net exports/GDP

- ### ○ Exogenous parameters such as ratios to GDP, growth rate are calibrated using data from 1994 to 2019. (Adjustments are made as needed based on changes in trends or other circumstances.)



## 8. The model equations

|                                |   |  |  |
|--------------------------------|---|--|--|
| <Output>                       | Gross Domestic Product<br>Net Domestic Product  | $Y = C_p + I_p + G + NEX$<br>$NY = (1 - \delta) \cdot Y$   | $C_p$ : Private consumption, $I_p$ : Private investment, $G$ : Government expenditure, $NEX$ : Net exports<br>$\delta$ : Consumption of fixed capital/GDP  |
| <Consumption>                  | Private consumption<br>Households consumption<br>Non_profit inst. consumption   | $C_p = C_h + C_{npi}$<br>$C_h = \alpha 1 \cdot Yde + \alpha 2 \cdot V_h(-1)$<br>$C_{npi} = \tau \cdot Y$   | $\alpha 1$ : Propensity to consume out of disposal income, $\alpha 2$ : Propensity to consume out of net financial asset,<br>$V_h$ : Households net financial asset<br>$\tau$ : Non_profit inst. consumption/GDP   |
| <Investment>                   | Private investment<br>Households investment<br>Firms investment<br>Financial firms investment<br>Non_profit inst. investment                        | $I_p = I_h + I_{nf} + I_f + I_{npi}$<br>$I_h = \beta h \cdot Y(-1)$<br>$I_{nf} = -100673.4 - 40773.64 \cdot \text{GDP/Fixed Capital} + 367034.6 \cdot \text{Shortloan Rate} + 0.405041 \cdot \text{GDP}$<br>$I_f = \beta f \cdot Y(-1)$<br>$I_{npi} = \beta npi \cdot Y(-1)$ | $\beta h$ : Households investment/GDP<br><br>$\beta f$ : Financial firms investment/GDP<br>$\beta npi$ : Non_profit inst. investment/GDP   |
| <Government expenditure>       | Government expenditure<br>Government consumption<br>Government individual consumption<br>Government collective consumption<br>Government investment | $G = C_g + I_g$<br>$C_g = C_{g\_ind} + C_{g\_col}$<br>$C_{g\_ind} = \mu ind \cdot Y$<br>$C_{g\_col} = \mu col \cdot Y$<br>$I_g = (1 + grg) \cdot G(-1)$  | $\mu ind$ : Government individual consumption/GDP<br>$\mu col$ : Government collective consumption/GDP<br>$grg$ : Growth rate of government investment   |
| <Net exports>                  | Net exports   | $NEX = \varepsilon \cdot Y$  | $\varepsilon$ : Net exports/GDP  |
| <Consumption of fixed capital> | Total consumption of fixed capital/GDP  | $\delta = \delta h + \delta nf + \delta g + \delta f + \delta npi$   | $\delta h$ : Households consumption of fixed capital/GDP, $\delta nf$ : Firms consumption of fixed capital/GDP,<br>$\delta g$ : Government consumption of fixed capital/GDP, $\delta f$ : Financial firms consumption of fixed capital/GDP,<br>$\delta npi$ : Non_profit inst.consumption of fixed capital/GDP |
| <Tax>                          | Total tax   | $T = (\theta i + \theta dh + \theta dnf + \theta df) \cdot Y$  | $\theta i$ : Indirect tax/GDP, $\theta dh$ : Households direct tax/GDP, $\theta dnf$ : Firms direct tax/GDP,<br>$\theta df$ : Financial firms direct tax/GDP   |

## 8. The model equations

|  |  |   |
|--|--|---|
| <p>&lt;Operating surplus&gt;</p> <p>Total operating surplus</p> <p>Households operating surplus</p> <p>Firms operating surplus</p> <p>Financial firms operating surplus</p>  | <p><math>OS = \chi \cdot Y</math></p> <p><math>OS_h = \chi_h \cdot OS</math></p> <p><math>OS_{nf} = \chi_{nf} \cdot OS</math></p> <p><math>OS_f = \chi_f \cdot OS</math></p>   | <p><math>\chi</math> : Total operating surplus/GDP</p> <p><math>\chi_h</math> : Households operating surplus/Total operating surplus</p> <p><math>\chi_{nf}</math> : Firms operating surplus/Total operating surplus</p> <p><math>\chi_f</math> : Financial firms operating surplus/Total operating surplus</p>   |
| <p>&lt;Wage&gt;</p> <p>Total wage</p> <p>Domestic wage</p> <p>Rest of the world wage</p>   | <p><math>WB = WB_d + Wb_o</math></p> <p><math>WB_d = (1 + grwb) \cdot WB_d(-1) \cdot (1 + grpr + grpp)</math></p> <p><math>WB_o = \sigma \cdot Y</math></p>  | <p><math>grwb</math> : Wage increase rate, <math>grpp</math> : Population growth rate</p> <p><math>\sigma</math> : Rest of the world wage/GDP</p>   |
| <p>&lt;Property income&gt;</p> <p>Sectoral(*)Property income</p> <p>* = h, nf, g, npi, o</p> <p>Financial firms property income</p>  | <p><math>PI_* = V\_IBA_* \cdot R\_IBA_* + V\_EQA_* \cdot R\_EQA_*</math><br/> <math>+ V\_ASA_* \cdot R\_ASA_* + V\_IBL_* \cdot R\_IBL_*</math><br/> <math>+ V\_EQL_* \cdot R\_EQL_* + V\_ASL_* \cdot R\_ASL_*</math></p> <p><math>PI_f = -(PI_h + PI_{nf} + PI_g + PI_{npi} + PI_o)</math></p> | <p><math>V\_IBA_*</math> : Interest bearing asset, <math>R\_IBA_*</math> : Yield of interest bearing asset,<br/> <math>V\_EQA_*</math> : Equity asset, <math>R\_EQA_*</math> : Yield of equity asset,<br/> <math>V\_ASA_*</math> : Asset under management, <math>R\_ASA_*</math> : Yield of asset under management,<br/> <math>V\_IBL_*</math> : Interest bearing liability, <math>R\_IBL_*</math> : Yield of interest bearing liability,<br/> <math>V\_EQL_*</math> : Equity liability, <math>R\_EQL_*</math> : Yield of equity liability,<br/> <math>V\_ASL_*</math> : Liability of asset under manegemant, <math>R\_ASL_*</math> : Yield of liability of asset under management</p> <p><math>PI_h</math> : Households property income, <math>PI_{nf}</math> : Firms property income, <math>PI_g</math> : Government property income,<br/> <math>PI_{npi}</math> : Non_profit inst. property income, <math>PI_o</math> : Rest of the worlds property income</p> |
| <p>&lt;Rent&gt;</p> <p>Households rent/GDP</p>   | <p><math>\kappa_h = -(\kappa_{nf} + \kappa_g + \kappa_f + \kappa_{npi} + \kappa_o)</math></p>  | <p><math>\kappa_{nf}</math> : Firms rent, <math>\kappa_g</math> : Government rent, <math>\kappa_f</math> : Financial firms rent, <math>\kappa_{npi}</math> : Non_profit inst. rent,<br/> <math>\kappa_o</math> : Rest of the world rent</p>   |
| <p>&lt;Social benefit other than social transfers in kind&gt;</p> <p>Households social benefit(Receivable)</p> <p>Firms social benefit(Payable)</p> <p>Government social benefit(Payable)</p> <p>Financial firms social benefit(Payable)</p> <p>Non_profit inst. social benefit(Payable)</p> | <p><math>SBEN_h = \omega_{bh} \cdot Y</math></p> <p><math>SBEN_{nf} = SBEN_h \cdot 0.012</math></p> <p><math>SBEN_g = SBEN_h \cdot 0.864</math></p> <p><math>SBEN_f = SBEN_h \cdot 0.116</math></p> <p><math>SBEN_{npi} = SBEN_h \cdot 0.008</math></p>  | <p><math>\omega_{bh}</math> : Households social benefit/GDP</p>   |

## 8. The model equations

|   |  |   |
|---|--|---|
| <b>&lt;Social contributions&gt;</b><br>Households social contributions(Payable)<br>Firms social contributions(Receivable)<br>Government social contributions(Receivable)<br>Financial firms social contributions(Receivable)<br>Non_profit inst. social contributions(Receivable) | $SCON_h = \omega ch \cdot Y$<br>$SCON_{nf} = SCON_h \cdot 0.011$<br>$SCON_g = SCON_h \cdot 0.887$<br>$SCON_f = SCON_h \cdot 0.100$<br>$SCON_{npi} = SCON_h \cdot 0.002$  | $\omega ch$ : Households social contributions/GDP   |
| <b>&lt;Other current transfers&gt;</b><br>Households other current transfers/GDP  | $\rho h = -(\rho_{nf} + \rho_g + \rho_f + \rho_{npi} + \rho_o)$  | $\rho_{nf}$ : Firms other current transfers/GDP、<br>$\rho_g$ : Government other current transfers/GDP、<br>$\rho_f$ : Financial firms other current transfers/GDP、<br>$\rho_{npi}$ : Non_profit inst. other current transfers/GDP、<br>$\rho_o$ : Rest of the world other current transfers/GDP、                |
| <b>&lt;Capital transfers, etc.&gt;</b><br>Households capital transfers, etc./GDP  | $\lambda h = -(\lambda_{nf} + \lambda_g + \lambda_f + \lambda_{npi} + \lambda_o)$  | $\lambda_{nf}$ : Firms capital transfers, etc./GDP、<br>$\lambda_g$ : Government capital transfers, etc./GDP、<br>$\lambda_f$ : Financial firms capital transfers, etc./GDP、<br>$\lambda_{npi}$ : Non_profit inst. capital transfers, etc./GDP、<br>$\lambda_o$ : Rest of the world capital transfers, etc./GDP、 |
| <b>&lt;Households&gt;</b><br>Disposable income<br>Expected disposable income<br>Adjustment for the change in pension entitlements<br>Net lending<br>Net financial asset   | $YD = WB_d + OS_h + PI_h + \kappa h \cdot Y - \theta dh \cdot Y - SCON_h + SBEN_h + \rho h \cdot Y$<br>$Yde = (1 + grwb) \cdot YD(-1)$<br>$PEN_{adj\_h} = SCON_h - SBEN_h$<br>$NL_h = YD - C_h + PEN_{adj\_h} - I_h + \delta h \cdot Y + \lambda h \cdot Y$<br>$V_h = V_{IBA\_h} + V_{EQA\_h} + V_{ASA\_h} + V_{IBL\_h} + V_{EQL\_h} + V_{ASL\_h}$                             |   |
| <b>&lt;Firms&gt;</b><br>Entrepreneurial profits<br>Retained earnings<br>Net lending<br>Net financial asset<br>Net financial asset(Issued share adjusted)  | $F = NY - \theta i - OS + OS_{nf} - WB + PI_{nf} + \kappa_{nf} \cdot Y$<br>$FU = F - \theta d_{nf} \cdot Y + SCON_{nf} - SBEN_{nf} + \rho_{nf} \cdot Y$<br>$NL_{nf} = FU - I_{nf} + \delta_{nf} \cdot Y + \lambda_{nf} \cdot Y$<br>$V_{nf} = V_{IBA_{nf}} + V_{EQA_{nf}} + V_{ASA_{nf}} + V_{IBL_{nf}} + V_{EQL_{nf}} + V_{ASL_{nf}}$<br>$V_{nf\_adj} = V_{nf} - V_{EQL_{nf}}$ |   |

## 8. The model equations

|   |  |  |
|---|--|--|
| <p><b>&lt; Government &gt;</b></p>        | <p>Net lending <math>NL_g = T - G + PI_g + \kappa g \cdot Y + SCON_g - SBEN_g</math><br/> <math>+ \rho g \cdot Y + \delta g \cdot Y + \lambda g \cdot Y</math></p> <p>Net financial asset <math>V_g = V\_IBA_g + V\_EQA_g + V\_ASA_g + V\_IBL_g</math><br/> <math>+ V\_EQL_g + V\_ASL_g</math></p> <p>Government debt <math>DEBT_g = -(V\_IBL_g + V\_EQL_g + V\_ASL_g)</math></p>  |  |
| <p><b>&lt; Financial firms &gt;</b></p>   | <p>Adjustment for the change in pension entitlements <math>PEN\_adj\_f = -PEN\_adj\_h</math></p> <p>Net lending <math>NL_f = OS_f + PI_f + \kappa f \cdot Y - \theta df \cdot Y + SCON_f</math><br/> <math>- SBEN_f + \rho f \cdot Y + PEN\_adj\_f - I_f + \delta f \cdot Y</math><br/> <math>+ \lambda f \cdot Y</math></p> <p>Net financial asset <math>V_f = V\_IBA_f + V\_EQA_f + V\_ASA_f + V\_IBL_f</math><br/> <math>+ V\_EQL_f + V\_ASL_f</math></p> |  |
| <p><b>&lt; Non_profit inst. &gt;</b></p>  | <p>Net lending <math>NL\_npi = PI\_npi + \kappa npi \cdot Y + SCON\_npi - SBEN\_npi</math><br/> <math>+ \rho npi \cdot Y - C\_npi - I\_npi + \delta npi \cdot Y + \lambda npi \cdot Y</math></p> <p>Net financial asset <math>V\_npi = V\_IBA\_npi + V\_EQA\_npi + V\_ASA\_npi</math><br/> <math>+ V\_IBL\_npi + V\_EQL\_npi + V\_ASL\_npi</math></p>  |  |
| <p><b>&lt; Rest of the world &gt;</b></p> | <p>Net lending <math>NL_o = -NEX + WB_o + PI_o + \kappa o \cdot Y + \rho o \cdot Y + \lambda o \cdot Y</math></p> <p>Net financial asset <math>V_o = V\_IBA_o + V\_EQA_o + V\_ASA_o + V\_IBL_o</math><br/> <math>+ V\_EQL_o + V\_ASL_o</math></p>  |  |

## 9. Simulation Results

| Verification period :<br>2025~2045               | Parameters                         |                                  |                                    |  |                       |                                    |   |                         | Landing value after 20 years |                                    |   |  |                                       |
|--|------------------------------------|----------------------------------|------------------------------------|--|-----------------------|------------------------------------|---|-------------------------|------------------------------|------------------------------------|---|--|---------------------------------------|
|  | Public investment<br>(Growth rate) | Cash transfers<br>(Ratio to GDP) | In-kind benefits<br>(Ratio to GDP) | Social contributions<br>(Ratio to GDP) | Wage<br>(Growth rate) | Propensity to consume<br>out of YD | Propensity to consume out<br>of n.f.asset | Change in interest rate | GDP growth rate              | #Government debt<br>(Ratio to GDP) | Firms net financial asset<br>(Multiplier) | Households net financial asset<br>(Multiplier) | Change in tax revenue<br>(Multiplier) |
| ①Baseline  | 1.28%                              | 14.28%                           | 12.34%                             | 15.07%                                 | 0.39%                 | 0.772                              | 0.045                                     |                         | 0.29%                        | 313%                               | <b>8.04</b>                               | 1.27   | 1.08                                  |
| ②Interest rate hike                              | 1.28%                              | 14.28%                           | 12.34%                             | 15.07%                                 | 0.39%                 | 0.772                              | 0.045                                     | <b>+1%</b>              | 1.13%                        | 347%                               | <b>12.44</b>                              | 1.56   | 1.32                                  |
| ③Wage increase                                   | 1.28%                              | 14.28%                           | 12.34%                             | 15.07%                                 | <b>3.39%</b>          | 0.772                              | 0.045                                     |                         | <b>2.85%</b>                 | <b>164%</b>                        | <b>6.53</b>                               | 1.56   | 2.02                                  |
| ④Increase in Cash Transfers                      | 1.28%                              | <b>15.53%</b>                    | 12.34%                             | 15.07%                                 | 0.39%                 | 0.772                              | 0.045                                     |                         | <b>0.44%</b>                 | 319%                               | <b>8.46</b>                               | 1.28   | 1.12                                  |
| ⑤Increase in In-Kind Benefits<br>+ Wage Increase | 1.28%                              | 14.28%                           | <b>13.59%</b>                      | 15.07%                                 | <b>3.39%</b>          | 0.772                              | 0.045                                     |                         | <b>3.01%</b>                 | <b>172%</b>                        | <b>7.27</b>                               | 1.56   | 2.10                                  |

#The government debt-to-GDP ratio for 2019 is 238%.

- ① Baseline
- ② Interest Rate Increase: Assume an increase of 1%
- ③ Wage Increase: Based on recent policy trends and recent performance, assume a continuation of a 3% wage increase rate in the future
- ④ Increase in Cash Transfers: Assume an expenditure equivalent to 1% of the increase in interest rates (1% of government net debt) ⇒ Comparison of the effects of an interest rate hike and cash transfers
- ⑤ Increase in In-Kind Benefits + Wage Increase: Assume an expenditure equivalent to 1% of the increase in interest rates (1% of government net debt) + 3% wage increase rate ⇒ Evaluation of the effects of implementing JGP

## 10. Analysis of Simulation Results

### ① Baseline

- A tendency for firms to accumulate internal reserves can be observed.
- Firms have been investing these internal reserves abroad rather than in the domestic market, where growth prospects are limited.
  - ⇒ Even if corporate performance is strong, there has been no tangible sense of it.

### ② Interest Rate Increase

- Generally, increasing interest rates are thought to suppress growth by reducing investment; nonetheless, in Japan, an increase in interest rates tends to stimulate growth through income effects.
- However, much of the income remains as internal reserves within companies, and its contribution to growth through increased consumption is limited.

### ③ Wage Increase

- Wage increases significantly boost the economy through expanded consumption.
- The transfer of income from firms to households leads to a reduction in corporate internal reserves.
- Increased tax revenues from economic growth substantially reduce the government debt-to-GDP ratio.

## 10. Analysis of Simulation Results

### ④ Increase in Cash Transfers

- While there is a growth-stimulating effect, corporate internal reserves increase.
- The transfer of income from firms to households does not advance significantly, resulting in a limited contribution to growth through expanded consumption.

### ⑤ Increase in In-Kind Benefits + Wage Increases

- The growth-stimulating effect of increased in-kind benefits is enhanced by the effect of wage increases, leading to significant economic growth.
- The increase in tax revenues resulting from this growth causes a substantial reduction in the government debt-to-GDP ratio.

## 11. Summary: Insights for Revitalizing the Japanese Economy

### ○ Wage increase

Income Transfer from Firms to Households through Wage Increases is Key.

However, in Japan, where labor unions are weak, achieving wage increases presents a significant challenge.

### ○ Interest Rate Increase

Contrary to conventional wisdom, raising interest rates can stimulate the economy through income effects (consistent with MMT claims).

However, there are potential drawbacks:

- Benefits primarily accrue to asset holders, with minimal impact on overall consumption.
- Without accompanying wage increases, corporate internal reserves are likely to rise without boosting consumption.



## 11. Summary: Insights for Revitalizing the Japanese Economy

### ○ Increase in Cash Transfers

Generally considered to have high redistributive effects, but not as effective as wage increases.



How to Achieve Wage Increases?



### ○ Implementing a Job Guarantee Program

- This program could establish a real wage floor, potentially leading to higher overall wage levels.
  - An increase in wage levels → Increase in consumption → Increase in investment → Increase in income → Increase in consumption...
- ⇒ This cycle is expected to emerge, leading to a way out of the deflationary spiral.