Introduction about China’s Quarterly Macro Econometric Model

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outline

• History of China’s econometric modeling work
• General information about the IQTE quarterly model (QECM model)
• Structure of the QECM model
• Variable and data issue
• Equation specification and econometric method
• Model building
• Model performance check: within and out-of sample
• Model application: forecast and scenario policy simulation
History of China’s modeling work

- Before China started economic reform and opening up in 1978, China conducted central-planned economy. Quantitative economic analysis or econometrics did not exist.
- Econometrics was introduced to China since 1980s, mainly driven by econometricians in US. The Chinese government took the advice and started to promote the quantitative economics and econometrics.
- To build China’s macroeconometric model acted as a starting point for the adoption and development of econometrics in China.
annual econometric model in IQTE

• Due to data availability, the first macro model which was built in the late 1980s, is based on annual data, sample starting from 1952
• The annual model is a standard structural macroeconometric model, including about 80 equations, and 15 exogenous variables.
• It is still maintained and upgraded every year, and applied for the forecast and policy simulation.
• Two forecast reports (in May and October) made by IQTE are issued based on the annual model, and were published as book series by IQTE since 1990, together with other analysis reports.
• Forecast is combination of model and experience
Quarterly macroeconometric model in IQTE

• The idea to build a quarterly model was motivated by the availability of quarterly data and new modeling methods.

• The quarterly GDP was released in 1992, from then on more quarterly data are available.

• The sample for quarterly model starts from 1978Q1 when the economics reform began rather than 1952 for annual model.

• Dynamic modeling method i.e. ECM model which became popular is applied to build the quarterly model.
QECM in IQTE

• The first version of China’s quarterly model (QECM) was developed in 1993 by the IQTE, with cooperation of the Oxford Univ and Oxford Economic Forecast (OEF), the sample starts from 1978Q1

• During 1997 to 2000 IQTE issued Quarterly Economic Forecast Report every quarter based on the QECM model.
Specification of behavior equations in QECM

- Behaviors equations are in Error Correction Mechanism Form (ECM)

\[ \Delta y_t = c + \sum_{i=1}^{k_1} a_i \Delta y_{t-i} + \sum_{i=0}^{k_2} b_i \Delta x_{t-i} - \alpha (y_{t-1} + \sum \beta_i x_{t-1}) + \varepsilon_t \]

- Long-run terms (ecm) are specified based economic theories
- Short-run dynamics depend on data
- Take general to specific method, eliminated the insignificant terms
- Check error terms for model specification test
Other models

Models in other institutes or universities

- Annual model developed in 1980s by the State Information Center, an institute affiliated to the National Development and Reform Commission. This model has been used as Chinese model in the Project Link.
- A few other quarterly models developed by universities and institutes, i.e. Xiamen Univ, IWEP of CASS
- No quarterly models are developed and maintained in ministries or the central bank.
- A few multi-country model have been developed, such as the Asian-country model developed by the Asian Development Bank in 2005

Other models in IQTE

- CGE, DSGE, GVAR (Global Autoregressive Model)
Figure 1. A flow chart of the China model

- Population & labor force
  - Employment
  - Long-term GDP Trend
    - Primary Sector
    - Secondary Sector
    - Tertiary Sector
  - Price & wage Block
- Capital
- Private Consumption + Government Consumption + Capital Formation + Exports - Imports
- Urban & Rural household Consumption & Income
- Government Block: fiscal policy
- Banking Block
  - Long-term policy
  - Monetary policy
- World Trade
  - World price Exchange rate
- Budgetary Investment
- Business Investment
- FDI
Datasets and data issues

- Datasets (WIND, Bloomberg, CEIC, etc.) are available, making the data collection convenient and easier than before.
- Main problems with the data are inconsistent, not complete, low frequency, etc.
- Interpolation is often used to deal with the problems.
features of the QECM model

• The specification of the equations in QECM are in the form of ECM model, which is the commonly used dynamic econometric method.
• The model is mainly demand oriented, due to the market economic character of China’s economy after reform, supply side is also included.
• QECM is a standard macroeconometric model, with medium size, 60 endogenous, 11 exogenous variables
• 7 blocks, 31 behavior equations, 29 identities
• Software : Eviews8.0 programming
• Application: forecast and policy simulation
• Can be extended to include more details, or to link to multi countries models
7 blocks in QECM model(1)

- **Production block**
  - To model potential GDP and output gap based on the product function

- **Income and expenditure block**
  - Income and expenditure are separately modeled for urban and rural households
  - Income mainly depends on productivity and wage. Expenditure mainly depends on income and inflation

- **Investment block**
  - Investment in fixed asset are divided into loan investment, self raised capital investment, FDI, and government investment, according to the source of investment. The 4 types of investment are modeled separately.

- **Government block**
  - Government revenue and expenditure are modeled
7 blocks in QECM model(2)

- Price and wage block
  - Consumer price index is explained by the output gap, money supply, import price,
  - other price indices, such as GDP deflator, price index of investment goods, etc are modeled.
  - urban wage rate is explained by the productivity of 2+3 industries
- Banking sector block
  - deposit of firm, household, government, and other sectors separately modeled,
  - Money supply M1 and total loan are modeled.
- Trade block
  - Export and import of commodities are modeled (no data for the trade of service)
  - Export depends on world trade, exchange rate
  - Import depends on export, domestic demand and exchange rate
Data issue: an example

• Accounting identity:
  • \( \text{gdp}(r) = \text{cons}_p(r) + \text{cons}_g(r) + \text{cap}(r) + \text{ex-im} \) \hspace{1cm} (1)

• Available data:
  • Gdp(r): domestic output: Quarterly from 1992Q1
  • Cons_p(r): private consumption: annual
  • Cons_g(r): government consumption: annual
  • Cap(r): capital formation: annual
  • ex/im: export/import of total commodities and services: nominal, annual

• Data can be used for interpolation
  • Rs: Retail sales: monthly, to interpolate consumption
  • If: investment for fix asset: monthly, to interpolate investment
  • Exc/imc: export/import for commodities, in current price

• Inconsistent Problem
  • For the quarterly data, left side is inconsistent with the right side in (1)
Forecast and stochastic simulation

- To use simulated value as historical data value
- Can be used for model performance check and h-step forecast
- An example: forecast for LGDPC for 2013Q1-2014Q4
forecast and scenario simulation

• Scenario simulation: change on exogenous variables, such as world trade, oil price, exchange rate, etc.
• Example: scenario: set world trade increase 30% during 2013Q1-2014Q4. compare the change of export
• Baseline scenario is 5%
Application

- Macroeconometric model provided a useful framework for consistent economic analysis
- Forecast and scenario simulation
- Evaluated policy effect. The stimulus package was issued after the financial crisis in 2008. The model can be applied to evaluated the stimulus effect on China’s macroeconomic variables
- Interrelationship, spillover effect, etc between countries (with country-linked model),
- Analyze social and economic issues by means of integrating with a more detailed model, e.g. monetary policy transmission, SDGS relevant issues.
required skills to build model

• Macro economic theories
  • To design the frame of the model
  • To understand the interaction between the blocks
  • To specify the behavior equations
• Econometric knowledge
  • To understand and interpret the output
• Econometric software
  • To write the program codes
• Understanding of the institutional factors of individual countries
  • Especially the definition of indicators
• Invest your time in modeling