

An Analysis of Macroeconomic Impacts Produced by the Fixed Capital Investment in China

Liu Baojun

Tianjin University of Finance and Economics, Tianjin, 300222,China

Abstract. In this paper we analyzed macroeconomic impacts produced by fixed capital investment in China, and proposed a model to analyze effect of structural change of fixed capital investment for macroeconomic impacts of fixed capital investment and used it to analyze the Chinese change from 1990 to 1995.

Introduction

In this paper we analyzed macroeconomic impacts from 1990,1992, and 1995 *Input-Output Table of China* by Department of National Economic Accounting of State Statistical Bureau of P. R China. We treated them in 1990 constant price in order to eliminate the effects of price change in macroeconomic impacts analysis.

The paper is divided into five sectors. They are :

- 1.The Sector Output Impacts of Unit Fixed Capital Investment
- 2.The gross Output Impacts of Unit Fixed Capital Investment
- 3.The Primary Input Impacts of Unit Fixed Capital Investment
- 4.The gross Output Impacts of Gross Fixed Capital Investment
- 5.The Effect of The Structural Change of Fixed Capital Investment for Sector Output Impacts of Unit Fixed Capital Investment

1.The Sector Output Impacts of Unit Fixed Capital Investment

The investment growth can induce economic growth. The sector output impacts of unit fixed capital investment implies the induced sector output by unit fixed capital investment. Let R represent a column vector of the sector output impacts, then

$$R = (I - \hat{D}A)^{-1} T_d / i' T_d = (I - \hat{D}A)^{-1} \begin{pmatrix} \frac{d_1 t_1}{\sum_{i=1}^n d_i t_i} \\ \frac{d_2 t_2}{\sum_{i=1}^n d_i t_i} \\ \vdots \\ \frac{d_n t_n}{\sum_{i=1}^n d_i t_i} \end{pmatrix} \quad (1)$$

where $(I - \hat{D}A)^{-1}$ represents total output requirements coefficients matrix. Its element indicates the total domestically produced products requirement of sector i for producing one unit of final demand of sector j. \hat{D} represents a diagonal matrix,

$$\hat{D} = \begin{pmatrix} d_1 & 0 & \cdots & 0 \\ 0 & d_2 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots \\ 0 & \cdots & \cdots & d_n \end{pmatrix}$$

Where d_i represents domestic content ratios. T represents column vector of investment,

$$T = \begin{pmatrix} t_1 \\ t_2 \\ \vdots \\ t_n \end{pmatrix} \text{ its element is investment of sector } i, T_d = \begin{pmatrix} d_{11} t_{11} \\ d_{22} t_{22} \\ \vdots \\ d_{nn} t_{nn} \end{pmatrix}. T_d / i' T_d \text{ represents a}$$

column vector of structure coefficient of investment.

Using formula (1) we calculated the sector output impacts of unit fixed capital investment in China in 1990,1992 and 1995 on the basis of input-output tables of China with 33 sectors at 1990 constant price.

We find that the sector output impacts of unit fixed capital investment is larger for manufacture of machinery, construction , manufacture of building materials and other non-metallic mineral products , primary metal manufacturing ,commerce, chemical industries than others.

2.The Gross Output Impacts of Unit Fixed Capital Investment

The gross output impacts of unit fixed capital investment can be obtained from I'R.

We define G as value added impacts of unit fixed capital investment. G implies the induced value added by unit fixed capital investment.

$$G = Z'R \quad (2)$$

Where Z' represents a row vector of value added coefficient, $Z' = (z_1, z_2, \dots, z_n)$, value added of sector j divided by gross output of sector j is z_j . In Table 1 we show the gross output and value added impacts of unit fixed capital investment, respectively.

Table 1 The Gross Output Impacts of UFCI in China unit:RMB a hundred million yuan

	1990	1992	1995
i'R	2.4519	2.4853	2.4021
G	0.8787	0.8392	0.8303

3.The Primary Input Impacts of Unit Fixed Capital Investment

Let L as a column vector of induced compensation of labours by unit fixed capital investment

$$L = \hat{V}(I - \hat{D}A)^{-1} Td / i' Td \quad (3)$$

Where \hat{V} represents a diagonal matrix, the elements on its diagonal are v_j , ($j=1,2,\dots,n$). v_j represents coefficient of compensation of labors of sector j. Compensation of labors of sector j divided by gross output of sector j is v_j . While, let N as a column vector of induced net taxes on production and operating surplus by unit fixed capital investment ,its element (n_i) represents induced net taxes on production and operating surplus of sector i by unit fixed capital investment

$$N = \hat{M}(I - \hat{D}A)^{-1} Td / i' Td \quad (4)$$

Where \hat{M} represents a diagonal matrix, the elements on its diagonal are m_j , ($j=1,2,\dots,n$). m_j represents coefficient of social net income of sector j. Net taxes on production and operating surplus of sector j divided by gross output of sector j is m_j .

Table 2 The Primary Input Impacts of UFCI in China unit:RMB a hundred million yuan

	1990	1995
I'L	0.4115	0.3511
I'N	0.3841	0.3460

4.The Gross Output Impacts of Gross Fixed Capital Investment

The gross output impacts imply the ratio of gross output induced by gross fixed capital investment in social gross output. While, the impacts imply the ratio of value added induced by gross fixed capital investment in the gross domestic product also.

Let GOI represents the gross output impacts, VAI represents the value added impacts, then

$$GOI = \frac{i'R * i'Td}{i'X} \quad (5)$$

Where X represents a column vector of gross output, GDP represents the gross domestic product.

$$VAI = \frac{G * i'Td}{GDP} \quad (6)$$

Table 3 The Gross Output Impacts of GFCI unit: %

	1990	1992	1995
GOI	36.06	34.03	38.09
VAI	31.03	29.72	35.17

It is shown in Table 3 that 36.06% of social gross output in 1990, 34.03% in 1992 and 38.09% in 1995 induced by gross fixed capital investment. The impacts of 1992 have decreased 2.03 percentage point than that of 1990, and the impacts of 1995 have increased 4.06 percentage point than that of 1992. 31.03% of gross domestic product in 1990, 29.72% in 1992 and 35.17% in 1995 induced by gross fixed capital investment. The impacts of 1992 have decreased 1.31 percentage point than that of 1990, and the impacts of 1995 have increased 5.45 percentage point than that of 1992.

5.The Effect of The Structural Change of Fixed Capital Investment for Sector Output Impacts of Unit Fixed Capital Investment

The sector output impacts of unit fixed capital investment effected by total output requirements coefficients, domestic content ratios and structure coefficients of investment. In order to analyze the degree of influence of each factor above for the impacts of unit fixed capital investment during two years' time ,we will study as follows:

Let $B = (I - \hat{D}A)^{-1}$ and $K = T_d / i'T_d$,then from formula((1),

$$\begin{aligned}
R &= B\hat{D}K \\
\Delta R &= B_{t+1}\hat{D}_{t+1}K_{t+1} - B_t\hat{D}_tK_t \\
&= B_{t+1}\hat{D}_{t+1}\Delta K + B_{t+1}\Delta\hat{D}K_t + \Delta B\hat{D}_tK_t
\end{aligned} \tag{7}$$

In the right side of formula (7) the first item indicates the effect of structural change of fixed capital investment for the sector output impacts of unit fixed capital investment. The second item indicates the effect of domestic content ratios shift for the sector output impacts of unit fixed capital investment. The third item indicates the effect of production technology shift for the sector output impacts of unit fixed capital investment. Using formula (7) we get the following results calculated on the basis of Input-output Tables of China in 1990, 1992 and 1995. The gross output induced by unit fixed capital investment in 1992 had been increased by a factor of 100000 yuan than that in 1990, and that in 1995 reduced by a factor of 2980000 yuan as compared with that in 1992 due to the structural change of investment.

In the above analysis we put interaction effect into the effect of the structural change of fixed capital investment. We will divide the interaction effect into additional effect of production technology shift, additional effect of domestic content ratios shift and that of the structural change of fixed capital investment according to the ratio of their structural change of fixed capital investment as follows:

$$\begin{aligned}
\Delta R &= R_{t+1} - R_t \\
&= B_{t+1}\hat{D}_{t+1}K_{t+1} - B_t\hat{D}_tK_t \\
&= \Delta B\hat{D}_tK_t + B_t\Delta\hat{D}K_t + B_t\hat{D}_t\Delta K + B_t\Delta\hat{D}\Delta K + \Delta B\hat{D}_t\Delta K + \Delta B\Delta\hat{D}K_t + \Delta B\Delta\hat{D}\Delta K
\end{aligned} \tag{8}$$

Where $B_t\hat{D}_t\Delta K$, $B_t\Delta\hat{D}K_t$, and $\Delta B\hat{D}_tK_t$ represent primary effect of production technology shift, primary effect of domestic content ratios shift and that of the structural change of fixed capital investment, respectively. $B_t\Delta\hat{D}\Delta K$, $\Delta B\hat{D}_t\Delta K$, and $\Delta B\Delta\hat{D}K_t$ represent interaction effect of the two corresponding factors, respectively. $\Delta B\Delta\hat{D}\Delta K$ represents interaction effect of three factors shift. If numerical value of column vectors $B_t\Delta\hat{D}\Delta K$, $\Delta B\hat{D}_t\Delta K$, $\Delta B\Delta\hat{D}\Delta K$, $\Delta B\hat{D}_tK_t$, $B_t\Delta\hat{D}K_t$, and $B_t\hat{D}_t\Delta K$ are given, using following equations

$$B_t\Delta\hat{D}\Delta K = \hat{P}(B_t\Delta\hat{D}K_t + B_t\hat{D}_t\Delta K) \tag{9}$$

$$\Delta B\hat{D}_t\Delta K = \hat{Q}(\Delta B\hat{D}_tK_t + B_t\hat{D}_t\Delta K) \tag{10}$$

$$\Delta B\Delta\hat{D}\Delta K = \hat{H}(\Delta B\hat{D}_tK_t + B_t\Delta\hat{D}K_t + B_t\hat{D}_t\Delta K) \tag{11}$$

We will get numerical value of diagonal matrices \hat{P} , \hat{Q} and \hat{H} , respectively. Then

$$B_t\hat{D}_t\Delta K + \hat{P}B_t\hat{D}_t\Delta K + \hat{Q}B_t\hat{D}_t\Delta K + \hat{H}B_t\hat{D}_t\Delta K = (I + \hat{P} + \hat{Q} + \hat{H})B_t\hat{D}_t\Delta K \tag{12}$$

is the total effect of the structural change of fixed capital investment for the sector output impacts of unit fixed capital investment. In above formula (12) $B_t\hat{D}_t\Delta K$ represents primary effect of the structural change of fixed capital investment for the sector output impacts of unit fixed capital investment, $\hat{P}B_t\hat{D}_t\Delta K$, $\hat{Q}B_t\hat{D}_t\Delta K$, and $\hat{H}B_t\hat{D}_t\Delta K$ represent additional effect of the structural change of fixed capital investment for the sector output impacts of unit fixed capital investment.

Reference:

Chen Xikang and Guo Ju-e, Chinese Economic Structure and SDA Model, "Systems Science and Systems Engineering"