

Macro economy and Material stock & flow

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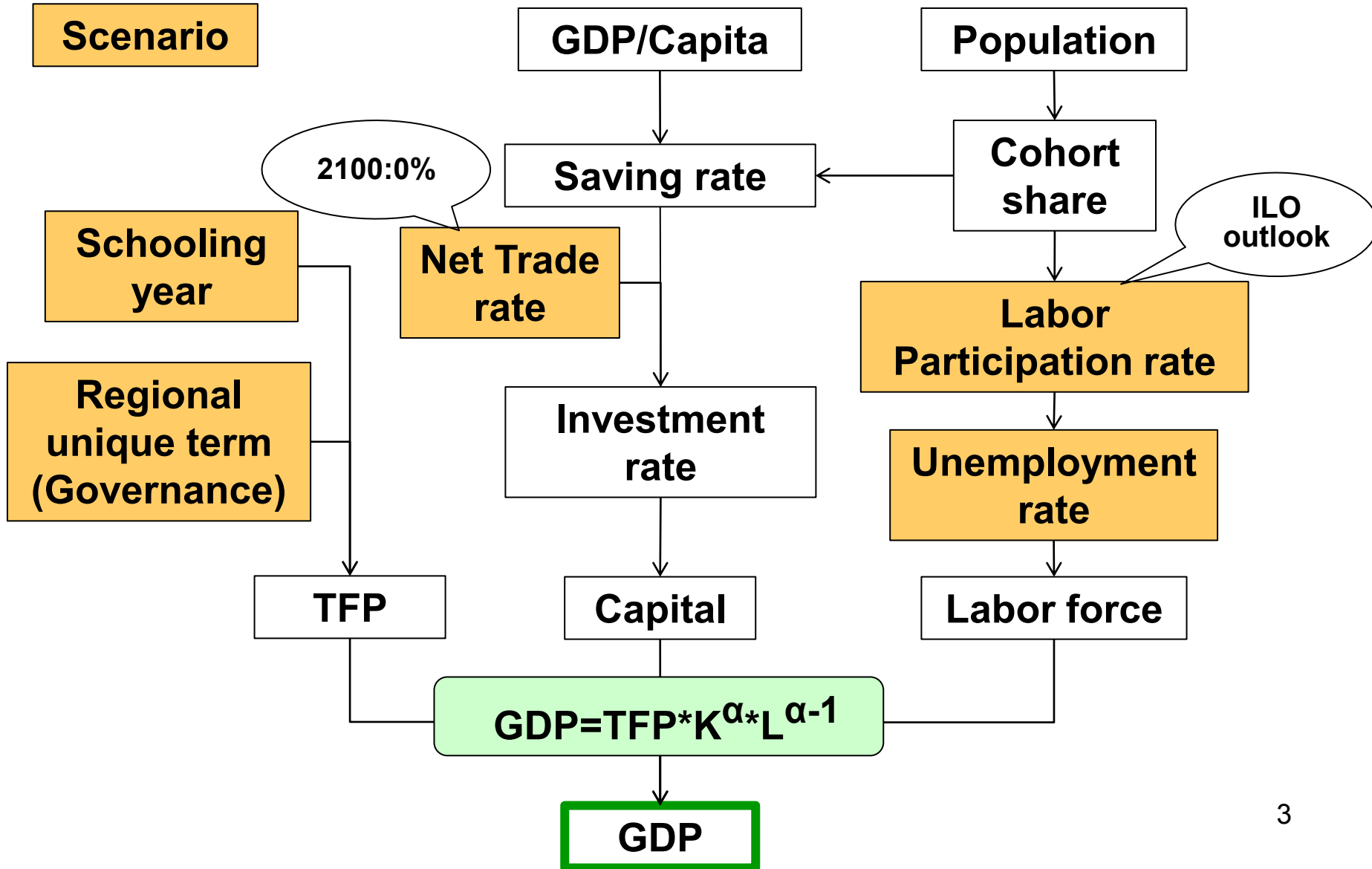
National Institute for Environmental Studies,
Tsukuba, Japan

Description of MEM

Macro Economic Model (MEM)

- Econometric model
- Output: baseline GDP
 - 230 countries , 1980-2100
 - Actual value: up to
 - 2015 : Regions with GDP growth rate outlook (IMF)
 - 2007-2009: Regions without GDP growth rate outlook
- Input :
 - Population
 - Parameters: Estimated by regression analysis or set by scenarios
- Output is used for :
 - Calculation of GHG burden sharing
 - Development of quantitative scenarios

Macro Economic Model (MEM)



Scenario: SLCS and SSTAG

$$\text{TFP} : \log \frac{\text{TFP}_{r,t}}{\text{TFP}^{\text{USA}}_{r,t} - \text{TFP}_{r,t}} = \text{a1} * \text{H}_{r,t} + \text{a2} * \text{GC}_{r,t}$$

a1 * H_{r,t}
Schooling year
+ a2 * GC_{r,t}
Regional unique term
(Governance Index + α)

	Schooling year : H	Regional unique term: GC	Unemployment rate
SLCS			2075: 0%
SSTAG			Constant: 2009 level

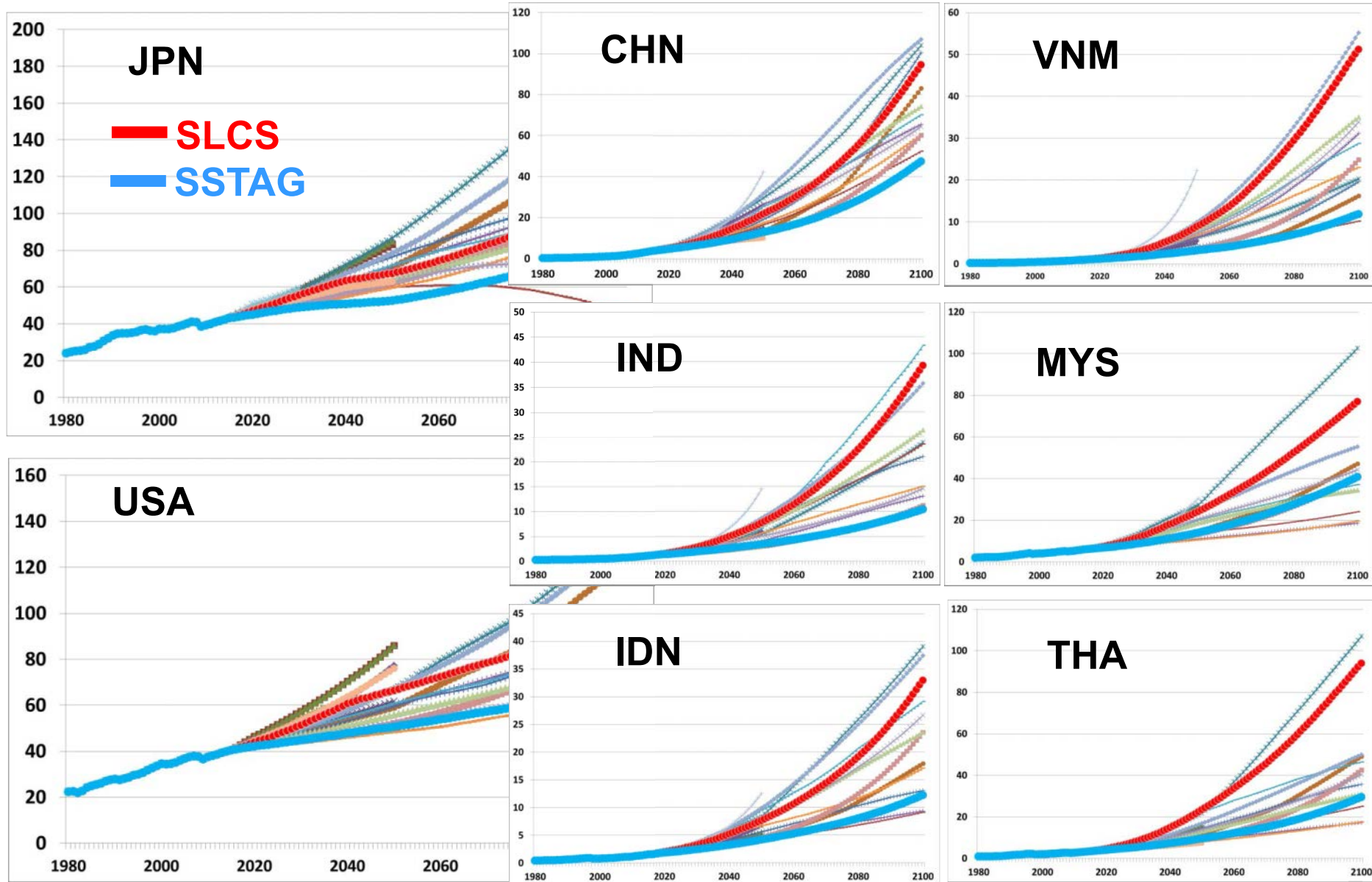
Output: Change rate of GDP, GDP/capita

	1980–2010		2010–2050		SSTAG	GDP	GDPcap
	GDP	GDPcap	SLCS				
			GDP	GDPcap			
Japan	1.93	1.63	0.98	1.37	0.36	0.74	
China	9.26	8.13	5.41	5.49	4.06	4.14	
Indonesia	5.26	3.65	5.39	4.86	3.80	3.28	
India	6.18	4.22	6.74	5.88	4.56	3.72	
Korea	6.24	5.35	3.01	3.07	1.92	1.98	
Malaysia	5.79	3.29	5.10	3.99	3.67	2.57	
Philippines	3.01	0.69	5.31	3.98	3.92	2.61	
Singapore	6.44	3.83	2.74	2.27	1.96	1.49	
Thailand	5.46	4.14	5.66	5.59	3.31	3.24	
Viet Nam	6.77	5.05	6.96	6.51	4.27	3.83	
Taiwan	5.95	5.02	2.81	3.17	1.96	2.32	
Ot. South Asia	4.78	2.44	8.01	6.88	4.51	3.42	
Ot. East Asia	0.63	-0.56	6.66	6.34	3.22	2.92	
Ot. South-east Asia	4.26	2.62	7.07	6.51	3.65	3.10	
Ot. oceania	3.66	1.39	6.76	5.17	3.92	2.37	

Output: Decomposition of change rate

		GDP	TFP	0.31*K	0.69*L	K	L	POP
Japan	80-10	1.93	0.77	0.87	0.28	2.81	0.40	0.29
	SLCS	0.98	1.22	0.34	-0.58	1.09	-0.84	-0.38
China	80-10	9.26	5.09	3.09	1.08	9.97	1.56	1.04
	SLCS	5.41	3.47	2.05	-0.12	6.61	-0.17	-0.08
Indonesia	80-10	5.26	1.61	2.05	1.60	6.63	2.32	1.56
	SLCS	5.39	3.23	1.54	0.61	4.98	0.89	0.51
India	80-10	6.18	2.27	2.45	1.46	7.91	2.11	1.88
	SLCS	6.74	3.64	2.40	0.70	7.75	1.02	0.81
Korea	80-10	6.24	2.67	2.34	1.23	7.56	1.78	0.84
	SLCS	3.01	2.21	1.09	-0.29	3.51	-0.42	-0.06
Malaysia	80-10	5.79	1.57	2.08	2.14	6.72	3.10	2.43
	SLCS	5.10	2.87	1.51	0.72	4.88	1.04	4.88
Thailand	80-10	5.46	2.02	2.25	1.18	7.26	1.71	1.26
	SLCS	5.66	3.64	1.96	0.06	6.34	0.08	0.07
Viet Nam	80-10	6.77	2.66	2.57	1.54	8.29	2.23	1.63
	SLCS	6.96	4.60	1.94	0.42	6.25	0.61	0.42
Taiwan	80-10	5.95	3.09	1.81	1.04	5.85	1.51	0.89
	SLCS	2.81	1.74	1.42	-0.35	4.58	-0.51	-0.35

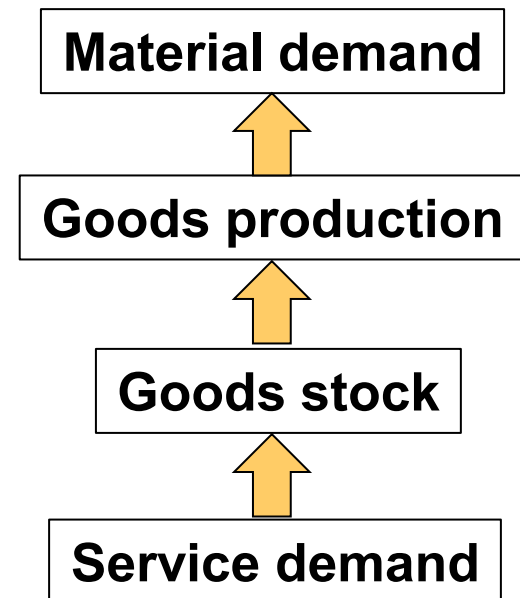
Comparison of GDP per capita with scenario database



Description of MSFM

Material Stock and Flow Model (MSFM)

- Material : Energy intensity material (Steel and Cement)
- Description :
 - 35 regions, 2005-2050
 - Service demand : 9 classifications
Households, Production,
Transport, Infrastructure
 - Goods stocks : 29 classifications
- Output:
 - Service demand by service
 - Goods stocks by goods
 - Goods production by goods
 - Material demand by goods



Framework of MSFM

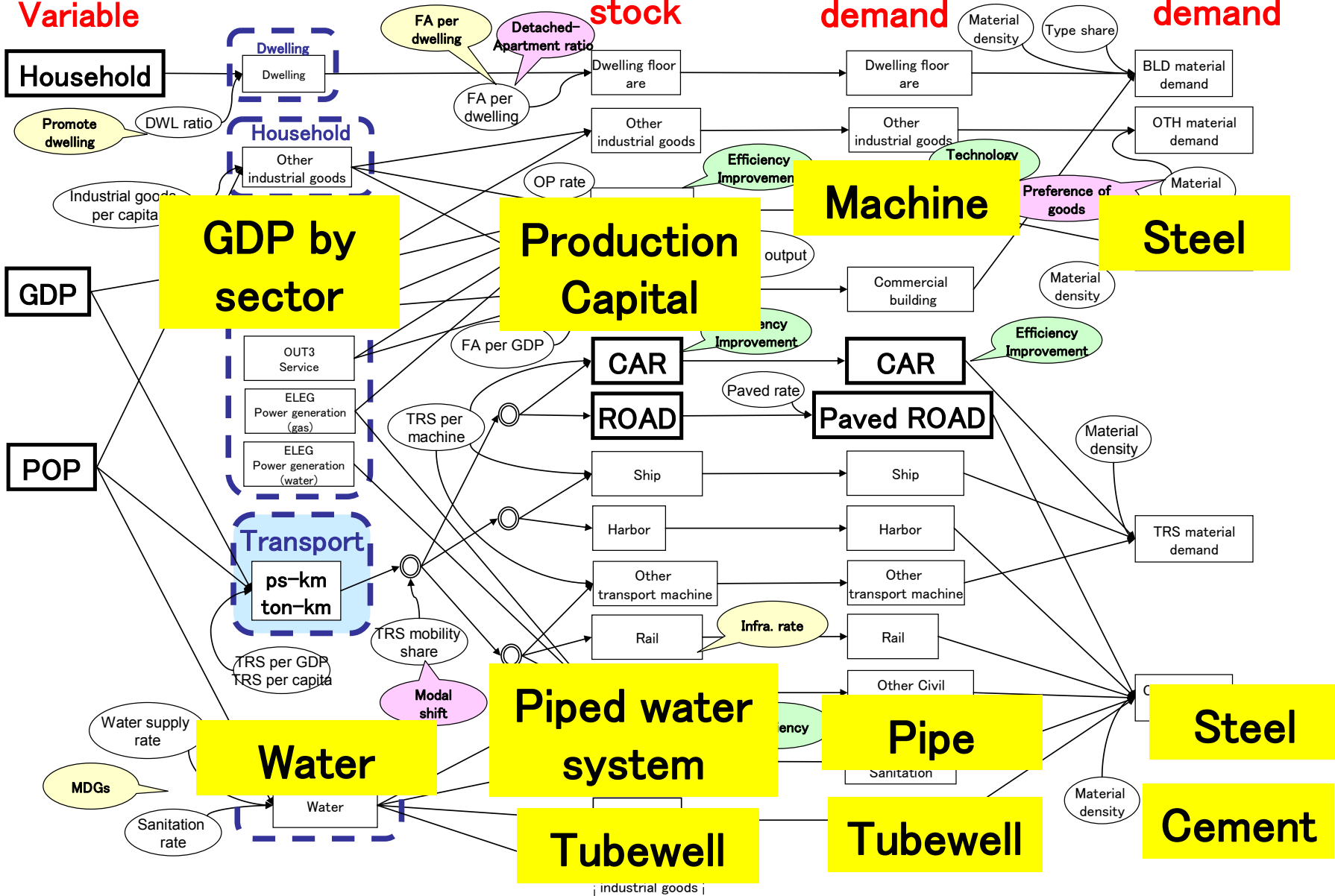
Macro-Economic Variable

Service

Goods stock

Goods demand

Material demand



Input Data

Output of
CGE model

➤ Macro-economic variable

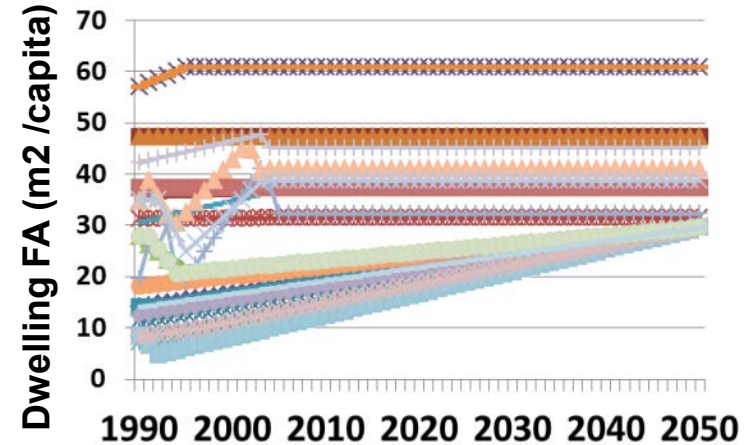
population, GDP by sector, households,
the size of households

➤ Coefficient of service demand

- dwelling FA per capita
- production capital ratio to GDP
- transportation demand per capita
- access rate to improved water & sanitation, *etc*

➤ Technology parameter

- share of structure type of dwelling, material input per floor area
- efficiency of power generation, operation rate of capital
- road length per car, share of transportation mode
- share of improved water source,
- diffusion rate of high performance material, *etc*



Output of
Transport Model

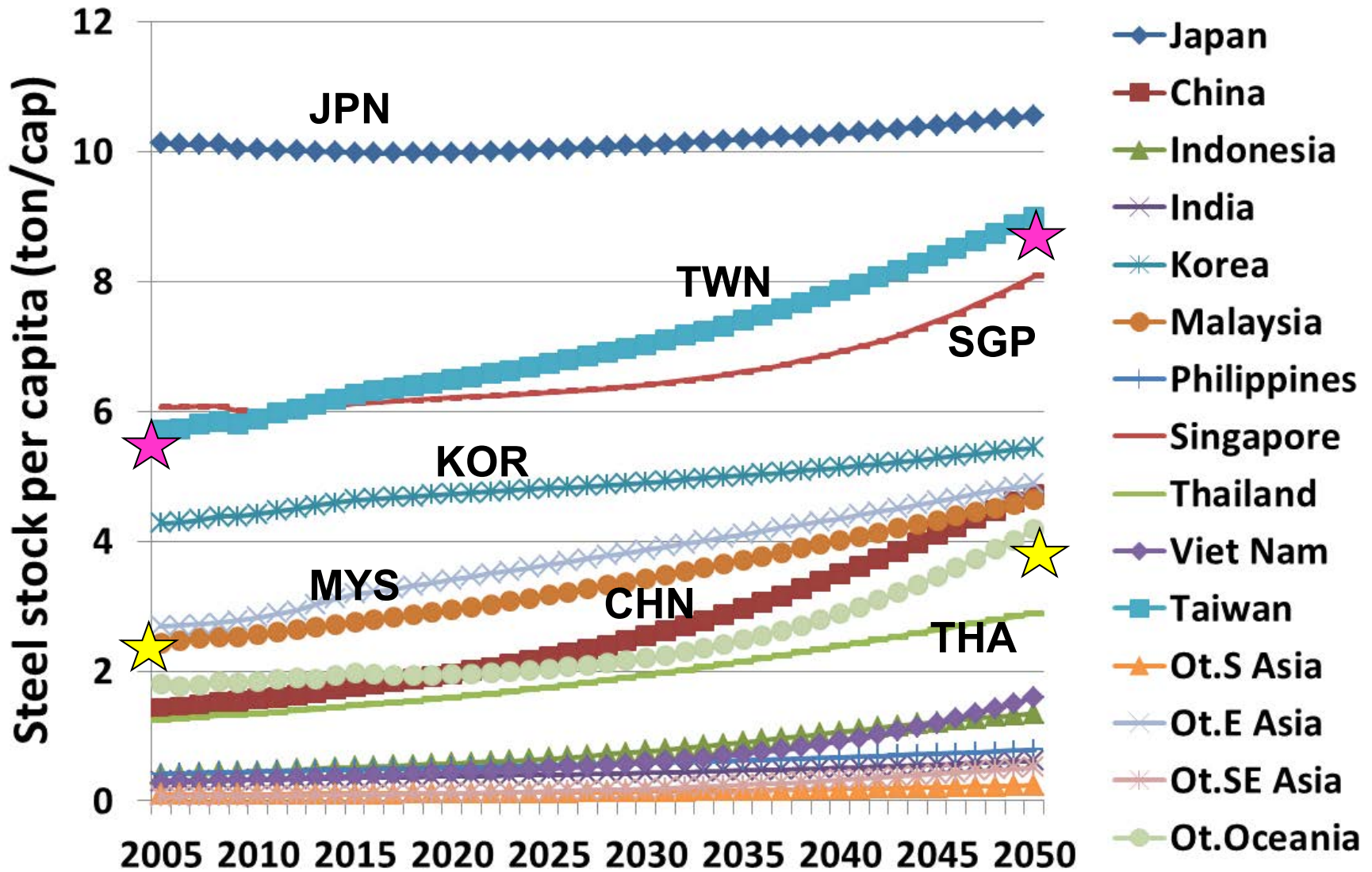
Ex. high tension steel

Output: Service demand

Service demand in 2050 (ratio to 2005)

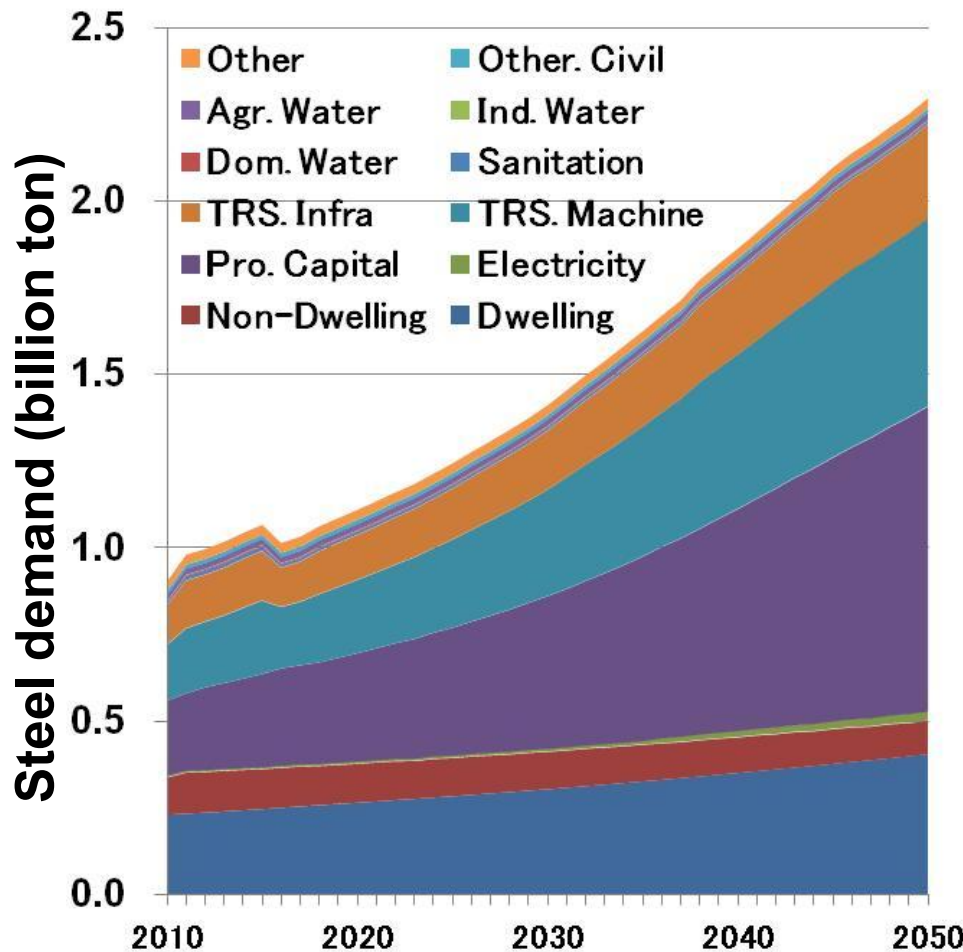
	Dwe lling	Prod. Capital	Electri city	Pass. Tran.	Freight Tran.	Dom. Water	Ind. water	Agr. water	Sanita tion
Japan	0.9	1.3	1.9	0.9	0.7	0.9	0.8	0.7	0.9
China	1.8	13.0	4.5	1.0	21.4	1.1	7.6	1.2	1.3
Indonesia	2.2	8.9	18.1	1.3	7.3	1.5	6.2	1.0	1.9
India	3.6	13.0	11.4	1.5	6.3	1.6	8.9	1.1	3.7
Korea	1.3	2.7	1.9	1.0	1.5	1.0	1.6	0.9	1.3
Malaysia	2.8	6.6	7.7	1.7	3.5	1.7	5.3	1.0	1.7
Philippines	4.2	5.2	7.2	1.8	4.2	1.9	3.8	1.4	2.1
Singapore	1.9	5.4	3.7	1.4	2.4	1.4	5.7	1.0	1.4
Thailand	2.4	6.7	6.1	1.1	4.4	1.1	4.2	1.0	1.1
Viet Nam	2.9	9.9	9.1	1.3	25.7	1.3	11.0	1.0	1.6
Taiwan	1.2	2.4	2.0	0.9	2.0	0.9	1.5	1.0	1.2
Ot. South Asia	3.7	6.5	5.9	1.6	5.2	1.9	5.8	1.6	2.5
Ot. East Asia	2.6	4.3	3.2	1.2	3.8	1.3	3.6	1.0	1.6
Ot. South-east Asia	11.4	8.0	17.9	1.3	12.7	1.5	6.8	3.0	2.0
Ot. Oceania	5.3	4.2	5.6	2.0	4.7	2.3	2.0	2.4	2.4

Output: Material stock

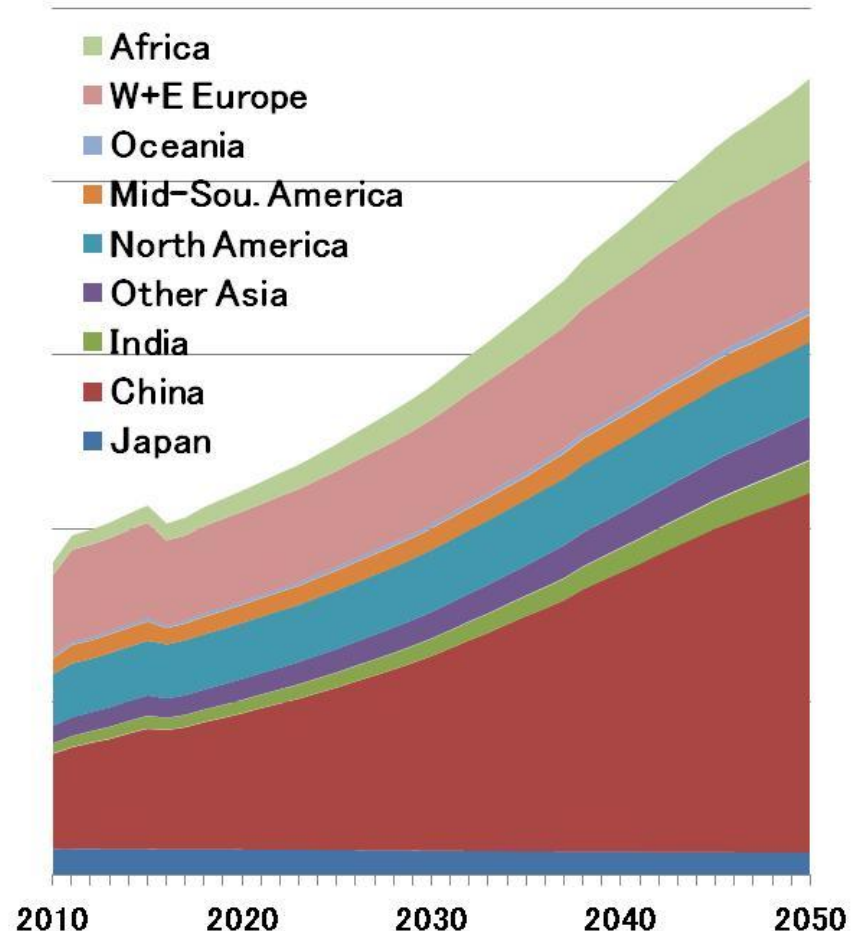


Output: Material demand (Steel:BaU)

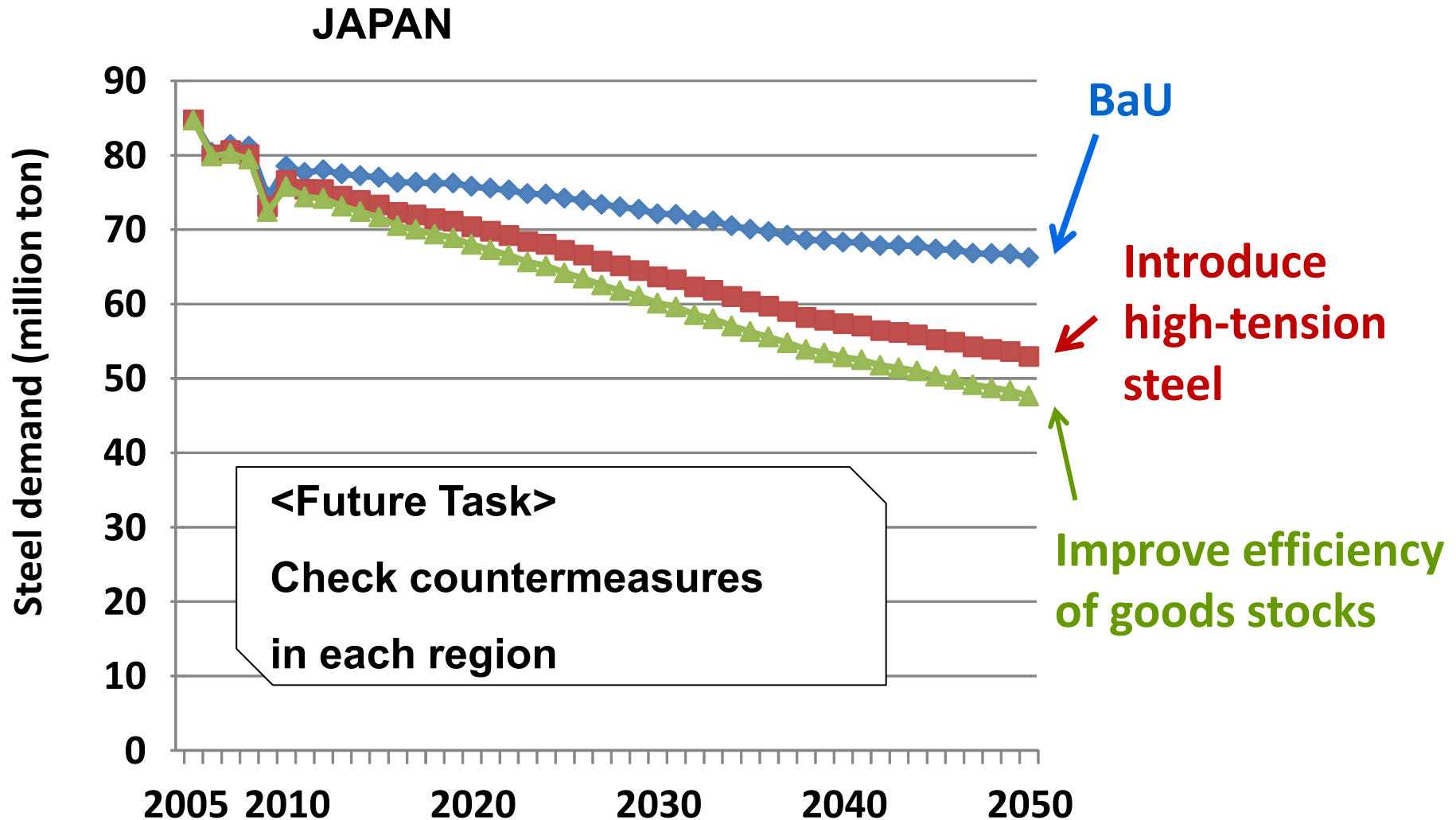
By goods



By regions



Output: Material demand (scenario analysis)



Thank you



Framework of MSFM

