Meta-syntheses Methodology and its Application to Economy System

Purpose

- A Sub-project of Meta-syntheses System Approach for Supporting the Decision-making of Macro-economic Problems, supported by NSFC
- The purpose of this subject is to study the HWMSE from the perspective of macroeconomic problem solving

Content

1. Meta-syntheses & Macroeconomic Issues Discussion
- Meta-syntheses — methodology for macroeconomic system study
  - From the integration viewpoint
    - Up-down & bottom-up
    - From whole to part & from part to whole
  - Integration of studies from macro and micro view
- Meta-syntheses: Qualitative & Quantitative
  - Approach unstructured problem through structured series
- Hall for Workshop on Meta-synthetic Engineering (HWMSE)
  - Human centered man-machine cooperation system
  - Platform for experts to discuss and work together

1. Meta-syntheses & Macroeconomic Issues Discussion
- Framework of Macroeconomic system analyses For HWMSE
- Macro-economic Modeling and Simulation
- Case-Based Reasoning
- Conclusion

Process of Meta-syntheses

- Problem Recognition
  - System description, planning, conditions, experiment
  - Conceptual approach, methodology
- Expert System
  - Knowledge Discovery
- Machine System

HWMSE & Macroeconomic Issues Discussion

- HWMSE——Domain knowledge
  - Expert system —— Domain experts, system experts
  - Machine System —— Domain analyses: methods and tools
  - Knowledge system —— Domain systematic analyses and problem solving
- Macroeconomic Issues Discussion under HWMSE
  - Way to convergence
    - General methods and tools
    - Domain problems solving, patterns, thoughts and knowledge
  - Supporting Resources for the Workshop
    - Information, Data, Models, Methods, Knowledge, Cases
2. Framework of Macroeconomic system analyses for HWMSE

From the view of system

For the construction and study of the HWMSE

For limited targets

Macroeconomic system analyses — Macroeconomic Information system

- Characteristics of Macroeconomic Information
  - Macroeconomic information Obtain, organization and use
  - Sources and channels
  - Expression and display : Exhibition in the workshop
    - Statistic data
    - Strategy information
    - Situation and business cycle information
    - Problems in economic system
    - Others, such as economic theories and concepts
  - Information process and utilization
    - Analyses and evaluation
    - Modeling and forecast
    - Discussion supporting

Macroeconomic system analyses — Indicator systems

- Descriptive indicator system
- Evaluation indicator system
- Decision–making indicator system
- Policy indicator system

Descriptive indicator system

- Economy State variables
  - Describe the running characteristics of economic system
  - Different set of State variables for systems at different level or different aspects
- Observable variables
  - According to an economic state, result or for analyses purpose
- Environmental variables
- Adjustment variables
  - Lever variables, policy variables

Evaluation indicator system

- Object of Evaluation
  - Economic Development
    - Situation of Macroeconomic running
    - Quality of Macroeconomic running
    - Different profiles
  - Economic policy analyses and evaluation
    - Policy simulation
    - Evidential analyses
  - Rationality of quantitative analyses and forecast
    - Rationality of models: beforehand / afterwards
    - Rationality of economic policies
    - Evaluation on future economic development
Macroeconomic policy indicator

- Aim at different adjustment targets
- Combination of several kinds of adjustment measures
  - Monetary measures
  - Fiscal measures
  - Income policies
  - Employment policies
  - Foreign trade policies
  - Price adjustment policies
  - Technology and education policies

Macroeconomic system analyses—Economy adjustment system

- Macro economic adjustment patterns
  - Economy adjustment history and patterns of different countries
  - Economy adjustment practice of China
  - Macro economic adjustment measures and policies
    - Planning, Economic, administrative, legal measures
  - Ways and patterns of Macro economic adjustment
    - Targets acknowledgment
    - Adjustment time selection
    - Adjustment strength control
    - Pattern formation and measures selection

To set up economy adjustment system

- Object
- Target
- Tasks
- Organization
- Patterns

Role of HWMSE in the Economy adjustment system

3. Macroeconomic Modeling and simulation

- Open, Dynamic, Complementary
Model system

Macroeconomic Model Group

- **Some Macro Models**
  - **Macroeconomic Forecast Model**
    - Forecast and simulation
  - **Policy simulation models**
    - Scenario analyses of macroeconomic policies
    - Financial policy simulation
    - Investment policy simulation
  - **Macro-economic Input-Output Model**
    - Multi-industrial I-O analyses
    - Industry equilibrium and industry evolution

- **Micro Simulation Models**
  - Software Platform: SWARM
  - Multi-agent economic experimental model
    - To simulate the behaviors of micro agents follow given rules under certain environment and to observe the macro economic phenomena.
  - Main Modeling principles
    - Simulate simple units
    - Local control instead of global control
    - Behaviors emerge from lower layers
  - Main Models
    - Inhabitant Consumption Behaviors Model
    - Influence of Public Debt on Macroeconomic Development Model

Macroeconomic Model Group

- **Economic Monitoring system**
  - Business cycle analyses
  - Business cycle indicator and signals system
  - Behaves of economic policy in business cycle and countermeasure against fluctuation
- **Capital market Forewarn model**
  - Capital market indicator system
  - Forecast Model
  - GA
- **Control Model of Investment**
  - It is built based on the Birth & Death process to describe the evolution path of capital investment. The boundary condition are expressed respectively in the CES and neutral technical advance production function.
  - Some evidential analyses have been done to estimate the contribution of technical advance to Chinese Economic progress as well.

Influence of Public Debt on Macroeconomic Development Model

- **Influence of Public Debt on Macroeconomic Development Model**
  - The purpose of the model is to estimate the pulling effectiveness of expansionary fiscal policy and estimate the influence to economy if the public debt decreases.

Construction and Application of Models

- **Under the HWMSE: Experts participation**
  - Modeling
    - Mechanism analyses
    - Data process
    - Model integration
  - Application
    - Conditions
    - Model selection
    - Scenario formation
    - Evaluation
4. Case-based Reasoning (CBR)

- Methods and key techniques of CBR
  - Case Representation
    - A five element group: Problem description (P), Problem environment description (E), Object of problem solving (O), Solution (S), Expert evaluation (V)
  - Case Retrieval
    - Nearest-neighbor approach, inductive algorithm, knowledge-guided, Template Retrieval
  - Case Adaptation
  - Solution Evaluation
  - Case Learning

Application Framework of CBR

Application of Case-based Reasoning

- Case-based Financial Crisis Warning System - CFCWS
  - Knowledge base: Financial Crisis of South-east Asia, Latin America
  - Financial forecast
  - Un-complete decision tree Financial Crisis Fuzzy warning model
- Case base: Inflation, deflation and their regulation
  - History of inflation, deflation
  - Evaluation of inflation, deflation
  - Countermeasures against inflation & deflation countermeasure
- Case base: Forewarn of capital market
  - Relevant policies
  - History of capital market fluctuation
  - Fluctuation analyses and countermeasures

Conclusion

- To sum up, all these works aim to study and support macroeconomic problem solving under the virtual meta-synthetic workshop.
- Actual economic forecasts and analyses by different experts for China economy are analyzed and evaluated. Experts behaviors in some macroeconomic seminars are analyzed as well.
- Macroeconomic problems discussion pattern study & experiment
- CBR for Group Discussion
  - Group Case Base
  - Individual Case Base
  - Coordination Case Base

Macro-economic situation analyses and policy simulation:

A Case of Macroeconomic Problem Discussion

Thank you!