

Friede Gard Prize 2025
Award Seminar Online
(70 minutes)

**Accounting System Dynamics (ASD) Modeling of
Money Creation and Macroeconomic Stability
(Hands-on Simulation)**



by Dr. Kaoru Yamaguchi
Japan Futures Research Center

Saturday, October 18, 2025
11am - 2 pm (German time)
6 - 9 pm (Japan time)

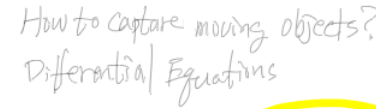
1. Accounting System Dynamics (ASD) Modeling
2. Money Creation: Flow and Stock Approach
3. Monetary Stability with 100% Reserves
4. ASD Macroeconomic Modeling of
Loanable Fund vs Endogenous Money

What is ASD ?

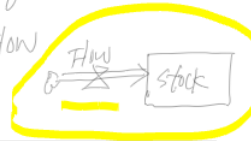
(Accounting System Dynamics)

(Accounting System Dynamics)

System Dynamics
(Differential Equation)
Foundation of
Natural Science



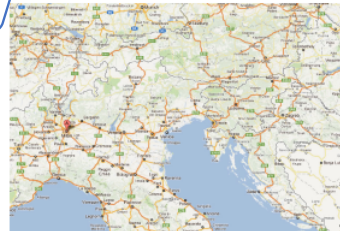
Stock-Flow



Birth of ASD (Accounting System Dynamics)



1445 - 1517



meets
in
2



1494 in Venice
(27 pages)



“Renaissance man”

- Such transfer of insights from one setting to another helps to break down the barriers between disciplines. It means that learning in one field becomes applicable to other fields.

There is now a promise of reversing the trend of the last century that has been moving away from the "Renaissance man" toward fragmented specialization. We can now work toward an integrated, systemic, educational process that is more efficient, more applicable to a world of increasing complexity, and more compatible with a unity in life.

--- The Beginning of System Dynamics, p.1
Jay Wright Forrester ---



“Renaissance man”

Leonardo da Vinci
1452-1519

1432 - 1539

that has been moving away from the
"Renaissance man"
toward fragmented specialization.



"Renaissance man"



1452-1

the trend of the last century
that has been moving away from
"Renaissance man"
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1. Accounting System Dynamics and Macroeconomic Modeling

Principle of Accounting System Dynamics - Modeling Corporate Financial Statements -

Presented at the 21st International Conference of the
System Dynamics Society , New York, 2003

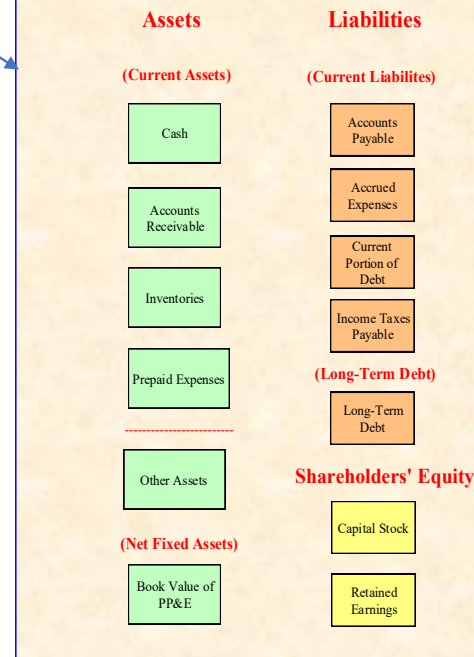
Analytical
Methods

Balance Sheet	
A	Cash
B	Accounts Receivable
C	Inventories
D	Prepaid Expenses
A + B + C + D = E	Current Assets
F	Other Assets
G	Fixed Assets @ Cost
H	Accumulated Depreciation
G - H = I	Net Fixed Assets
E + F + I = J	Total Assets
K	Accounts Payable
L	Accrued Expenses
M	Current Portion of Debt
N	Income Taxes Payable
K + L + M + N = O	Current Liabilities
P	Long-Term Debt
Q	Capital Stock
R	Retained Earnings
Q + R = S	Shareholders' Equity
O + P + S = T	Total Liabilities & Equity

Table 3.1: Balance Sheet in Ittelson (1998)

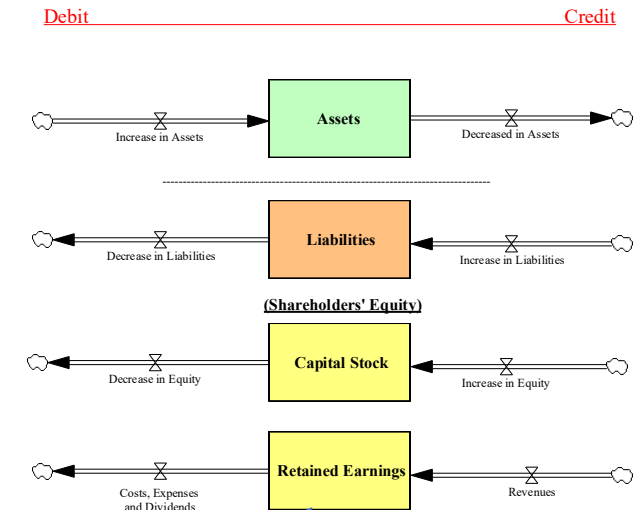
Income Statement	
1	Net Sales
2	Cost of Goods Sold
1 - 2 = 3	Gross Margin
4	Sales & Marketing
5	Research & Development
6	General & Administrative
4 + 5 + 6 = 7	Operating Expenses
3 - 7 = 8	Income From Operations
9	Net Interest Income
10	Income Taxes
8 + 9 - 10 = 11	Net Income

Table 3.2: Income Statement in Ittelson (1998)



Balance Sheet as a System of Stocks

Double Entry Rule of Bookkeeping as Debit and Credit



1. Accounting System Dynamics and Macroeconomic Modeling

Figure 3.10: Accounting System

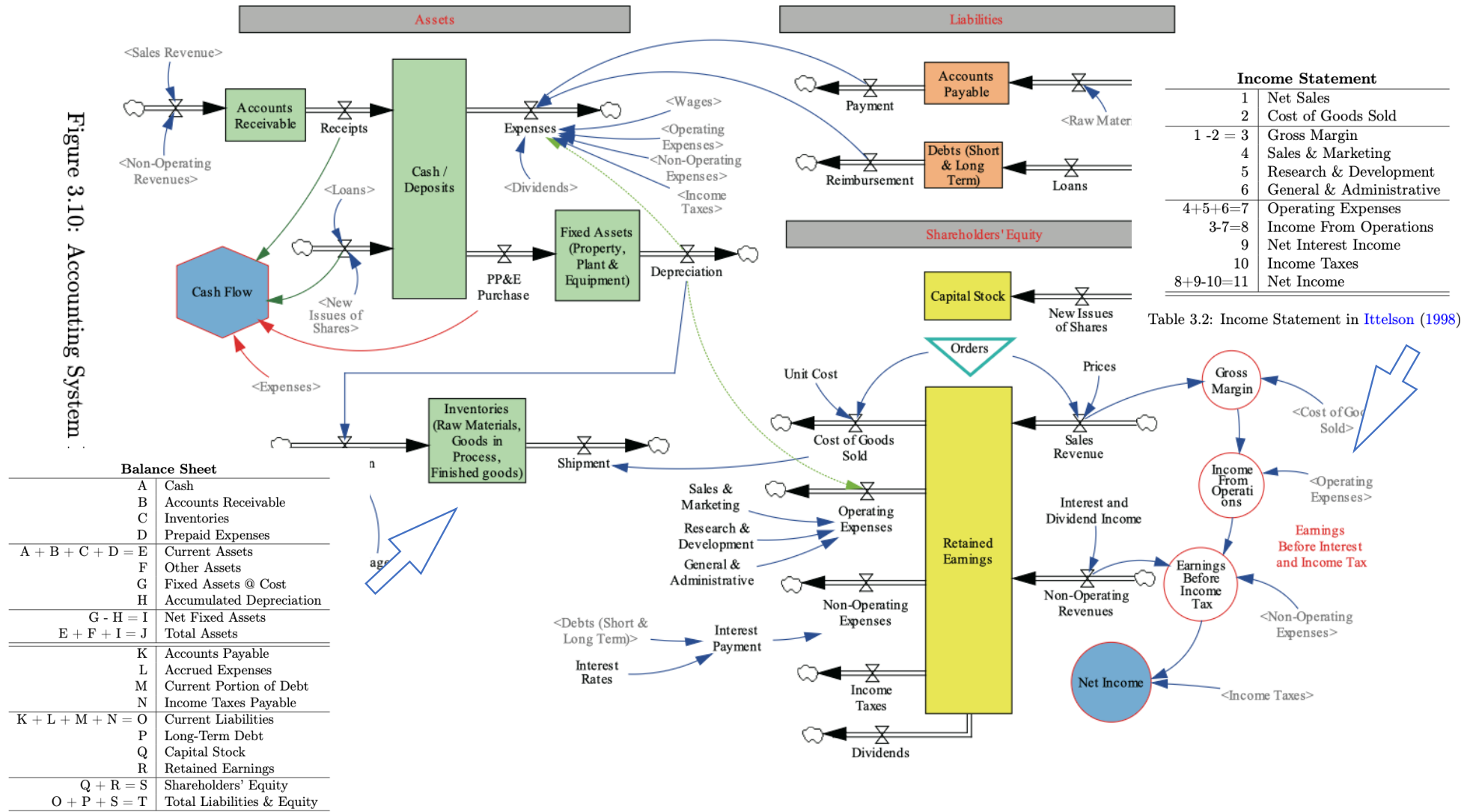


Table 3.1: Balance Sheet in Ittelson (1998)

Table 3.2: Income Statement in Ittelson (1998)

2. Money Creation: Flow and Stock Approach

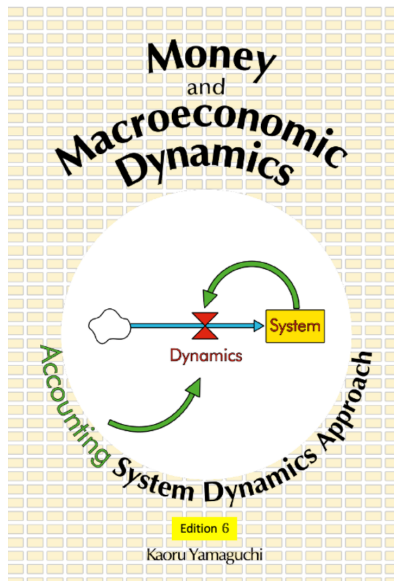
Money and Macroeconomic Dynamics- Accounting System Dynamics Approach -

Edition 6 (Download) June 20, 2022

(free download e-book)

No Quotations, Please!

<https://kaoru.muratopia.net/>



The entire book of edition 6 (draft) is now hyper-linked to jump to any chapter and section
Accordingly, chapter copies of edition 6 are no longer available.

Preface	My Off-Rad Journey for A Better World (Contents included) Preface to Edition 6
Part I: Accounting System Dynamics	
Chapter 1	System Dynamics (SD models 1)
Chapter 2	Demand and Supply (SD models 2)
Chapter 3	Accounting System Dynamics (SD models 3)
Part II: Debt Money System	
Chapter 4	Macroeconomic System Overview (SD models 4)
Chapter 5	Money
Chapter 6	Creation of Money (SD models 6)
Chapter 7	Money as Debts (SD models 7)
Chapter 8	Interest and Equity (SD models 8)

2. Money Creation: Flow and Stock Approach

$$M^s = M_0 + M_0\alpha + M_0\alpha^2 + M_0\alpha^3 \dots \quad (\text{Flow Approach})$$

$$= M_0 + \alpha(M_0 + M_0\alpha + M_0\alpha^2 + M_0\alpha^3 \dots)$$

$$= M_0 + \alpha M^s$$

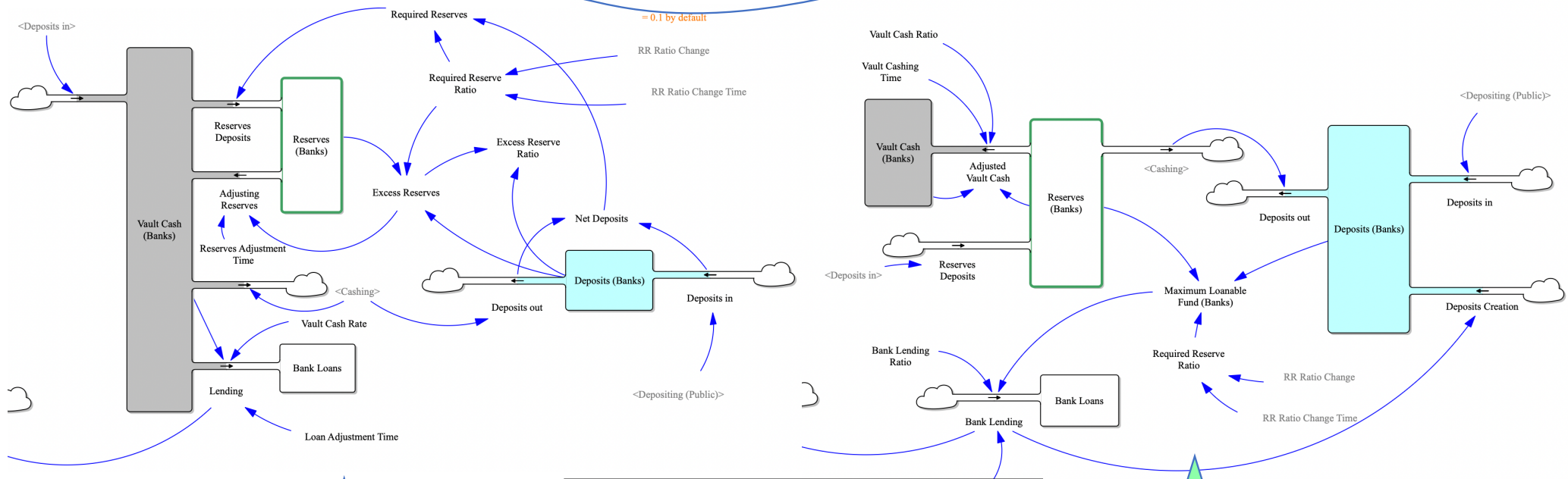
where

α = loan ratio

r = reserve ratio

$$\alpha + r = 1$$

$$M^s = \frac{M_0}{1 - \alpha} = \frac{M_0}{r} \quad (\text{Stock Approach})$$



Flow Approach
1. Gold Standard

$$M_0 = C + R$$

$$M^s = C + D$$

$$\frac{M^s}{M_0} = \frac{C + D}{C + R} = \frac{c + 1}{c + r} = m = \frac{1}{r} \quad \text{if } c = 0$$

Instability of Money Multiplier

Stock Approach
1. Gold Standard

2. Money Creation: Flow and Stock Approach

Head and Tail of Gold Standard

$$M_0 = C + R$$

$$M^s = C + D$$

$$\frac{M^s}{M_0} = \frac{C + D}{C + R} = \frac{c + 1}{c + r} = m = \frac{1}{r} \text{ if } c = 0$$

Instability of Money Multiplier

$$m = \frac{c + 1}{c + r} = \frac{0.2 + 1}{0.2 + 0.1} = 4$$

$$M^s = m M_0 = 4 * 200 = 800$$

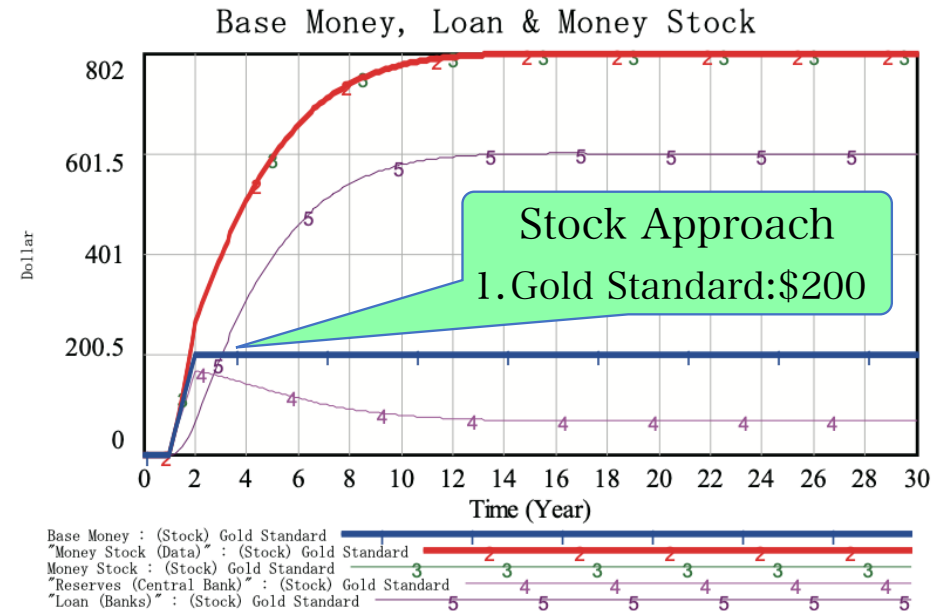
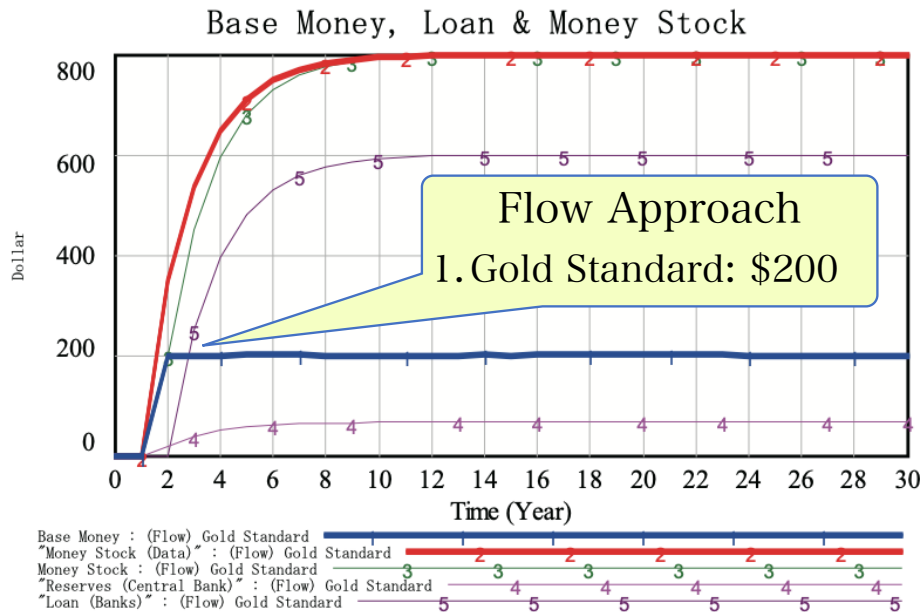
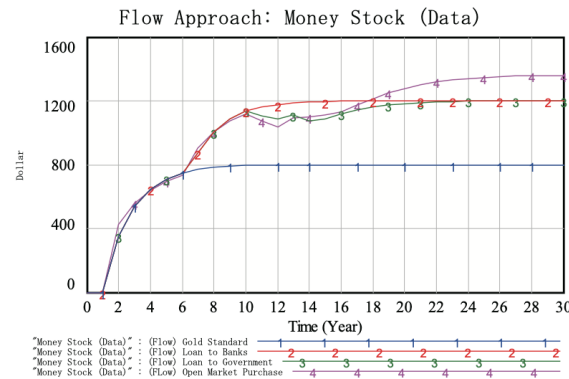
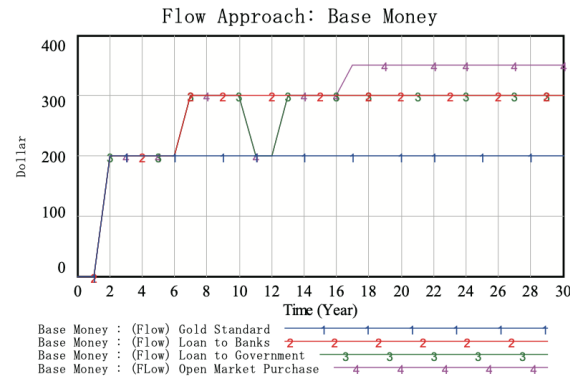


Figure 10: Gold Standard Behaviors: Flow and Stock Approaches

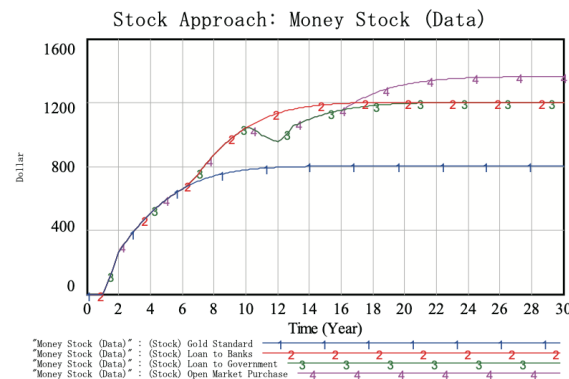
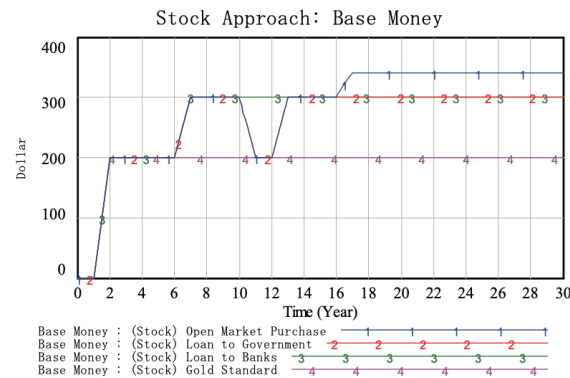
2. Money Creation: Flow and Stock Approach



Flow Approach

1. Gold Standard: \$200
2. Loan to Banks: \$100, $t=6$
3. Loan to Government: \$100, $t=10$
- Open Market Purchase: 50%, $t=16$

Figure 14: Behaviors of Base Money and Money Stock: Flow Approach



Stock Approach

1. Gold Standard
2. Loan to Banks: \$200
3. Loan to Government: \$100, $t=10$
4. Open Market Purchase: 50%, $t=16$

Figure 15: Behaviors of Base Money and Money Stock: Stock Approach

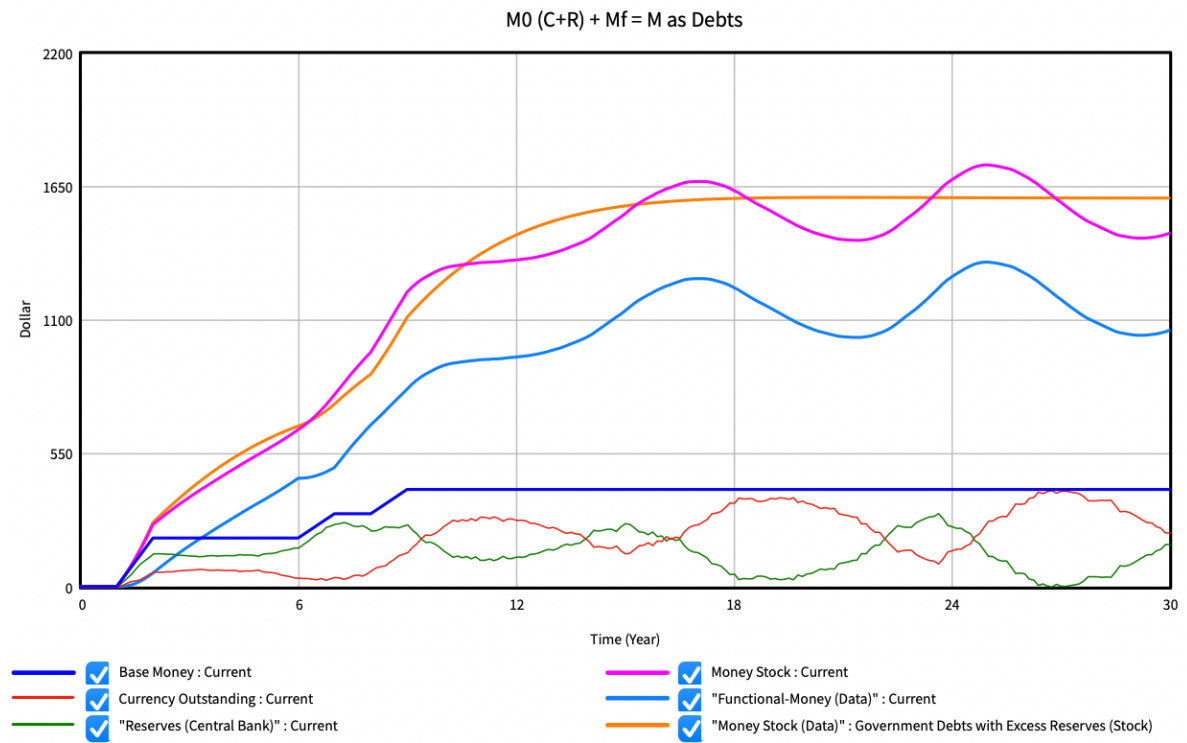
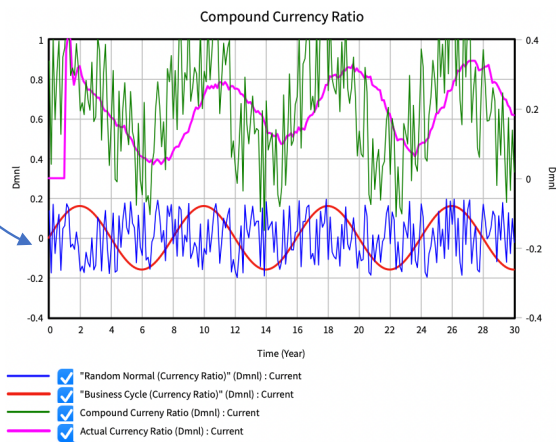
3. Monetary Stability with 100% Reserves

$$M_0 = C + R$$

$$M^s = C + D$$

$$\frac{M^s}{M_0} = \frac{C + D}{C + R} = \frac{c + 1}{c + r} = m = \frac{1}{r} \text{ if } c = 0$$

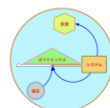
Instability of
Money Multiplier



4. ASD Macroeconomic Modeling of Loanable Fund vs Endogenous Money

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Home

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システムダイナミックス
System Dynamics

1. The Long-Run Endogenous Money-Interest ASD Model of the Debt Money System (Part IV) (JFRC 01-2024) (New!)
-- Built-in Unfair Income Distribution and Inflation --

Podcast-like Guide to Part IV (10:35), Longer guide to Part IV (47:23) , Part IV 論文の音声解説 (14:09)

2. The Long-Run Endogenous Money ASD Model of the Debt Money System (Part III) (JFRC 02-2023) (New!)
-- Paradigm Shift in Economics AS A Science --

Podcast-like Guide to Part III (15:33), Longer guide to Part III (42:30) , Part III 論文の音声解説 (23:35)

3. The Endogenous Money ASD Model of the Debt Money System (Part II-Revised) (JFRC 01-2023) (New!)
-- Loanable Funds vs Endogenous Money --

Podcast-like Guide to Part II (17:22), Longer guide to part II (51:44) , Part II 論文の音声解説 (25:53)

4. The Endogenous Money IS-LM Model of the Debt Money System (Part I) (JFRC 01-2022)
-- A Paradigm Shift in Macroeconomics --

Podcast-like Guide to Part I (19:34), Longer guide to Part I (1:07:40) , Part I 論文の音声解説 (19:21)

4. ASD Macroeconomic Modeling of Loanable Fund vs Endogenous Money

23 equations with 23 unknowns

$Y, AD, C, I, G, Y_d, T, i, r, L^d, S, I_H, W + \Pi, I_P, \Delta D_H, \Delta D_P, \Delta D_G, \Delta LF, \Delta M^s, M^s, K, Y_{full}, P$

15 exogenously determined parameters:

$C_0, c, T_0, t, T_r, I_0, \bar{G}, V, \alpha, a, b, \pi^e, \bar{I}_H, \delta, L$

Appendix 2: Long-run Endogenous Money ASD Model

IS curve

$$Y = AD \quad (\text{Aggregate Demand Equilibrium}) \quad (42)$$

$$AD = C + I + G \quad (\text{Aggregate Demand}) \quad (43)$$

$$C = C_0 + cY_d \quad (\text{Consumption Decisions}) \quad (44)$$

$$Y_d = Y - T - \delta K \quad (\text{Disposable Income}) \quad (45)$$

$$T = T_0 + tY - T_r \quad (\text{Tax Revenues}) \quad (46)$$

$$I = \frac{I_0}{r} - \alpha r \quad (\text{Investment Decisions}) \quad (47)$$

$$G = \bar{G} \quad (\text{Government Expenditures}) \quad (48)$$

LM curve

$$\frac{M^s}{P} V = L^d \quad (\text{Equilibrium of Money}) \quad (49)$$

$$L^d = aY - bi \quad (\text{Demand for Money}) \quad (50)$$

$$r = i - \pi^e \quad (\text{Fisher Equation}) \quad (51)$$

Capital

$$\frac{dK}{dt} = I - \delta K \quad (\text{Net Capital Accumulation}) \quad (52)$$

$$Y_{full} = F(K, L) \quad (\text{Production Function}) \quad (53)$$

Price

$$\frac{dP}{dt} = \Psi(Y - Y_{full}) \quad (\text{Flexible Price}) \quad (54)$$

Budgets

$$PC + PT + PI_H + S = W + \Pi + \Delta D_H \quad (\text{Households Budgets}) \quad (55)$$

$$W + \Pi = PY \quad (\text{Distributed Income}) \quad (56)$$

$$PI_H = \Delta D_H \quad (\text{Housing Budgets}) \quad (57)$$

$$I_H = \bar{I}_H \quad (\text{Housing Investment}) \quad (58)$$

$$W + \Pi + PI_P = PY + \Delta D_P \quad (\text{Producers Budgets}) \quad (59)$$

$$I_H + I_P = I \quad (\text{Private Investment}) \quad (60)$$

$$PG = PT + \Delta D_G \quad (\text{Government Budget}) \quad (61)$$

$$\Delta D_H + \Delta D_P + \Delta D_G = \Delta LF \quad (\text{Loanable Funds of Debts}) \quad (62)$$

Loanable Funds

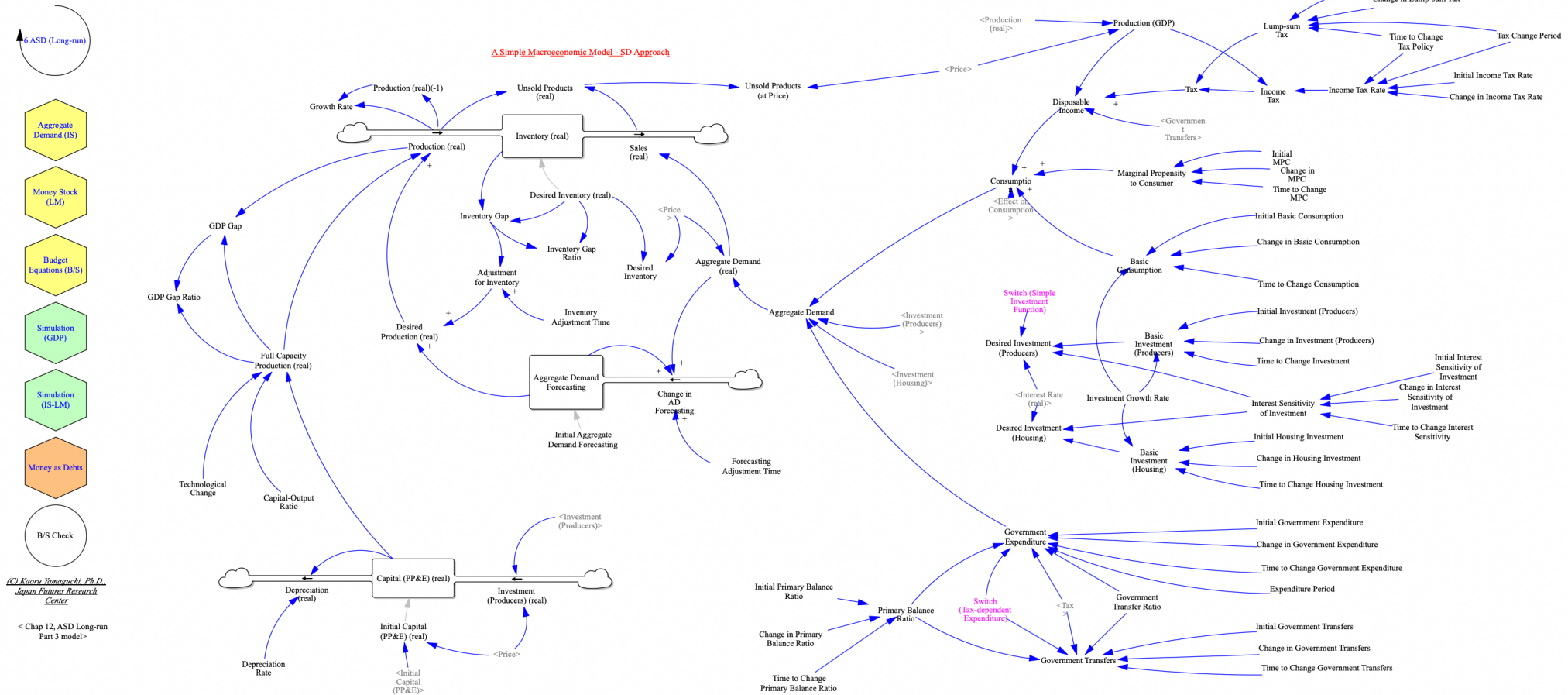
$$(\Delta LF = S) \quad (\text{Savings as Loanable Funds by Banks})$$

Endogenous Money

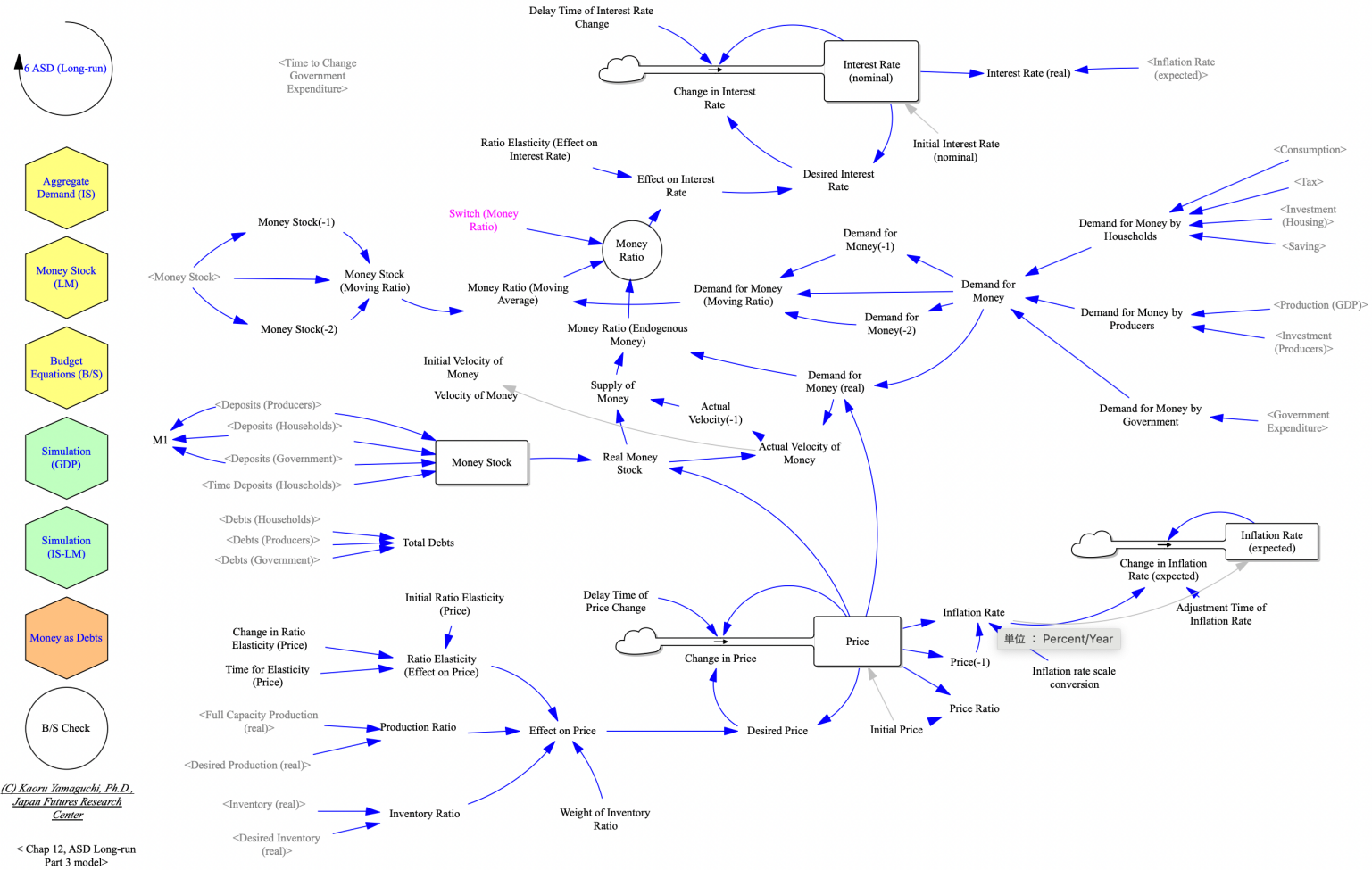
$$\Delta LF = \Delta M^s \quad (\text{Endogenous Deposits Creation}) \quad (63)$$

$$M^s = \int \Delta M^s dt \quad (\text{Endogenous Money Stock}) \quad (64)$$

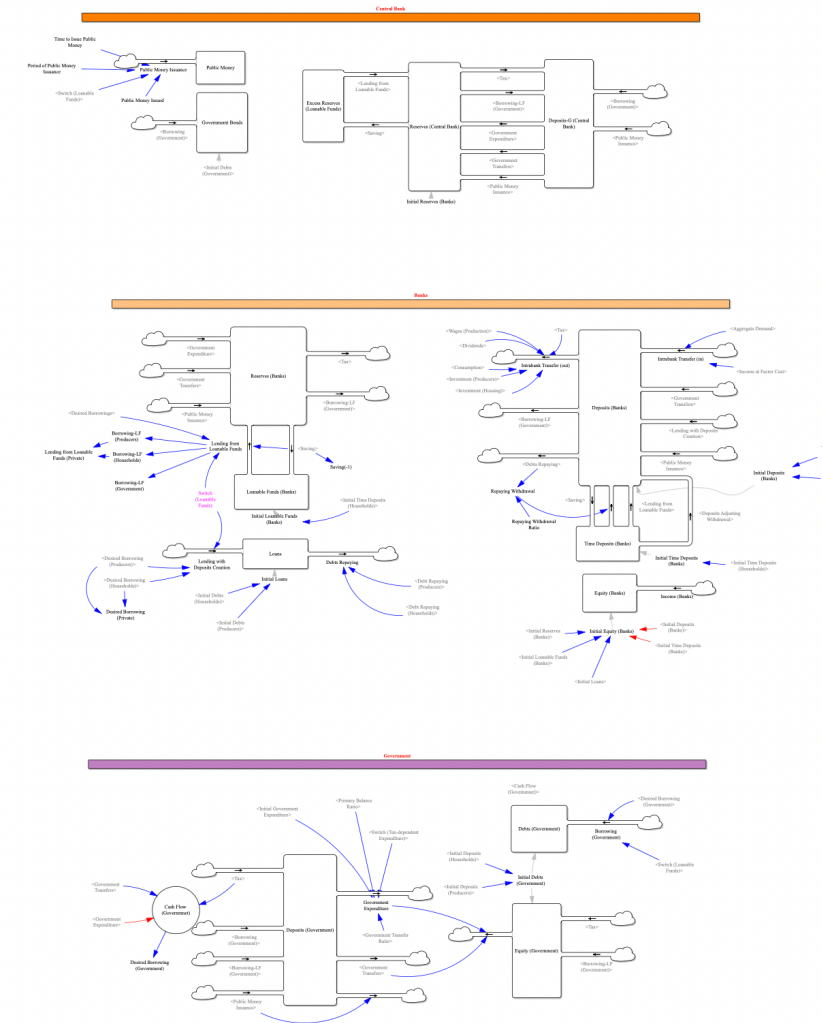
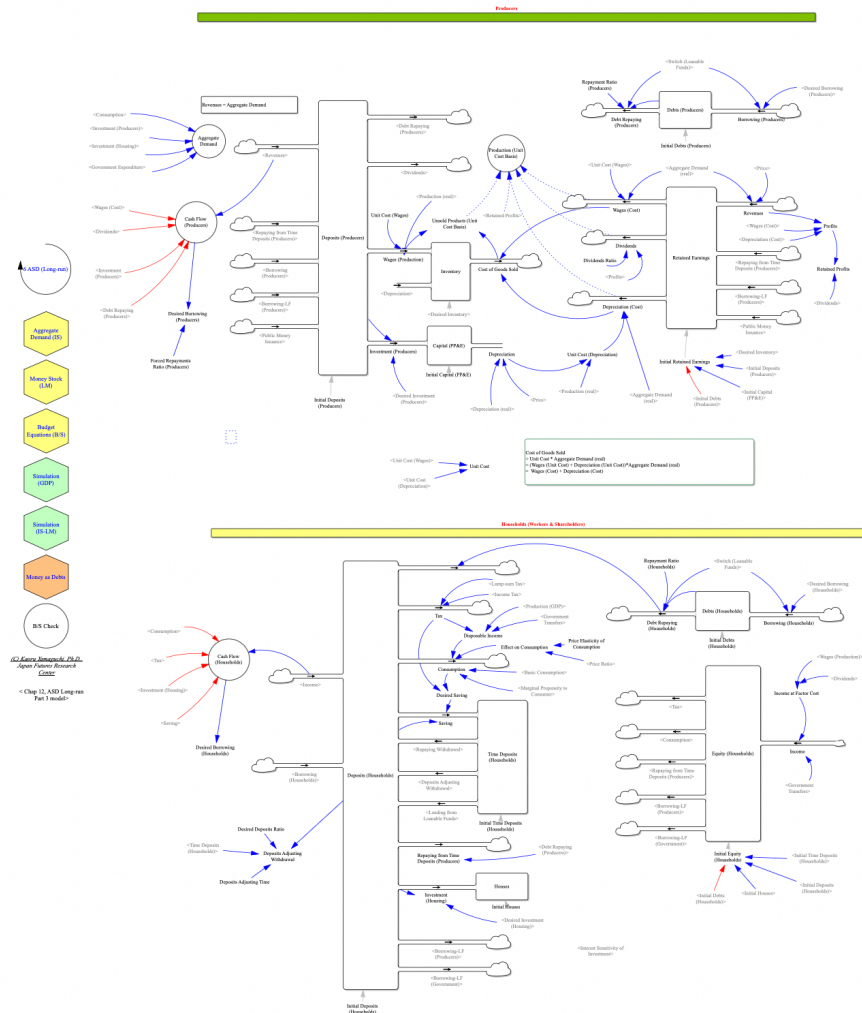
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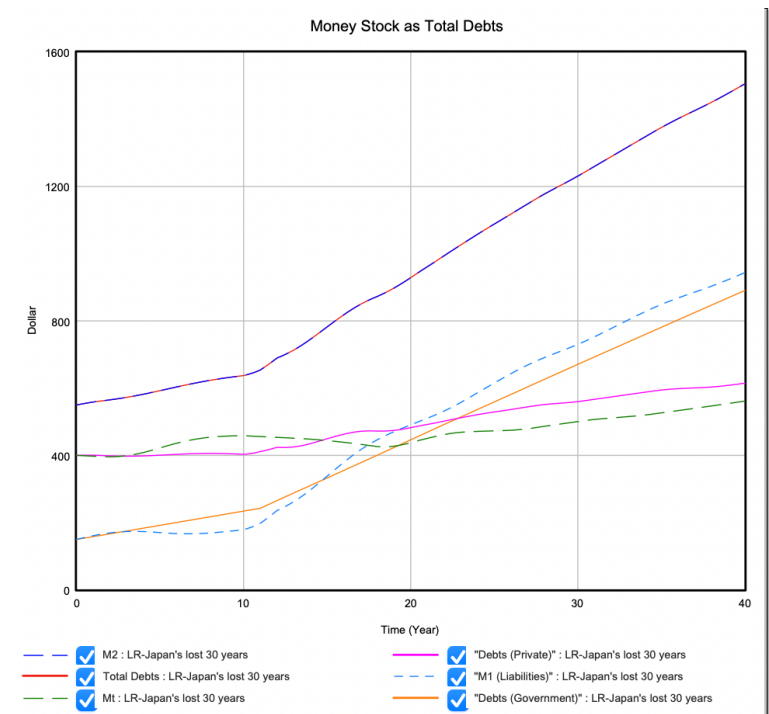
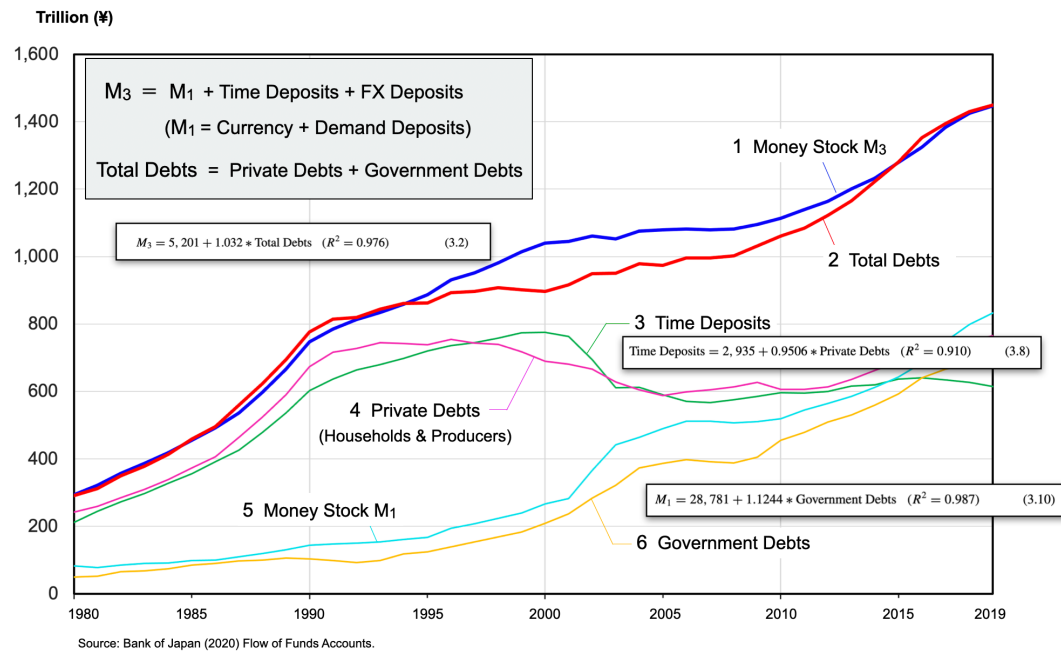


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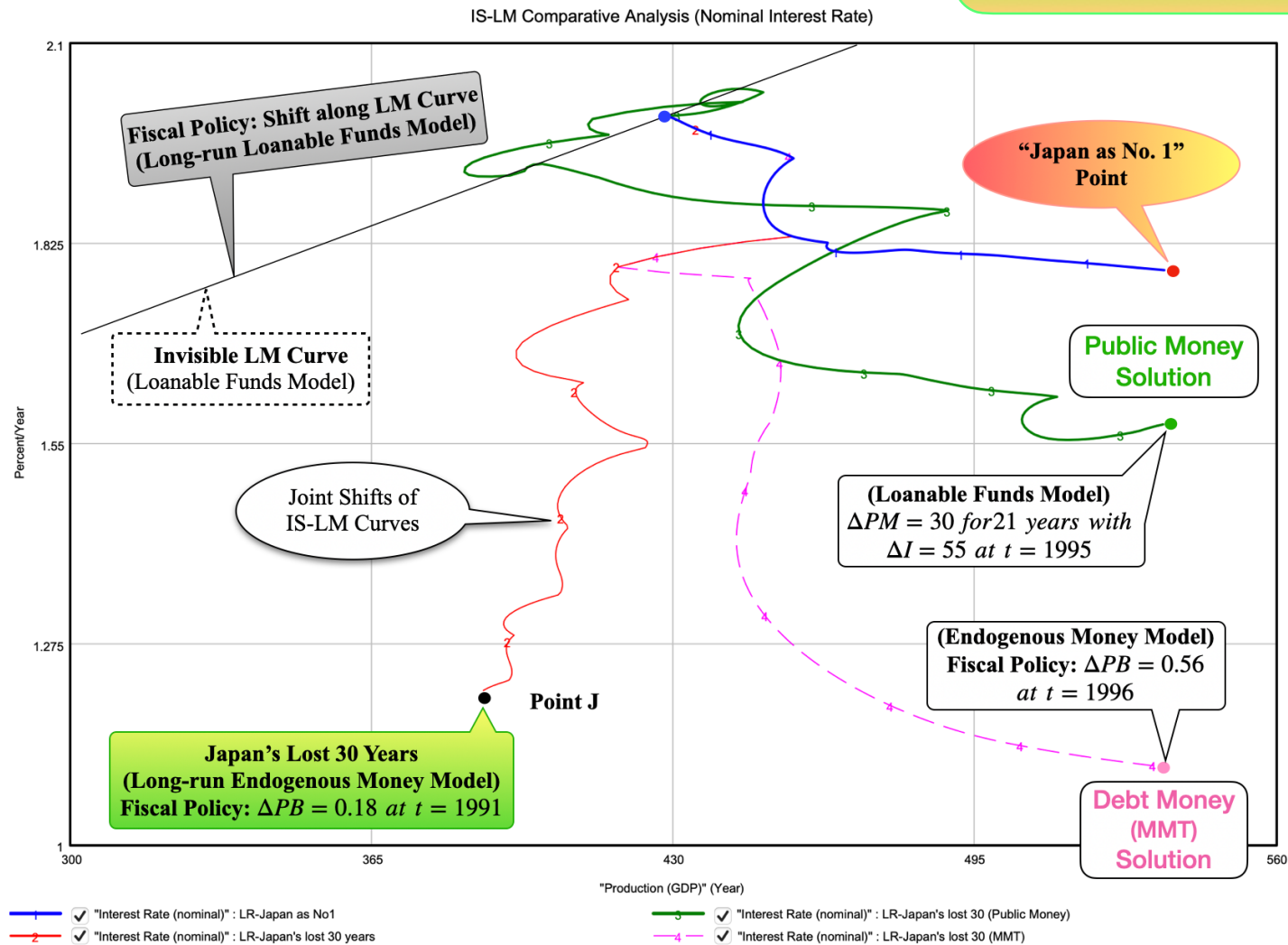


4. ASD Macroeconomic Modeling of Endogenous Money

ASD model produces structurally similar behaviors of monetary data.



Public Money or Debt Money ?



Public Money or Debt Money ?

