A macroeconomic model of China economy

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Introduction

We are constructing a macroeconomic model of China economy. The objective of the model is to capture the trend of Chinese economy since 1992. Our economic system has transformed from planned economy to market economy during this period. At the same time, the national accounts system has been transformed from the material product system (MPS) to national accounts system (SNA).

In this paper, we will present the structure of the model and a preliminary specification of equations .

We call the model CUFEM, that means the model of Central University of Finance and Economics.

CUFEM is an annually model. The sample period is from 1992 to 2007. In this period, data used by our model can be obtained from the public resources, such as China statistical yearbook.

The model contains 105 equations, in which 47 are behavioral equations.

The model is demand oriented and follows Keynes' framework. In this model, we begin the analysis with aggregate demand, which includes consumption, investment and net exports.

Consumption includes urban household consumption and rural household consumption, each of them is divided into five categories : food, medicine, durable consumer goods, education and others.

Investment includes investment in fixed assets and change in inventories. Investment in fixed assets is divided into state-owned investment, collective-owned investment, self-employed individual investment, direct foreign investment and other investment.

Exports and Imports are divided into imports of goods, exports of goods, imports of services, and exports of services.

Structure of the Model

The model includes following modules :

consumption, investment, imports and exports, income, price, employment, value-added, government finance and finance, as showed in figure 1.

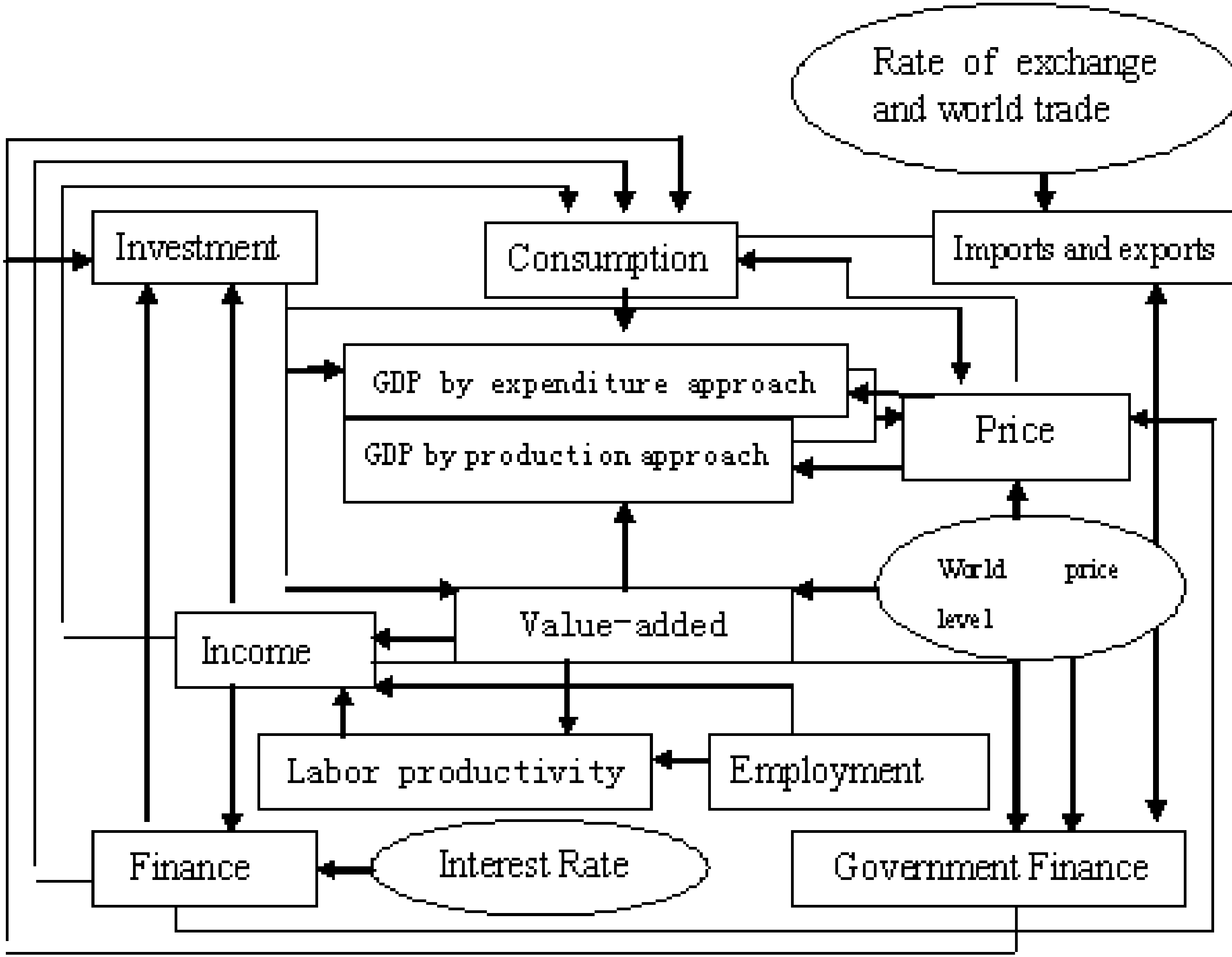

Figure 1 the infrastructure of model

A convenient starting point for the specification of a macroeconomic model is the GDP identity:

$$gdpR = cR + invR + gR + exR - imR$$

Where all the variables are measured in real terms, and

gdpR = gross domestic product

cR = consumption expenditure

invR = investment

exR = exports

imR = imports

Consumption

In this module, we construct consumption equations for urban household and rural household respectively.

According to the data of consumption, we divide consumption into five categories : food, medicine, durable consumer goods, education and others. So we specify one equation for each category. For example, the estimated equation of urban households’ durable consumption goods is

$$cu\hat{R}\_dura = 72.891 + 0.074 dyuR - 1.259 Rpu\_dura \quad \bar{R}^2 = 0.88$$
$$t: \quad (18.35) \quad (9.44) \quad (-3.49)$$

where, cuR_dura is expenditure of durable goods per capita of urban households, yuR is disposable income per capita of urban households, dyuR is the difference of yuR, Rpu_dura is consumer price index of durable goods. All variables are measured in real terms.

We then get urban household consumption, rural household consumption and total consumption by following identities:

cuR = cuR_food+cuR_dura+cuR_edu+cuR_medc+cuR_other

TcuR = cuR*upop

crR = crR_food+crR_dura+crR_edu+crR_medc+crR_other

TcrR=crR*rpop

cR=TcuR+TcrR

Where cuR and crR are urban household consumption per capita and rural household consumption per capita respectively. TcuR and TcrR is total urban household consumption and total rural household consumption respectively. cR is total household consumption.

Investment

In the specification of investment equations, we divided the total fixed assets investment into five parts by investor:

state-owned investment
collective-owned investment
self-employed individual investment
direct foreign investment
other investment

We construct one behavioral equation for each kind of investment. The main explanatory variables for investment equations include change in GDP, government expenditure in economic construction , bank loans, interest rate and price of fixed assets investment.

For example, the estimated equation of state-owned investment is as follows.

$$\begin{array}{llllll} fi\hat{R}\_state = & -6007.15 & + 3.45 loanR & + 1.63 efecR & + 47.91 pfi & \bar{R}^2 = 0.998 \\ t: & (-4.35) & (16.08) & (3.76) & (4.15) & \end{array}$$

Where, fiR_state is state-owned investment, loanR is balance of bank loans, efecR is government expenditure of economic construction, pfi is fixed assets investment deflator.

We get the investment in fixed assets and total investment by following identities:

$$fiR = fiR\_fore + fiR\_state + fiR\_coll + fiR\_indi + fiR\_other$$

$$invR = viR + fiR$$

Where

fiR = investment in fixed assets.

fiR_fore = direct foreign investment

fiR_state = state-owned investment

fiR_coll = collective-owned investment

fiR_indi = individual investment

fiR_other = other investment

invR = total investment

viR = change in inventories

Imports and exports

The foreign trade equations explain exports and imports in terms of both activity variables and relative prices. The relevant activity variable for exports is world trade, which acts as a proxy for world income and that for imports is domestic GDP. In each case the relative prices variable is

$$P/(PW*E)$$

Where P is the domestic price level, PW is the world price level, and E is the exchange rate (RMB/US$).

We specify behavioral equations for imports of goods, exports of goods, imports of services, and exports of services. For example, the estimated equation of imports of goods is as follows.

$$\hat{gimR} = 16242.96 + 34.99 relprice + 0.17 dgdp + 14.92 time \quad \bar{R}^2 = 0.99$$
$$t: \quad (3.98) \quad (9.29) \quad (17.73) \quad (3.01)$$

Where gimR is import goods, relprice is the relative price. dgdp is the first difference of GDP, time is a time trend.

We then get total imports and exports by two identities:

$$exR = gexR + sexR$$
$$imR = gimR + simR$$

GDP

After getting consumption, investment and net exports, GDP based on expenditure approach (gdpR) can be calculate as:

$$gdpR = cR + invR + gR + exR - imR$$

To estimate GDP based on production approach (gdp), we estimate value added of primary industry (agriculture), secondary industry (industry and construction) , and thirdly industry (tertiary), all measured in current prices. The estimated equation of agriculture value added is as follows.

$$agr\hat{a}dd = -18081.63 + 0.58dtyr + 6.41ccf + 120.50dia + 0.11tpam \quad \bar{R}^2 = 0.99$$

$$t: \quad (-7.98) \quad (6.92) \quad (5.61) \quad (2.76) \quad (2.36)$$

$$LM(1) = 0.99(p = 0.32)$$

Where agradd is value-added of primary industry. dtyr is the first difference of total income of rural household. ccf is consumption of chemical fertilizer, dia is the first difference of irrigated areas, tpam is the total power of agriculture machinery.

After estimating value added for three industries, we can get nominal GDP and GDP deflator:

gdp = agradd + secadd + teradd

gdpD = gdp/gdpR

Prices

In the price module, we use behavioral equations to decide the following price indexes:

(1) consumers' prices index (cpi)
(2) producer price index for manufactured goods (ppi)
(3) commodity retail price index (rpi)
(4) fixed assets investment deflator
(5) consumption deflator
(6) deflator for value-added of agriculture
(7) deflator for value-added of industry
(8) deflator for value-added of tertiary industry

The main explanatory variable used in these equations is GDP deflator (gdpD).

Income

We specify two behavioral equations to estimate income per capita of urban households and that of rural households.

In the equation of income per capita of urban households, we choose value-added of the secondary industry and tertiary industry as explanatory variables.

To describe the income per capita of rural households, we choose the value-added of the primary industry, secondary industry and tertiary industry as explanation variables. the estimated equation of rural income is:

$$y\hat{r} = 79.63 + 0.63(agradd - agrtax)/rpop + 0.47\,yr(-1) \quad \overline{R}^2 = 0.997$$

$$t: \quad (2.47) \quad (10.51) \qquad\qquad\qquad\qquad (8.17)$$

All variables in the two behavioral equations are measured in current prices. We then use identities to get income per capita of urban households and rural households in constant prices, and get income of urban households and rural households in current and constant prices:

yrR = yr/pr

yuR = yuR/pu

tyr=yr*rpop*10000

tyu=yu*upop*10000

tyrR=yrR*rpop*10000

tyuR=yuR*upop*10000

Employment

In the employment module, we construct the equations for employment of each industry.

Employment is mainly decided by value-added of the related industries. For example, the estimated equation of employment of the tertiary industry is as follows.

$$ter\hat{e}mp = 14108.80 - 54.96(\sec addR + agraddR) / teraddR * 100 + 0.57 gdpR$$

$$t: \quad (3.81) \quad (-3.51) \quad (11.87)$$

$$\bar{R}^2 = 0.97$$

Total employment is the sum of three industries:

Temp = agremp + secemp + teremp

Labor productivity

We use identities to calculate labor productivities for three industries in current and constant prices respectively:

agrlp = agradd/agremp

agrlpR = agraddR/agremp

seclp = seclp/secemp

seclpR = secaddR/secemp

terlp = teradd/teremp

terlpR = teraddR/teremp

Government finance

In this module, we estimate government revenue and expenditure. In the equation of expenditure, we assume that expenditure is mainly affected by revenue. In the equation of revenue, we assume that revenue is decided by the growth of economy.

At the same time, we use behavioral equations and identities to describe taxes, which is the main source of government revenue.

As an example, the estimated government revenue equation is as follows.

$$n\hat{g}r = 1266.87 + 0.054gdp - 11535.37D1 + 0.15gdpD \qquad \bar{R}^2 = 0.996$$

$$t: \quad (1.19) \quad (3.75) \quad (-8.59) \quad (6.62)$$

Where D1 is a dummy variable, D1=0, t<1997; D1=1, otherwise.

Finance module

In the module of finance, we only specify behavioral equations to describe money supply M1and M0 at moment. This module need to be improved.

We choose GDP and interest rate of loan as the explanatory variables for M1, and use the deposit (save) of urban and rural households to explain M0, where save is estimated by

Save = f(tyr + tyu, ird)

The estimated results of M0 equation is as follows.

$$\hat{m}0 = 3612.71 + 0.15 save \qquad \bar{R}^2 = 0.99$$

$$t: \qquad (10.47) \qquad (39.48)$$

Thank you !