Estimation of Global Cement Demand

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Introduction of Research

Material Stock and Flow Model (MSFM)

- Material : energy intensity material (Steel and **Cement**)
- Focus on
  - Material demand with considering goods demand
  - Goods demand based on goods stock in the society

Macro Economic Model

- Basic econometric model
- To estimate the input variables for MSFM
  - Each country(35 regions): GDP, Investment
  - World: Balance of Import and Export (Goods and Money)

Contents

1. Framework of Material Stock and Flow Model/CEM
   - Model Description
   - Model Structure
   - Current version ; MSFM/CEM

2. Results of MSFM/CEM

Description of MSFM/CEM 1

Final demands goods

Buildings

- **Dwelling, Commercial**
- **Dwelling Type : Detached house, Apartment**
- **Construction material:**

Wood	**Wood**
Steel Reinforced Concrete	**Masonry or cement**
Concrete Block	**Traditional materials & Other**
Traditional Materials &Other	

Civil engineering structures

- **Road, Railway, Dam, Airport, Harbor,**
- **Water supply and sewerage, Other**

1 category

Description of MSFM/CEM 2

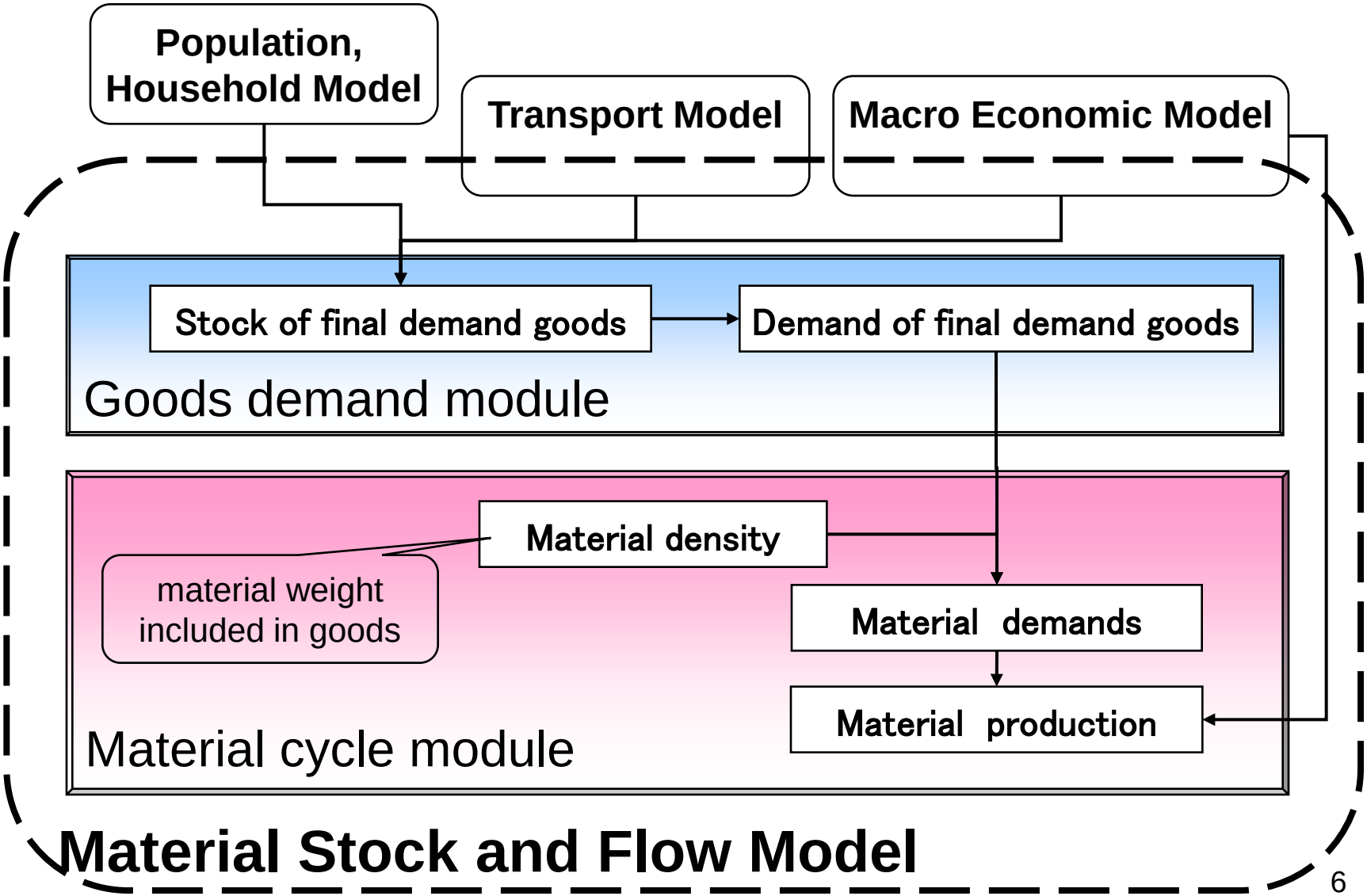
County classification:35 regions

Code	Name	Code	Name	Code	Name
JPN	: Japan	XEA	: Other East Asia	ZAF	: South Africa
CHN	: China	XCS	: Central Asia	XAF	: Other Africa
IND	: India	XME	: Middle East	RUS	: Russia
IDN	: Indonesia	XLM	: Other Latin America	MEX	: Mexico
KOR	: Korea	CAN	: Canada	ARG	: Argentine
THA	: Thailand	USA	: USA	BRA	: Brazil
MYS	: Malaysia	XE15	: EU-15	AUS	: Australia
VNM	: Viet Nam	XE10	: EU-10	NZL	: New Zealand
TWN	: Taiwan	XE2	: EU-2	XOC	: Other oceania
SGP	: Singapore	TUR	: Turkey		
PHL	: Philippines	XENI	: Other Europe		
XSE	: Other South-east Asia	XEWI	: Other Western Europe in Annex I		
XSA	: Other South Asia	XEEI	: Other Eastern Europe in Annex I		

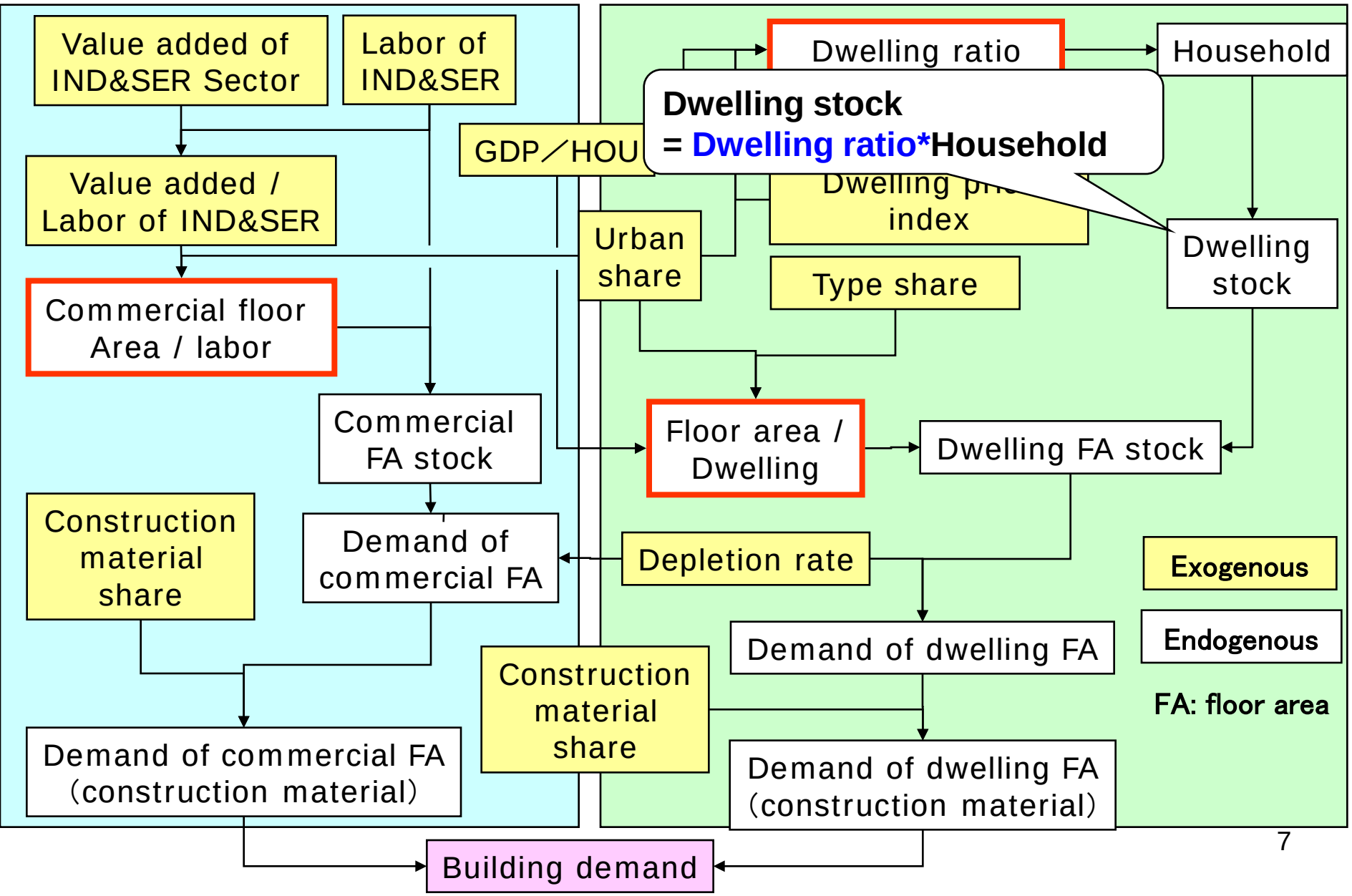
Current progress: 21 regions--finished. 14 regions--under construction

Time periods: 1900 – 2050 (1960-2030)

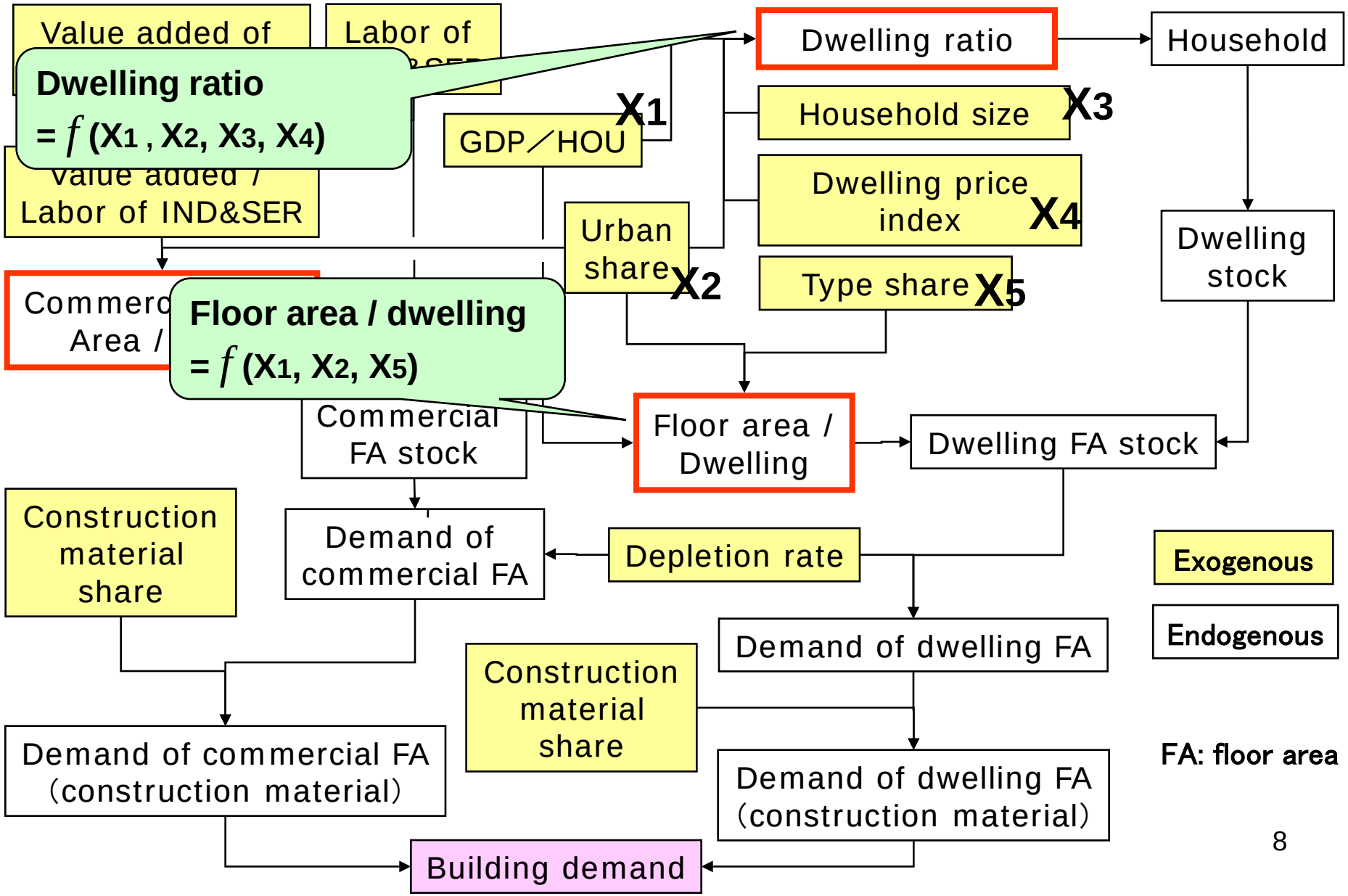
Material Stock and Flow Model



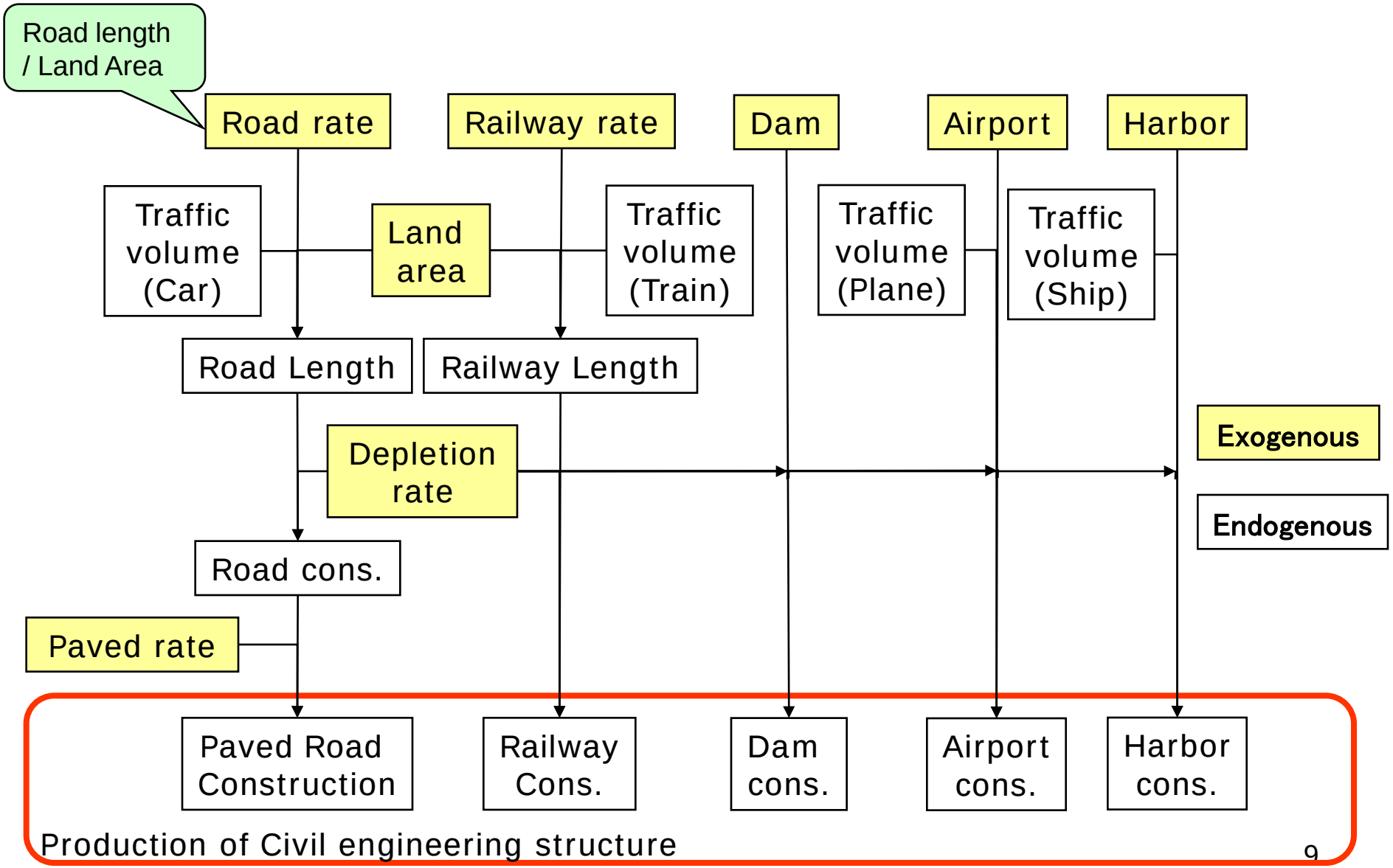
Goods Demand Module: Building



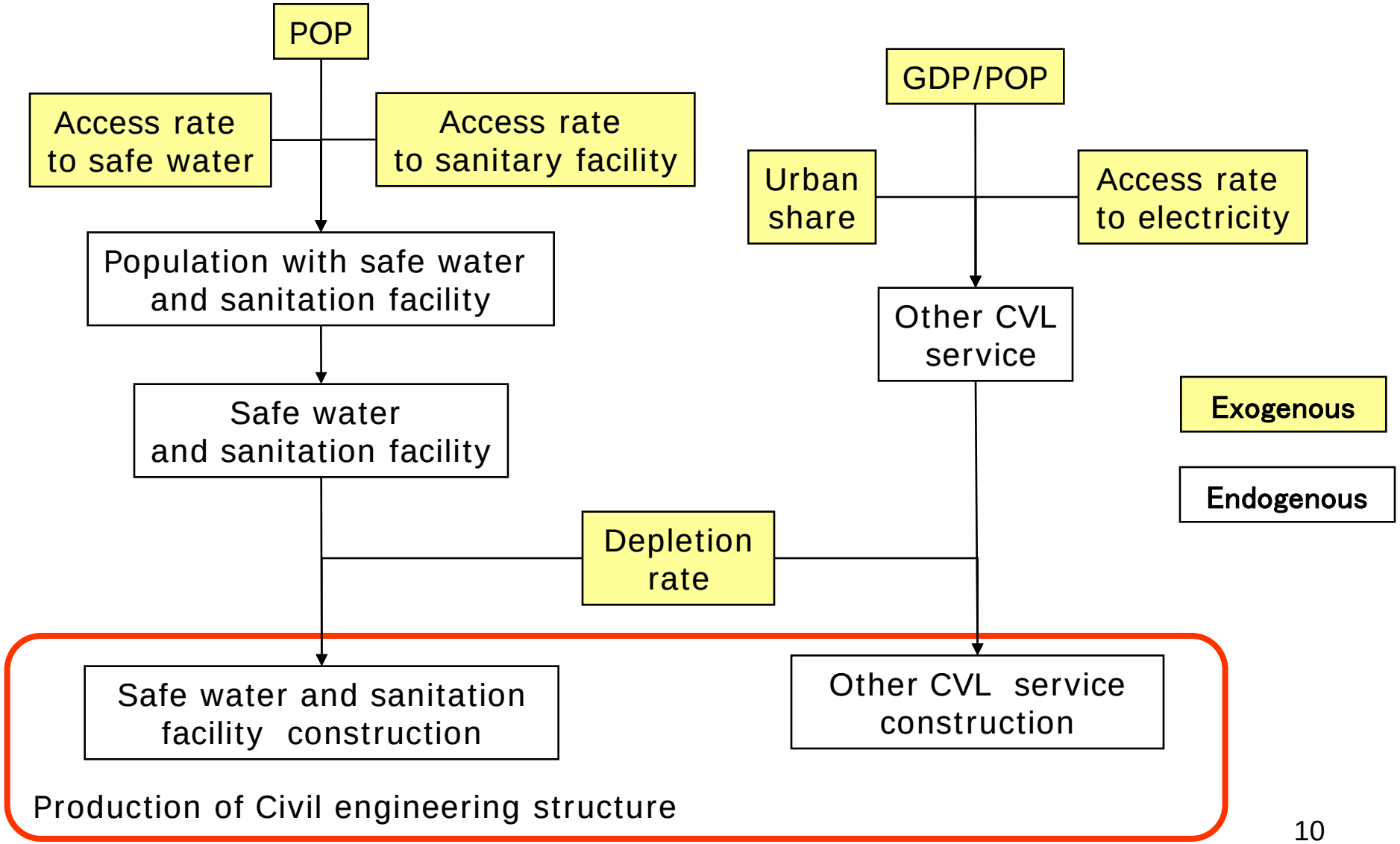
Goods Demand Module: Building



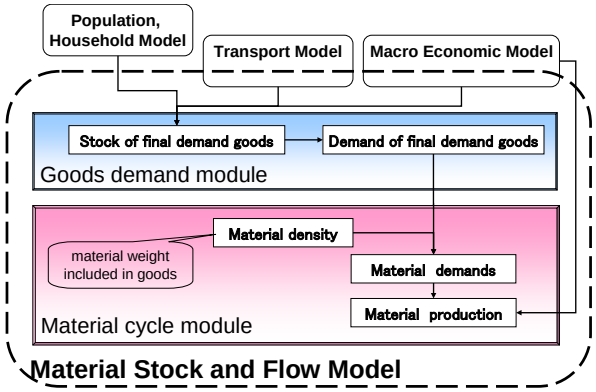
Goods Demand Module: Civil Eng.1



Goods Demand Module: Civil Eng.2



Material Cycle Module



Goods demand module

Civil Engineering structures construction

Building construction

Exogenous

Endogenous

Goods material density (ton/unit)

Cement demand [goods] (ton)

Depletion rate

Waste generation rate

Material stock [goods] (ton)

Material production [goods] (ton)

Production material density (ton/unit)

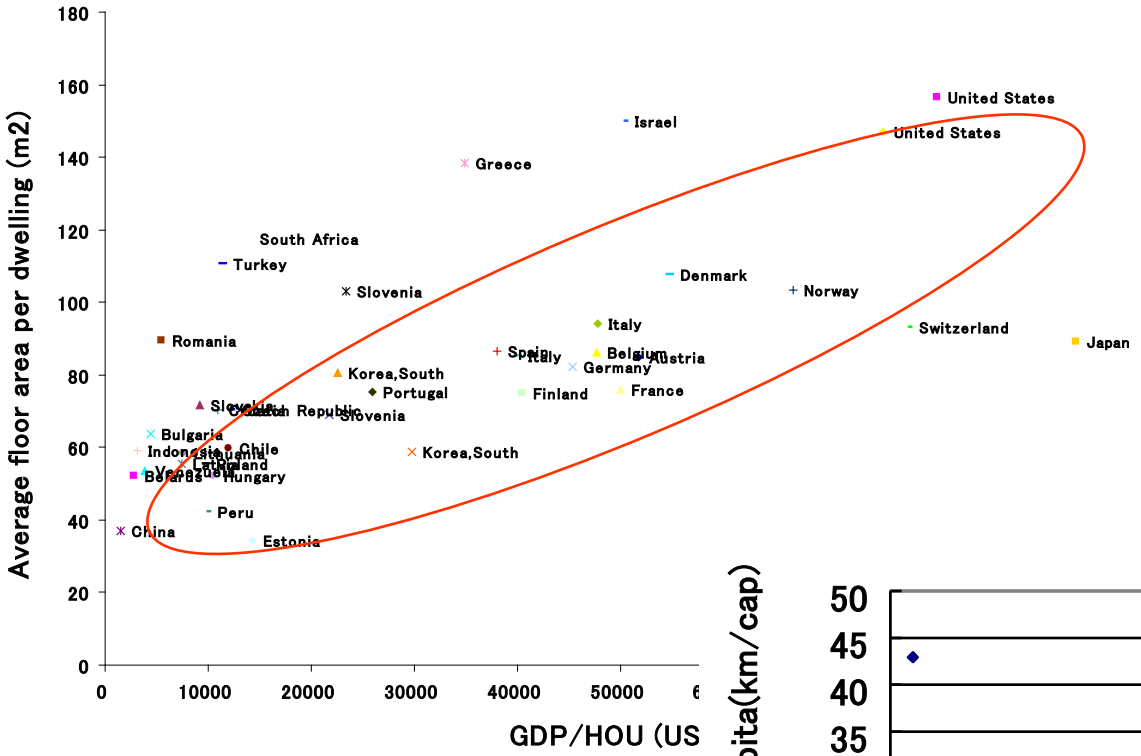
Material stock (ton)

Material production (ton)

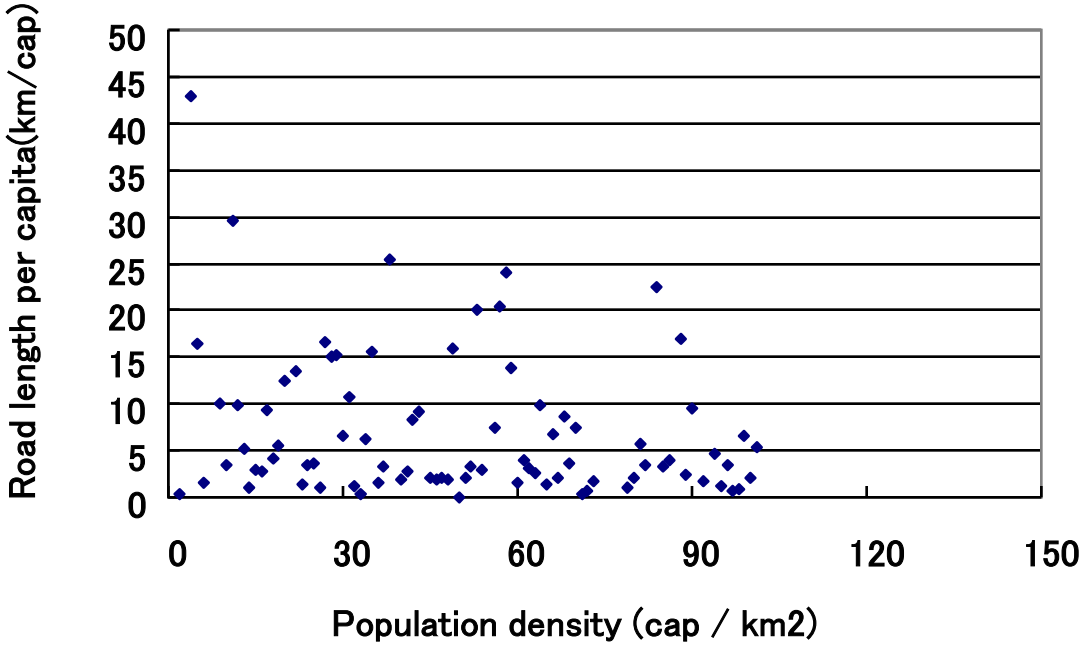
Data

Variables	Literature	Author/Institute
GDP/CAP	World Development Indicater	World Bank
GDP/HOU		
Value add		
Population		
Urban POP share		
Access to water and sanitation		
Railway Length		
Labor	World Development Indicater	World Bank
	Yearbook of labour statistics	ILO
Household	GMID	Euromonitor
Household size		
Dwelling type share		
Commercial floor area per Labor	YB of construction statistics	UN
Dwelling floor area per unit	Book of the Year	BRITANNICA
Construction share		
Depletion rate	Waste management fund report	Daigo. et al(2006)
Process scap rate	Dahlström(2004)	PSI
Road length	World Road Statistics	IRF
Air port-with paved runways	Fact Book	CIA
Dam	World Register of Dams	ICOLD

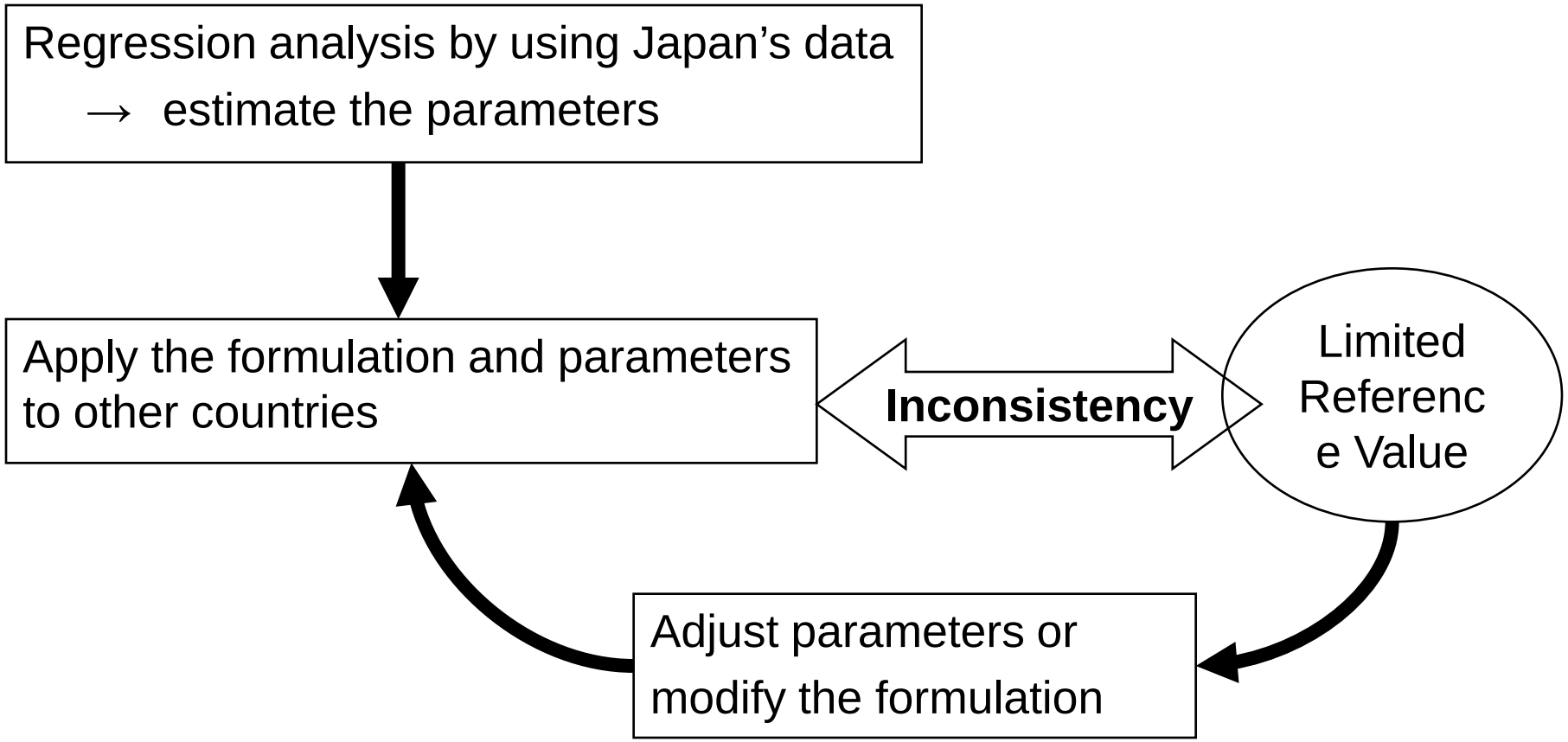
Data Introduction



* Year is different depending on countries.



Parameter Adjustment Step

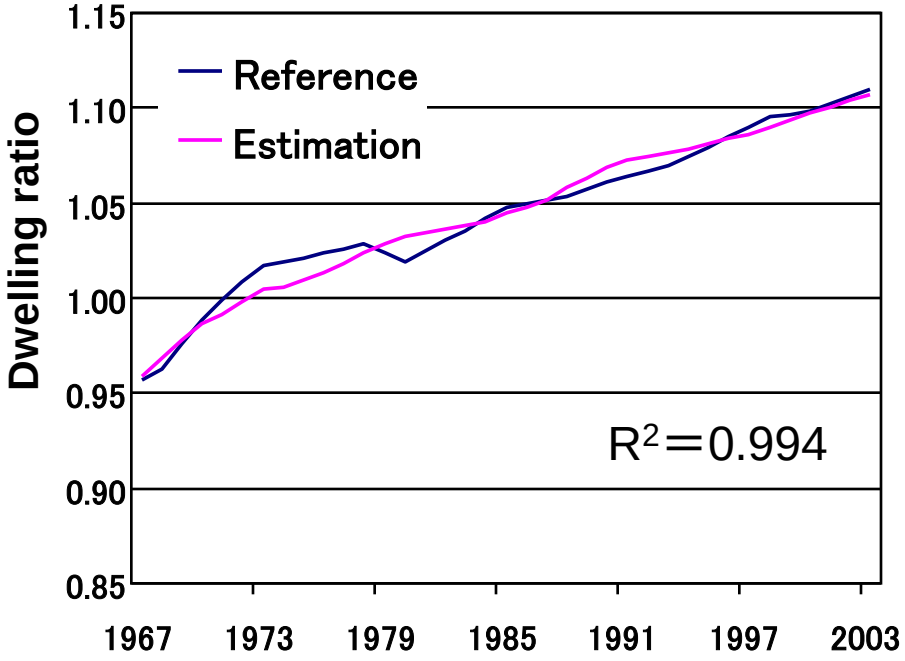


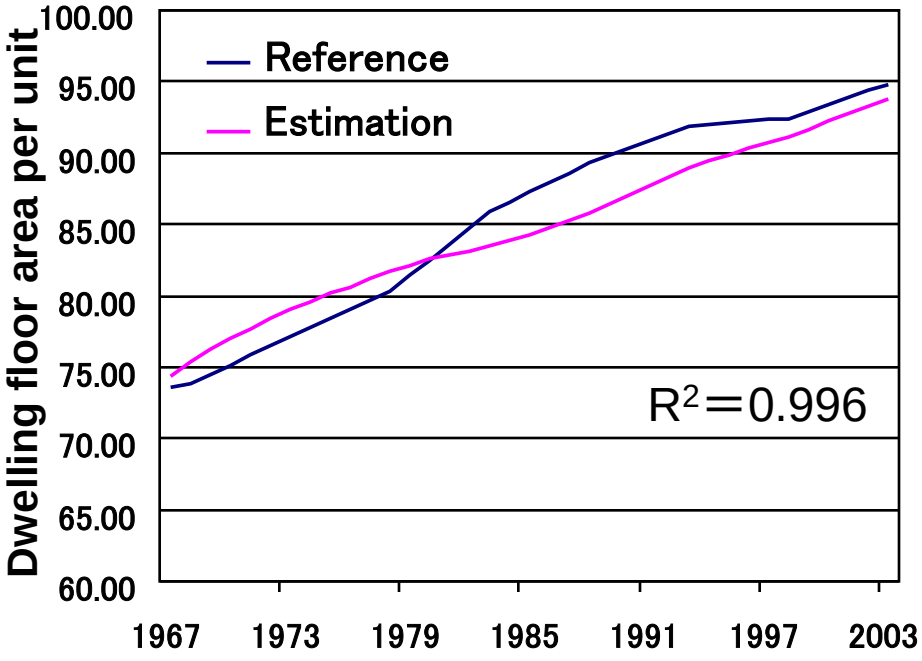
Model Performance (Japan):1

Regression analysis (1967-2003)

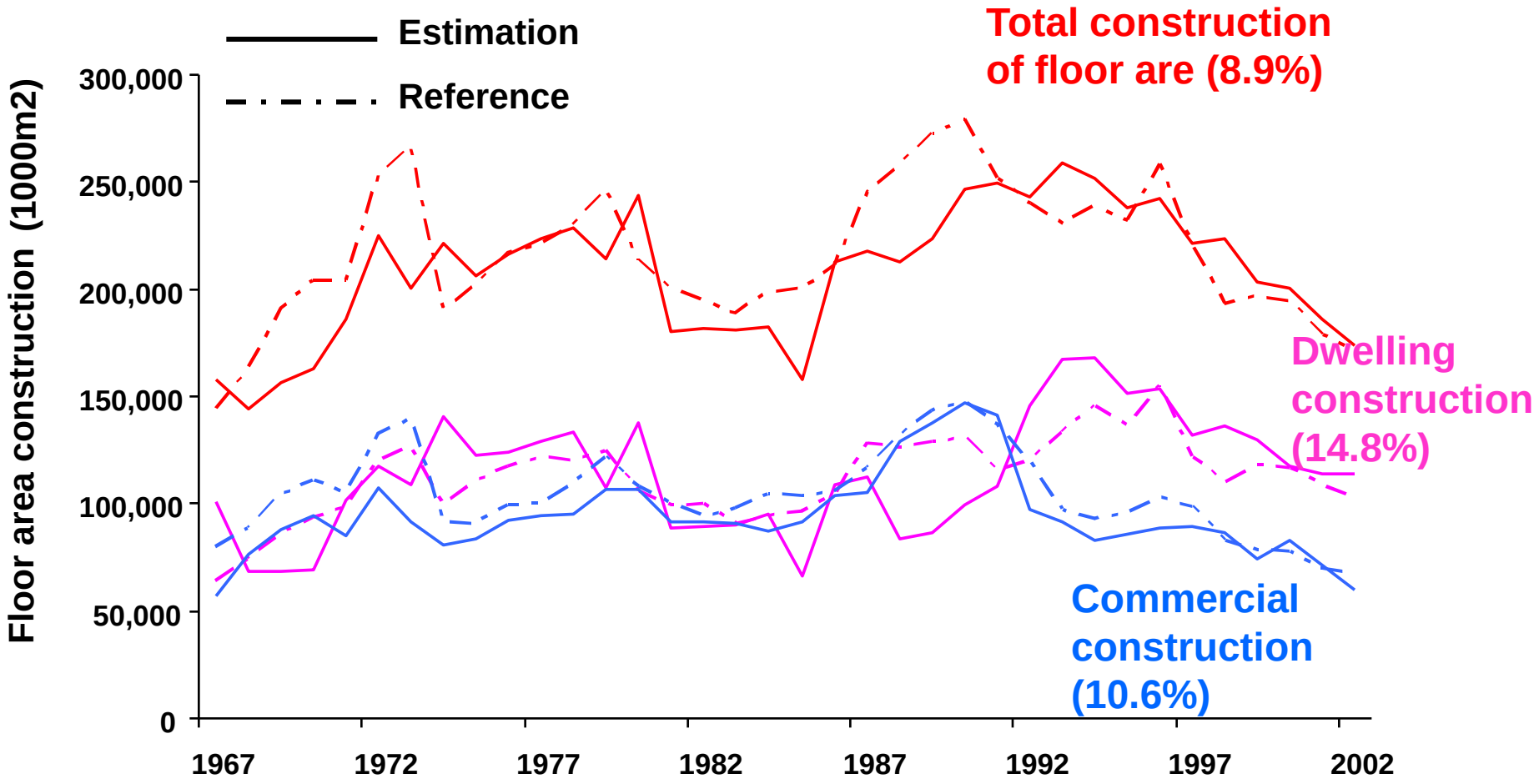
- Dwelling ratio (dwelling stock / number of households)

$= 8.56 * 10^{-7} * \text{GDP/HOU} - 6.8 * 10^{-2} * \text{Household size} + 2.0 * 10^{-4} * \text{Urban share} + 1.772$



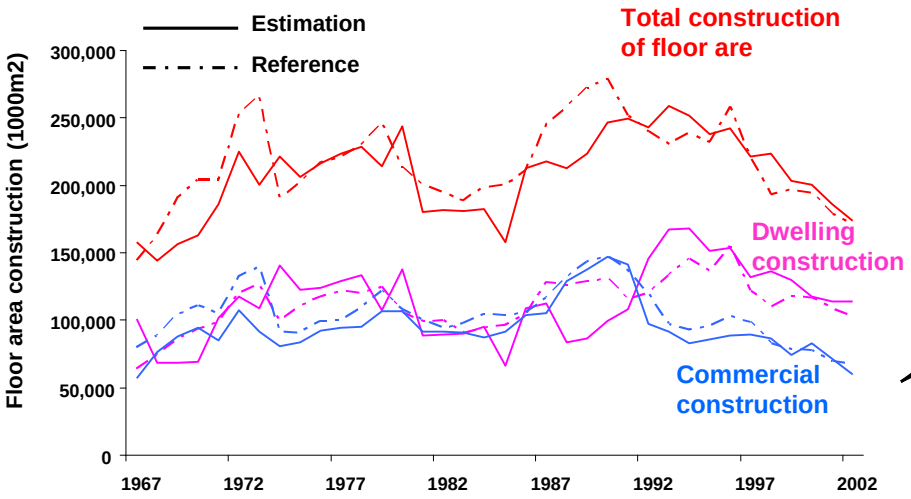


Model Performance (Japan):2

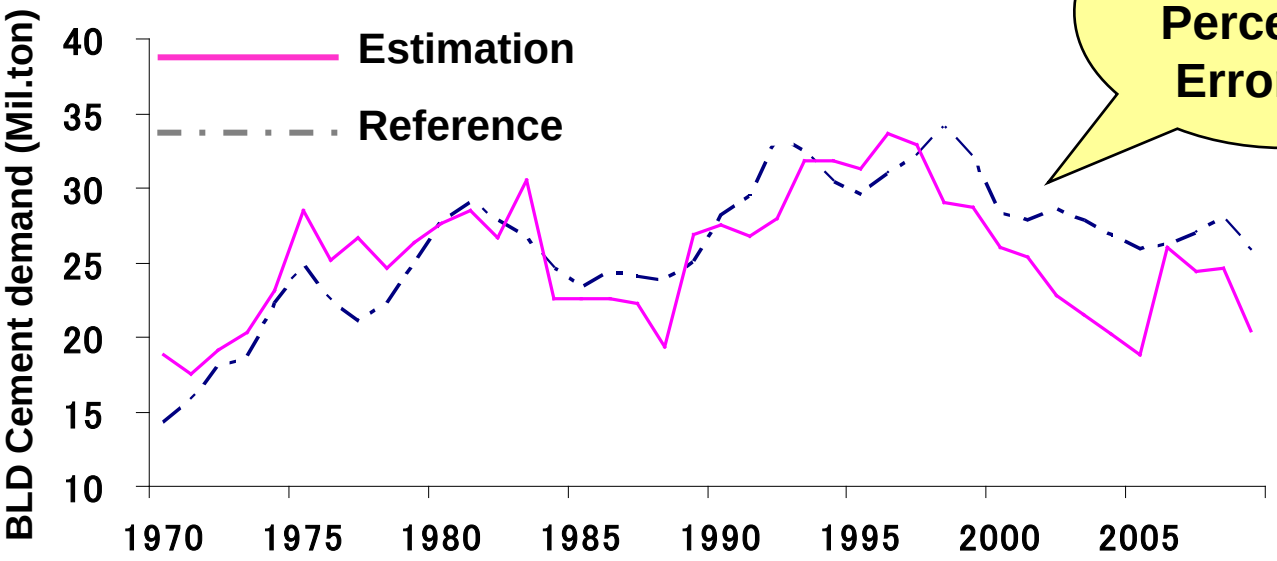


Mean Absolute Percentage Error: about 10%

Model Performance (Japan):3



Conversion of Building demand to BLD cement demand



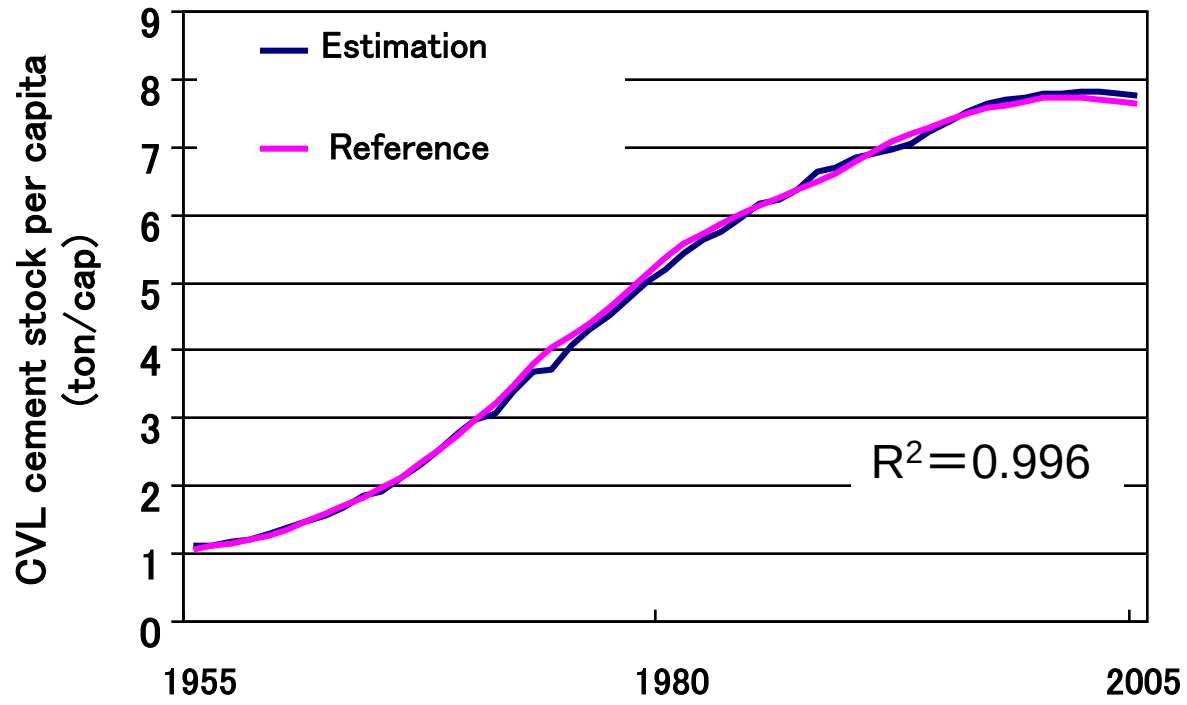
Mean Absolute Percentage Error:10%

Model Performance (Japan):4

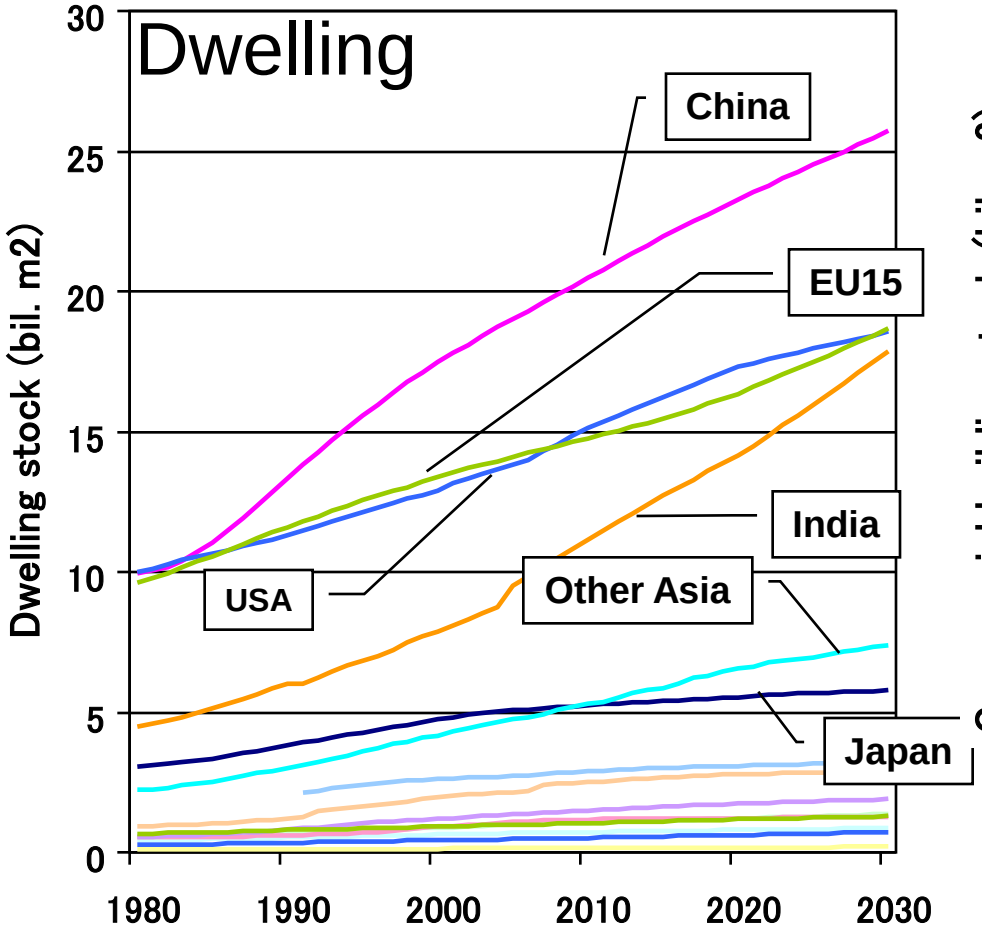
CVL cement stock per capita

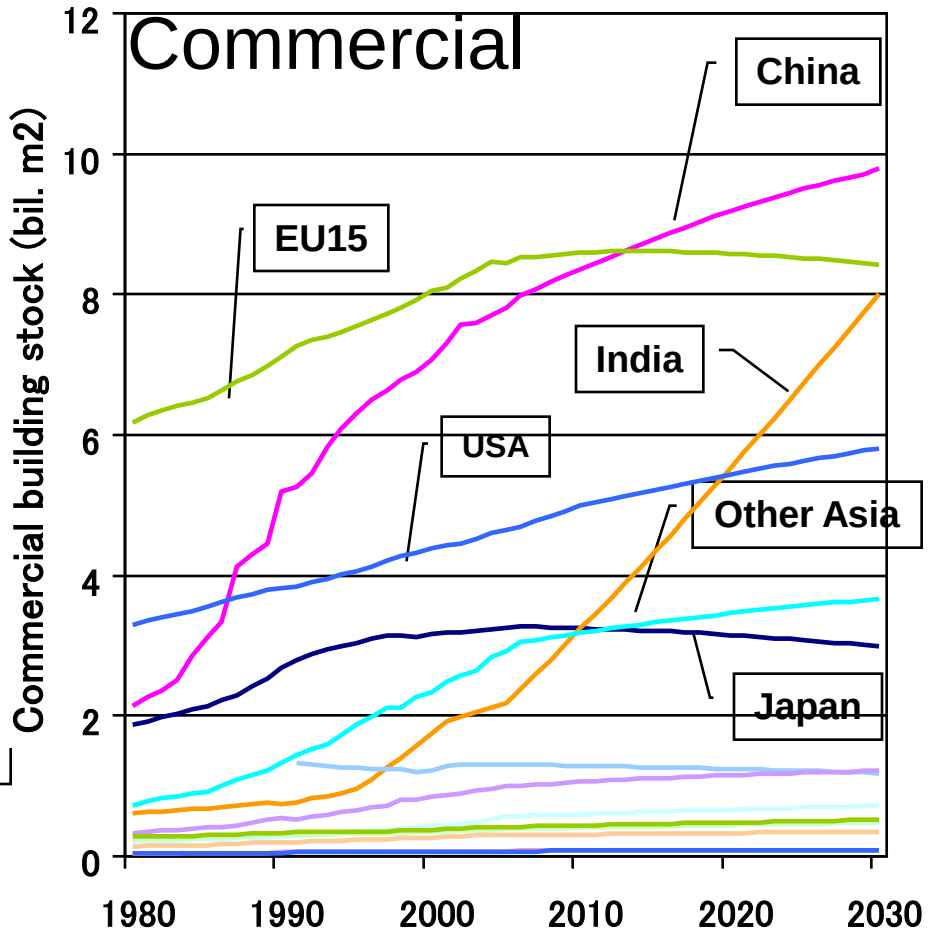
$= 1.46 * 10^{-2}$ GDP/CAP+0.96

Regression Analysis ; Japan
(periods：1955-2005)



Results: Building Stock

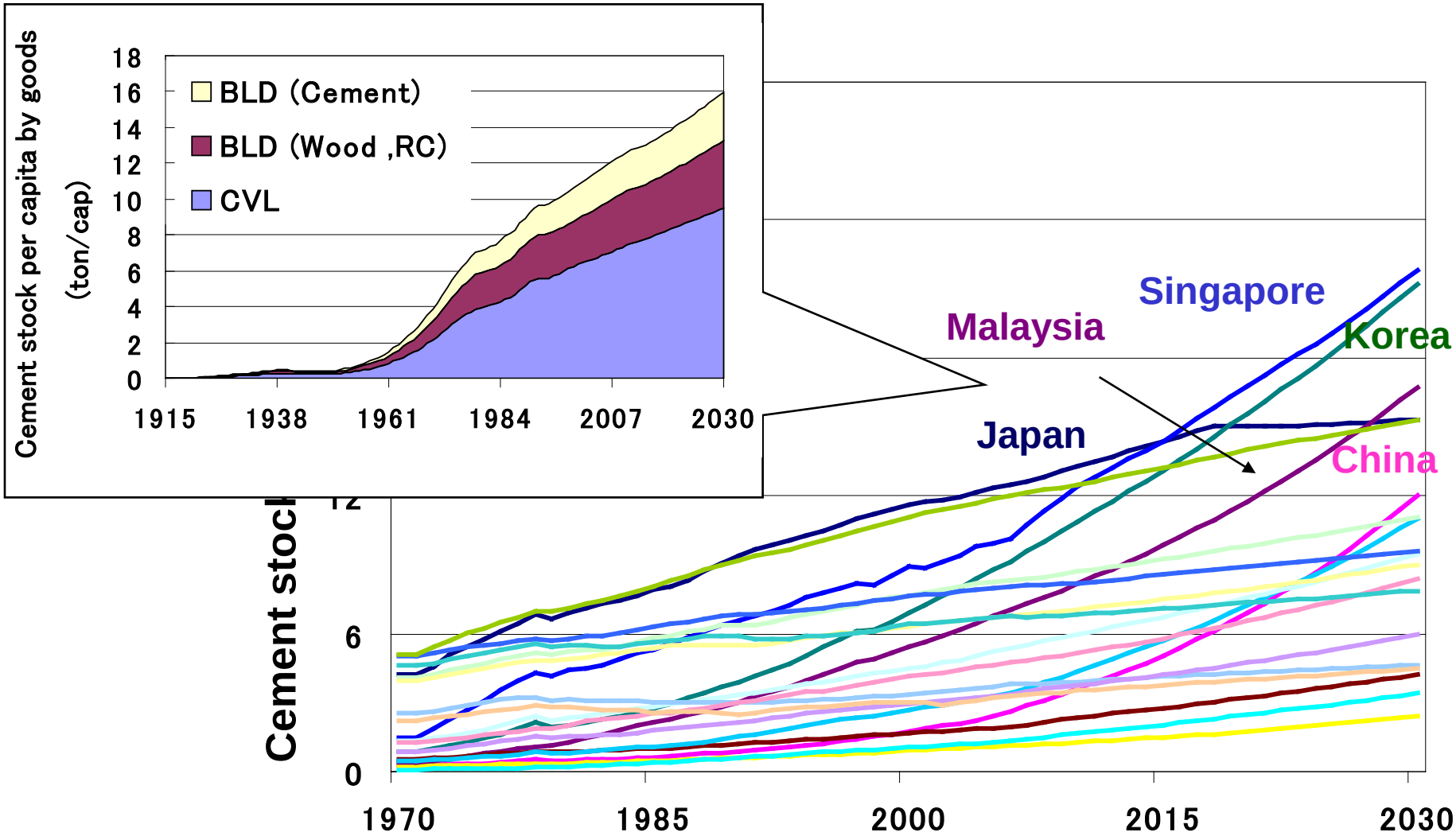




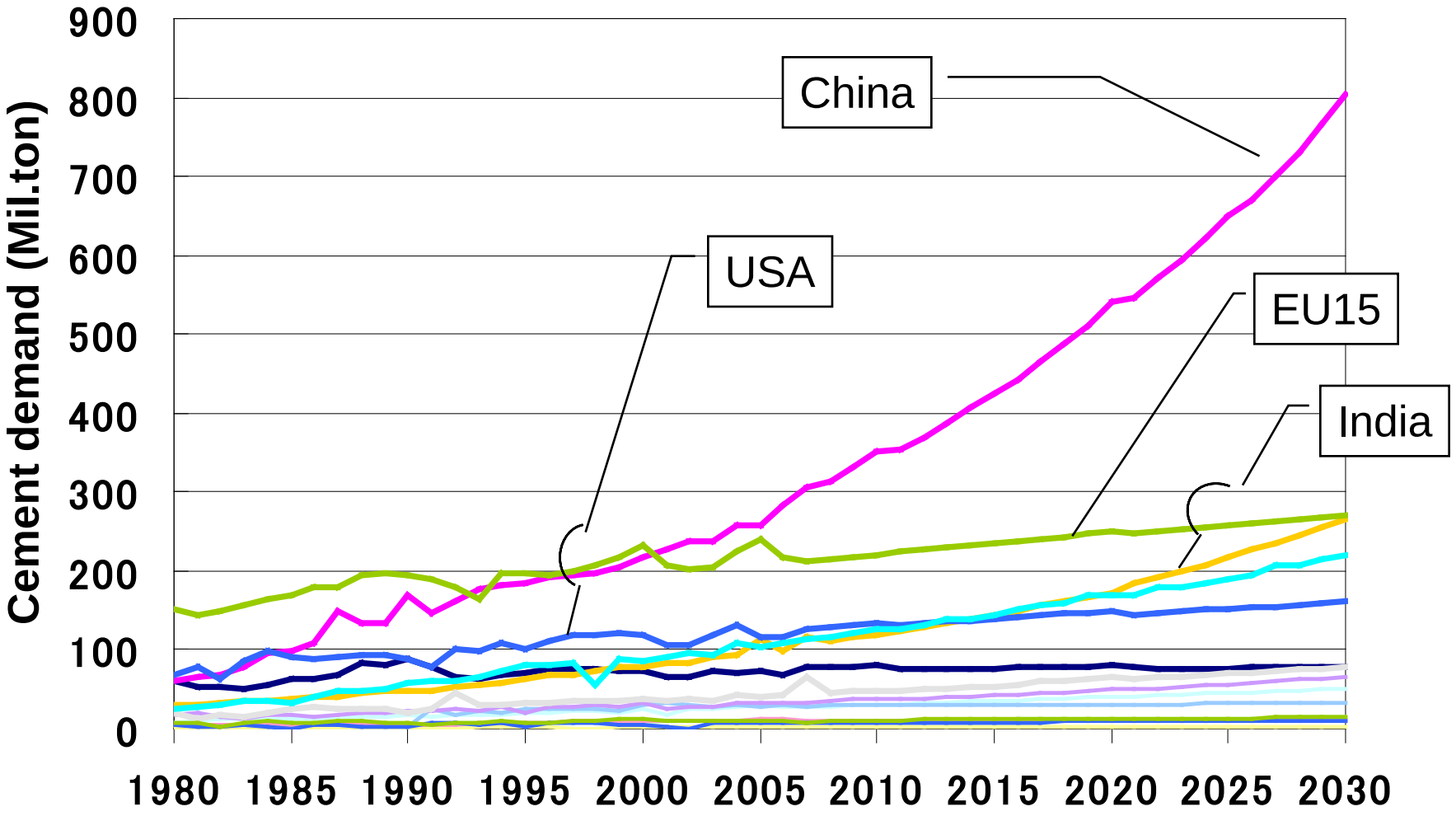
Dwelling stocks increase gradually,

Commercial building stocks are saturated in some developed countries

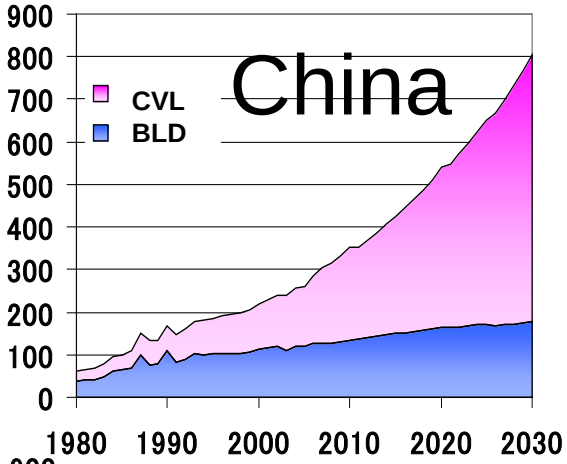
Results : Cement Stock per Capita

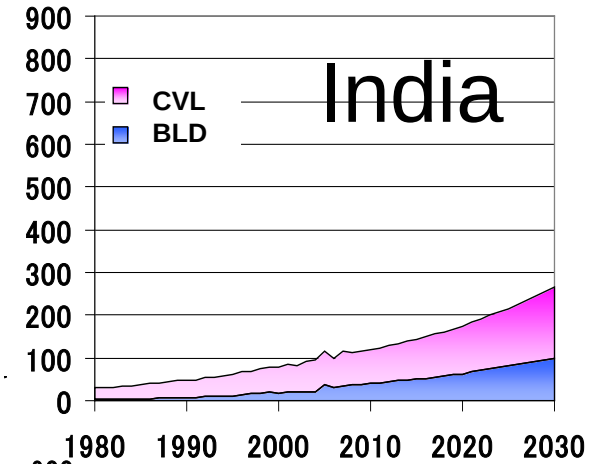


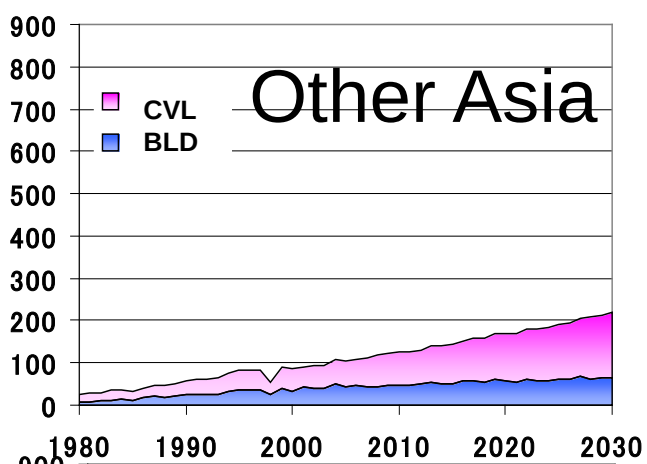
Results : Cement Demand

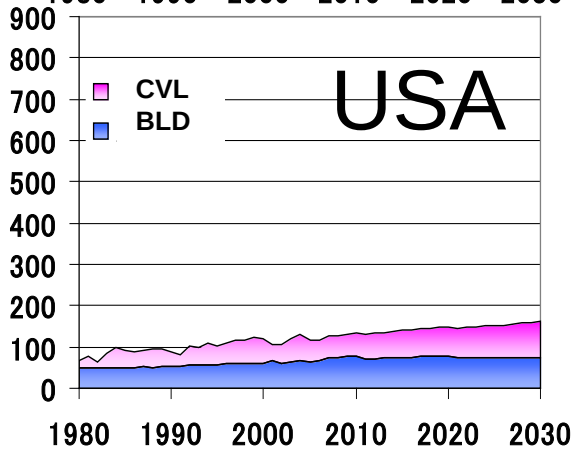


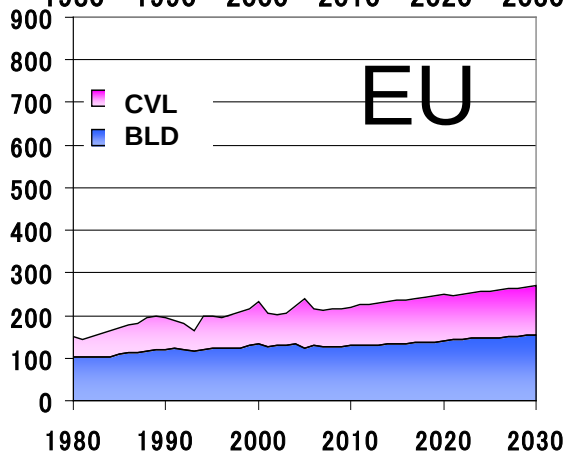
Results : Cement Demand

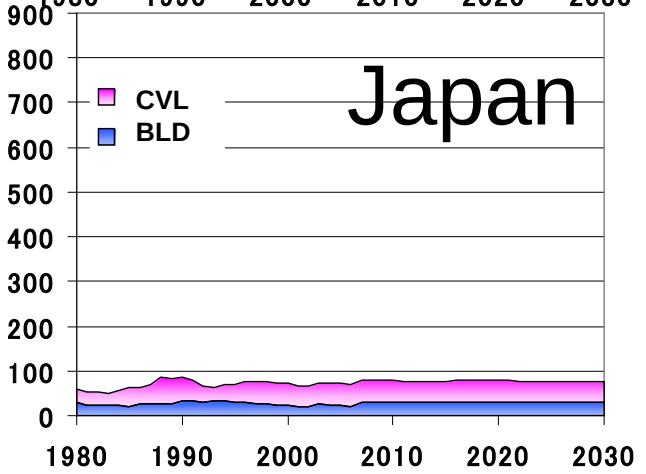












In Asian countries, the CVL cement demand is a key factor of increase of the CVL cement demand. In developed countries, CVL and BLD cement demands are almost same.

Thank you